# *The* DEMOGRAPHY OF CEYLON

BY

N. K. SARKAR, M.A. (Cal.) ; Ph.D. (Lond.)

# 1957

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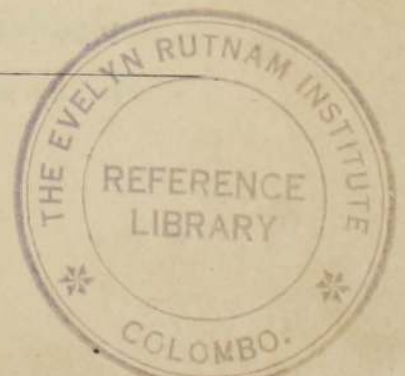# THE
# DEMOGRAPHY OF CEYLON

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# PREFACE

THE counting of human population is, perhaps, as old as human society itself. The primitive communities could not have possibly organised their wars, hunting expeditions, migrations and large constructional works without figuring their numbers in some way or other. Many ancient societies, however, regarded counting their numbers as an act of sacrilege which brought upon them the wrath of the gods and the plagues. In any case, the need for a population census was felt only occasionally in these societies so that earlier censuses were sporadic and rare. It is only with the growth of modern society that the counting of human population has become a regular and a highly complex process creating the need for a separate science to deal with it.

Demography is, however, not concerned with the problem of counting alone. Its scope has been broadened to include every aspect of the population problem. Both as a means and as an end, the human population enters into the field of study of many sciences. The sciences of public health, medicine, biology, genetics, economics, sociology, politics, geography, history &c., are all interested in some or other aspect of the population question. Demography covers a good deal of common ground with these sciences. Thus the main task of demography is not only to evolve accurate measures of the biometric variables such as fertility, mortality, &c., which are directly responsible for population growth, but also to collate the findings of the related sciences into a systematic and co-ordinated body of knowledge. Its aim in doing so is to deduce the general principles which govern the population movement. The ultimate aim of the science of demography is not different from other sciences viz., to understand and unravel the mystery of the natural processes, and to bring them under conscious social control.

The present work is a treatise on applied demography. It illustrates, on the one hand, the capabilities and limitations of the statistical tools used by demographers ; and, on the other, the heavy debt of the demographers to the other scientists who deal with the population problem. Discussions on the demographic tools have been limited to Chapter 3 and the Appendices of Chapters 4–6. These sections can be omitted by the readers not interested in formal demography without loss of continuity.

My thanks are due to Prof. D. V. Glass, Prof. E. Grebenik, Mr. N. Carrier and Mr. H. Peries for their suggestions and criticisms. My thanks are also due to the Rockefeller Foundation and the University of Ceylon for the grants which made this work possible.

N. K. SARKAR

University of Ceylon,
Peradeniya, 10th May, 1957.

# THE
# DEMOGRAPHY OF CEYLON

## CONTENTS

# CHAPTER 1

## INTRODUCTION

### The Historical and the Geographical Background

CEYLON is a small island detached from the southern tip of the Indian subcontinent by a small stretch of sea. Foreigners often identify Ceylon with India and there are good reasons for doing so. Culturally Ceylon is an extension of India as much as it is geographically. The social pattern of Ceylon is not different in essentials from that of India. Though small, the complexity of heterogeneity in its population is no less than that of India. In its evolution the twists and turns of history have left indelible marks and created problems and maladjustments which are as complicated as those in India. Demographically she is a prototype of Southern Asia. The population problem created in Ceylon during the recent period of her history is not an isolated phenomenon but closely resembles those of other parts of Asia. The interest in Ceylon's demography, therefore, is not restricted to her borders. The conclusion drawn here and the solutions—if found—will have a much wider application.

In this respect Ceylon provides a tempting ground for the demographic research worker. The facilities that she provides as a case study are unique in Asia. The volume of demographic and other statistical data that are available in Ceylon is really impressive. Their quality, reliability and coverage, though not as perfect as could be wished, are yet much superior to those available for other Asian countries. Registration of deaths was made compulsory in 1867 and the returns are available from that date. Failure to register births was made punishable in 1893. Marriage registration became compulsory for most communities in the middle of the last century. The first census was taken in 1814. Annual estimates of population are available since 1826. Regular decennial censuses have been taken since 1871. In view of the general backwardness of the country and the high percentage of illiteracy, these statistics must necessarily be defective in many ways. Nevertheless, it is often possible to correct their deficiencies and to use them to deduce important conclusions. The purpose of this study is to investigate the basic factors underlying the population trend and to examine the problems created by it. In view of the defective nature of the data extraordinary precautions have to be taken in using them and a substantial part of the present work has been devoted to this kind of investigation.

Since some doubt will always attach to this kind of data, it has been thought wise to examine all the evidences available, even to the point of boredom. It is not alwyas that the data from the various sources are consistent. In such cases the conclusion that fits the general picture most satisfactorily has been accepted. The general picture that ultimately emerges is adequately distinct and shows forcibly the critical stage in which the country is placed today. The picture is not pleasant. It is

hoped that its grimness will rouse the national and international efforts necessary to avoid the consequences.

A brief historical and geographical outline will help a proper appreciation of the problem.

The source materials from which the history of Ceylon is generally culled are somewhat meagre, being limited to a number of ancient chronicles written mostly by Buddhist priests, and a few inscriptions and *ola*-leaf manuscripts. Philological and archaeological evidences support the story of the chronicles, that the ancestors of the Sinhalese were Aryans who migrated from somewhere in North India. It is commonly believed that the ancestors of the present day Veddas were the original inhabitants of Ceylon whom the Aryans drove into the jungles and settled down in the country.

The renaissance of the Sinhalese civilisation occurred after the country was converted to Buddhism. In Ceylon, as in India, the egalitarian ethics of Buddhism provided a rallying point of all the progressive and creative forces in society and led to revolutionary progress in technology, arts, culture and social organisation. The gigantic irrigation tanks, the carefully planned cities, the temples, statues and frescoes all give evidence of the high technological and cultural level of the ancient Sinhalese civilisation. The period of this prosperous phase of Sinhalese civilisation is generally ascribed to between 543 B.C. and 1300 A.D.

At the foundation of the Sinhalese civilisation was the ingenious irrigation system which they developed by utilising fully the geographical peculiarities of the country.

The central region of the island rises sharply in three peneplanes to a height of 8,000 feet, as shown by the east-west cross section in Fig. 1. The first peneplane lies between the height of 0 and 100 feet. Then, at about 50 miles from the western coast, it suddenly rises to a height of 1,000 feet. The second peneplane begins from here, and after a distance of about 20 miles sharply rises to a height of about 3,000 feet. The third peneplane rises slowly to a height of 5,000 feet, finally crowned by the highest peaks of Ceylon rising to a height of 8,000 feet. On the eastern section the decline follows a similar pattern but more steeply.

The top peneplane was not inhabited by the ancient Sinhalese. The intermediate peneplane was partially settled. These two peneplanes were thick forest areas and received a heavy rainfall. Most of the perennial rivers of Ceylon had their origin in these two peneplanes.

Sinhalese civilisation flourished in the lower peneplane. Fig. 2 shows the cross section of the country from north to south. The gentle gradient of the lower peneplane explains how, with slight manipulation, the heavy rain water in the two top peneplanes could be diverted into this region. The steep rise of the hills in the southern regions intercepted the south-west monsoon (May to September) and caused heavy rainfall (75 inches to 200 inches) in these regions. These regions were, therefore, termed the wet-zone. The northern and eastern regions receive a rainfall of below 75 inches and are known as dry-zone.

*Fig.* 1—CEYLON : WEST-EAST CROSS-SECTION

SCALES

Horizontal. 1 inch = 6 Miles
Vertical  1/2 inch = approx. 1,000

Cartography by Edmund .V. Christian

PIDURUTALAGALA

COLOMBO

KOMARI

West

East
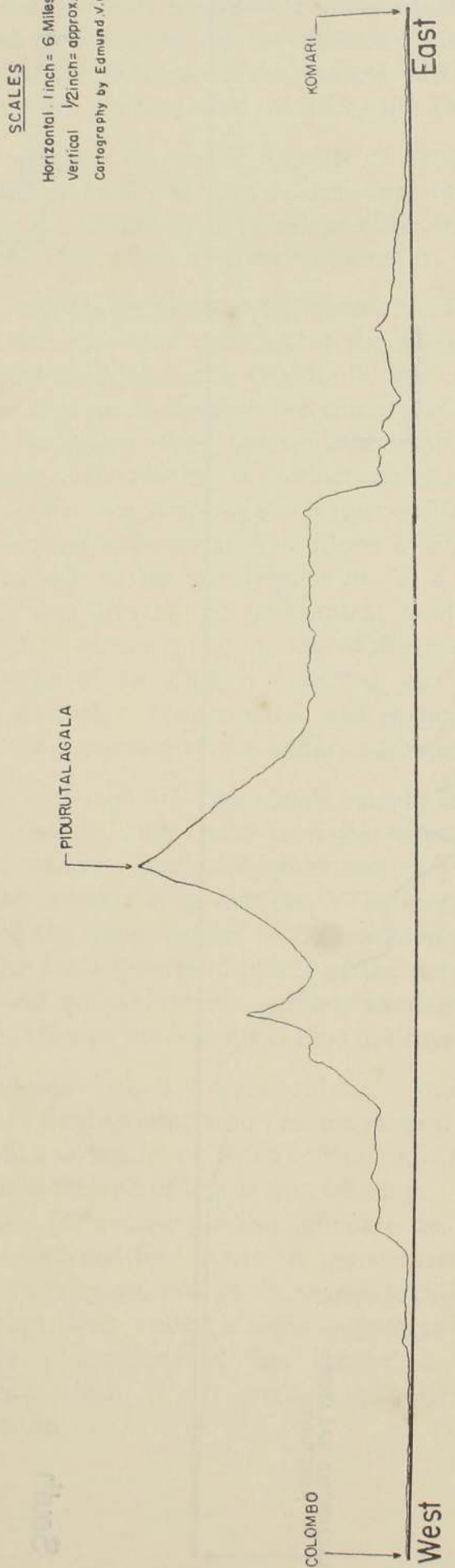
TOPOGRAPHICAL SECTIONS OF CEYLON
SHOWING THE VARIOUS LEVELS

*Fig.* 2—CEYLON : SOUTH-NORTH CROSS-SECTION
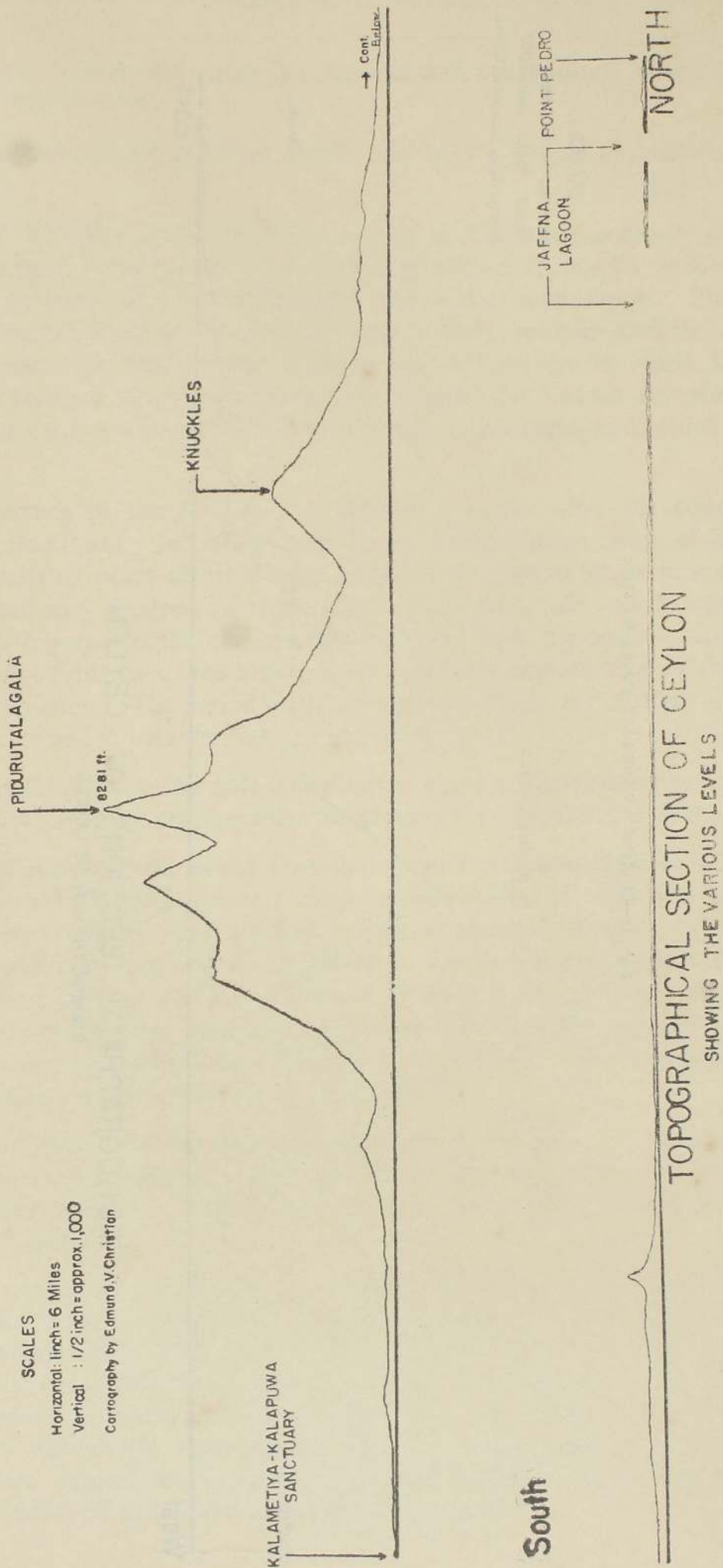
The successive Tamil invasions from South India which began in the thirteenth century, gradually led to the decay of the Sinhalese civilisation. The Sinhalese were driven back to the southern and south-western parts of the Island, while the north and the north-eastern districts were settled by the Tamils.

The Portuguese conquered the coastal districts of Ceylon in 1505. The Dutch displaced the Portuguese in 1640 and were in turn supplanted by the British in 1796. The central areas of Ceylon, known as the Kandyan districts, succeeded in maintaining their independence until 1815, when they were annexed by the British.

The Portuguese and the Dutch periods of Ceylon's history did not see any radical change in the social and economic structure of the country. The rulers of these periods were traders and their interest in Ceylon did not go far outside trade. The British, however, were anxious to develop the country as a field of investment for British capital. The plantations were opened and roads and railways developed to facilitate the transport of the plantation products and labour. The ancient closed society was thus laid open to the attack of a vigorous civilization. At the same time the growth of liberalism and an imperialistic outlook in England led to the development of a paternal attitude to the government of the colonies. The educational and the public health activities of the government gradually expanded with the expansion of the plantation economy and the rise of the revenue. Spread of Western education led to the rise of an English educated class who became intensely nationalistic in their outlook. The criticism and participation in administration of this class hastened the expansion of the welfare activities of the government.

The availability of land and the high death rate in ancient Ceylon led to a demographic balance and the high death rate was matched by a high birth rate. The balance between resources and population was thus achieved by establishing a cultural pattern which favoured large families. The spread of the welfare activities of the government and the improvement of the economic position led to a fall in the death rate. At the same time the inroads of the plantation economy into the rural subsistence farming created a scarcity of land available for peasant cultivation. The balance of population and resources was thus destroyed.

In the absence of industrialisation, the cultural outlook of the population remained more or less the same. English education became in most cases a means of earning a livelihood rather than a mode of living. The only noticeable change in the demographic field was in the rise of age at first marriage. The decline in the death rate, however, exerted a far greater positive influence on population increase than the negative influence imposed by the rise in age at marriage and consequent fall in fertility. Thus the cultural outlook of the ancient period associated with the death rate of a modern period have created a rapid population growth. The failure to expand the resources proportionately has created a dangerous situation of demographic unbalance which, if not rectified quickly, will inevitably develop into an explosive situation.

# POPULATION OF CEYLON IN THE ANCIENT AND IN THE MODERN PERIODS

## Population in ancient Ceylon

THE population of Ceylon in 1946 was seven million ; in 1901 it was four million. It is commonly believed that the population of ancient Ceylon was much higher than this. So far, no inscription or documentary evidence has been found of any enumeration of the population in the ancient period. The belief that Ceylon was densely populated during the period of the Sinhalese kings has originated from two sources : the ancient chronicles of Ceylon, and the ruined cities, monuments and irrigation works.

In several of these ancient chronicles mention is made of the numbers of villages, soldiers, sweepers, &c., at the times of different Sinhalese kings, all of which create an impression of splendour, power, oppulence and teeming population. A selection of such references will demonstrate the point.

| *Statement* | *Source and approximate date* |
|---|---|
| (1) Number of sweepers in Anuradhapura is stated as 1,000 | Mahavansa X—91 ; 400 B.C. |
| (2) Number of priests as 3,000 | Mahavansa XVII—61 ; 300 B.C. |
| (3) Devanampiyatissa's army said to number 40,000 | Mahavansa XIV—2 ; 300 B.C. |
| (4) Number of priests—100,000 <br> Number of priestesses 90,000 | Mahavansa XXII—15 ; 150 B.C. |
| (5) King Dutthugamunnu's forces numbered 60,000 | Mahavansa XXIV—32 ; 150 B.C. |
| (6) Parakrama Bahu's army raised to attack India numbered 2,125,000 | Pujavaliya, p. 35, 1170 A.D. |
| (7) Number of villages stated to be 1,470,000 | Rajavaliya, p. 65 ; 1300 A.D. |
| (8) Number of villages stated to be 1,541,000 | Rajaratnacari, p. 112 ; date unknown |

From the reference in *Rajavaliya,* which gives the number of villages in Ceylon as 1,470,000, Sir Ponnambalam Arunachalam estimated the population of Ceylon in 1300 A.D. to be 10 million, assuming 10 persons per village and allowing " a good margin for exaggeration ".[1]

It is dangerous, however, to base any estimate on statements such as these. The figures mentioned in the ancient chronicles are often meant to create a literary effect rather than to give statistical facts.

The ruined cities, monuments and irrigation works, on the other hand, are concrete evidence of the glory of the ancient Sinhalese civilisation, and provide a firmer basis for deductions than do the old records.

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[1] *Census of Ceylon,* 1901, p. 23.

The vast ruins of the ancient cities with their palaces, streets, drainage systems, temples, parks ; the statues, the frescoes, and above all, the gigantic irrigation works with their complicated constructional ingenuity, cannot fail to make a deep impression on even the casual visitor. " In ancient times reservoirs were built almost everywhere by damming the valleys of the rivers with earth levees provided with masonry spillways. The number of such reservoirs or " tanks" is very large. More than 10,000 are known ; many are now ruins, but more than half are in operation today. Their size varies from a capacity of only a few acre feet to nearly 100,000. Often there are several tanks built on the same stream.

" But the ancient irrigation works were not confined to tanks. The tanks themselves were generally on small rivers or tributaries, construction on the main rivers being apparently thought too risky or beyond the powers of the ancient Sinhalese. In consequence the catchment areas were often inadequate for the size of individual tanks ; hence water was diverted from neighbouring valleys by overflow dams or anicuts through long canals, called Ela, joining one valley to the other. Some canals are more than 50 miles long, with low grades and excavated very accurately. "[1] This was the description of the irrigation expert sent to Ceylon with the Mission organised by the International Bank for Reconstruction and Development.

Attempts have been made by a number of writers to infer the extent of the population of Ceylon in the ancient period, from the constructional requirement and maintenance of these gigantic tanks. Emmerson Tennent, for example, writes, " The labour necessary to construct one of these gigantic irrigation works is in itself an evidence of local density of population ; but their multiplication by successive kings, and the constantly recurring records of district after district brought under cultivation in each successive reign, demonstrate the steady increase of inhabitants and the multitude of husbandmen whose combined and sustained toil was indispensable to keep these prodigious structures in productive activity . . . . No one who has visited these regions, now silent and deserted, once homes of millions, can hesitate to believe that when the Island was in the zenith of its prosperity, the population of Ceylon must of necessity have been at least ten times as great as it is at the present day ".[2]

Similarly Forbes writes, " The great extent of Anuradhapoora, covering within its walls a space of two hundred and fifty-six square miles, will not give any just grounds on which to estimate the extent of its population as tanks, fields, and even forests are mentioned as being within its limits. The number and magnitude of the tanks and temples constructed by the Kings Dootoogaimoonoo . . . .

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[1]*The Economic Development of Ceylon*, p. 414. Tennent observed in 1859, " The emotion of the traveller of the present time, as day after day he traverses the northern portions of the island and penetrates the deep forests of the interior, is one of unceasing astonishment at the inconceivable multitude of deserted tanks, the hollows of which are still to be traced ; the innumerable embankments, overgrown with timber, which indicate the sites of vast reservoirs that formerly fertilised districts now solitary and barren. Every such tank is the landmark of one village at least and such are the dimensions of some of them that in proportion to their area, it is probable that thousands of villages may have been supported by a single one of these great lakes ". J. E. Tennent : *Ceylon*, Vol. 1., Part IV., Chapter 1, p. 421, 1859.

[2]*Ibide*. Vol. 1, Part IV, Chapter 1, p. 421.

Walagam-bahoo and Mahasen . . . . are the best vouchers for the numerous population which at these periods existed in Ceylon. Yet as the tanks at least were formed by forced labour, we cannot rate the wealth of the nation by the extent of the monuments. The public works of Parakrama Bahoo the First prove that even then Ceylon had a much more numerous population than it now possesses ; and Cingalese accounts of that period state the number of males, exclusive of children, as amounting to three million four hundred and twenty thousand. This number may be, and probably is, overrated : but let those who doubt that an immense population formerly existed in Ceylon compare the prodigious bulk of the ancient monuments of Anuradhapura, Mayam and Polonnaruwa, with those erected by the later kings of the Island, then let them compare singly the remains of Kalaa tank, the Kaudela tank, or many others, with any or all public works accomplished in Ceylon for the last five hundred years. "[1]

Estimates on similar lines were made by many others. Some of these estimates are given below :

### TABLE 1—POPULATION IN ANCIENT CEYLON

| Author | Estimated Population[2] Million |
|---|---|
| Tennent | 17·5 |
| Johnston | 4 to 5 |
| Pridham | 6 |
| Forbes | 5 |
| Arunachalam | 10 |
| Denham | 4 |

[1] Forbes ; *Eleven Years in Ceylon*, London, 1840, p. 237.

[2] Tennent, *Ibid*. Vol. 1 : Pridham : loc. cit. p. 451. p. 422–3. Forbes : *Ibid*, p. 237 ; Arunachalam : *Ibid*. Vol. 1, p. 23. Denham : *Ceylon at the Census of* 1911. p. 9 ff. Alexander Johnston's letter to Graves C. Haughton, M.A., F.R.S., Honourary Secretary to the Royal Asiatic Society, dated December 31, 1831. It is worthwhile quoting more fully from this letter of Johnston, firstly because this letter so far seems to have escaped the notice of the scholars of Ceylon's history, and secondly, because of the significance of its contents : " I particularly directed my researches to such parts of the history and of the antiquities of the island as were connected with the state of the country between the third and the thirteenth centuries of the Christian era, when the immense tanks or reservoirs of water, called Kattocarre, Padwielcolom, Minerie, and Kaudeley, in the northern districts, and the three large tanks in the eastern districts, together with between three and four thousand smaller tanks, were kept in perfect repair by the then government of the island, and formed as grand and as beneficial a system of irrigation as ever prevailed in any country, not excepting even Egypt, while the celebrated Lake Moeris was in use for regulating the innundations of the Nile.

" My view in instituting these inquiries was to obtain for His Majesty's ministers such information as might enable them to carry into effect a plan which I proposed to the late Lord Londonderry, the then Secretary of State for the Colonies, in 1809 ; the object of which was to encourage European capitalists by giving them grants upon the most advantageous terms, such of the government lands as were in former days highly cultivated though at present completely waste, to introduce into Ceylon European capital, European industry and European arts and science, and thereby restore the population, the agriculture and the commerce of the island to the state of prosperity which they had attained when Ceylon, according to the concurrent testimony of historians, had a population of between four and five millions of inhabitants, a system of agriculture which enabled it to supply not only its own but the population of neighbouring countries with rice and many other descriptions of grains, and a system of commerce which made it, for many centuries, the great emporium of all the trade which was carried on between the western and eastern portions of the globe ".

It is evident that the estimates derived from the line of reasoning used by these authors amount to nothing but guess-work, and Denham, the 1911 Census Superintendent, found no difficulty in discrediting them.

" None of these irrigation works appear to have been constructed under one sovereign or at one time. Though the name of Parakrama Bahu the Great, is associated with many of the great tanks, it does not follow that they were begun or even completed in his reign. On the contrary, he appears to have practically restored many of these tanks ; others were creations of many generations. Whole villages miles round were turned out in these irrigation works ; the labour was compulsory and regular ".[1]

Denham further comments : " All such estimates are, of course, pure guess-work, based only on the extent of the country and the signs of its ancient population, and little better than the Emperor Heliogabalus' estimate of the greatness of Rome, from 10,000 pounds of cobwebs having been found in the city. It is very doubtful whether the population of Ceylon has ever been larger than it is today ".[2]

Denham does not, however, indicate his reasons for drawing this conclusion.

Turner, the 1921 Census Superintendent, takes a more cautious, though inconclusive line and says, " In the absence of reliable data, it appears to be impossible either to make or to contradict, any statement to the effect that the population was much larger previously than it is now, and no case appears to have been made for either view. "[3]

Sir Ivor Jennings argues very much on the same lines as Denham and says, " The evidence of ruins is quite inconclusive. The ruins of Anuradhapura bear evident signs of a wealthy civilisation ; but its buildings were erected over at least 1,300 years ; there is apparently no evidence that they were all in use at the same time ; and it costs little to maintain a temple once it has been erected. Indeed, it costs little to erect a temple if slave labour, labour employed under service tenure, or voluntary labour is employed. Nor is there any evidence about the proportion of the national income devoted to religion. The *Mahavansa* and other religious documents are not good evidence about the condition of the people, for they necessarily tell a one-sided story. The tanks supply much better evidence, but as Mr. R. L. Brohier has pointed out, they were not all in use at the same time. As larger tanks were erected the smaller tanks were deprived of their water supply and were allowed to silt up. It must have been as true a thousand years ago as it is today that adequate subsistence for one family requires fives acres of land, of which two acres are paddy lands. There is no evidence that the wet zone or the hill country was occupied by a large population. It follows that the total population of the Island must have been comparatively small and that Sir Edward Denham's guess of four million is more likely to be accurate than Sir Ponnambalam Arunachalam's estimate of ten million ".[4]

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[1] Ibid. p. 9.

[2] Ibid. p. 9.

[3] 1921 *Census Report*, Vol. 1, Part 1, p. 30.

[4] Sir Ivor Jennings : " The General Report of the Census ", *The University of Ceylon Review* ; October, 1950, p. 210.

Unfortunately Sir Ivor Jennings does not give details of the calculations which, based on the line of argument he had developed, led him to an estimate of the order of four million.

Any attempt to estimate the population of ancient Ceylon from the extent of the ruined buildings they have left must be doomed to failure in the absence of knowledge of the period over which their construction was spread and, too, of the type of labour employed and the organisation and technique used. The line of argument suggested by Sir Ivor, however,—to approach the problem from the point of view of the capacity for food production as opposed to *accumulated* capital production and the labour force required to produce it—is capable of development and, by evaluation of the quantities involved, of producing a positive estimate of the population of ancient Ceylon. This point was touched upon by Tennent [1] but he also, like Sir Ivor, went no further than to state the principle.

The tanks satisfied a positive need which was different from the need satisfied by monuments, pyramids or temples. The latter may be regarded as " ostentatious " goods and, therefore, their relationship to population may vary within a wide range. The demand for irrigation works, on the other hand, arose from the need for increased agricultural output which, in ancient Ceylon, was more or less synonymous with the production of rice. The king's power was vitally dependent on manpower and manpower depended, in the final analysis, on the amount of rice available. The kings were, therefore, as much interested in the maintenance and extension of the tanks as were the people. Thus large population and large tanks were closely associated. Had the population been small, there would have been no need to make such large tanks, and, once the large tanks were made they, in their turn, led to a rise in population. This may be the reason why the tanks were extended from generation to generation, and larger tanks were built as the population increased.

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[1] " In no single instance do the chronicles of Ceylon mention the precise amount of the population of the Island, at any particular period ; but there is a sufficiency of evidence, both historical and physical, to show that it must have been prodigious and dense, especially in the regions of the more prosperous kings. Whatever limits to the increase of man's artificial wants may interpose in a civilised state and in ordinary climate, they are unknown in a tropical region, where clothing is an encumbrance, the smallest shelter a house, and sustenance supplied by the bounty of the soil, in almost spontaneous abundance. Under such propitious circumstances, in the midst of a profusion of fruit-bearing trees, and in country replenished by a teeming harvest, twice, at least, in each year, with the least possible application of labour, it may readily be conceived that the number of the people will be adjusted mainly, if not entirely, by the extent of arable land ".

Ibid. p. 421.

Many reasons have been suggested for the stagnation and subsequent decay of this previously expanding civilisation of Ceylon. Turner lists the following, "foreign invasion and internecine strife, the decay of irrigation, the increased prevalence of malarial fever, the ravages of smallpox, and the change in the course of trade. "[1] It is difficult to arrange these causes in a logical pattern, and some, indeed, are the consequence of others rather than independent causes. Dr. L. Nicholls regards the introduction of malaria from India as the primary cause.[2] That malaria can destroy a prosperous district and transform it into a wilderness is demonstrated by the fate of parts of Bengal during the last hundred years. It should, however, be admitted that, in the case of Bengal, the rise in the incidence of malaria was associated with the hasty and unplanned development of the railways, leading to the disruption of the drainage system. The historians are probably correct in suggesting that, in the case of Ceylon's civilisation, the primary causes of decay were foreign invasion and internal strife.[3] In the absence of peace and political tranquility, the rulers could not maintain the irrigation works in good repair. The economic foundation of the civilisation was thus destroyed, and the country was both ravaged by famine and scourged by malaria.

### An estimate of the population of ancient Ceylon

Before proceeding to consider in detail the elements from which an estimate of the population of ancient Ceylon may be constructed on the basis of the country's capacity for food production, a general warning should be made. It is perhaps presumptuous to use the word " estimate" in this context, the result of such calculations as are possible being little better than a guess. It has, however, this distinction. The other guesses, referred to earlier, required an element of judgment in matters on which we today have no background experience, for instance, the amount of exaggeration in a reference in an ancient chronicle to the total number of villages. (Was it double or ten times the true number ?). The new estimate, on the other hand, requires guesses of, for instance, the daily food consumption per head in ancient Ceylon. They may have exaggerated ten times as much as today, but they can hardly have eaten ten times as much. Nevertheless, it must be stressed that the new estimate is little more than a guess.

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[1] Ibid., p. 4.

[2] " Malaria and the Lost Cities of Ceylon " in the *Indian Medical Gazette*, Vol. LVI, No. 4, April, 1921.

[3] Tennent, Ibid, p. 424. H. F. Carter : *Repor on Malaria and Anopheles Mosquitoes in Ceylon.* Sessional Paper, VII., 1927.

Some elements in the calculation of this new estimate may be somewhat conjectural, but the calculations are not themselves complex, since neither the economy nor the diet of the people were complex. Some inferences can be made from Knox's description of the food, dress, furniture and entertainments of the people of Kandy during his time.[1]

Because of their geographic isolation the people of Kandy were cut off from all outside influences till the British conquest in 1815, and it is likely that by Knox's time their ways of living had undergone very little change for centuries past. From Knox's description it is evident that the standard of living of the people was extremely simple. The self-supporting non-exchange economy needed very little trade and foreign trade also was insignificant. " The mass of the people grew their own food, built their own houses and furniture and made their own clothes ".[2]

The staple diet was rice, and rice was neither exported nor imported except for perhaps negligible amounts. The maximum population was thus determined by the country's total possible rice production and the per capita consumption, and the agricultural practice of the time.

First, the consumption of rice : The demand for rice, or paddy, comes from three source—(a) for food ; (b) for seeds, and (c) for building a reserve against drought and crop failure. Over a period the reserve stock would remain constant, so that the entire output of an *average* year may be balanced against food consumption and seed requirements.

The average consumption of rice per head in 1946 was 6 oz. per day. The ancient Ceylonese probably consumed more because there was little variety in their food. An allowance of 8 oz. per head as the average daily consumption does not appear unreasonable under the circumstances. On this basis the consumption of paddy per head per year will be 5·07 bushels.[3]

There is no evidence of substantial changes in techniques or equipment for rice production and the changes that have occurred have tended to cancel one another, some tending to increase yield and others to decrease it. Current yield data will therefore be assumed, that is, a seed allowance of 1/13th part of the average annual output, and a yield of 20 bushels per acre.

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[1] Robert Knox, *An Historical Relation of the Island of Ceylon*, 1681. Knox was taken prisoner by the Sinhalese King of Kandy in 1660 together with other sailors from his ship and was interned in the kingdom. Most of the other European prisoners married Singhalese women and were absorbed among the people ; but Knox escaped after about 20 years and wrote his famous book which is believed to be the precursor of Robinson Crusoe. His description of the ways of the Sinhalese, their manners and customs is believed to have been " written with great truth and integrity ".

[2] Sydney D. Bailey, *Ceylon*, p. 35. *See* also John Davy : *Interior of Ceylon* : 1821, p. 278.

[3] 8 oz. of rice is taken to be equivalent to 1 lb. of paddy, and one bushel to be equal to 64 lb. Assumption of higher consumption would, of course, give a lower population figure.

Fig. 3—CEYLON : DISTRIBUTION OF IRRIGATION TANKS AND WELLS
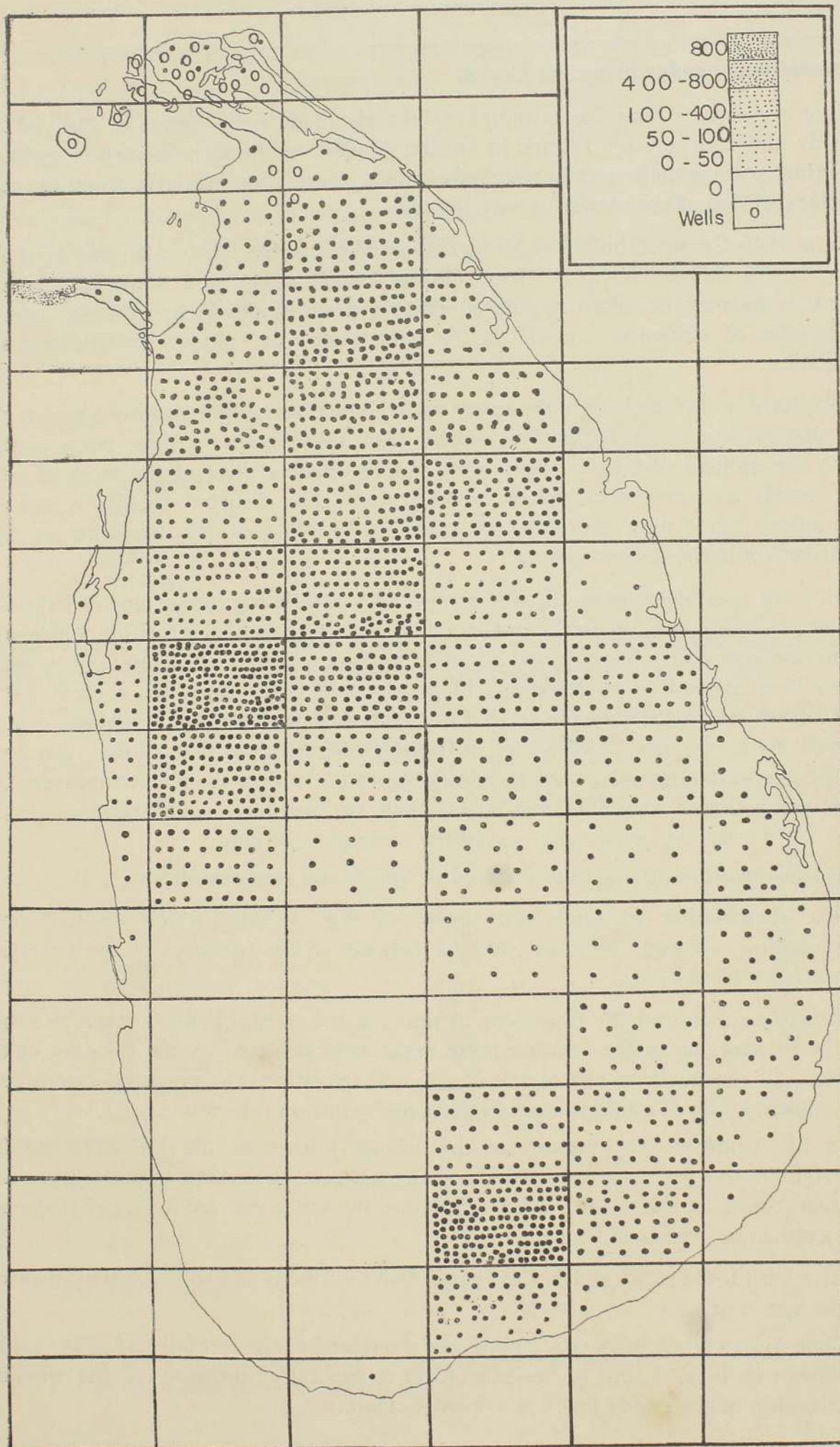
## Acreage under paddy in ancient Ceylon

More conjectural than the assumptions already made with regard to the yield of paddy and consumption of rice in ancient Ceylon are those necessary to estimate the total acreage under paddy ; not only is little information available about the past, but knowledge of the present is very limited.

The 1946 Census tabulations show figures of cultivable land, cultivated land and land under different crops. The definition of cultivable land is ambiguous, but presumably may be taken in this context to mean land which, with the existing technique of cultivation, could be brought under the plough by clearing and irrigation.

We have in the one inch scale survey maps some information about the geographical distribution of the irrigation tanks. The tanks shown in these maps include both the modern and the ancient ones, but fortunately most of the modern tanks are merely old ones re-excavated or renovated. The distribution of the tanks in the survey maps may, therefore, be taken to be more or less the same as their distribution in the ancient period.

It is not possible to proceed with precision by calculating the volume of irrigation water available, tank by tank, and to relate each acre-foot of irrigation water with a precise area of land under paddy. The tanks are largely silted up, and in many cases it is impossible to determine their area and irrigation-water content. It is not known over what area the water from each tank was used for irrigation, or how intensively it was used. Moreover, it is commonly believed that all the tanks were not in use simultaneously, and in order to prevent overflow from excessive rain they were often linked to each other by channels or aqueducts which cannot now be traced. These connected tanks served the same plots of land.

It was therefore necessary to proceed by rough and ready methods.

The distribution of tanks are shown in Fig. 3 from which by a visual examination, a rough judgment may be formed of the adequacy of the irrigation supply in each district.

It may be seen that the frequency of tanks in the coastal areas is much less than in the interior, no doubt because these areas were irrigated by the flooding of the rivers. In the northern tip of the island well irrigation was practised extensively, the subsoil being of a nature that retained the monsoon rain water.

In the south-western regions of the Island, known as the wet zone, rainfall throughout the year was sufficient to make artificial irrigation unnecessary. The central regions of the island, which fall within the wet zone, are hilly and steep and rice cultivation here is difficult.

Rice used to be cultivated in the plains of the southern and south-western districts of the wet zone.

Thus from a study of the distribution of the rivers, of the rainfall and of the tanks, as shown in Figs. 3 and 4, we may form a general impression of the possible distribution of the paddy fields in ancient Ceylon.

The land surface of Ceylon could be divided into three classes—the irrigated lands, the wet-zone plains and the wet-zone hills.  Rice could probably have been cultivated only in the first two areas.

## Estimate of the cultivable paddy land

The distribution of the tanks, wells and rivers shows that the whole of the northern region, namely, the districts of Jaffna, Vavuniya, Mannar, Anuradhapura, Puttalam, Trincomalee, Batticaloa and Chilaw, was ensured of a water supply.

In the case of a number of other districts the tanks are distributed over only a portion of the area and the proportion of the total area which was irrigated may be estimated from Fig. 3.

| District | Approximate proportion of irrigated to total area Per cent. |
|---|---|
| Kurunegala | 66 |
| Matale | 45 |
| Kandy | 15 |
| Badulla | 30 |
| Ratnapura | 25 |
| Hambantota | 50 |

Table 2 gives the cultivable land as enumerated in the 1946 Census, and the area available for paddy in ancient times on the basis of the above proportions.

TABLE 2—ESTIMATE OF THE AREA AVAILABLE FOR PADDY IN ANCIENT CEYLON—IRRIGATED DISTRICTS

| District | Proportion of irrigated to total area | Cultivable area— 1946 Census | Area available for paddy in ancient period |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| | | ('000 acres) | ('000 acres) |
| A.—Fully irrigated : | | | |
| 1.  Jaffna | 1·00 | 153 | 153 |
| 2.  Vavuniya | 1·00 | 32 | 32 |
| 3.  Mannar | 1·00 | 38 | 38 |
| 4.  Anuradhapura | 1·00 | 170 | 170 |
| 5.  Puttalam | 1·00 | 80 | 80 |
| 6.  Trincomalee | 1·00 | 31 | 31 |
| 7.  Batticaloa | 1·00 | 167 | 167 |
| 8.  Chilaw | 1·00 | 110 | 110 |
| B.—Partially irrigated : | | | |
| 9.  Kurunegala | 0·66 | 585 | 386 |
| 10.  Matale | 0·45 | 168 | 76 |
| 11.  Kandy | 0·15 | 402 | 60 |
| 12.  Badulla | 0·30 | 266 | 80 |
| 13.  Ratnapura | 0·25 | 306 | 77 |
| 14.  Hambantota | 0·50 | 132 | 66 |
| | | | 1,526 |

Note.—Col. (2) is obtained from the scatter map of the tanks, wells and rivers.
    Col. (3) is obtained by multiplying Col. (2) and Col. (3).

Fig. 4

CEYLON
showing
ANNUAL AVERAGE RAINFALL
( 1911-40 )m

50"

25-50"

50-75"

50"

75"

75-100"

150-200"

125-50"

50-75"

125-150"

100-125"

200

50-75"

100-125"

100"

100-125"

125-150"

150-200"

50"

100"

50"

75"
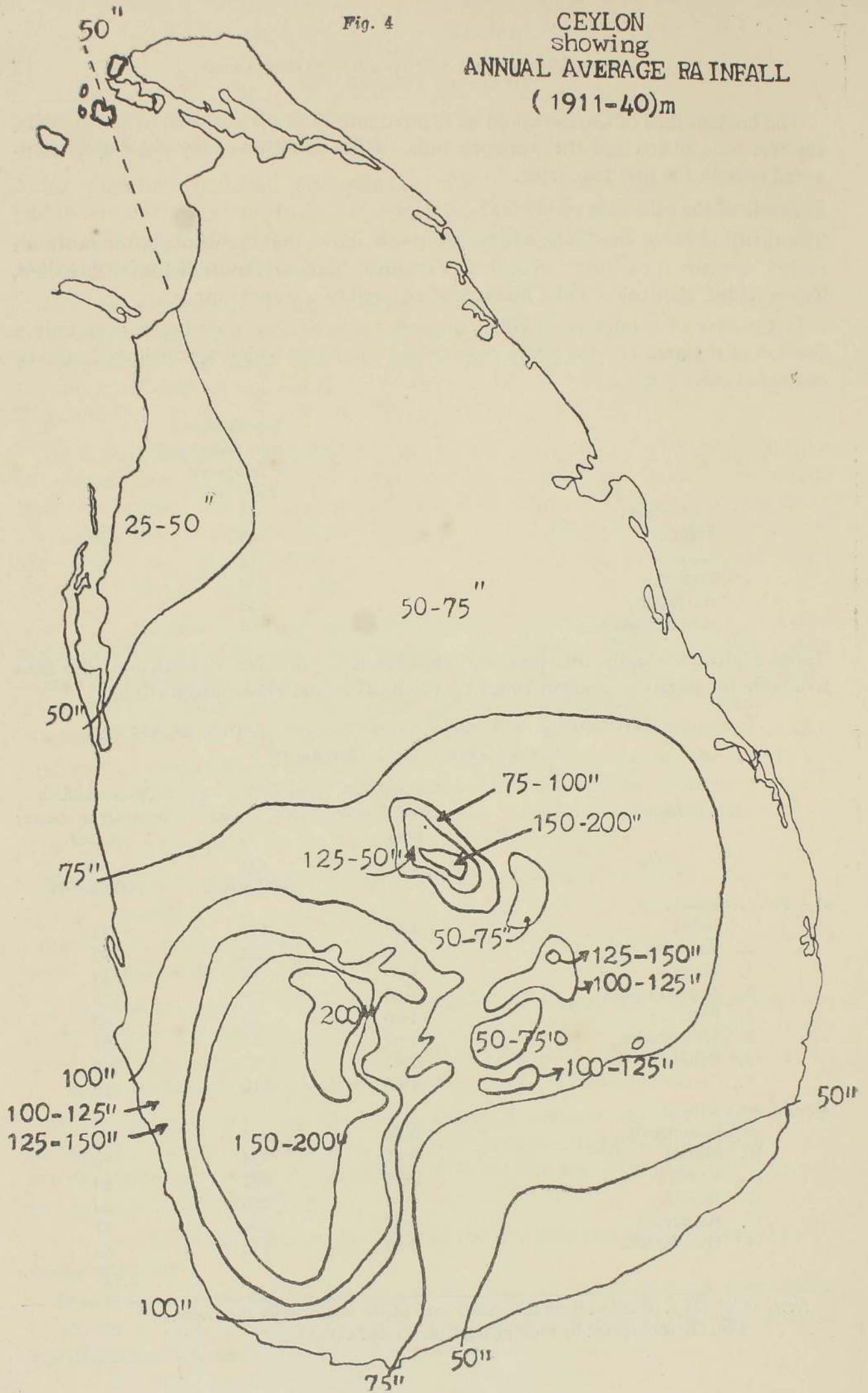
Today, tea, rubber and coconuts are grown along with paddy in the plains of the wet zone. It is probable that rubber and coconuts are grown on some of the land which was formerly devoted to paddy. We will arbitrarily assume that half of the land under rubber and coconut was thus diverted away from paddy. The substitution of tea cultivation for paddy may be ignored ; the cases where such substitution is possible are extremely limited.

An estimate of the paddy land in these districts in the ancient period will thus be given by :

Cultivable paddy land = Total cultivable land – tea land – $\frac{1}{2}$ (rubber + coconut land).

Table 3 shows the results of applying this formula to the four districts of the wet-zone.

TABLE 3—ESTIMATE OF THE AREA AVAILABLE FOR PADDY IN
ANCIENT CEYLON—WET-ZONE                  (*Thousands of Acres*)

| District | Total cultivable land 1946 Census | Land under tea | Land under rubber | Land under coconut | Available paddy land |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| 1. Colombo | 417 | 1 | 51 | 202 | 290 |
| 2. Kalutara | 256 | 10 | 108 | 32 | 176 |
| 3. Galle | 233 | 18 | 59 | 33 | 169 |
| 4. Matara | 216 | 18 | 24 | 38 | 167 |
| | | | | | 802 |

*Note.*—Cols. (2) to (5) obtained from the 1946 Census.

Col. (6) = Col. (2) – Col. (3) – $\frac{1}{2}$ (Col. (4) + Col. (5)).

The total estimate of the available cultivable land is thus :

| | Acres |
|---|---|
| Irrigated area | 1,527,000 |
| Wet-zone | 802,000 |
| Total | 2,329,000 |

## Maximum population estimate

The maximum population estimate will be based on the assumption that all the land available for paddy was in fact cultivated. The assumptions already discussed on yield and consumption, that is an *average* total yield of 20 bushels per acre, a seed allowance of 1/13th part of the total yield, and a per capita consumption of 5·07 bushels per year, are applied to the acreages estimated above. The 1,526 thousand acres of irrigated land under these assumptions would support a population of 5·56 millions and the 802 thousand acres in the wet-zone would support 2·91 millions. They would then support between them a maximum population of 8·47 millions.

## A Moderate Estimate

It is unlikely that all the tanks were functioning at the same time and to allow for this it would be assumed that say only 75 per cent of the available area in the irrigated region was actually cultivated. The acreage in the wet-zone will not be affected by this assumption.

Under this alternative assumption the irrigated area would support only three quarters of the 5·56 million population estimated previously, that is 4·17 millions, whilst the wet-zone area would support 2·91 million as before. The total population supported would then be 7·08 millions.

There are, of course, a variety of sets of assumptions, no less valid than those advanced here, from which alternative estimates of the population of ancient Ceylon could be derived, but their iteration would serve no useful purpose. The significant conclusion is that, from the availability of cultivable paddy land, a population of some 7 or 8 millions at most could have been supported in ancient Ceylon.

The actual population at any particular point of time, would fall short to a greater or lesser extent depending on the changing phase of prosperity, famine, epidemics, invasion and war—the famous Malthusian checks.

## Population of Ceylon in the Modern Era

The first census in Ceylon was taken by Governor Vander Graff in 1789. This census covered the entire Dutch territory, i.e. all the maritime provinces, and the population enumerated was 817,000. The census was taken for the purpose of taxation, and serious underenumeration was suspected. The common belief at the time was that the population of the whole Island was approximately 2 million. Bournard, a Dutch officer, believed the population to be $1\frac{1}{2}$ million and Bertollacai estimated it to be a little less.[1]

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[1] " I will communicate what knowledge I derived upon this subject from a gentleman of the Dutch Government employed in the Civil Department, who has resided for upwards of 25 years on that Island ; and whose accuracy of judgment, and superior abilities have been acknowledged on several occasions by the British Government in Ceylon. Mr. Bournard expresses himself thus : ' The common opinion of those that I have conversed with, is that the population of Ceylon amounts to 2 millions of inhabitants : one million in the territory that is now in the possession of the British Government, another in that which belongs to the King of Kandy. This estimate, however, is likely to be exaggerated. An enumeration, as correct as it was possible, was made in the year 1789 by the order of Governor Vander Graff, of all the inhabitants in the Dutch East India Company, and the reckoning gave 817,000 inhabitants, of both sexes, and all ages. In the villages (and they were many) where no regular registers of the population had been kept, the numbers were taken by approximation, and consequently very incorrectly.

' With regard to the Candyan provinces the population is numerous in those that are cultivated : but it must be remarked that, with the exception of the country immediately surrounding the town of Candy, and the provinces of Uva and Matale, all the interior of Ceylon is, in the proportion of seven-eighths, covered with woods and forests, and, therefore, it may be concluded that this part of the territory of the King of Kandy is, in proportion to its extent, even more thinly peopled than the country under the British.

' The Wannyship of Soerlie and Nogerie, the whole of the great forest occupied by the Weddas, from Maagame in the South to the Coklay river in the northern side of the Island, does not contain ten thousand inhabitants. These reflections will lead to a conclusion that Ceylon does not contain more than one million and a half of inhabitants.'

" This opinion of Mr. Bournard I have not, by my own observations, found reason to contradict, and if I were inclined to differ materially from it, I should rather make the population of Ceylon a little under the number he assigned to it." Anthony Bertolaccai : *A View of the Agricultural, Commercial and Financial Interests of Ceylon*, 1817, p. 62.

The next estimate was by Bertolaccai, which gave the population of the maritime provinces as 700,000 between 1808 and 1810. His estimate was based on food consumption, but as the statistics of imports, exports and local production of grains were seriously defective, particularly in the Kandian provinces, such an estimate is suspect and probably involved serious under-estimation.[1]

During the years 1811–1813, a serious famine occurred in the British territory which must have reduced the population substantially either by death or by emigration to the Kandian territory. In 1814 a census was taken and the population in the maritime provinces was found to be only 492,000.

The Kandian provinces were annexed in 1815 and a census of the newly conquered territories was taken in 1821, when the population was found to be 257,000.

In 1827, a census was taken of all provinces and it gave the population as 890,000 including 595,000 on the maritime provinces and 295,000 in the Kandian provinces. The results of this census are unlikely to be accurate, as it followed a rebellion, only suppressed with extreme barbarity and in which innumerable villages in the Kandian province were devastated. The method and the exact date or dates of enumeration are not known.

After 1827 no complete census was taken until 1871. However annual estimates were made from the returns of the government agents, and published in the Blue Books. The method of compiling the returns varied from district to district and depended on the whims of the agents. In most cases the returns were based on data supplied by the village headman ; although occasional efforts to take a sample census were made in a few villages. Governor Torrington attempted to collect exact information for the Blue Book but his efforts caused considerable dissatisfaction among the people and were mentioned by Tennent in his evidence before the Select Committee as being one of the causes of the 1848 revolt. The Blue Book figures thus remained in most cases mere guesses.

The first census on modern lines was taken in 1871, but produced many unexpected results. Many people fled from their villages and spent weeks in the forests ; others hastily got married and even took the unusual step of getting their marriages registered. The panic arose from a wide-spread rumour that the purpose of the counting was to transport younger males to Europe to make good the depletion in manpower caused by the Franco-Prussian war. The figures from the 1871 census have, therefore, to be discounted, but it served as an introduction and smoothed the way for subsequent censuses.

Since 1871, censuses have been taken every tenth year except in 1941, when the war caused a postponement of the census until 1946. Considering the illiteracy, poverty and ignorance of the people and the difficulties of communication, the results of the censuses can be looked upon with some satisfaction.

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[1] " With regard to our old territory I should be led to form a rough calculation and surmise from the quantity of food produced, and thereby to conclude the whole population of our dominion to have been eight or ten years ago, 700,000 inhabitants ". *Ibid*, p. 62.

Bringing together these various estimates and correcting for the more glaring inconsistencies, a more or less systamatic picture of the population trend for the major part of the modern period is produced.

### Estimating the population of Kandy

The first gap in the picture arises from the lack of any information on the population of Kandy in the earlier years of the modern period. This deficiency may be rectified by using a method developed by Kingsley Davies for use under similar circumstances in India.

The method consists of ascribing the growth rate of the neighbouring areas to the area for which only a later population estimate is available, and then applying this rate in reverse to derive an estimate for an earlier period.[1]

In 1821 the first census of the Kandian districts gave a population of 257,000 : the next census, in 1827, gave the population as 295,000. This gives a growth rate of 2·5 per cent. per year, which must be regarded as too high when compared with the growth rate of the maritime provinces, which was 1·23 per cent. per year for the period 1814 to 1827. The political history of Kandy during this period was anything but conducive to population growth. On the contrary, the fall of the King of Kandy and the devastation caused by the rebellion and its cruel suppression would lead one to expect a lower rate of growth than that in the coastal areas.

On these grounds the growth rate of the maritime provinces is to be preferred and the 1814 population of Kandy may be calculated from that of 1827 by assuming the maritime provinces growth rate to have applied in the intervening period.

There was no census in the British period prior to 1814, but the population in 1809 was estimated by Bertolaccai to be 700,000 for the maritime provinces. If this is correct, the rate of decline from 1809–1814 was 4·4 per cent. per year partly attributable no doubt to the severe famine to which reference has already been made.

TABLE 4—POPULATION OF MARITIME DISTRICTS AND KANDY

| Year | Maritime districts | Kandyan districts | Source |
|------|--------------------|--------------------|--------|
| 1789 | 817,000 | ? | Vander Graff's Census |
| 1809 | 700,000 | ? | Bertolaccai's estimate |
| 1814 | 492,000 | ? | Census |
| 1821 | — | 257,000 | Census |
| 1827 | 595,000 | 295,000 | Census |

[1] Vide, *Population of India and Pakistan*, p. 235–36.

It would not be valid to assume this declining rate for the Kandian population in the same period, since the available evidence suggests that they suffered no famine, or at least to a lesser extent than the maritime provinces.    According to Bertolaccai, Kandy had a food surplus and exported rice to the low country except during the famine.[1]

In the circumstances it seems reasonable to assume the Kandian populations in 1809 and 1814 to be the same.

Finally, a figure for Kandy in 1789 may be inserted, consistent with the Kandian and maritime provinces experiencing the same growth rate from 1789 to 1809.[2]

The estimates of population obtained from these assumptions are shown in Table 5.

TABLE 5—ESTIMATED POPULATION OF CEYLON

| Year | Population of maritime provinces | Population of Kandy | Total |
|------|------|------|------|
| 1789 | 817 | 285 | 1,102 |
| 1809 | 700 | 244 | 944 |
| 1814 | 492 | 244 | 736 |
| 1821 | — | 257 | — |
| 1827 | 595 | 295 | 890 |

Between 1827 and 1871, the Blue Books provide the only estimates of population and, as mentioned above, these are little better than guesses.    While in the censuses the error is in general that of under-enumeration, the Blue Book estimates suffer both from under and over-statement.

## Correction of the Population Estimates for the Whole Island

The population figures obtained from the three sources, viz., the censuses, the Blue Books and from Table 5, are shown in Column (2) of Table 6 and Column (3) shows the percentage growth rates per year implied by these figures.

An examination of these rates shows that those for the periods 1809–1814, 1827–1837 and 1857–1871 deviate abnormally from the general trend.  The growth rate of − 4·408 during 1809–1814 may be attributed to the famine of this period, but no similar justification is seen for the other two rates.

The explanation probably derives from the fact that the populations shown for 1827 and 1871 were based on censuses and those for 1837 and 1857 on Blue Books. The end populations being based on different sources, and thus liable to different

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[1] Bertolaccai, Ibid, p. 64.

[2] The decline in the population from the most prosperous days of the ancient Sinhalese kings up to the beginning of the British period may be due to the destruction of the irrigation and drainage systems and epidemics of cholera, small-pox, and malaria, and there is no reason to believe that the Kandians escaped these disasters.

types of errors, the population increases calculated for these periods lack compensatory errors and are thus unduly inaccurate. It has therefore seemed better to disregard these rates and to replace them by the mean of the rates for the adjacent periods, and this has been done in Column (4).

The method of correcting the censuses for under-enumeration for the years 1871 to 1946 is fully discussed in another Chapter. The figures given there have been inserted in Column (5), and the growth rates implied, in Column (4).

Thus, having obtained the corrected growth rates in Column (4) for the whole period, and a set of corrected population figures in Column (5) for the census years from 1871 onwards, the remainder of Column (5) may be completed by working backwards using the rates of Column (4). The corrected population thus obtained are shown in Table 6.

TABLE 6—CORRECTED POPULATION OF CEYLON

| Year | Population (uncorrected for under-enumeration) ('000) | Growth rate per cent per year uncorrected population | Corrected growth rate per cent per year | Corrected population ('000) |
|------|------|------|------|------|
| (1) | (2) | (3) | (4) | (5) |
| 1789 | 1,102 | — | — | 1,788 |
| 1809 | 944 | −0·717 | −0·717 | 1,533 |
| 1814 | 736 | −4·408 | −4·408 | 1,195 |
| 1827 | 890 | +1·609 | +1·609 | 1,445 |
| 1837 | 1,256 | +4·112 | +1·999 | 1,734 |
| 1847 | 1,556 | +2·389 | +2·389 | 2,148 |
| 1857 | 1,728 | +1·105 | +1·105 | 2,385 |
| 1871 | 2,400 | +2·778 | +1·303 | 2,820 |
| 1881 | 2,760 | +1·500 | +0·794 | 3,044 |
| 1891 | 3,008 | +0·899 | +0·940 | 3,330 |
| 1901 | 3,566 | +1·855 | +2·105 | 4,031 |
| 1911 | 4,106 | +1·514 | +1·664 | 4,702 |
| 1921 | 4,499 | +0·957 | +1·280 | 5,304 |
| 1931 | 5,307 | +1·795 | +1·412 | 6,053 |
| 1946 | 6,657 | +1·696 | +1·173 | 7,122 |
| 1953* | 8,104 | +3·106 | +1·970 | 8,104 |

* The 1953 census figures are provisional.

# A METHOD OF CORRECTING CENSUSES FOR ERRORS OF ENUMERATION

## Introduction

IN general, censuses in backward countries suffer from a much greater degree of under-enumeration than those in more advanced countries. The reasons are many, including extensive illiteracy, difficulties of communication, the gulf between the government officials and the people, the general apathy and absence of co-operation, and the presence of numerous groups, often hostile to each other. In addition, the inferior position women generally occupy in such societies leads to a greater degree of under-enumeration of females as compared to males.[1] Moreover, in a primarily agricultural country where production is on a small scale with the use of simple primitive tools, the necessity for counting beyond a few score is rarely felt ; and in India and Ceylon vast numbers of peasants can hardly count beyond several score. In such a primitive economy the need for precision and accurate measurement is rarely felt and ages, for instance, tend to be given in an approximate form. It is important, therefore, before using them, to adjust the tabulated results of these censuses for errors of enumeration.

The methods that have been developed in the more advanced countries for checking and correcting errors of enumeration in censuses are rarely applicable to under-developed countries. In this Chapter the methodology of correcting the census results of under-developed countries is considered, and applied to the censuses of Ceylon : in this context correcting implying the reduction rather than the elimination of the errors present.

## Building a Model

The first step in the application of our method consists in formulating a certain *a priori* model of the population structure from a study of sources other than the censuses, that is of laying down a number of rules which should broadly be followed by the correct numbers in the various sex-age groups at the times of the various censuses. Vital records provide important indications of population structure, in spite of their incompleteness, for instance the long term trend in population growth that they show may be substantially correct. In the case of Ceylon, the following characteristics of the vital records are relevant.

### (1) BALANCE OF BIRTHS AND DEATHS

The vital records show generally an increase in the number of deaths and births from decade to decade, as shown in Table 1. The rate of increase for both births

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[1] "The number of both males and females were probably understated, and it is possible that the under statement of females was somewhat greater than that of males." *Turner* : Census of Ceylon, 1921, Vol. 1, Part II, p. 1.

and deaths increased slowly until the turn of the century, after which a sharp fall is shown by the deaths, whilst a far gentler decline is shown by the births. A gradual improvement in the completeness of registration could explain the rising part of the trends in the growth rate, but not the later fall. Since the growth rates of the deaths show in every case a greater fall than the growth rates of the births, a systematic natural increase in the population may be assumed. Judged from a purely arithmetic point of view, the difference between births and deaths shows a continuous increase, indicating the volume of natural increase of the population. This difference, however, is affected by the improvement in the registration machinery, and is not therefore an exact measure of the increase. But, in conjunction with the growth rates, it could be accepted as supporting evidence so far as the direction of the trend is concerned, and it is the direction of the trend with which we are at the moment concerned, and not with any quantitative measurement of it.

TABLE 1—BIRTHS AND DEATHS AND THEIR GROWTH RATE

| Decade | Births ('000) | Deaths ('000) | Percentage increase or decrease (−) over previous decade | |
|---|---|---|---|---|
| | | | Births | Deaths |
| 1871–1880 | 708 | 507 | — | — |
| 1881–1890 | 837 | 692 | 18·2 | 17·7 |
| 1891–1900 | 1,122 | 897 | 34·1 | 29·6 |
| 1901–1910 | 1,460 | 1,103 | 30·1 | 23·0 |
| 1911–1920 | 1,648 | 1,329 | 12·9 | 20·5 |
| 1921–1930 | 1,946 | 1,289 | 18·1 | −3·01 |
| 1931–1940 | 2,048 | 1,295 | 5·2 | 0·5 |

*Source :* Compiled from the Registrar-General's Annual Reports.

(2) RELATIVE INCREASE OF MALES AND FEMALES AND THE SEX RATIO

Further insight into the nature of natural increase is provided by considering birth and death registration separately for the two sexes. It is generally accepted that both birth and death under-registration in Ceylon declined after penalties for failure to register were introduced in 1893. Evidence to support this as far as births are concerned is provided by examining the ratio of registered female and male births, shown in Table 2.

It is found in many countries that under-registration of female births exceeds that of males, so that the sex ratio of registered births and under-registration are correlated, and, as the sex ratio steadies to its asymptotic limit, under-registration may be taken to have become small. Further, a correction may be applied to reduce

under-registration of females to that of males by replacing registered female births by the number required to reproduce the asymptotic sex ratio, in this case 0·966 female births per male.

TABLE 2—RATIO OF FEMALE BIRTHS TO MALE BIRTHS

| Period | Female births per male births |
|---|---|
| 1871–1880 | 0·89 |
| 1881–1890 | 0·92 |
| 1891–1900 | 0·93 |
| 1901–1910 | 0·95 |
| 1911–1920 | 0·96 |
| 1921–1930 | 0·964 |
| 1931–1940 | 0·965 |
| 1941–1950 | 0·966 |

This has been done in Table 3 which shows that the natural increase of males always exceeded that of females, except in the decade 1891–1900. No correction has been included for under-registration of deaths, which may be assumed to be greater in the case of females. The true excess of the male natural increase may therefore, in general, be taken to be greater than that shown in Table 3, and in particular the true natural increase for males in 1891–1900 may be taken to exceed that for females.

TABLE 3—NATURAL INCREASE OF MALES AND FEMALES

| | Males | | |
|---|---|---|---|
| Period | Births | Deaths | Increase |
| (1) | (2) | (3) | (4) |
| 1891–1900 | 580,054 | 459,809 | 120,245 |
| 1901–1910 | 747,718 | 563,351 | 184,367 |
| 1910–1920 | 841,693 | 670,185 | 171,508 |
| 1921–1930 | 991,838 | 651,707 | 340,131 |
| 1931–1940 | 1,043,719 | 643,963 | 399,756 |
| 1941–1950 | 1,308,619 | 591,835 | 716,784 |

| | Females | | | Excess of male increase over females |
|---|---|---|---|---|
| Period | Births | Deaths | Increase | |
| (1) | (5) | (6) | (7) | (8) |
| 1891–1900 | 560,721 | 436,746 | 123,975 | − 3,730 |
| 1901–1910 | 722,794 | 540,120 | 182,674 | + 1,693 |
| 1911–1920 | 813,637 | 658,475 | 155,162 | +16,346 |
| 1921–1930 | 958,780 | 640,365 | 318,415 | +21,716 |
| 1931–1940 | 1,008,932 | 641,571 | 367,361 | +32,395 |
| 1941–1950 | 1,265,042 | 556,410 | 708,632 | + 8,152 |

Note : Col. (4)=Col. (2)−Col. (3)    Col. (7)=Col. (5)−Col. (6)    Col. (8)=Col. (4)−Col. (7)

Source : Compiled from the Registrar-General's Annual Reports.

To this excess of males in the natural increase for a period of 50 years or more, has to be added the excess of males in the immigration balance. If every year's net addition has this large excess of males, then eventually the sex ratio in the stock must show an excess of males, whatever the sex composition of the original stock.[1]

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[1] All the censuses in Ceylon, without exception, show an excess of males over females. This phenomenon, so different from European experience, has rarely escaped mention in the census reports of Ceylon. Mr. J. B. Turner, one of the ablest of the census superintendents of Ceylon, investigated this question thoroughly by examining the sex-ratio of different races, both foreign and native, and of different localities. After examining a number of possible explanations, such as under-enumeration of females, higher female death rate, excess of male immigration over female immigration, and racial characteristics he rejected the last as unverifiable, and was more inclined to accept the second and the third. About the first he says, " The first explanation of the high excess of males, which would occur to one, is that the census of females contains a considerable error of under-statement due to careless enumeration or to unwillingness of the indigenous races to have their women enumerated. But in order to bring down the Ceylon masculinity to the figure of India (516 males per thousand population : Ceylon masculinity was 529 in 1921, N. S.), there would have to be an under-statement of about 120,000 females at the census of Ceylon, and it cannot be admitted that an error of this magnitude occurred even for both sexes. Further, on the assumption of under-statement of females, one would expect the proportion of males among the Mohammedans to have been very high say, higher than the Sinhalese, among whom the women are allowed more freedom. But this is not the case. It may also be noted that the masculinity of India is less than that of Ceylon, though there is every reason to believe that the females are enumerated in Ceylon at least as correctly as in India. It is, of course, true that in Ceylon male children are more valued than female, but it does, not appear that the high masculinity in Ceylon is, to any significant extent, due to faulty enumeration of females. " Census of Ceylon, 1921, Vol. 1, Part II, p. 3.

The number of males per thousand of the total population in the Ceylon censuses were as follows :—

| Year | Proportion | Year | Proportion |
|------|-----------|------|-----------|
| 1871 | 533 | 1911 | 530 |
| 1881 | 532 | 1921 | 529 |
| 1891 | 530 | 1946 | 531 |
| 1901 | 532 | | |

It is interesting to note that as early as 1849 Pridham observed the abnormal sex ratio of the Ceylon population. He comments, " The disparity in the number of the sexes exhibited by the returns is a curious phenomenon, and peculiar to Ceylon. It exists in the greatest degree among the Sinhalese, where the disproportion of females averages 12 per cent., but it is even observable in the case of the Malabar population in the northern province, where the disproportion averages 6 per cent. This disparity is greatest in the poorest parts of the country, and where the population is thinest and where it is most difficult to support life, and smallest where there is least want. In some of the villages on the coast where food is abundant, the number of females rather exceeds that of the males, hence there is reason to hope that the daily improvements in agriculture and incitements to industry now existing, will eventually modify, if not correct this discouraging circumstance altogether. " Charles Pridham—*An Historical, Political and Statistical Account of Ceylon and its Dependencies*, Vol. I, 1849, p. 451.

The Census Report of 1946 says " It seems evident that the great excess of males over females in the population of Ceylon is due to a preponderance of males at birth and to a higher female death rate throughout life, particularly after the first year. " *Census of Ceylon*, Vol. 1, Part 1, p. 144.

For a discussion on similar sex disparity in India see D. GHOSH : *Pressure of Population and Economic Efficiency in India*, New Delhi, 1946, pp. 6 ff, and *Census of India* Vol. 1 Part 1—A. 1953, p. 54*ff*.

## (3) THE BALANCE OF IMMIGRATION

Migration statistics, shown in the Registrar-General's Reports are less reliable and complete than those of births and deaths, but may to some extent be rectified by the wealth of descriptive material available. This material derives, in the main, from the papers of the various Immigration Commissions, the Labour Commission of 1908 and the Sanderson Commission Report of 1910.[1]

Economic development in Ceylon has been synonymous with the development of the plantation industry which, in the early stages, and to a large extent even now, depended on emigrant South Indian labour. The migration into (and out of) Ceylon has closely followed the fortunes of the plantation industry.

The broad features of the trends in the plantation industries and the consequent immigration movement are noted below :

1830–1879 :  Development of coffee plantations—immigration of Indian labour.

1880–1889 :  Collapse of coffee plantations—decrease in the inflow of South Indian labour.

1890–1930 :  Growth of tea plantations followed by rubber—heavy immigration.

1930–1942 :  Depression in plantation industries—heavy emigration.

1942–1944 :  Revival of plantation industries due to war demand—rise in employment and wages in plantations—Exodus of Indians from Ceylon after bombing of Colombo by the Japanese, resulting in a negative immigration balance in spite of rise in the demand for labour.

1945–1950 :  Post-war boom—heavy immigration in 1945. Restriction of immigration, introduction of passports and visa system.

Some of the other features of migration which are relevant to our purpose may be noted here :

(1) Of the recorded immigrants 90 per cent are from South India and 50 to 60 per cent are employed in estates as plantation labour. The rest are mostly non-estate labour, such as Colombo harbour workers, municipal workers or traders. The unrecorded immigration, which is believed to be large, is entirely from South India.

(2) The South Indian estate labour migration is peculiar in the sense that the labourers often bring their entire family to Ceylon. This is partly because they leave India only when conditions drive them to seek a living elsewhere ; partly because work is available in the estates of Ceylon, not only for the male members of the family, but also for the women and children.

Thus immigration into Ceylon is under economic pressure and, as soon as they can afford it, the labourers return to their village in India. Thus, out of the many

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[1] For a fuller discussion on immigration and references see Chapter 8.

3—J. N. B 59926 (10/56)

thousands who come to Ceylon every year, only a few settle there permanently.[1] During their stay in Ceylon, their one ambition is to save enough to redeem their mortgaged holdings, to buy a plot of land in their own village, or to start a small shop there. Saving, out of their small income is hard, and it takes some years to realise their ambition. The immigrants are thus concentrated in the younger age groups, while the emigrants tend to be older. The non-estate immigrants move more frequently between India and Ceylon ; many of them leaving their families behind in India.[2]

Thus there is an excess of males over females in the immigrating population, though to a less extent among the estate labourers than among the immigrants as a whole. For example, the statistics of immigration given by the 1938 Immigration Commission, show that the percentages of males, females and children of both sexes among the immigrants during 1933–35 were as follows : males, 81·9 per cent ; females, 8·4 per cent and children, 9·7 per cent. Among the estate labourers the percentages were : males, 58·9 per cent ; females 20·1 per cent and children, 21·0 per cent.

## Tests of Underenumeration in Censuses

Once we have obtained some general idea of the broad features of population growth from other sources, we can devise a number of simple tests to check for under-enumeration in the censuses. The tests that we have used are these :

### (1) Gro    ates test

(a) The percentage g owth rates should not be negative in any age group.

(b) The growth rate in any age group should not be excessively high or excessively low relative to the growth rates in the adjacent age groups in that census or to the growth rates in the same age groups in other censuses, except in the early working ages where heavy immigration may push up the rates.[3] If any such high rate occurs in any age group in any census, then it must be traceable in the following censuses as this generation grows older and moves through the censuses.

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[1] " Of the agricultural immigrants about 70 per cent. return to India, the remaining 30 per cent. remain in the Island. " Sanderson Committee Report, 1910, p. 24.

" We were told that about 40 per cent. of the immigrants remain in the Island and for the most part are quite content to reside on the estates as labourers with their families, and so continue for generations, being allowed land to keep any farm stock which they may buy from their savings. A small proportion, about 10 per cent. acquire small holdings ; others settle down as small shop keepers. The majority however, of those who amass any considerable sum return to India. " Sanderson Committee Report, 1910, p. 32.

[2] " It is found that only a small number among non-estate Indian immigrant workers, certainly less than 20 per cent. live a family life in Ceylon and then only when they have been in secure employment for a number of years. " The Report of the Committee on Immigration into Ceylon, 1938, p.8.

[3] The history of population growth in Ceylon differs in this respect from that of India. In India population growth shows a spasmodic change from census to census, mostly because of nation-wide famines and epidemic (*Cf. Population cf India and Pakistan* by KINGSLEY DAVIES, p. 27 ff.) Ceylon has been free from famine for at least the last hundred and twenty-five years, and there are records of only two nation-wide epidemics during the last hundred years, namely the influenza epidemic of 1919 and the malaria epidemic of 1935. The other malarial epidemics have been limited to certain localities only.

(c) The female growth rates should not differ excessively from the male rates because the sex ratio of births, deaths and migrants have undergone little change during the last eighty years.

If the growth rates show any marked deviation from these standards, not explained by migration or epidemics, then under-enumeration at one of the two censuses involved is suggested. If the female rates are excessively high relative to the male rates in the same age group it suggests that females were under-enumerated in the preceding census. On the other hand, a suspiciously low growth rate would suggest a relative female under-enumeration in the current census.

Another form of census error—mis-statement of age—may be recognised by abnormal, but complementary, growth rates in neighbouring age groups. In such cases a better estimate of the growth rate may be obtained by combining the offending age-groups.

### (2) *The sex-ratio test*

The two basic biological factors which determine the sex composition of a population are the relative excess of male births over female in general, and the greater power of survival of the female. In every country where records are available male births show an excess over female but, in the absence of external factors, the greater power of survival of the female would give them parity, and subsequently superiority, over the males in each generation.[1]

In practice, economic and social factors intervene, resulting either in an excess of females (e.g. England, France, Sweden and other European countries), or in an excess of males (e.g. Australia, Canada, Eire, Malay, India, Japan, Mauritius, Algeria, &c.). Amongst the more important factors involved may be mentioned migration, war, strenuous and hazardous occupations, the social attitude towards women, and the state of progress achieved in sanitation, public health, infant and maternity care. It will be observed that these forces generally become operative in the reproductive and the working ages, so that the deflection from the normal trend in the sex composition of a population occurs during these ages. Thus in almost all countries the ratio of females to males rises gradually till the age of 15 years. As is shown in Table 4, after this age the sex ratio[2] continues to rise in England and in other European countries, while in the second group of countries mentioned above, it declines until late old age is reached. Reasons for the rise in the sex ratio in England and Europe generally, are, in addition to the normal greater longevity of females, predominantly male emigration, war deaths and occupational mortality, coupled with improvement in maternal care and health services, leading to a decline in maternal mortality.

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[1] In most countries the females overtake the males at about adolescence. Even with the exremely low current mortality of England and Wales, in a life table population females would overtake males at some age between 50 and 60.

[2] It is usual to measure the sex ratio by the proportion of males per female, or by the proportion of males per thousand of total population. I have, however, defined it as a ratio of females to males, because in the case of Ceylon this ratio is generally less than 1, and is therefore more convenient to work with. Conversion from one definition which is used into another is easy and it matters little.

Reasons for the decline in the sex ratio in the second group of countries are :

(i) *Immigration.*—Australia, Canada and Malaya receive every year large numbers of immigrants with an excess of males.

(ii) *Excessive female mortality.*—In most of the countries in Asia and Africa females suffer excessive mortality from puerperal fever and other related causes. It may be mentioned that a decline in the sex-ratio at these age groups is shown in the early censuses of England and Wales, before measures were taken to reduce maternal mortality.

(iii) *Absence of hazardous occupations for men.*—As these countries are mostly agricultural, the males suffer from less stress and strain in their daily lives than do males of Western countries.

(iv) *Social attitude towards women.*—In Eastern countries the social values are such that women suffer from a greater degree of malnutrition and general neglect than males, tending to counteract the biological advantage of females.[1]

TABLE 4—SEX COMPOSITION (RATIO OF FEMALES TO MALES)

| Age Group | England and Wales | | | Canada 1941 | Australia 1933 | Malaya 1931 | Japan 1935 | India 1931 | Eire 1936 | Algeria Moslems 1936 | Mauritius 1931 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1851 | 1861 | 1947 | | | | | | | | |
| Less than 1 | 0·99 | 0·99 | 0·95 | 0·96 | 0·96 | 1·00 | 0·97 | 1·01 | 0·96 | 0·99 | 1·00 |
| 1–4 | | | | 0·97 | 0·96 | 0·98 | 0·98 | 1·04 | 0·96 | 0·83 } | 1·00 }<br>0·99 } |
| 5–9 | 0·99 | 1·00 | 0·96 | 0·98 | 0·96 | 0·95 | 0·98 | 0·91 | 0·98 | | |
| 10–14 | 0·98 | 0·99 | 0·97 | 0·98 | 0·97 | 0·97 | 0·99 | 0·88 | 0·97 | 0·79 | 0·97 |
| 15–19 | 1·01 | 1·02 | 0·98 | 0·96 | 0·98 | 0·93 | 0·98 | 1·00 | 0·94 | 0·85 | 0·98 |
| 20–24 | 1·09 | 1·13 | 1·00 | 0·99 | 0·96 | 0·69 | 1·00 | 1·03 | 0·89 | 0·82 } | 0·95 }<br>0·98 } |
| 25–29 | 1·10 | 1·14 | 1·02 | 0·98 | 0·94 | 0·51 | 0·96 | 0·95 | 0·91 | | |
| 30–34 | 1·06 | 1·10 | 1·01 | 0·95 | 0·95 | 0·42 | 0·95 | 0·90 | 0·95 | 0'93 } | 0·92 } |
| 35–39 | 1·04 | 1·07 | 1·01 | 0·92 | 1·03 | 0·46 | 0·94 | 0·82 | 0·98 | | |
| 40–44 | 1·04 | 1·06 | 1·02 | 0·94 | 0·98 | 0·47 | 0·93 | 0·87 | 0·82 | 0·92 } | 0·91 } |
| 45–49 | 1·03 | 1·05 | 1·07 | 0·91 | 0·95 | 0·47 | 0·96 | 0·86 | 0·94 | | |
| 50–54 | 1·05 | 1·06 | 1·19 | 0·88 | 0·95 | 0·56 | 1·01 | 0·89 | 0·94 | 0·84 } | 0·99 } |
| 55–59 | 1·06 | 1·05 | 1·20 | 0·84 | 0·98 | } | 1·05 | 0·94 | 0·91 | | |
| 60–64 | 1·14 | 1·12 | 1·20 | 0·86 | 0·99 | | 1·10 | 0·99 | 0·95 | | |
| 65–69 | 1·18 | 1·17 | 1·29 | 0·93 | 0·97 | 0·73 } | 1·20 | 0·97 | 0·88 | 1·03 | 1·26 |
| 70–74 | 1·20 | 1·23 | 1·33 | 0·95 | 0·97 | | 1·31 | 1·02 } | 1·10 | | |
| 75+ | 1·33 | 1·37 | 1·57 | 1·08 | 1·08 | | 1·63 | | 1·20 | | |

*Source* : Demographic Year Book : 1949, and Statistics Committee Report of the Royal Commission on Population, 1950, London.

[1] c.f. JOHN DEVY : *Interior of Ceylon* : 1821, p. 278.

The chance of survival for females relative to that for males is certainly less in Eastern than in Western countries, as is shown by Table 5 below.

### TABLE 5—RELATIVE DEATH-RATE OF FEMALES TO MALES

| Country | Ratio of females to males (a) | Ratio of female deaths to male deaths (1938–40) | Ratio of female death rate to male (b) |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| England and Wales | 1·115 | 0·95 | 0·85 |
| France | 1·19 | 0·93 | 0·78 |
| Japan | 1·01 | 0·93 | 0·92 |
| India | 0·94 | 0·91 | 0·97 |

Note.— (a) Sex ratio for 1941 in England and Wales and for 1931 in India : the rest are for 1940.

(b) Col. (4)=(Col. (3)÷Col. (2) )

=(the female death rate ÷ the male death rate).

Source : Compiled from the Demographic Year Book.

In all countries shown in Table 4, the sex ratio rises again in late old age, because the greater power of survival of the female reasserts itself once the socio-economic influences cease to operate. The rise in the sex ratio, however, is much greater in the Western countries than in the second group of countries, where the discrepancy in the sex ratio caused by a heavy female mortality and male immigration in the reproductive and working ages are not fully made good by greater male mortality in later age groups.

The economic and social history of Ceylon show that she falls in the second group of countries rather than the first. She is an immigrant-receiving agricultural country, and in this respect is similar to Canada, Australia and Malaya. Since the 1830s Ceylon has been receiving large numbers of immigrants ; in the early phases, predominantly males. Later, when transport developed and the rigours of the journey were eased, females also came into the country, but the proportion of males remained high throughout.

In public health, maternal care and sanitation, and in the social attitude towards women, Ceylon is more akin to the other Asian countries than to the West. All these factors lead to a greater female mortality relative to that of males than is observed in Western countries. Notwithstanding that the proportion of females in the population is higher in England and Wales than in Ceylon, the ratio of female to male death rate is higher at 0·98 in Ceylon than in England and Wales (0·85), showing that the relatively lower mortality of females over males holding in England and Wales is not present in Ceylon.

The lower standard in maternal care is shown by the higher proportion of deaths caused by childbirth, pregnancy and other puerperal causes, set out in Table 6.

TABLE 6—PROPORTION OF DEATHS DUE TO PUERPERAL CAUSES, 1939–1940

| Country | Proportion of female deaths caused by puerperal diseases to total deaths |
| --- | --- |
| | Per cent. |
| England and Wales | 0·7 |
| France | 0·4 |
| Ceylon | 4·0 |

*Source :* Compiled from Demographic Year Book.

In one important respect Ceylon differs from Canda, Australia and Malaya, in that most immigrants do not settle permanently, but return home on retirement or earlier.

The combined effect of these factors on the sex ratio of the population at each age may now be considered.

The sex ratio at birth shows a gradual rise over the last fifty years to an almost constant figure of 0·966 female births to male births, as shown in Table 2. In the main this rise may be attributed to an improvement in birth registration, and the true sex ratio at birth over the whole period could be taken as the final value. Secondly, Table 7 shows that in the first year of life, male deaths exceed female deaths. The sex ratio in the population of age under 1 year should therefore be at least 0·966 females per male.

Table 7 shows female deaths to be higher than male deaths in absolute numbers in all age groups between 1 and 34 years, only to a small extent in the age groups

TABLE 7—MALE AND FEMALE DEATHS

*(In thousands)*

| Age | 1891–1893 | | 1899–1901 | | 1909–1911 | | 1919–1921 | | 1929–1931 | | 1939–1941 | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | *Male* | *Female* | *Male* | *Female* | *Male* | *Female* | *Male* | *Female* | *Male* | *Female* | *Male* | *Female* |
| 0– | 25·3 | 23·6 | 38·4 | 34·3 | 48·0 | 44·1 | 52·9 | 47·9 | 55·6 | 48·5 | 50·7 | 44·5 |
| 1– | 5·5 | 5·8 | 7·1 | 7·9 | 9·0 | 9·9 | 11·9 | 13·0 | 11·1 | 12·2 | 8·7 | 9·8 |
| 2– | 6·0 | 6·9 | 7·2 | 8·3 | 8·0 | 9·8 | 11·4 | 13·0 | 9·8 | 11·1 | 7·5 | 9·1 |
| 3– | 6·2 | 7·2 | 7·0 | 8·3 | 7·6 | 9·2 | 10·4 | 12·1 | 7·9 | 9·0 | 5·9 | 6·9 |
| 4– | 4·2 | 4·5 | 4·6 | 5·0 | 5·1 | 5·8 | 7·0 | 7·6 | 4·7 | 5·4 | 3·5 | 4·3 |
| 5– | 10·6 | 10·6 | 9·8 | 10·7 | 12·1 | 13·3 | 12·7 | 13·7 | 8·6 | 9·6 | 7·3 | 8·3 |
| 10– | 6·1 | 4·8 | 6·3 | 5·2 | 6·8 | 7·0 | 6·7 | 6·5 | 4·1 | 4·3 | 4·0 | 4·1 |
| 15– | 5·3 | 4·6 | 5·5 | 4·6 | 6·2 | 5·6 | 6·6 | 7·1 | 4·6 | 5·6 | 3·5 | 5·2 |
| 20– | 5·3 | 6·5 | 5·6 | 7·5 | 7·1 | 9·3 | 8·5 | 11·5 | 6·4 | 10·3 | 5·9 | 8·7 |
| 25– | 13·1 | 14·1 | 13·0 | 15·9 | 15·9 | 20·4 | 18·4 | 23·0 | 13·9 | 19·7 | 12·4 | 16·6 |
| 36– | 12·5 | 12·7 | 12·8 | 10·5 | 15·9 | 13·5 | 18·9 | 15·3 | 14·1 | 12·6 | 13·7 | 12·5 |
| 45– | 13·8 | 8·1 | 11·1 | 8·4 | 14·3 | 10·4 | 16·0 | 11·3 | 12·6 | 9·7 | 14·2 | 9·6 |
| 55– | 8·2 | 7·9 | 10·4 | 7·8 | 12·4 | 9·8 | 14·3 | 10·4 | | | 14·7 | 10·0 |
| 65+ | 14·2 | 12·1 | 15·6 | 14·2 | 20·3 | 18·7 | 26·3 | 23·3 | 27·8 | 26·0 | 31·7 | 28·2 |
| Total | 136·2 | 129·4 | 154·4 | 148·6 | 188·7 | 186·8 | 222·0 | 215·7 | 181·2 | 184·0 | 183·7 | 177·8 |

1–14 years, but to a greater extent in the age groups 15–34 years. If lower female mortality rates than those of males, or even equal rates, are assumed, the proportion of females to males in the base population would be far higher than in any other country. This is inconceivable in view of the predominantly male immigration, to which reference has already been made.

It follows that, at these ages, female mortality exceeds that of males in Ceylon, although this is not in accordance with the basic biological tendency for a greater power of survival of the female. However, it has already been shown that the impact of socio-economic factors may neutralise the biological factors. All the external evidence and the need for internal consistency, therefore, suggest that the socio-economic factors in Ceylon have inflated female mortality, especially in the reproductive age groups. Coupled with this, the heavy immigration of an excessive number of males of working age since the last century lead to the conclusion that the sex ratio may be expected to fall during this age period.

Table 4 further shows that in most countries the sex ratio rises in the retiring ages and in late old age. The rise, however, is by no means equal in all countries. In Western countries the rise is rapid and leads ultimately to a substantial excess of females while in the second group of countries, females rarely exceed the males until about 75 years of age. The ratio of female deaths to male deaths at 75 years and over exceeds unity in most countries of the world. In Ceylon it exceeds unity at about 85 years, which suggests that at about this age females first exceed the males in the population.

In the census tabulations, the age group over 65 are shown as a whole, but the number over age 85 are likely to be negligible compared with the rest of the group.

The group as a whole will therefore contain a mojority of males.

The conclusions reached regarding the sex ratios (that is proportion of females to males) to be expected in the population at various ages may therefore be summarised as follows :—

> (i) *Under* 1 *year of age*

The sex ratio should be at least 0·966.

> (ii) 1–14 *years of age*

No definite conclusion can be reached on the trend of the sex ratio at these ages. The predominantly male immigration and higher female mortality may be expected

to lower the sex ratio, but doubt arises since neither factor operates very strongly at these ages.

### (iii) 15–44 *years of age*

A sharp decline in the sex ratio may be expected from the predominantly male immigration and higher female mortality which operate strongly at these ages.

### (iv) 45 *years of age and above*

After age 45 the predominantly male immigration continues for 5 or 10 years, but at a declining tempo, subsequently giving way to predominantly male emigration. A decline is also registered in the excess of female mortality relative to male.   Thus, in the first place the sharp rise in the sex ratio shown at the earlier ages gives way to a gentler rise.   At some stage the forces favouring the female take charge, and the sex ratio starts to recover, but it cannot be foreseen at what stage the sex ratio will rise, and by how much.

Examination of the sex ratio, thus provides a test for detecting and correcting under-enumeration in censuses.   The sex ratio should not be less than 0·966 in the first year of age and should show a declining trend in the 15–44 age groups.   In the age groups 1–14 years and 45 years +, the trend in the sex ratio is less definite, but some continuity may be expected.   If the sex ratios are calculated for each age group from the tabulated Census populations, then in every age group a row-wise or coloumn-wise discontinuity in the sex ratio is suspect.

### (3) *Comparison with Estimated Population*

Estimates were made for each of the age groups and by sex for the years 1901, 1911, 1921 and 1946 by using the inflow-outflow concept.   For the age groups 0–9 years, the estimates were made by deducting the appropriate number of deaths, using various separation factors, from the corrected number of births.   For the other age groups, the deaths were calculated in a similar way and were deducted from the preceding census figure on the generation diagonal.   Details of the procedure will be found in the appendices to this Chapter.   The value of these estimates, suffering as they do from errors in the vital statistics on which they are based, and from the omission of any allowance for immigration, lies in their being additional and independent

evidence on which to judge the tabulated census figures.   The method of using them as a test for under-enumeration is illustrated below on page 40 and the following.

## (4) *Comparison of Generation Movement*

The fourth test used consists of tracing each generation as it passes through each of the censuses.

If we select a particular generation, aged $x$ in a census year $t$, with a population of $n$, then in the following census, ten years later, this generation would be of age $x + 10$ years, and the number in it, $n'$, should generally be less than $n$, unless replenished by an excess of immigation balance.

The ratio $r = \dfrac{n-n'}{n}$ is a measure of the rate of exit from the generation by death and net emigration.   We will call this ratio $r$ the *exit rate*.   Table 8 gives the exit rates of the generations so far as they are traceable in the censuses from 1881.   In this table the columns show the exit rate of a generation as it grows older from census to census.   The rows show the exit rates of different generations but at the same census date.   The diagonals, reading along the links and from top to bottom, show the exit rate of a given age group at different census dates.

The exit rates must decline as the generation passes from infancy to youth, because of the decline from infant mortality to that of childhood, and, to some extent, the improvement in the environmental factors from census to census.   Subsequently the positive immigration balance in the working ages will become an outstanding factor in continuing the process.   With advancing age, the generation will decline at an increasing rate through both death and emigration.   Thus a complete curve of exit rates from birth to old age should be $U$-shaped, and the exit rates of generations traceable for only part of their lives will follow the appropriate part of the $U$ only.

Studied row-wise, the exit rates should form a similar pattern, i.e. declining from childhood to youth and rising from youth to old age.

Studied diagonally from top to bottom along the links, the exit rates generally should decline, due to improvement in mortality and environment over the census years.

An exit rate which shows either too high or too low a value relative to the three directional trends mentioned above would require explanation.   In addition, the male and the female rate should not differ excessively from each other.

## TABLE 8A—EXIT RATES (PER CENT PER YEAR) CENSUS MALES

| Year | | | | | Age in Years | | | | | |
|------|---|---|---|---|------|------|------|------|------|------|
| | | | | | 0–4 | 10–14 | 20–24 | 30–34 | 40–44 | 50–54 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| 1891 (1) | — | — | — | — | 3·362 | 0·915 | 2·592 | 3·421 | 3·545 | 4·106 |
| 1901 (2) | — | — | — | 2·707 | 0·785 | 1·501 | 3·014 | 2·493 | 2·053 | — |
| 1911 (3) | — | — | 1·740 | 0·385 | 0·952 | 1·358 | 0·451 | 8·723 | — | — |
| 1921 (4) | — | 0·533 | 1·841 | 1·015 | 2·912 | 3·192 | 2·448 | — | — | — |
| 1946 (5) | 0·258 | 0·483 | ·688 | 1·825 | — | — | — | — | — | — |

*Continued*

| Year | | | | | Age in Years | | | | | |
|------|---|---|---|---|------|------|------|------|------|------|
| | | | | | 5–9 | 15–19 | 25–29 | 35–39 | 45–49 | |
| (1) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) | |
| 1891 (6) | — | — | — | — | 3·804 | 1·549 | 2·849 | 3·862 | 0·880 | |
| 1901 (7) | — | — | — | 2·724 | 3·788 | 1·872 | 3·396 | 1·008 | — | |
| 1911 (8) | — | — | 3·256 | 1·526 | 2·235 | 3·217 | 2·462 | — | — | |
| 1921 (9) | — | 2·580 | 2·314 | 1·596 | 3·197 | 3·108 | — | — | — | |
| 1946 (10) | 0·638 | 0·598 | 2·09 | 2·36 | — | — | — | — | — | |

## TABLE 8A—EXIT RATES (PER CENT PER YEAR) CENSUS MALES

## TABLE 8B—EXIT RATES (PER CENT. PER YEAR) CENSUS FEMALES

| Year | | | | | Age in Years | | | | | |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | | | | | 0–4 | 10–14 | 20–24 | 30–34 | 40–44 | 50–54 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| 1891 (1) | — | — | — | — | 4·332 | 1·276 | 4·986 | 2·801 | 2·543 | 5·519 |
| 1901 (2) | — | — | — | 3·771 | 2·484 | 4·025 | 2·608 | 2·634 | 2·360 | — |
| 1911 (3) | — | — | 2·397 | 2·085 | 1·990 | 2·779 | 4·406 | 3·235 | — | — |
| 1921 (4) | — | 1·293 | 0·665 | 2·285 | 2·837 | 1·803 | 4·449 | — | — | — |
| 1946 (5) | 0·568 | 0·785 | 1·525 | 2·181 | — | — | — | — | — | — |

*Continued*

| Year | | | | | Age in Years | | | | |
|------|------|------|------|------|------|------|------|------|------|
| | | | | | 5–9 | 15–19 | 25–29 | 35–39 | 45–49 |
| (1) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) |
| 1891 (6) | — | — | — | — | 1·34 | 1·22 | 3·10 | 1·68 | 3·44 |
| 1901 (7) | — | — | — | 5·25 | 0·04 | 2·96 | 1·88 | 3·71 | — |
| 1911 (8) | — | — | 2·97 | 0·80 | 3·98 | 3·98 | 5·55 | — | — |
| 1921 (9) | — | 2·76 | 1·93 | 3·51 | 2·84 | 4·11 | — | — | — |
| 1946 (10) | 1·11 | 1·19 | 2·19 | 2·07 | — | — | — | — | — |

### (5) *Estimate of Immigration Balance*

Our fifth test consists in estimating the intercensal migration balance of each generation from the terminal census populations and the deaths registered at the appropriate ages. The number of deaths in a generation during its intercensal movement is calculated in connection with the computation of the population estimates. The difference in the numbers of a generation at two successive censuses in the notation of section (4) above (i.e. $n - n'$), that is "exits", is due to deaths and emigration balance. In symbols :

$$R = D + (E - I)$$

where $R$ stands for exits, $D$ for deaths, $E$ for emigration and $I$ for immigration.

Hence,

$$I - E = D - R$$

Thus the immigration balance is obtained by subtracting the exits from deaths. This estimated immigration balance should conform broadly to our model, and should give positive values in the working ages and negative values in the later part of life. In view of errors in the migration statistics and under-reporting of deaths, close resemblance between the estimated and the recorded numbers must not be expected. The general pattern, however, must conform to our model.

### (6) *Estimating the Population for the First five Years of Life from Life Tables*

For the ages under 5 years an additional test has been applied by using life tables. Births are estimated by the life table reversal method and the estimated and observed births are compared. The $l_x$ column of the life table is based on census populations. Since these suffer from a degree of under-enumeration, the death rates derived from them are over-estimated and the $l_x$ values are under-estimated. It can be shown that this under-estimation in $l_x$ only partly offsets the under-estimation of births caused by the under-enumeration of the population.[1] Wherever the estimated births fall short of the observed births, corrected for under-registration, an estimate of the population can be obtained by multiplying the census population by the ratio of observed to estimated births. A fuller description of the method is given in Appendix B(1).

### The iterating process of correction

The quantitative correction process consists in finding, by trial and error, a suitable number that will satisfy all the tests. There will not be a unique solution to these five constraints, which are themselves of a qualitative nature. All we can do is to

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[1] See Appendix B(2)

select, from the possible values, an arbitrary number satisfying the conditions of our model. It may be noted, however, that the range of possible values is considerably reduced by the five constraints.

The estimated population can generally be expected to fall short of the true population because of under-registration of births and under-enumeration of the preceding census base. Under-registration of deaths would, of course, inflate the estimates, but the under-registration of births may be assumed to be greater than that of deaths.[1] Hence, wherever the estimated population is higher than the census population we may generally take the estimated population as our lower limit in the correction process. In all other cases we take the census population as the lower limit. The upper limit is generally determined by the population in the next lower age group, except when there is reason to believe that there has been heavy immigration into an age group. Within these two limits we have to choose a number that will satisfy the growth rates, the sex ratio, the exit rate and the immigration balance tests.

The actual procedure is illustrated below by taking two examples. It should be mentioned that the checks are not all independent. We have three independent sources of information, namely, the censuses, birth and death registrations and the general outline of the immigration and emigration pattern. In every test we use one or more of these three sets of information, hence the tests can at best be regarded as semi-independent. All that the correction process attempts is to remove inconsistencies and build up a systematic model standing on these three corner-stones. To a large extent the process involves empirical decisions, and therefore, like all empirical processes, requires an intimate knowledge of the situation, much of which cannot be expressed numerically.

The results obtained by this iterative process are shown in Tables 21–28. It will be noticed that the corrected figures agree much more satisfactorily with our model, than do the census figures. We can, therefore, regard the corrected figures as more satisfactory in the sense that they present a more consistent picture than the raw census data.

In conclusion, two features of the earlier censuses may be mentioned because of their unusual nature. The first is the case of over-enumeration of children in the age group 0–1 and 1–2 years in the censuses of 1881, 1891 and 1901. Even a casual glance at the population figures in these age groups reveals the absurdity of such large numbers. Probably the reason for such over-enumeration was that the number of children born during the preceding 12 months was entered on the census schedules, instead of the number of the children still alive. In a country where census operations were comparatively new, and the enumerators were as ignorant as the

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[1] "The registration of deaths though less neglected than of births, left much to be desired in regard to both accuracy and completeness". *Census of Ceylon*, 1901, Vol. 1, p. 216.

enumerated, such mistakes in the census returns are not an impossibility.* By 1911 this error was rectified.

The second notable error in the earlier censuses was the under-enumeration of males in the age groups 15–19 years. The males in this age group are particularly liable to be omitted, because at this age many young people leave their homes in search of work. They are too young to have a home of their own where they could be traced by the enumerators. For a similar reason greater under-enumeration occurs in the age groups which receive immigrants in large numbers. The immigrants take some time to settle down, to start a home of their own, and to become known to the enumerators.

## Illustration of the correcting process

The actual method used to correct the censuses for under-enumeration may be illustrated by two concrete examples. The first example will be of the age groups under 5 years, of say, 1921, and the second of a higher age group, 25–34 years of 1946, both of which belong to the same generation.

EXAMPLE 1

The data needed are the following :

(1) The census figures of 1921 and 1946 for the age groups under 5 years.

(2) The corrected figures for the same age group for the year 1946. We will assume that the 1946 figures for this age group have already been corrected by

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\* The number in the two age groups in the 1901 census, for example are :—

| Age | ('000) | |
| --- | --- | --- |
| | Males | Females |
| 0–1 | 99 | 94 |
| 1–2 | 61 | 58 |
| Total | 160 | 152 |

The very large numbers in the age group 0–1 is partly due to mis-statement of age. Even so, the numbers in the two groups taken together seem excessive. The suggestion that this over-enumeration resulted from children born being returned, and not children alive, becomes plausible when we compare these numbers with the relevant number of births registered in the two preceding years, namely 138,000 males and 130,000 females, and allow for under-registration of births in the early years.

applying methods about to be described. These basic data are given in Table 9 below.

### TABLE 9—POPULATION OF AGE 0–4 YEARS

| | Males | | (´000) | Females | | |
|---|---|---|---|---|---|---|
| Age | 1921 Census | 1946 Census | 1946 Corrected | 1921 Census | 1946 Census | 1946 Corrected |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 0 | 61 | 81 | 105 | 59 | 79 | 103 |
| 1 | 55 | 85 | 102 | 53 | 82 | 99 |
| 2 | 70 | 86 | 98 | 68 | 84 | 96 |
| 3 | 74 | 96 | 103 | 70 | 94 | 99 |
| 4 | 68 | 89 | 90 | 64 | 85 | 86 |
| | 328 | 437 | 498 | 314 | 424 | 483 |

*Note.*—Cols. (2), (3), (5) and (6) are obtained from the Census Reports.

Cols. (4) and (7) are obtained by applying the growth rate test, the sex ratio test and comparing the census figures with the estimated figures.

(3) From Table 9 the growth rates and sex ratios, given in Table 10, are calculated.

### TABLE 10—GROWTH RATES AND SEX RATIOS

| | Growth Rates (Per cent per year) | | | | |
|---|---|---|---|---|---|
| | Males | | Females | | |
| Age | 1921–1946 Both Censuses | 1921–1946 (1921 Census & 1946 Corrected) | 1921–1946 Both Censuses | 1921–1946 (1921 Census & 1946 Corrected) | Sex Ratio 1921 Census |
| 0 | 1·31 | 2·89 | 1·36 | 2·98 | ·98 |
| 1 | 2·18 | 3·41 | 2·19 | 3·47 | ·95 |
| 2 | 0·91 | 1·60 | 0·94 | 1·65 | ·97 |
| 3 | 1·19 | 1·57 | 1·37 | 1·66 | ·95 |
| 4 | 1·23 | 1·29 | 1·31 | 1·38 | ·94 |

(4) Estimated populations at each age are also required. The first set of estimates is obtained by deducting the deaths from births and making some allowance for

migration, as explained in Appendix A. The second set is obtained by a life table reversal method, explained in Appendix B (1). Such estimates are shown in Table 11.

TABLE 11—CENSUS AND ESTIMATED POPULATION, 1921

| | | Males | ('000) | | Females | |
| | | | | | | |
| Age | Census | Estimated by deducting deaths from births | Estimated by life table reversal method | Census | Estimated by deducting deaths from births | Estimated by life table reversal method |
|---|---|---|---|---|---|---|
| 0 | 61 | 72 | 74 | 59 | 68 | 72 |
| 1 | 55 | 62 | 65 | 53 | 60 | 63 |
| 2 | 70 | 69 | .. | 68 | 67 | .. |
| 3 | 74 | 68 | .. | 70 | 64 | .. |
| 4 | 68 | 63 | .. | 64 | 57 | .. |

Consider now the age group 0–1 year. The census figures of 61,000 males and 59,000 females are lower than the estimated figures of 72,000 males and 68,000 females.

If we assume that the under-registration of births is greater than the under-registration of deaths, then the figures given by the balancing equation, being higher than the census figures, could be taken as the lower limit of the true population. If $P_m$ and $P_f$ be the true number of males and females respectively, then,

$$P_m \geq 72[1]$$
$$P_f \geq 68$$

Now consider the growth rates given in Table 10. The growth rate test lays down that no growth rate should show an excessively high value compared with the growth rates in the adjacent age groups. Applying this standard, we may suspect the high growth rate of 2·89 for males and 2·98 for females shown by the 1946 corrected figures in relation to the 1921 census figures.

The 1946 figures have already been corrected. This high growth rate must, therefore, be attributed to the under-enumeration of the 1921 census. Applying the various growth rates observed in the adjacent age groups on the 1946 corrected figures, we can obtain a third set of estimates of the population under the age of 5 years. These estimates are shown in Table 12.

TABLE 12—ESTIMATED POPULATION OF AGE 0–1 YEAR BASED ON VARIOUS ASSUMED GROWTH RATES DURING 1921–1946

| | Male | Female | Sex Ratio |
|---|---|---|---|
| Assumed growth rate of : | | | |
| (a) 2–3 years male growth rate for males i.e. 1·60, and female rate for females i.e. 1·65 per cent per year : 1921 census and 1946 corrected basis | 75 | 73 | ·97 |

[1] Henceforth all numbers will be written in thousands.

TABLE 12—ESTIMATED POPULATION OF AGE 0–1 YEAR BASED ON VARIOUS ASSUMED GROWTH RATES DURING 1921–46—(contd.)

| Assumed growth rate of : | Male | Female | Sex Ratio |
|---|---|---|---|
| (b) 2–3 years male growth rate both for males and females i.e. 1·60 per cent per year : 1921 census and 1946 corrected basis | 75 | 74 | ·98 |
| (c) 3–4 years male growth rate for males i.e. 1·57, and female rate for females i.e. 1·66 : 1921 census and 1946 corrected basis | 78 | 72 | ·92 |
| (d) 3–4 years male rate for males and females both : 1921 census and 1946 corrected basis | 78 | 76 | ·98 |
| (e) 0–1 years based on 1921 and 1946 census figures. The male rate for males i.e. 1·31, and the female rate for females i.e. 1·36 per cent per year. | 79 | 77 | ·98 |
| (f) 0–1 year growth rate based on 1921 and 1946 census figures for males only i.e. 1·31 both for males and females | 79 | 78 | ·99 |

The estimates obtained by the balancing equation, that is, by subtracting deaths from births, and also by the life table reversal method may be mentioned here for comparison. They are :

(g) Balancing equation estimate :

|  |  |
|---|---|
| Males | 72 |
| Females | 68 |
| Sex ratio | ·94 |
| Growth rates— |  |
| Males | 1·46 per cent per year. |
| Females | 1·51 per cent per year. |

(h) Life table reversal method :

|  |  |
|---|---|
| Males | 74 |
| Females | 72 |
| Sex ratio | ·97 |
| Growth rates— |  |
| Males | 1·46 per cent per year |
| Females | 1·43 per cent per year |

All these estimates satisfy the conditions arrived at earlier, namely that $P_m \geq 72$ and $P_f \geq 68$. The lowest values given by them are 72 for males and 68 for females ; the highest are 79 for males and 78 for females, which we may accept as the upper limits of our estimate. If the true value is assumed to be still higher, then it becomes difficult to explain the sudden drop in the next higher age group, unless we assume an abnormally large number of deaths under one year of age in the previous year, or a large number of births in the current year. The recorded evidence of the vital statistics does not show any such variation, nor is it reasonable to suppose that the error in the registered births or deaths could be substantially different in one year from the next.

4—J. N. B 59926 (10/56)

We can, therefore, deduce the following limits :

$$79 \geq P_m \geq 72 \quad \text{...............................} \quad (1)$$

$$78 \geq P_f \geq 68 \quad \text{...............................} \quad (2)$$

and

$$\frac{P_f}{P_m} \geq 0.97 \quad \text{.......................................} \quad (3)$$

Let us now impose the condition that the sex ratio in this age group must not exceed the limit of 1. This condition is not altogether arbitrary, as Table 5 shows that the sex ratio rarely exceeds the limit of 1 in this age group. Estimates based on the births and deaths registered also give a lower sex ratio, as shown in Table 11. We then get the following limits :

$$1 \geq P_f / P_m \geq 0.97 \quad \text{...............................} \quad (4)$$

Assuming the sex ratio to be $\cdot 97$, relation (1) gives us a new set of limits for the females,

$$77 \geq P_f \geq 70 \quad \text{......................................} \quad (5a)$$

Assuming the sex ratio to be 1, relation (1) gives us the limits :

$$79 \geq P_f \geq 72 \quad \text{......................................} \quad (5b)$$

Conditions (5a) and (5b) have to be combined to satisfy the condition (4). We, thus, get the female limits :

$$79 \geq P_f \geq 70 \quad \text{......................................} \quad (5)$$

Combining (2) and (5), we get :

$$78 \geq P_f \geq 70 \quad \text{......................................} \quad (6)$$

A similar combination of the conditions (4) and (6) does not lead to any narrowing of the male limits (1). We are therefore left with

$$79 \geq P_m \geq 72 \text{ from (1)}$$

and $78 \geq P_f \geq 70$ from (6)

It should be noted, however, that for any particular value of $P_f$ within the range (6), $P_m$ is not free to cover the whole range of (1), but is restricted by (4) to that part of the range (1) which satisfies $P_f \div 0.97 \geq P_m \geq P_f$.

Alternatively, for any particular value of $P_m$, $P_f$ is restricted to that part of the range of (6) which satisfies $P_m \geq P_f \geq 0.97 \, P_m$.

In the absence of any information apart from (1), (4) and (6), it would be in accordance with accepted statistical practice to select the pair of values for $P_m$ and $P_f$ which minimise the likely error. This would lead to the selection of values for $P_m$ and $P_f$ not far from the mid points of the ranges of (1) and (6). However,

a lower value than the mean would be preferable, say 74 and 72 for $P_m$ and $P_f$, because of the various more or less independent estimates produced, the majority tend to the lower end of the range rather than the upper.

In some cases further improvement of the result may be obtained by comparing the growth rates and the sex ratios of the age groups with the growth rates and sex ratios of the 1911 census figures and then with the 1911 corrected figures.

### Age group 1–2 years

Having selected 74 and 72 thousand as the male and female populations respectively under age one, these may be regarded as the upper limits of the age group 1–2 years, subject to an examination of the birth, death and migration records which might indicate that a still higher limit should be set. In practice, no special examination of the birth, death and migration records is necessary. If it is necessary to raise the upper limit, this will be shown by the estimates based on the balancing equation for age 1–2 proving higher than that for age under 1. In the absence of such evidence, the true male population, $P_m$, and female population, $P_f$, must satisfy the constraints :

$$P_m < 74$$
$$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (1)$$
$$P_f < 72$$

In the next age group, i. e. 2–3 years, 70,000 males and 68,000 females were enumerated. The balancing equation gives an estimate of 69,000 males and 67,000 females for age 2–3 years. We can say, therefore, that the population in the age group 1–2 years should be greater than the census population in the age group 2–3 years, i.e.

$$P_m > 70$$
$$P_f > 68$$

Thus we get the two limits,

$$74 > P_m > 70$$
$$\cdots\cdots\cdots\cdots\cdots\cdots\cdots (2)$$
$$72 > P_f > 68$$

Assuming $P_m$ successively equal to 71, 72 and 73, the following growth rates are obtained for the period 1921–1946 :

| $P_m$ | Growth Rates 1921–1946 (Corrected) |
|---|---|
| 71 | 1·76 per cent. per year |
| 72 | 1·66 ,, |
| 73 | 1·60 ,, |

The growth rate for the corrected males in the age group 0–1 year is 1·68 per cent. per year, suggesting 72,000 as the corrected number for age 1–2 years.

To obtain the appropriate number of females, we apply the earlier deduction that the sex ratio in this age group should not differ greatly from that of age 0–1 year. Assuming the sex ratio to be successively ·95, ·96, ·97, ·98 and· 99, we get,

| Assumed Sex Ratio | $P_f$ |
|---|---|
| ·95 | 68 |
| ·96 | 69 |
| ·97 | 70 |
| ·98 | 71 |
| ·99 | 71 |

The corrected number for 1946 in this age group is 99,000, hence the corresponding growth rates are :

| $P_f$ | Growth Rate |
|---|---|
| 68 | 1·84 per cent per year |
| 69 | 1·78    do. |
| 70 | 1·64    do. |
| 71 | 1·56    do. |

The male growth rate is 1·68.   The nearest female growth rate is 1·64 corresponding to 70,000 for $P_f$, which may therefore be accepted as the number of females in the age group 1–2 years in 1921.

### Age groups 2–3, 3–4 and 4–5 years

The census numbers in these age groups are higher than the estimates.  The growth rates and the sex ratio of the census population are more or less consistent with our population model and do not show any outstanding discrepancy.  The numbers in the age group 3–4 years are higher than the population in the preceding lower age group ;  but this is justified by the births and deaths of this generation relative to the succeeding generations, shown by the similarly high figure obtained by the balancing equation estimate.  We can, therefore, accept the census figures as correct. Thus the corrected figures for ages under 5 years are as follows :—

TABLE 13—CORRECTED AND CENSUS POPULATION, 1921

| Age | Males | | Females | |
|---|---|---|---|---|
| | (’000) | | | |
| | Census | Corrected | Census | Corrected |
| 0– | 61 | 74 | 59 | 72 |
| 1– | 55 | 72 | 53 | 70 |
| 2– | 70 | 70 | 68 | 68 |
| 3– | 74 | 74 | 70 | 70 |
| 4– | 68 | 68 | 64 | 64 |
| | 328 | 358 | 314 | 344 |

*Age group 5–9 years*

To illustrate the next example, the corrected population in this age group is required. Obtained by following the same procedure as previously, they are :—

|  | *Census* | *Corrected* |
|---|---|---|
| Males | 293 | 309 |
| Females | 282 | 300 |

EXAMPLE 2

*Age group 25–34 years*

We have shown in the previous section the method applied to obtain the corrected population of age 0–4 years in 1921. By following a similar method the corrected population for the age group 5–9 years can also be obtained. These two age groups attain the age of 25–34 years in 1946. We will now illustrate the method more fully with this generation.

The following data are required :

(1) The 1946 census male and female population, aged 25–34.

(2) The corrected population of age 0–9 years in 1921.

(3) The corrected population aged 15–24 in 1946, assumed to have been obtained already by following the procedure illustrated in the previous section.

(4) The estimated population aged 15–24 in 1946, obtained by deducting the deaths which occur to the generation age 0–9 years in 1921, in the intercensal period of 25 years from 1921 to 1946.

These data are in Tables 14 and 15.

TABLE 14—POPULATION OF AGE 15–44, 1946 AND 1921

| | ('000) | | | | | | | |
| | 1946 | | | | | | 1921 Census | |
| | Males | | | Females | | | Males | Females |
| Age | Census | Estimated | Corrected | Census | Estimated | Corrected | | |
|---|---|---|---|---|---|---|---|---|
| 15– | 364 | 370 | 399 | 316 | 338 | 371 | 214 | 199 |
| 20– | 328 | 318 | 367 | 314 | 276 | 331 | 221 | 220 |
| 15–24 | 692 | 688 | 766 | 630 | 614 | 702 | 435 | 419 |
| 25–34 | 554 | 550 | ? | 473 | 470 | ? | 393 | 352 |
| 35–44 | 443 | .. | .. | 347 | .. | .. | 291 | 223 |

## TABLE 15—CENSUS AND CORRECTED POPULATION, 0–9 YEARS OF AGE, 1921

| | | | ('000) | | |
|---|---|---|---|---|---|
| Age | | Males | | Females | |
| | Census | Corrected | | Census | Corrected |
| 0–4 | 328 | 358 | | 314 | 344 |
| 5–9 | 293 | 309 | | 282 | 300 |
| Total | 621 | 667 | | 596 | 644 |

(5) The growth rates and sex ratios, calculated from the data of Tables 14 and 15, are given in Table 16.

## TABLE 16—ANNUAL PERCENTAGE GROWTH RATES AND SEX RATIOS

| | Growth Rates | | | | Sex ratio | |
|---|---|---|---|---|---|---|
| | 1921–1946 | | 1921–1946 Census and | | Census Corrected | |
| Age | Census Basis | | Corrected Basis | | | |
| | Male | Female | Male | Female | | |
| 15– | 2·80 | 2·35 | 3·44 | 3·46 | ·87 | ·93 |
| 20– | 1·94 | 1·71 | 2·64 | 2·02 | ·96 | ·93 |
| 15–24 | 2·36 | 2·01 | 3·04 | 2·70 | ·91 | ·93 |
| 25–34 | 1·64 | 1·37 | .. | .. | ·85 | .. |
| 35–44 | 2·09 | 2·22 | .. | .. | ·78 | .. |

For the male population aged 25–34 years in thousands, the census figure is 554 and the estimate 550. The corresponding figures for females are 473 and 470, respectively. The census figures being higher, we can take them as the lower limits of the true population. Thus.

$$P_m \geqslant 554$$
$$\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$
$$P_f \geqslant 473$$

It has been shown that the incidence of births has been increasing and therefore, in the absence of substantial migration balances in recent years, each of the younger generations should, numerically, exceed the next older generation. The available statistics show that there was little migration from the depression of 1930 to the end

of the war. We may, therefore, assume the true population of the age group 25–34 years to be less than the true population in the preceding lower age group 15–24 years.

Thus,

$$P_m < 766$$
$$\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(2)}$$
$$P_f < 702$$

Combining (1) and (2),

$$766 > P_m \geq 554$$
$$\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(3)}$$
$$702 > P_f \geq 473$$

By using the balancing equation, we can narrow the limits still further.

Let $D$ be the deaths in the generation during the intercensal period 1921–1946 ;

$P_o$ be the corrected population of the generation in 1921, when its age was 0–9 years ;

$X$ be the true number of this generation in 1946 when its age was 25–34 years ;

and $I - E$ be the immigration balance during the intercensal period to this generation.

Then, from the balancing equation we get,

$$X = P_o - \left[ (D) - (I - E) \right]$$

In our model $I - E$ is positive for the age group 25–34 years, and, in view of the small immigration balance during 1931–1945,

$$D > I - E$$

and therefore     $P_o > X$

But             $I > E$

therefore        $X > P_o - D$

and therefore    $P_o > X > P_o - D \dots\dots\dots\dots\dots\dots \text{(4)}$

For this generation age 25–34 years in 1946, $D$, calculated already in connection with the construction of the population estimate, is 130 for males and 158 for females in the period 1921–1946. $P_o$, the corrected population in the age group 0–9 years in 1921 is 667 males and 644 females.

Relation (4), therefore, gives the limits :

$$667 > X_m > 537 \text{ for males}$$
$$\dots\dots\dots\dots\dots \text{(5)}$$
$$644 > X_f > 486 \text{ for females}$$

Combining (3) and (5),

$$667 > X_m > 554 \text{ for males}$$
$$\dots\dots\dots\dots\dots \text{(6)}$$
$$644 > X_f > 486 \text{ for females}$$

We may assume the under-enumeration of this generation to have been greater in 1921 when its age was 0–9 years, than in 1946 when its age was 25–34 years, first because persons of age 0–9 years are more liable to under-enumeration than those aged 25–34 years ; secondly, the census machinery operated with greater efficiency in 1946 than in 1921, and, lastly, that the environmental factors responsible for under-enumeration (e.g. difficulty in communication, illiteracy, &c.) operated with less force in 1946 than in 1921.

Let $C_0$ be the enumerated population in 1921 aged 0–9 years ;

$C_1$ be the enumerated population in 1946 aged 25–34 years ;

$P_0$ be the true population of this generation in 1921 ;

$X$ be the true population of this generation in 1946.

Owing to under-enumeration,

$$P_0 > C_0$$

and $$X > C_1$$

Since the extent of under-enumeration was greater in 1921 than in 1946 for this generation,

$$\frac{P_0}{C_0} > \frac{X}{C_1}$$

or,

$$\frac{P_0}{X} > \frac{C_0}{C_1}$$

or,

$$\frac{P_0 - X}{X} > \frac{C_0 - C_1}{C_1}$$

or,

$$\frac{P_0 - X}{C_1} > \frac{C_0 - C_1}{C_1} \quad \ldots\ldots\ldots\ldots \text{Since } X > C_1$$

or, $$P_0 - X > C_0 - C_1$$

i.e. $$P_0 - C_0 + C_1 > X \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(7)$$

Thus, by adding to the census population the population omitted from the same generation in the preceding census, we get an upper limit of the true population.

In relation (7),

|  | | Males | Females |
|---|---|---|---|
| $P_0$ | = | 667 | 644 |
| $C_0$ | = | 621 | 596 |
| $C_1$ | = | 554 | 473 |

Therefore,     for males     $X < 600$

$$\ldots\ldots\ldots\ldots (8)$$

and females     $X < 521$

Combining (6) and (8) we get,

$$600 > X_m > 554 \text{ for males}$$

$$\ldots\ldots\ldots\ldots (9)$$

$$521 > X_f > 486 \text{ for females}$$

Assume a sex ratio of ·90. Then, given the male limits, we get a female limit of—

$$540 > X_f > 499 \ldots\ldots\ldots\ldots\ldots (10)$$

If we take the female limits to be given, the sex ratio of ·90 gives us the male limits of—

$$579 > X_m > 540 \ldots\ldots\ldots\ldots (11)$$

Combining (9), (10) and (11), and assuming a sex ratio of ·90, we get new narrower limits of—

$$579 > X_m > 554 \text{ for males}$$

$$\ldots\ldots\ldots\ldots (12)$$

$$521 > X_f > 499 \text{ for females}$$

In a similar manner, with the assumptions of sex ratios varying from ·88 to ·93 we get the following limits :

TABLE 17—LIMITS OF POPULATION GIVEN BY ASSUMED SEX RATIOS

| Assumed Sex Ratio | Limits obtained | | | | | |
|---|---|---|---|---|---|---|
| | Males | | | Females | | |
| ·88 | 592 > | X | > 554 | 521 > | X | > 488 |
| ·89 | 586 | X | 554 | 521 | X | 493 |
| ·90 | 579 | X | 554 | 521 | X | 499 |
| ·91 | 571 | X | 554 | 521 | X | 504 |
| ·92 | 566 | X | 554 | 521 | X | 510 |
| ·93 | 560 | X | 554 | 521 | X | 515 |

According to our model, the sex ratio in the reproductive ages should show a decline. We can, therefore, assume the sex ratio of the age group 20–24 years to be greater than that of the age group 25–34 years. The sex ratio of the former is 0·93. Hence, the upper limit of the sex ratio in the age group 25–34 years may be taken as ·93.

Table 4, on the other hand, shows that the sex-ratio of this age group does not fall below ·90 in any country except Malaya. We may, therefore, take ·90 as the

lower limit of the sex ratio in this age group. Thus if $X_m$ be the number of corrected males and $X_f$ the number of corrected females in the age group 25–34 years, then

$$\cdot 93 \geq \frac{X_f}{X_m} \geq \cdot 90 \dots\dots\dots\dots\dots\dots\dots (13)$$

Applying relation (13), from Table 17, we get,

$$579 > X_m > 554$$
$$\dots\dots\dots\dots\dots\dots\dots (14)$$
$$521 > X_f > 499$$

The growth rates in the age group 20–25 years, calculated on the basis of 1921 census figures and 1946 corrected figures, is 2·64 per cent per year for males and 2·02 per cent per year for females. The nearest rate to this, within the limits of (14), is obtained by taking 578 males and 520 females which gives growth rates of 1·88 for males and 1·91 for females. The growth rate obtained by choosing any other number within condition (14) is smaller and is, therefore, less satisfactory from the point of view of the growth rate test.

### Exit Ratio Test

The requirement of this test is that the exit rate read column-wise and row-wise should form a complete or partial U-shaped curve ; and, read diagonally, should decline.

This test therefore cannot be applied to an isolated group. This is true of the growth rate test also ; but in the case of the latter a comparison with the adjacent groups is sufficient, whilst in case of the former a complete table is necessary to examine the validity of any exit ratio.

The exit rates given by the census figures are shown in Table 8. The corrected exit rates are shown in Table 18. Diagram 1 illustrates the exit rate curves read column-wise of the generation 10–14 of 1881. It shows clearly the improvement in the shape and smoothness of the curve achieved by the correction process.

### The Migration Balance Test

The migration balance requirement of our model is that the immigration balance of this generation should be positive. We have assumed it to be so in deducing limit (4).

According to our population model, the immigration balance should be positive in the working age groups and should be negative in the retiring ages. Table 19 shows the inconsistent nature of the immigration balance given by the census figures and also the conformity to the model achieved by the corrected figures.

### TABLE 18—EXIT RATES (PER CENT. PER YEAR)

| Year | | | | | Age in Years | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0–4 | 10–14 | 20–24 | 30–34 | 40–44 | 50–54 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| 1891 (1) | — | — | — | — | 1·61 | 2·44 | 1·25 | 2·20 | 2·50 | 1·09 |
| 1901 (2) | — | — | — | 0·85 | −0·69 | −0·42 | 1·76 | 1·95 | 1·46 | — |
| 1911 (3) | — | — | 1·05 | −0·04 | 0·64 | 2·10 | 2·65 | 2·73 | — | — |
| 1921 (4) | — | 1·36 | 0·36 | 0·51 | 2·40 | 2·74 | 3·80 | — | — | — |
| 1946 (5) | 0·57 | 0·59 | 1·29 | 2·32 | — | — | — | — | — | — |

Continued

| Year | | | | | Age in Years | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 5–9 | 15–19 | 25–29 | 35–39 | 45–49 |
| (1) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) |
| 1891 (6) | — | — | — | — | 1·97 | 2·12 | 1·92 | 2·50 | 1·48 |
| 1901 (7) | — | — | — | 0·44 | 0·22 | 1·68 | 2·70 | 2·16 | — |
| 1911 (8) | — | — | 0·19 | 0·21 | 1·39 | 2·62 | 3·00 | — | — |
| 1921 (9) | — | 0·35 | 0·12 | 1·25 | 2·26 | 2·50 | — | — | — |
| 1946 (10) | 0·36 | 1·40 | 2·10 | 2·60 | — | — | — | — | — |

TABLE 18—EXIT RATES (PER CENT. PER YEAR)

### TABLE 18—EXIT RATES (PER CENT. PER YEAR)—(*contd.*)

| Year | | | | | Age in Years | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0–4 | 10–14 | 20–24 | 30–34 | 40–44 | 50–54 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| 1891 (1) | — | — | — | — | 1·95 | 2·17 | 1·60 | 2·24 | 3·06 | 3·20 |
| 1901 (2) | — | — | — | 1·08 | –0·74 | 0·07 | 1·36 | 2·76 | 2·32 | — |
| 1911 (3) | — | — | 1·35 | –0·04 | 1·03 | 2·35 | 3·16 | 2·90 | — | — |
| 1921 (4) | — | 1·60 | 0·30 | 0·44 | 2·08 | 2·60 | 4·75 | — | — | — |
| 1946 (5) | 0·57 | 0·90 | 1·35 | 2·56 | — | — | — | — | — | — |

*Continued*

| Year | | | | | Age in Years | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 5–9 | 15–19 | 25–29 | 35–39 | 45–49 |
| (1) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) |
| 1891 (6) | — | — | — | — | 2·18 | 2·13 | 2·10 | 2·76 | 2·08 |
| 1901 (7) | — | — | — | 0·75 | 0·46 | 2·56 | 3·04 | 2·36 | — |
| 1911 (8) | — | — | 0·50 | 0·45 | 2·29 | 1·35 | 3·23 | — | — |
| 1921 (9) | — | 0·65 | 0·16 | 1·47 | 2·26 | 2·65 | — | — | — |
| 1946 (10) | 0·50 | 1·28 | 2·24 | 2·68 | — | — | — | — | — |

### TABLE 18—EXIT RATES (PER CENT. PER YEAR)—(*contd.*)

DIAGRAM 1—EXIL RATE OF GENERATION AGED 10–14 YEARS IN 1881, MALES, IN SUBSEQUENT INTERCENSAL PERIODS : CENSUS AND CORRECTED
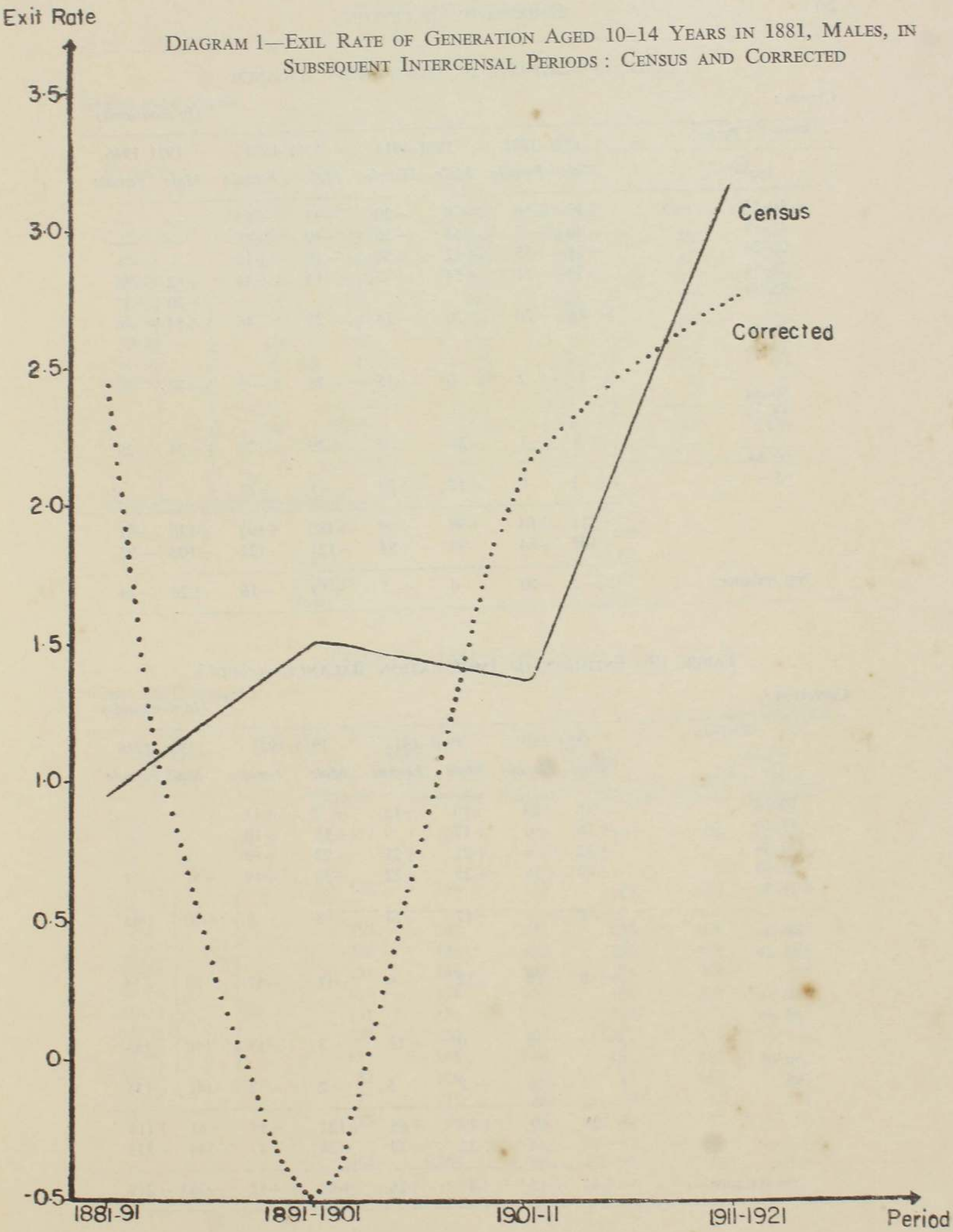
## TABLE 19—ESTIMATE OF IMMIGRATION BALANCE

Census:                                                    *(In thousands)*

| Period / Age | 1891–1901 Male | 1891–1901 Female | 1901–1911 Male | 1901–1911 Female | 1911–1921 Male | 1911–1921 Female | 1921–1946 Male | 1921–1946 Female |
|---|---|---|---|---|---|---|---|---|
| 10–14 | −37 | −50 | − 8 | −20 | +37 | +28 | — | — |
| 15–19 | −40 | + 7 | −64 | −50 | −49 | −49 | — | — |
| 20–24 | +31 | +55 | +12 | +54 | −18 | +12 | — | — |
| 25–34 | +70 | −11 | +54 | + 2 | +114 | +44 | +62 | +35 |
| 35–39 | } −18 | −20 | +20 | −24 | −25 | −46 | +20 } +54 | +17 } −6 |
| 40–44 | | | | | | | | |
| 45–49 | } −13 | + 2 | 0 | +15 | −28 | −5 | } −74 | } −89 |
| 50–54 | | | | | | | | |
| 55–59 | } + 8 | − 3 | −26 | 0 | +29 | −22 | } −34 | } +29 |
| 60–64 | | | | | | | | |
| 65+ | + 2 | 0 | +12 | +28 | −1 | +22 | | |
| | +111 | +64 | +98 | +99 | +180 | +106 | +136 | +81 |
| | −108 | −84 | −98 | −94 | −121 | −122 | −108 | −95 |
| Net Balance | + 3 | −20 | 0 | + 5 | +59 | −16 | +28 | −14 |

## TABLE 19—ESTIMATE OF IMMIGRATION BALANCE—(*contd.*)

Corrected:                                                    *(In thousands)*

| Period / Age | 1891–1901 Male | 1891–1901 Female | 1901–1911 Male | 1901–1911 Female | 1911–1921 Male | 1911–1921 Female | 1921–1946 Male | 1921–1946 Female |
|---|---|---|---|---|---|---|---|---|
| 10–14 | +16 | +20 | +16 | +13 | + 7 | +11 | — | — |
| 15–19 | +16 | 0 | +17 | + 9 | +15 | +10 | — | — |
| 20–24 | +32 | + 4 | +21 | +21 | +22 | +19 | — | — |
| 25–34 | +40 | +36 | +25 | +22 | +78 | +19 | +51 | +71 |
| 35–39 | } − 4 | − 9 | −12 | −13 | − 8 | − 9 | } +10 | } +43 |
| 40–44 | | | | | | | | |
| 45–49 | } − 8 | −17 | −12 | − 9 | −11 | −17 | } −57 | } −33 |
| 50–54 | | | | | | | | |
| 55–59 | } −10 | − 2 | 0 | −12 | − 3 | −19 | } −146 | } −165 |
| 60–64 | | | | | | | | |
| 65+ | − 1 | −16 | − 8 | − 5 | − 2 | − 2 | −141 | −135 |
| | +104 | +60 | +79 | +65 | +122 | +59 | +61 | +114 |
| | −23 | −44 | −32 | −39 | −24 | −47 | −344 | −333 |
| Net Balance | +81 | +16 | +47 | +26 | +98 | +12 | −283 | −219 |

## TABLE 20—1871 POPULATION

**Census and Corrected :**

*(In thousands)*

| Age years | Males | | Females | | Total | |
|---|---|---|---|---|---|---|
| | *Census* | *Corrected* | *Census* | *Corrected* | *Census* | *Corrected* |
| Under 10 | 422 | 437 | 380 | 426 | 802 | 863 |
| 10–19 | 249 | 339 | 238 | 318 | 487 | 657 |
| 20–29 | 221 | 240 | 209 | 225 | 430 | 465 |
| 30–39 | 151 | 171 | 119 | 162 | 270 | 333 |
| 40–49 | 96 | 113 | 80 | 106 | 176 | 219 |
| 50–59 | 82 | 82 | 51 | 74 | 133 | 156 |
| 60–69 | 35 | 48 | 23 | 43 | 58 | 91 |
| 70+ | 18 | 19 | 15 | 17 | 33 | 36 |
| | 1,274 | 1,449 | 1,115 | 1,371 | 2,389 | 2,820 |

**Degree of under-enumeration :**

| | Per cent. |
|---|---|
| Males | 12·08 |
| Females | 18·67 |
| Total | 15·28 |

## TABLE 21—1881 POPULATION

**Census and Corrected :**

*(In thousands)*

| Age years | Males | | Females | | Total | |
|---|---|---|---|---|---|---|
| | *Census* | *Corrected* | *Census* | *Corrected* | *Census* | *Corrected* |
| 0– 1– | 117 | 104 | 112 | 101 | 229 | 205 |
| 2– 3– 4– | 138 | 138 | 129 | 135 | 267 | 273 |
| 0–4 | 255 | 242 | 241 | 236 | 496 | 478 |
| 5–9 | 228 | 228 | 199 | 220 | 427 | 448 |
| 10–14 | 157 | 188 | 122 | 175 | 279 | 363 |
| 15–19 | 134 | 174 | 164 | 164 | 298 | 338 |
| 20–24 | 131 | 136 | 131 | 131 | 262 | 267 |
| 25–34 | 230 | 230 | 181 | 217 | 411 | 447 |
| 35–44 | 136 | 144 | 106 | 138 | 242 | 282 |
| 45–54 | 87 | 100 | 79 | 95 | 166 | 195 |
| 55–64 | 73 | 77 | 41 | 59 | 114 | 136 |
| 65+ | 33 | 48 | 24 | 42 | 57 | 90 |
| | 1,464 | 1,567 | 1,288 | 1,477 | 2,752 | 3,044 |

Degree of under-enumeration :

|  | Per cent. |
|---|---|
| Males | 6·57 |
| Females | 12·80 |
| Total | 9·59 |

Degree of under-enumeration would have been greater but for the over-enumeration in the age-group under 2 years. This remark is applicable for 1891 and 1901 also.

### TABLE 22—1891 POPULATION

Census and Corrected :

*(In thousands)*

| Age years | Males | | Females | | Total | |
|---|---|---|---|---|---|---|
|  | Census | Corrected | Census | Corrected | Census | Corrected |
| 0– | 40 | 58 | 38 | 56 | 78 | 114 |
| 1– | 90 | 55 | 85 | 53 | 175 | 108 |
| 2–4 | 146 | 146 | 136 | 141 | 282 | 287 |
| 0–4 | 276 | 259 | 259 | 250 | 535 | 509 |
| 5–9 | 247 | 247 | 218 | 239 | 465 | 486 |
| 10–14 | 169 | 203 | 136 | 190 | 305 | 393 |
| 15–19 | 141 | 183 | 172 | 172 | 313 | 355 |
| 20–24 | 142 | 142 | 137 | 137 | 279 | 279 |
| 25–34 | 252 | 256 | 209 | 239 | 461 | 495 |
| 35–44 | 160 | 183 | 123 | 170 | 283 | 353 |
| 45–54 | 90 | 108 | 86 | 98 | 176 | 206 |
| 55–64 | 78 | 87 | 57 | 70 | 135 | 157 |
| 65+ | 36 | 53 | 26 | 44 | 62 | 97 |
|  | 1,591 | 1,721 | 1,423 | 1,609 | 3,014 | 3,330 |

Degree of under-enumeration :

|  | Per cent. |
|---|---|
| Males | 7·55 |
| Females | 11·56 |
| Total | 9·49 |

## TABLE 23—1901 POPULATION

**Census, Estimated and Corrected :** (*In thousands*)

| Age years | Males | | | Females | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Census | Estimated | Corrected | Census | Estimated | Corrected | Census | Corrected |
| 0– | 99 | 59 | 69 | 94 | 56 | 67 | 193 | 136 |
| 1– | 61 | 54 | 66 | 58 | 51 | 65 | 119 | 131 |
| 2– | 62 | 50 | 64 | 59 | 49 | 62 | 121 | 126 |
| 3– | 56 | 36 | 60 | 52 | 45 | 58 | 108 | 118 |
| 4– | 51 | 39 | 54 | 47 | 35 | 52 | 98 | 106 |
| 0–4 | 329 | 238 | 313 | 310 | 236 | 304 | 639 | 617 |
| 5– | 264 | 156 | 264 | 240 | 148 | 256 | 504 | 520 |
| 10– | 202 | 246 | 237 | 161 | 212 | 223 | 363 | 460 |
| 15– | 180 | 225 | 236 | 206 | 199 | 221 | 386 | 457 |
| 20– | 183 | 151 | 217 | 174 | 119 | 204 | 357 | 421 |
| 25– | 316 | 246 | 327 | 253 | 264 | 300 | 569 | 627 |
| 35– | 194 | 212 | 212 | 150 | 170 | 191 | 344 | 403 |
| 45– | 110 | 124 | 139 | 97 | 95 | 124 | 207 | 263 |
| 55– | 88 | } 99 | 88 | 58 | 60 | 75 | 146 | 163 |
| 65+ | 31 | | 54 | 20 | 30 | 46 | 51 | 100 |
| | 1,897 | 1,697 | 2,087 | 1,669 | 1,533 | 1,944 | 3,566 | 4,031 |

**Degree of under-enumeration :**

| | Per cent. |
|---|---|
| Males | 9·10 |
| Females | 14·15 |
| Total | 11·54 |

## TABLE 24—1911 POPULATION

**Census, Estimated and Corrected :** (*In thousands*)

| Age years | Males | | | Females | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Census | Estimated | Corrected | Census | Estimated | Corrected | Census | Corrected |
| 0– | 62 | 67 | 75 | 59 | 66 | 73 | 121 | 148 |
| 1– | 53 | 61 | 72 | 51 | 57 | 70 | 104 | 142 |
| 2– | 67 | 59 | 70 | 65 | 60 | 68 | 132 | 138 |
| 3– | 68 | 54 | 71 | 64 | 45 | 69 | 132 | 140 |
| 4– | 62 | 46 | 65 | 58 | 46 | 63 | 120 | 128 |
| 0–4 | 312 | 287 | 353 | 297 | 274 | 343 | 609 | 696 |
| 5– | 289 | 242 | 289 | 275 | 223 | 280 | 564 | 569 |
| 10– | 271 | 280 | 280 | 236 | 256 | 263 | 507 | 543 |
| 15– | 178 | 242 | 259 | 169 | 219 | 243 | 347 | 502 |

## TABLE 24—1911 POPULATION—(contd.)

**Census, Estimated and Corrected :**                                    (*In thousands*)

| | Males | | | Females | | | Total | |
|---|---|---|---|---|---|---|---|---|
| Age years | Census | Estimated | Corrected | Census | Estimated | Corrected | Census | Corrected |
| 20– | 194 | 182 | 238 | 195 | 141 | 224 | 389 | 462 |
| 25– | 373 | 238 | 434 | 329 | 326 | 394 | 702 | 828 |
| 35– | 256 | 268 | 268 | 193 | 207 | 241 | 449 | 509 |
| 45– | 150 | 150 | 156 | 131 | 116 | 148 | 281 | 304 |
| 55– | 97 | 71 | 99 | 76 | 69 | 83 | 173 | 182 |
| 65+ | 55 | 42 | 57 | 40 | 11 | 50 | 95 | 107 |
| | 2,175 | 2,002 | 2,433 | 1,941 | 1,842 | 2,269 | 4,116 | 4,702 |

Degree of under-enumeration :

| | Per cent. |
|---|---|
| Males | 10·60 |
| Females | 14·46 |
| Total | 12·46 |

## TABLE 25—1921 POPULATION

**Census, Estimated and Corrected :**                                    (*In thousands*)

| | Males | | | Females | | | Total | |
|---|---|---|---|---|---|---|---|---|
| Age years | Census | Estimated | Corrected | Census | Estimated | Corrected | Census | Corrected |
| 0– | 61 | 72 | 74 | 59 | 68 | 72 | 120 | 146 |
| 1– | 55 | 62 | 72 | 53 | 60 | 70 | 108 | 142 |
| 2– | 70 | 60 | 70 | 68 | 67 | 68 | 138 | 138 |
| 3– | 74 | 68 | 74 | 70 | 64 | 70 | 144 | 144 |
| 4– | 68 | 63 | 68 | 64 | 57 | 64 | 132 | 132 |
| 0–4 | 328 | 325 | 358 | 314 | 316 | 344 | 642 | 702 |
| 5– | 293 | 259 | 309 | 282 | 240 | 300 | 575 | 609 |
| 10– | 295 | 258 | 306 | 258 | 230 | 288 | 553 | 594 |
| 15– | 214 | 264 | 279 | 199 | 248 | 263 | 413 | 542 |
| 20– | 221 | 247 | 270 | 220 | 208 | 255 | 441 | 525 |
| 25– | 393 | 317 | 482 | 352 | 294 | 453 | 745 | 935 |
| 35– | 291 | 318 | 370 | 223 | 269 | 325 | 514 | 695 |
| 45– | 174 | 202 | 202 | 147 | 152 | 183 | 321 | 385 |
| 55– | 108 | 105 | 108 | 75 | 97 | 95 | 183 | 203 |
| 65+ | 62 | 59 | 62 | 46 | 24 | 52 | 108 | 114 |
| | 2,379 | 2,354 | 2,746 | 2,116 | 2,078 | 2,558 | 4,495 | 5,304 |

Degree of under-enumeration :

| | Per cent. |
|---|---|
| Males | 13·36 |
| Females | 17·27 |
| Total | 15·25 |

## TABLE 26—1946 POPULATION

Census, Estimated and Corrected :  (*In thousands*)

| Age years | Males | | | Females | | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Census | Estimated | Corrected | Census | Estimated | Corrected | Census | Corrected |
| 0– | 81 | 98 | 105 | 79 | 103 | 103 | 160 | 208 |
| 1– | 85 | 106 | 102 | 82 | 98 | 99 | 167 | 201 |
| 2– | 86 | 89 | 98 | 84 | 101 | 96 | 170 | 194 |
| 3– | 96 | 95 | 103 | 94 | 87 | 99 | 190 | 202 |
| 4– | 89 | 77 | 90 | 85 | 86 | 86 | 174 | 176 |
| 0–4 | 437 | 465 | 498 | 424 | 475 | 483 | 861 | 981 |
| 5– | 412 | 405 | 412 | 400 | 372 | 400 | 812 | 812 |
| 10– | 415 | 344 | 415 | 391 | 321 | 391 | 806 | 806 |
| 15– | 364 | 370 | 399 | 316 | 338 | 371 | 680 | 770 |
| 20– | 328 | 318 | 367 | 314 | 276 | 331 | 642 | 698 |
| 25– | 554 | 550 | 578 | 473 | 470 | 520 | 1,027 | 1,098 |
| 35– | | 290 | | | 216 | | | |
| 40– | }443 | | }444 | 347 | | }400 | 790 | 844 |
| 45– | | }367 | | | }313 | | | |
| 50– | }288 | | 304 | 227 | | }274 | 515 | 578 |
| 55– | | }295 | | | }260 | | | |
| 60– | }166 | | }166 | 128 | | }139 | 294 | 305 |
| 65+ | 125 | }276 | 125 | 105 | 142 | 105 | 230 | 230 |
| | 3,532 | 3,680 | 3,708 | 3,125 | 3,183 | 3,414 | 6,657 | 7,122 |

Degree of under-enumeration :

| | Per cent. |
|---|---|
| Males | 4·75 |
| Females | 8·46 |
| Total | 6·53 |

## TABLE 27—ANNUAL GROWTH RATES

*(Per cent of Preceding Period)*

**Census : Males**

| Period | 0–4 Years | 5–9 Years | 10–14 Years | 15–19 Years | 20–24 Years | 25–34 Years | 35–44 Years | 45–54 Years | 55–64 Years | 65+ Years |
|---|---|---|---|---|---|---|---|---|---|---|
| 1881–91 | 0·8 | 0·8 | 0·8 | 0·5 | 0·8 | 0·9 | 1·6 | 0·3 | 0·7 | ·9 |
| 1891–1901 | 1·9 | 0·7 | 1·9 | 2·7 | 2·8 | 2·5 | 2·1 | 2·2 | 1·3 | −1·4 |
| 1901–11 | −0·5 | 0·9 | 3·5 | −1 | 0·6 | 1·8 | 3·4 | 3·4 | 1·0 | 7·3 |
| 1911–21 | 0·5 | 0·1 | 0·9 | 2·0 | 1·4 | 0·5 | 1·3 | 1·6 | 0·1 | 1·3 |
| 1921–46 | 1·3 | 1·6 | 1·6 | 2·8 | 1·9 | 1·6 | 2·1 | 2·6 | 2·16 | 4·08 |

**Census : Females**

| Period | 0–4 Years | 5–9 Years | 10–14 Years | 15–19 Years | 20–24 Years | 25–34 Years | 35–44 Years | 45–54 Years | 55–64 Yeats | 65+ Years |
|---|---|---|---|---|---|---|---|---|---|---|
| 1881–91 | 0·8 | 0·9 | 1·2 | 0·5 | 0·5 | 1·5 | 1·6 | 0·9 | 3·9 | 0·8 |
| 1891–1901 | 2·0 | 1·0 | 1·8 | 2·0 | 2·6 | 2·2 | 2·0 | 1·3 | 0·2 | −3·3 |
| 1901–11 | −0·4 | 1·5 | 4·6 | 1·8 | 1·2 | 3·0 | 2·9 | 3·5 | 3·1 | 10·0 |
| 1911–21 | 0·6 | 0·2 | 0·9 | 1·8 | 1·3 | 1·2 | 1·5 | 1·2 | −0·2 | 1·5 |
| 1921–46 | 1·4 | 1·7 | 2·1 | 2·3 | 1·7 | 1·4 | 2·2 | 2·2 | 2·9 | 5·1 |

**Corrected : Males**

| Period | 0–4 Years | 5–9 Years | 10–14 Years | 15–19 Years | 20–24 Years | 25–34 Years | 35–44 Years | 45–54 Years | 55–64 Years | 65+ Years |
|---|---|---|---|---|---|---|---|---|---|---|
| 1881–91 | 0·7 | 0·8 | 0·8 | 0·5 | 0·4 | 1·1 | 2·7 | 0·8 | 1·3 | 1·0 |
| 1891–1901 | 2·1 | 0·7 | 1·7 | 2·9 | 5·3 | 2·8 | 1·6 | 2·9 | 0·1 | 0·2 |
| 1901–11 | 1·3 | 0·9 | 1·8 | 1·0 | 1·0 | 3·2 | 2·6 | 1·2 | 1·2 | 0·6 |
| 1911–21 | 0·1 | 0·7 | 0·9 | 0·8 | 1·3 | 1·1 | 3·8 | 3·1 | 0·9 | 0·9 |
| 1921–46 | 1·6 | 1·3 | 1·4 | 1·7 | 1·4 | 0·9 | 0·8 | 2·0 | 2·2 | 4·4 |

**Corrected : Females**

| Period | 0–4 Years | 5–9 Years | 10–14 Years | 15–19 Years | 20–24 Years | 25–34 Years | 35–44 Years | 45–54 Years | 55–64 Yeasr | 65+ Years |
|---|---|---|---|---|---|---|---|---|---|---|
| 1881–91 | 0·6 | 0·9 | 0·9 | 0·5 | 0·4 | 1·0 | 2·5 | 0·3 | 1·8 | 0·5 |
| 1891–1901 | 2·2 | 0·7 | 1·7 | 2·8 | 4·9 | 2·5 | 1·2 | 2·7 | 0·7 | 0·5 |
| 1901–11 | 1·3 | 0·9 | 1·4 | 1·0 | 1·0 | 3·1 | 2·6 | 1·9 | 1·1 | 0·9 |
| 1911–21 | 0·1 | 0·7 | 0·9 | 0·8 | 1·4 | 1·5 | 3·5 | 2·4 | 1·4 | 0·4 |
| 1921–46 | 1·6 | 1·3 | 1·4 | 1·6 | 1·2 | 0·9 | 1·0 | 2·0 | 1·8 | 4·0 |

## TABLE 28—SEX RATIOS

**Census :**

| Age Yrs. / Year | 0– | 1– | 2– | 3– | 4– | 0–4 | 5–9 | 10–14 | 15–19 | 20–24 | 25–34 | 35–44 | 45–54 | 55–64 | 65+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | | | | 10 | | 20 | 30 | 40 | 50 | 60 | |
| 1871 | | | | | | ·90 | | ·96 | | ·94 | ·79 | ·83 | ·61 | | ·72 |
| 1881 | | ·96 | | | ·93 | ·94 | ·87 | ·78 | 1·22 | ·99 | ·78 | ·79 | ·91 | ·55 | ·72 |
| 1891 | ·94 | ·95 | | ·93 | | ·94 | ·88 | ·80 | 1·21 | ·96 | ·83 | ·77 | ·95 | ·60 | ·70 |
| 1901 | ·95 | ·95 | ·97 | ·93 | ·92 | ·94 | ·91 | ·80 | 1·15 | ·95 | ·80 | ·77 | ·88 | ·65 | ·66 |
| 1911 | ·95 | ·96 | ·96 | ·95 | ·94 | ·95 | ·95 | ·87 | ·95 | 1·01 | ·88 | ·75 | ·87 | ·69 | ·72 |
| 1921 | ·98 | ·95 | ·97 | ·95 | ·94 | ·96 | ·96 | ·87 | ·93 | ·99 | ·89 | ·77 | ·85 | ·69 | ·74 |
| 1946 | ·97 | ·96 | ·97 | ·98 | ·96 | ·97 | ·97 | ·94 | ·87 | ·96 | ·85 | ·78 | ·79 | ·77 | ·84 |

**Corrected :**

| Age Yrs. / Year | 0– | 1– | 2– | 3– | 4– | 0–4 | 5–9 | 10–14 | 15–19 | 20–24 | 25–34 | 35–44 | 45–54 | 55–64 | 65+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | | | | 10 | | 20 | 30 | 40 | 50 | 60 | |
| 1871 | | | | | | ·98 | | ·94 | | ·94 | ·95 | ·94 | ·90 | | ·89 |
| 1881 | | ·97 | | | ·98 | ·97 | ·96 | ·93 | ·94 | ·96 | ·94 | ·96 | ·95 | ·77 | ·87 |
| 1891 | ·97 | ·97 | | ·97 | | ·97 | ·96 | ·91 | ·94 | ·96 | ·95 | ·93 | ·91 | ·81 | ·83 |
| 1901 | ·97 | ·98 | ·97 | ·96 | ·96 | ·97 | ·97 | ·94 | ·94 | ·94 | ·92 | ·90 | ·89 | ·85 | ·85 |
| 1911 | ·97 | ·97 | ·97 | ·97 | ·97 | ·97 | ·97 | ·94 | ·94 | ·94 | ·91 | ·90 | ·90 | ·89 | ·88 |
| 1921 | ·97 | ·96 | ·97 | ·96 | ·96 | ·96 | ·97 | ·94 | ·94 | ·98 | ·97 | ·88 | ·91 | ·88 | ·84 |
| 1946 | ·98 | ·97 | ·98 | ·96 | ·96 | ·97 | ·97 | ·94 | ·93 | ·93 | ·90 | ·90 | ·90 | ·84 | ·84 |

## APPENDIX A

**Method of Making Population Estimates**

THE population estimates are obtained by using the balancing equation based on an inflow-outflow concept. For the first five years of life, quarterly births and deaths are used because of pronounced seasonal variation to which they are subject.

Of the total infant deaths recorded in a year, a proportion occur to infants born in the previous year. This proportion is called the " separation factor ". The correct number of infant deaths out of the births of a year should exclude the deaths of infants born in the previous year and should include the deaths out of these births which occur in the next year. For estimating the appropriate separation factors, Valaoras' method was used. Valaoras found a fairly stable relationship between separation factors and the crude infant mortality rates over a wide range of variation for a long period for the North Atlantic countries, where the form in which the vital registration was kept enabled an accurate computation of separation factors. This relationship was generalised in an equation in which by substituting the crude infant mortality rate for any year, the separation factor for that year could be obtained.[1]

The total infant deaths, thus corrected, were then distributed over the quarters in proportion to the quarterly infant mortality rates. This procedure of distributing the infant deaths over the quarters reintroduced an error, in so far as the earlier parts of the year received a higher weight than they should, because the quarterly infant death rates were based on infant deaths from which the deaths of infants born in the preceding year were not separated. Nonetheless, the distortion in the quarterly distribution of deaths was reduced by the procedure.

For all other age groups an even distribution of deaths over the entire age period is assumed, and the separation factors are derived from this assumption.

The census date did not coincide with the beginning of a quarter of a year in any of the censuses, but fell in February or in March. This needed an adjustment of the data which was made by assuming an even distribution of deaths within a quarter or a year as the case may be.

To estimate the population of the first ten years of age the relevant number of deaths thus obtained was subtracted from the births. For other age groups the estimates were obtained by subtracting the relevant number of deaths from the population in the appropriate age group in the preceding census. The under-enumeration in the preceding census was thus carried forward to the estimates.

To the estimates thus obtained, some allowance for migration was made as follows : The emigration figures (which were under-recorded to a greater extent than immigration figures) were inflated arbitrarily by 25 per cent. The resulting immigration balance in the intercensal period was distributed over the various age groups according to the age distribution observed in 1891 in a newly opened tea estate where the population consisted mostly of recent immigrants. The immigration balance in each age group was then added to the estimated population to give the final estimates.

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[1] See Vasilios G. Valaoras : " Refined Rates for Infant and Childhood Mortality " : *Population Studies*, Vol. IV, 1950–51, pp. 253–266.

## APPENDIX B

### (1)

THE estimated births are obtained by the reverse life table method by using the formula

$$B_x = \frac{P_x + \frac{1}{2}D_x}{l_x}$$

where $B_x$ is estimated births in year $x + 1$ before census ;

$P_x$ is census population age $x$ last birth day ;

$D_x$ is deaths at age $x$ last birth day in year before census ;

$l_x$ is proportion of life table births surviving to exact age $x$.

In the tables below the estimated births thus obtained for four sets of years are given.

### TABLE 1—ESTIMATED BIRTHS

| Year | Age | Males | | | Females | | |
|------|-----|-------|---|---|---------|---|---|
| | | Estimated Births $(B_e)$ ('000) | Observed Births $(B_o)$ ('000) | $\dfrac{B_o}{B_e}$ | Estimated Births $(B_e)$ ('000) | Observed Births $(B_o)$ ('000) | $\dfrac{B_o}{B_e}$ |
| **1901 Set :** | | | | | | | |
| 1900 | 0– | 105·4 | 70 | 0·67 | 104·6 | 66 | 0·63 |
| 1899 | 1– | 71·1 | 68 | ·96 | 67 | 64 | ·95 |
| 1898 | 2– | 78·7 | 68 | ·86 | 75 | 61 | ·81 |
| 1897 | 3– | 73·0 | 64 | ·88 | 69 | 50 | ·72 |
| 1896 | 4– | 67·0 | 54 | ·81 | 63 | 49 | ·78 |
| **1911 Set :** | | | | | | | |
| 1910 | 0– | 69 | 80·5 | 1·17 | 65 | 77 | 1·18 |
| 1909 | 1– | 68 | 76 | 1·12 | 66 | 73 | 1·11 |
| 1908 | 2– | 91 | 82 | ·90 | 90 | 78 | ·87 |
| 1907 | 3– | 93 | 67 | ·72 | 92 | 63·5 | ·69 |
| 1906 | 4– | 89 | 73 | ·82 | 86 | 69 | ·80 |
| **1921 Set :** | | | | | | | |
| 1920 | 0– | 68·7 | 83·6 | 1·22 | 66·5 | 80·2 | 1·21 |
| 1919 | 1– | 69·8 | 82·5 | 1·18 | 72·1 | 78·9 | 1·09 |
| 1918 | 2– | 94·6 | 93·5 | ·99 | 94·4 | 90·0 | ·95 |
| 1917 | 3– | 100·1 | 93·4 | 0·93 | 98·8 | 90·2 | 0·91 |
| 1916 | 4– | 94·1 | 89·6 | ·95 | 93·5 | 85·3 | ·91 |
| **1946 Set :** | | | | | | | |
| 1945 | 0– | 102 | 121 | 1·19 | 112 | 117 | 1·05 |
| 1944 | 1– | 104 | 118 | 1·13 | 102 | 115 | 1·13 |
| 1943 | 2– | 110 | 126 | 1·14 | 106 | 122 | 1·15 |
| 1942 | 3– | 122 | 112 | ·92 | 127 | 109 | ·86 |
| 1941 | 4– | 114 | 112 | ·98 | 109 | 108 | ·99 |

The common feature that we note in the ratio of observed births ($B_o$) to the estimated births ($B_e$) is that its value is less than 1 for the age groups 2–, 3–, and 4– for the sets 1901, 1911 and 1921 and for the age groups 3– and 4– for the set of 1946. If we assume that the effect of the immigration balance (which is to inflate $B_e$) is neutralised by the effect of under-enumeration (which is to deflate $B_e$) in these age groups, then we obtain $B_e$ as a more correct figure than $B_o$. The ratio

$$1 - \frac{\sum\limits_{i=2}^{4} B_o i}{\sum\limits_{i=2}^{4} B_{ei}}$$

for the sets 1901–1921, and the ratio

$$1 - \frac{\sum\limits_{i=3}^{4} B_{oi}}{\sum\limits_{i=3}^{4} B_{ei}}$$

for the set 1946 give us an average measure of under-registration of births for each of these periods.

For the age groups 0– and 1– years in the 1911 and 1921 sets and 0–, 1–, and 2– years in the 1946 set, the census under-enumeration is much greater than in the other age groups in the sets and hence its effects on the birth estimates is not neutralised by the immigration balance. This accounts for the estimated births being lower than the observed births. In the 1901 set $B_e$ has a higher value than $B_o$ in the age groups 0–, and 1– years because of over-enumeration noted before.

To correct for under-registration of births, we multiply the observed births in the age groups 0–, 1– years in the sets 1901–1921 and 0–, 1–, and 2– in the set 1946 by $\dfrac{\sum\limits_{i=2}^{4} B_{ei}}{\sum\limits_{i=2}^{4} B_{oi}}$ and

$\dfrac{\sum\limits_{i=3}^{4} B_{ei}}{\sum\limits_{i=3}^{4} B_{oi}}$ respectively.

This method does not, however, give a satisfactory result for the female births. In case of female births the simple procedure was followed of correcting the male births first and assuming the female to be 0·966 of it.

Having corrected $B_o$ for under-registration in this manner, we correct the census population for under-enumeration by multiplying the census figures by the ratio of corrected births to the estimated births.

The results thus obtained may not be regarded as free from error and may require further adjustment if alternative independent estimates suggest this.

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### (2)

For a given number of deaths, and ignoring errors in death registration, the greater the under-enumeration of population, the higher the death rate deduced and the lower the value of $l_x$ ; hence the under-estimation of $l_x$ tends to compensate for under-enumeration of population. This can be proved algebraically as follows :

Let $P$ be the true population of age $x$ and $P'$ be the under-enumerated population of the same age, so that $P > P'$.

Let $B$ be the number of births estimated by using $P$ and $B'$ the births estimated by using $P'$.

Let $D = (\tfrac{1}{2}D_x)$ be $\tfrac{1}{2}$ the number of deaths at age $x$.

Then

$$B = \frac{P + D}{l_x}$$

$$= \frac{P + D}{\dfrac{P - D}{P + D} \cdot l_{x-1}} \quad \text{approximately.}$$

$$= \frac{(P + D)^2}{(P - D)\, l_{x-1}}$$

Similarly,

$$B' = \frac{(P' + D)^2}{(P' - D)\, l_{x-1}}$$

$$\therefore \quad \frac{B'}{B} = \frac{P'\left(P' + 2D + \dfrac{D^2}{P'}\right)(P-D)}{P\left(P + 2D + \dfrac{D^2}{P}\right)(P'-D)}$$

We require to prove that

$$\frac{P'}{P} < \frac{B'}{B} < 1$$

i.e. that $\quad \dfrac{P'}{P} < \dfrac{P'}{P}\dfrac{(P' + 2D + D^2/P')\,(P-D)}{(P + 2D + D^2/P)\,(P'-D)} < 1$

or, $\quad 1 < \dfrac{(P' + 2D + D^2/P')\,(P-D)}{(P + 2D + D^2/P)\,(P'-D)} < \dfrac{P}{P}$

This first in equality is true if,

$$(P + 2D + D^2/P)\,(P'-D) < (P' + 2D + D^2/P')\,(P-D)$$

i.e. $\quad PP' + 2DP' + D^2P'/P - PD - 2D^2 - D^3/P$
$$< PP' + 2DP + D^2P/P' - P'D - 2D^2 - D^3/P'$$

Cancelling and dividing by $D$ (which is positive), and multiplying both sides by $PP'$

$$3PP'^2 + DP'^2 - D^2P' < 3P^2P' + DP^2 - D^2P$$

Factorising

$$3PP'^2 + DP'(P'-D) < 3P^2P' + DP(P-D)$$

is required to be proved.

Now $P > P'$, $\therefore 3P^2P' > 3PP'^2$

and $(P-D) > (P'-D)$ and both are positive

$$\therefore \ P(P-D) > P'(P'-D).$$

Thus the required inequality is true.

The second inequality is true if

$$P'(P' + 2D + D^2/P')(P-D) < P(P + 2D + D^2/P)(P'-D)$$

i.e. if $P'(PP' + 2DP + D^2P/P' - P'D - 2D^2 - D^3/P')$

$$< P(PP' + 2DP' + D^2P'/P - PD - 2D^2 - D^3/P)$$

i.e. if $(PP'^2 + 2DPP' + D^2P - P'^2D - 2D^2P' - D^3$

$$< (P^2P' + 2DPP' + D^2P' - P^2D - 2D^2P - D^3)$$

Cancelling and collecting like terms,

i.e. if $(PP'^2 - P'^2D - 3D^2P') < (P^2P' - P^2D - 3D^2P)$

i.e. if $P'(PP' - P'D - 3D^2) < P(PP' - PD - 3D^2)$

Subtract $PP'D$ from both sides

i.e. if $P'(PP' - P'D - PD - 3D^2) < P(PP' - PD - P'D - 3D^2)$

i.e. if $P'(PP' - P'D - PD + D^2 - 4D^2) < P(PP' - PD - P'D + D^2 - 4D^2)$

i.e. if $P'[(P-D)(P'-D) - 4D^2] < P[(P-D)(P'-D) - 4D^2]$

In general $P$ and $P'$ will be larger than $3D$, so that $P-D$ and $P'-D$ are larger than $2D$ and their product is larger than $4D^2$.

Thus the common factor $((P-D)(P'-D) - 4D^2)$ on both sides is positive and may be cancelled.

It is thus only necessary to show that

$$P' < P$$

and this is so.

## CHAPTER 4

## TREND IN MARRIAGES

### Introduction

A DEVELOPED monogamic family system had not yet evolved in Ceylon, when she was suddenly brought into impact with the more vigorous Western civilisation. The Western influence was limited at first to the coastal areas, and, for about two centuries the central districts of Ceylon remained isolated and impervious to Western ideas. This accounts for the relatively slow development of the central districts of Ceylon known as the Kandyan districts.

Social behaviour in the pre-Western era in Ceylon was ruled by custom which rarely needed the intervention of the sovereign power for enforcement. In a static society where production was mostly for consumption and not for trade, the local customs were well-known and respected by the people. The need for neighbourly co-operation in agricultural processes—in making and maintaining irrigation works, for example—forced individuals to obey the accepted rules of social behaviour and to avoid ostracism, the consequence of which would include economic strangulation. Often these customs had religious and superstitious sanction behind them ; often they were deeply rooted in the economic and social needs of the community and based on the accumulated experience of past generations.

The customs which regulated the marriage system and family life were no exception. Though Ceylon had passed into a patriarchal form of family life at the time of Western conquest, yet women in Ceylon had never been lowered to the position held by women in India, for example. The absence of Islamic influence is, perhaps, the main contributing cause for the relatively better position of women in Ceylon, and partly explains the freedom of their sexual behaviour. Secondly, the vast irrigated rice fields and the heavy toll of malaria, jointly created a permanent labour shortage which generated, on the one hand, a demand for large families, and, on the other, a toleration of sexual laxity.[1]

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[1] The relative freedom of Sinhalese women drew the attention of a large number of Western observers, who judging from their own standard, could not fail to comment on their " immorality." A few examples of such remarks are given below.

" Indeed here are no Public Whores allowed by authority  .  .  .  .  But in private few or none can exempt themselves.  And for the matter of being with Child, which many of them do not desire they very exquisitely can prevent the same."  .  .  .  .

" In some cases the Men will permit their Wives and Daughters to lye with other Men.  And that is, when intimate Friends or great Men chance to Lodge at their houses, they commonly will send their Wives or Daughters to bear them company in their Chamber.  Neither do they reckon their Wives to be Whores for lying with them that are as good or better than themselves."

" Both Women and Men do commonly wed four or five times before they can settle themselves to their contentation."  Robert Knox : *An Historical Relation of Ceylon*, 1681, pp. 146, 147 and 149.

Thus, in addition to weakness of the marriage bonds, systems of concubinage, polygamy and polyandry were accepted as permissible and were in wide practice.

Polyandry survived for a long time even after it was made illegal in 1859, because it was linked closely with the land system of the country. During the reign of the Sinhalese kings the landlords had to render personal services to the king for long periods and often far away from home. " During their absence from home their family and lands would have been unprotected, unless the duty of protecting them and cultivating the lands devolved on a brother or near male relation, and was fortified by a bond of interest and affection. The custom also served as a check on the excessive subdivision of land which naturally occurs in Ceylon, where law and custom favour transmission of a parent's property in equal shares to the children  .  .  .   "[1]

In the coastal districts where the impact of Western civilisation was greatest, the Western conception of the monogamous family was formally accepted. Customs gradually changed and marriage by registration was adopted, at least for a large section of the population. In the Kandyan districts, however, a law promulgated in 1859, which prohibited polygamy, polyandry, and concubinage and made marriage registration compulsory remained more or less a dead letter. In 1905, Sir Ponnambalam Arunachalam writes : " Polyandry, though illegal, continues to exist among the Kandyan peasantry, especially in the case of the brothers. The law against polyandry is evaded by not registering the union at all or by registering it as with one brother only. In all cases the ceremonies of marriage are performed with one brother only. The association of other husbands follows by consent of parties, but when once established, becomes matter of public notoriety, and no disgrace attaches to it. The progeny of the woman is deemed the progeny of each husband individually and collectively, and the property is conserved in the family. The husbands do not call themselves husbands, but say they ' live in one house ' while the wife speaks of herself as ' cooking rice ' for all of them. It is true now as in Knox's time that ' the children do acknowledge and care for both fathers. Children born from marriages of this sort call each brother by the common name of father and have no idea of their being more nearly related to one father than another.' The elder father is called ' great father ' and the younger is called ' little father ' and if there was an intermediate father he would be called ' middle father '."[2]

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" A Sinhalese girl has a ' succession ' of husbands, from the beginning of her married life. The Sinhalese registrar of marriages has not much to do." S. P. Lewis, *Manual of Vanni Districts*, 1895, p. 102–3.

" Prior to 1859, there being no written law to regulate the subject of matrimonial alliance in the Kandyan provinces, loose and casual connection and fitful cohabitation of the sexes—with the paternity of the offspring resulting from such pernicious intercourse ever developed in a cloud of doubt and uncertainty—were of common occurrence." Major Frank Modder, f.r.g.s., *Twentieth Century Impressions of Ceylon*, p. 296.

[1] Sir Ponnambalam Arunachalam—*Twentieth Century Impressions of Ceylon*, p. 336.

[2] *Ibid.* pp. 336–7.

Polyandry is believed by many to be extinct today. It is difficult, however, to prove, especially if it exists in the hidden form mentioned above.

## Marriages : Legal and Customary

A marriage is legal if it is registered. The law relating to registration was passed in the early part of the last century for the coastal districts. For the Kandyan districts the law was passed in 1859 and was subsequently amended in 1897. For Moslem marriages registration was made compulsory in 1937. The civil courts, however, recognise marriages even if they are not registered.[1]

For Hindus, Moslems and Christians the marriage ceremonies are performed by priests according to established customary rites. The feasts given by the father or the guardian of the bride and the bridegroom are regarded as social approval of such marriage. The Buddhist priests, however, do not take any part in marriage ceremonies. The feasts and the innumerable rites performed before guests in connection with Buddhist marriage are the proof that such marriage has taken place.[2]

Among the Kandyan Sinhalese there are two systems of marriage which are recognised by law. First is the *diga* system. According to this system, " the conducting of the wife to, and the living in the husband's house or in any family residence of his—or if he does not own a house and lands, the taking her as his wife and the conducting her away from her family to a place of lodging—constitutes a *diga* marriage." [3] Second is the *bina* marriage : In *bina* marriage the bridegroom is received into the house of the bride and lives there as long as the wife permits him to stay. In *diga* marriage the bride gets a dowry and renounces all claim to her father's inheritance ; the sub-division of land is thus avoided. In *bina* marriage, the bride is generally an heiress or the daughter of a wealthy family in which there are few sons. The bridegroom does not acquire any right over the wife's property. The right of expelling him from the home of his wife is possessed not only by the wife but also by the wife's parents and brothers. Hence the Sinhalese adage that a *bina* husband should keep a torch and a stick ready so that he may at least walk back to his own village when expelled from his wife's home.

## Inadequacy of Marriage Statistics

This brief account of the various marriage systems in Ceylon is sufficient to indicate the difficulties encountered in collecting accurate marriage statistics in Ceylon. In

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[1] " Juristic decisions by the highest authorities removed much of the uncertainty by holding that registration was not essential to the validity of a marriage in Ceylon, and the marriage relation could be presumed on adequate evidence of cohabitation and repute." *Census of Ceylon*, 1946, Vol. 1, Part I, p. 192.

[2] John Davy, however, writes : " Amongst people of the lowest rank, little attention is paid to the marriage ceremony, and no formality is observed excepting that of asking leave of the parents to part with their daughter." *Interior of Ceylon*, p. 286. See also Leonard Woolf : *The Village in the Jungle*, The New Phoenix, 1951, pp. 50–52

[3] Sir Ponnambalam Arunachalam, ibid., p. 336.

spite of the fact that registration was made compulsory for most marriages a century ago, a large proportion are never registered even today. The 1946 Census Report, recording the results of the first enquiry into under-registration of marriages, states that 45 per cent of them were un-registered.

Even those who register their marriages do not always do so at the time of marriage. Years, sometimes decades, may pass before registration. The statistics published annually by the Registrar-General are of marriage registrations.

The extent of under-registration is probably declining, as the habit of registration spreads slowly with the increase of literacy and the general development of the country. Often a 'vital-statistics conscious' administrator may succeed in inducing the people to register their marriages, and it may happen that grandfathers and grandchildren register their marriages together.

There are three systems of registration in operation today which further complicates the matter. The general marriage registration system, which has been in operation for more than a hundred years, was used at first by Christians only, but was gradually adopted by the other communities as well. A second system, known as the Kandyan Registration, was first introduced in 1859 and later amended in 1871. The third system is only for the Moslems and was introduced in 1886. Thus the Kandyans and the Moslems can get their marriages registered if they wish to, under either the Kandyan or the Moslem Marriage Registration Acts or under the General Marriage Registration Act. These differ from one another in the minimum age limits prescribed, divorce procedure and the registration authority.

Tabulations of marriages by the age of either partner are not produced, though the ages of the parties have to be entered on the registration form. It is doubtful whether these statements of age are accurate. On the one hand there is an incentive to overstate the ages of minor girls in order to evade the minimum age limit regulations.[1] On the other hand males and females in the older age groups may be inclined to under-state their ages at marriage. These two factors, in addition to the much lower age range of marriage in eastern countries, lead to an unusual concentration of marriage ages in the age groups of middle youth.

The available data with regard to marriages are not classified into first and subsequent marriages. In recent years some information on this point has been provided, but in such a form that little use can be made of it.

The statistics of conjugal condition which are published in the census reports also suffer from a variety of errors. Turner, one of the ablest Census Superintendents of Ceylon, states that the enumerators, from their respect for the law, tend to report persons married without registration as unmarried.[2] Thus according to him the proportion of married in the population is understated in the census reports. Turner himself believes that the true proportion of ever-married population at older ages

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[1] " These mean age must be higher than the actual ages, for the illiterate persons seldom know the exact date of birth, and over-state their ages lest they be treated as " minors " ; besides registration takes place very often after they have lived for some time as husband and wife." *Registrar-General's Report*, 1916, p. L5.

[2] *Census Report*, 1921, Part II, p. 31.

is near 1. Considerable improvement has been made, however, in the 1946 census by providing 'customary marriages' as a separate item of enumeration.[1]

The age returns of the married population suffer from obvious defects, which the census superintendents have tried to remedy by tabulating in age groups of 10 years (instead of 5 years as is customary) to obtain smoother distributions.

We have seen in a previous chapter that all censuses in Ceylon suffer from serious under-enumeration. There is no reason to believe that the degree of under-enumeration is necessarily the same for the married and the non-married. There is no way however, of determining the difference in under-enumeration in these two groups and we have therefore to assume it the same.

The statistics of conjugal condition are further complicated by the presence of polygamy, polyandry and concubinage. All these shortcomings increase the uncertainty of any statistical deduction that may be made from them. However they may be weighed against the general social background. It is useful, therefore, to mention some of the important changes that have taken place in the institutional factors relating to marriage, as a background against which the statistical deductions can be examined.

## Social Changes affecting Marriage

In Ceylon as in most eastern countries, marriage is regarded as a pious duty. Celibacy, especially of women, is not looked upon with favour, except among the priests.[2]

The vast majority of marriages are arranged by the parents or by the head of the family. Caste, religious and family loyalties are very strong in Ceylon, even today ; and they exercise great influence in deciding the marriage. The social and the economic status of the families, the dowry offered by the bride's family and the verdict of the astrologers are all important considerations in striking the marriage bargain.[3] These factors have undergone little change during the present century. Even the intelligentia, enlightened in Western culture, seldom break these rules when marrying. This clearly demonstrates how difficult it is to bring about a change in the social behaviour pattern by a cultural appeal alone.

It was regarded as a bounden duty of the parents to get their daughters and sons married as soon after puberty as economic considerations would permit. When land was plentiful and labour was scarce, the agricultural families had no worry from the economic considerations involved, and married their sons and daughters on reaching this age. The need for agricultural labour thus fostered the system of early marriage.

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[1] *Census of Ceylon*, 1946, Vol. I. Part I, p. 192.

[2] " Old bachelors and old maids are rarely to be seen amongst the Sinhalese ; almost every man marries, and marries young, and the wife not of his own but of his father's choice." John Davy *Interior of Ceylon*, 1821, p. 285. 1946 *Census Report* says : " This (i.e. the proportion married, seems to confirm today the observation made by Davy." Ibid, Vol. I, Part I, p. 195.

[3] Cf. Bryce Ryan : *Institutional Factors in Sinhalese Fertility :* The Milbank Memorial Fund Quarterly, Oct. 1952, pp. 360–366.

With the destruction of the ancient system of irrigation, agricultural land became scarce and it became more and more difficult to collect the necessary dowry and to find a suitable bridegroom who was well off, yet willing to accept a low dowry. The economic status and security of income of the would-be-bridegrooms also deteriorated. This meant a prolonged wait for the bride, firstly to accumulate a dowry, and secondly to find a suitable bridegroom. Along with this, the slow and gradual infiltration of Western ideas and the spread of education have exercised an influence in Ceylon society ; first among the upper strata who were more closely associated with the new rulers, extending gradually into the lower strata who copied the upper classes as far as their purse permitted.[1] The net effect of all these changes was that when a ' mature ' girl remained unmarried for a few years, there was not the same fierce criticism as formerly.

The statistical data relating to current marriage habits, and their changes during the century, may now be examined against this background.

## Marriage Statistics

### UNDER-REGISTRATION OF MARRIAGES

In view of the shortcomings already found in the registrations of births, it is appropriate first to examine marriage statistics for under-registration.

A basis for such a study is provided by the number of married persons enumerated at the various censuses, to which may be added an allowance for under-enumeration at the same rate as that already determined for persons of all marital conditions. This assumption—that the proportionate under-enumeration of the married is the same as that of the non-married—is not entirely satisfactory, but no better data is available. In any event, under-enumeration is not on such a scale as seriously to invalidate the calculations. The estimated married population in census years, obtained in this way, may be compared with a second estimate

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[1] The extent to which education has been spreading in the country is indicated by the decrease in illiteracy of the registered married, as shown below :

*Percentage of illiterates marrying*

| Period | General Marriages | | Kandyan Marriages | |
|---|---|---|---|---|
| | *Male* | *Female* | *Male* | *Female* |
| 1896–1900 | 25·2 | 76·8 | 37·2 | 96·2 |
| 1901–10 | 23·1 | 68·4 | 33·2 | 94·5 |
| 1911–20 | 17·1 | 50·6 | 26·3 | 89·9 |
| 1921–30 | 13·5 | 43·6 | 19·8 | 76·7 |
| 1931–40 | 9·3 | 35·6 | 12·5 | 61·1 |
| 1941–50 | 5·8 | 23·5 | 9·4 | 44·4 |

based on marriage registrations from which a suitable deduction has been made for mortality. An allowance should also be made for migration, but statistics of migrants by marital condition are not available and, to make the comparison worthwhile, it is therefore necessary to restrict it to the younger ages, at which immigration and emigration of married persons may be expected to be at a minimum.

### THE DATA

The numbers of marriages registered annually are published by the Registrar-General in his report, but without distinction of the ages of the parties, although these are entered in the registers. To obtain the age distribution of the brides and bridegrooms, 50 random samples of 100 to 120 entries were taken from the Registrar-General's records, one for each year from 1896 to 1945. Because of the smallness of the samples, the fluctuations from year to year were somewhat excessive, and so the samples for the five individual years before each census were pooled to provide composite samples of 500 or more entries.

The Registrar-General publishes in his report the average age at marriage for both males and females, and these are compared with similar ages obtained from the pooled samples in the following statement :

| Period | Average age at marriage | | Standard Error of sample | (Col. 2–Col. 3) ÷ Col. 4 |
|  | Pooled sample | Population |  |  |
| (1) | (2) | (3) | (4) | (5) |
| Males : | | | | |
| 1896–1900 | 27·05 | 27.30 | 0·2571 | 1·01 |
| 1906–1910 | 27·63 | 27·20 | 0·2614 | 1·65 |
| 1916–1920 | 26·89 | 27·10 | 0·2165 | 1·41 |
| 1941–1945 | 28·35 | 28·16 | 0·2277 | 0·83 |
| Females : | | | | |
| 1896–1900 | 19·38 | 19·90 | 0·2189 | 2·40 |
| 1906–1910 | 19·37 | 20·30 | 0·2116 | 4·44 |
| 1916–1920 | 19·84 | 20·40 | 0·2249 | 2·50 |
| 1941–1945 | 21·52 | 21·36 | 0·1904 | 0·86 |

The sums of the squares of the last column are distributed as Chi-square with 4 degrees of freedom. The value for males, 6·42, is quite insignificant $(P > 0·20)$, and suggests that the male sample is satisfactory. The female value, 32·5, is very highly significant and suggests that something is wrong, either with the sample or the Registrar-General's figures. It will be noted that in general the sample gives lower ages at marriage than the Registrar-General's figure, suggesting that, if the fault lies in the sample and if this fault carries through into the calculated proportion of brides who were under age 20, the proportion obtained will be too high. An independent test of this does not, however, reveal any serious discrepancy. According to Registrar-General, the proportion of brides under age 20 was 0·499 in 1916 and 0·464 in 1921. A weighted mean of these values for 1916–20 is 0·485. From this, the proportion under age 20 may be estimated by deducting the proportion

at age 20. In view of the young average age of brides in Ceylon—under 20—an assumption that brides under 21 are evenly distributed from 15 to 21, that is that 1/6th are aged 20, is not likely to under-estimate the proportion aged 20 to a serious extent at all. This assumption leads to an estimate that 0·405 of brides are under 20 (compared with the sample value of 0·433). If the sample estimates of the proportion of brides is too high, they will of course lead to a small under-estimation of the extent of under-registration.

The accuracy of the statement of age given at marriage registration is not considered such as to indicate the number by single years of age. However it will be noted that the average age of brides in Ceylon is far lower than in England and Wales, for instance, and is about age 20. A simple assumption as to the distribution of marriages within the age group under 20 will therefore be adequate for our purpose, namely, that they are restricted to ages 15–19, and are evenly spread over these ages. This assumption would not be satisfactory for male marriages on their own, but the results of the computations may be anticipated to the extent of mentioning that male marriages will be found to be quite insignificant, notwithstanding that, as calculated, they are probably over-estimated.

Survival factors for determining the survivors to census date from the original marriages may be obtained from data available in abridged life tables. The mortality at the ages involved is not available in abridged life tables. The mortality at the ages involved is not severe, nor increasing rapidly with age, and an assumption that the mortality is constant from age 15 to 20 will be adequate for our purpose.

### THE METHOD OF COMPUTATION

The method of computation may best be described by considering a concrete case, the estimation of the married population under age 20 at the 1921 census by the two methods, one based on marriage statistics and the other on the enumerated population.

Under the assumption of an even distribution of marriages under 20 over the age range 15–19, the married population under age 20 at the 1921 census are the survivors of those married—

in 1916 at age 15–15½ (on average)
in 1917 „ „ 15–16½ „
in 1918 „ „ 15–17½ „
in 1919 „ „ 15–18½ „
in 1920 „ „ 15–19½ „

i.e. 0·1, 0·3, 0·5, 0·7 and 0·9 of the marriages at ages under 20 in 1916, 1917, 1918, 1919 and 1920 respectively.

According to the 1916–20 pooled sample, 0·0092 of the bridegrooms and 0·4330 of the brides of the period were under age 20, and these proportions may be applied to the number of marriages registered in each of these years, as follows :

| Year | Total No. of marriages registered | Males marrying under 20 years | Females marrying under 20 years |
|------|------|------|------|
| 1916 | 24,969 | 230 | 10,812 |
| 1917 | 25,201 | 232 | 10,912 |
| 1918 | 22,186 | 204 | 9,607 |
| 1919 | 18,869 | 174 | 8,170 |
| 1920 | 21,821 | 201 | 9,448 |

Of these, the number remaining under 20 years of age at the 1921 census are as follows :

| Year | Factor (see Text) | Number remaining under 20 years of age at 1921 Census | |
|------|------|------|------|
| | | Males | Females |
| 1916 | 0·1 | 23 | 1,081 |
| 1917 | 0·3 | 70 | 3,274 |
| 1918 | 0·5 | 102 | 4,804 |
| 1919 | 0·7 | 122 | 5,719 |
| 1920 | 0·9 | 181 | 8,503 |

On average, those married in 1916 must survive through $4\frac{1}{2}$ years to the 1921 census, and those married in 1917, 1918, 1919 and 1920 through $3\frac{1}{2}$, $2\frac{1}{2}$, $1\frac{1}{2}$ and $\frac{1}{2}$ years respectively. From the available abridged life table, the survival factor $_5p_{15}$ for the full 5 years from age 15 to 20 may be obtained. On the assumption of an even force of mortality from age 15 to 20, and denoting $\sqrt[10]{_5p_{15}}$ by $p$, the survival factors through $4\frac{1}{2}$, $3\frac{1}{2}$, $2\frac{1}{2}$, $1\frac{1}{2}$ and $\frac{1}{2}$ year within this age range are $p^9$, $p^7$ $p^5$, $p^3$ and $p$ respectively.

Survival factors calculated in this way are as follows :

| Survival factors through | Within the age range 15–20 and calendar years 1916–20 | |
|------|------|------|
| | Male | Female |
| $4\frac{1}{2}$ years | 0·969 | 0·966 |
| $3\frac{1}{2}$ ,, | ·976 | ·974 |
| $2\frac{1}{2}$ ,, | ·983 | ·981 |
| $1\frac{1}{2}$ ,, | ·990 | ·989 |
| $\frac{1}{2}$ ,, | ·997 | ·996 |

These survival factors are applied to the persons married in 1916, 1917, 1918, 1919 and 1920 respectively as follows :

| Year | Numbers married who would remain under 20 at 1921 Census if surviving | | Survival factors | | Estimated survivors to 1921 Census | |
| --- | --- | --- | --- | --- | --- | --- |
| | Male | Female | Male | Female | Male | Females |
| 1916 | 23 | 1,081 | 0·969 | 0·966 | 22 | 1,044 |
| 1917 | 70 | 3,274 | ·976 | ·974 | 68 | 3,189 |
| 1918 | 102 | 4,804 | ·983 | ·981 | 100 | 4,713 |
| 1919 | 122 | 5,719 | ·990 | ·989 | 121 | 5,656 |
| 1920 | 181 | 8,503 | ·997 | ·996 | 180 | 8,469 |
| | | | | | 491 | 23,071 |

Thus the estimate based on registered marriages, of married population under age 20 at 1921 census is 23,562.

The comparable estimate based on the enumerated married population, with an allowance for under-enumeration at the same rate as that found for persons of all marital conditions, is 75,434.

The proportion of the marriages of 1916–20 not registered may be estimated as :

$$1 - \frac{23,562}{75,434} = 0·68765$$

Estimates of under-registration, obtained similarly for other periods, are as follows :

| Period | Proportion of marriages not registered |
| --- | --- |
| 1896–1900 | 71·94 per cent. |
| 1906–1910 | 70·00 ,, ,, |
| 1916–1920 | 68·76 ,, ,, |
| 1941–1945 | 55·30 ,, ,, |

It may be noted that some of the data, employed for calculating these proportions, were obtained from samples and is thus liable to sampling errors. As the number of males involved is so small relative to the number of females, the order of magnitude of the error may be calculated by considering only the female data. The proportion of brides under age 20 were estimated from samples of 500 or so entries, the proportions found being between 0·4 and 0·5. The standard error of this is therefore approximately $0·5 \div \sqrt{500}$, or about 4 per cent. of the proportion found. This will lead to a standard error of about 2 per cent. in the proportion of marriages not

registered—shown above—and of about 4 per cent. in estimates of true marriages based on registered marriages with an allowance for under-registration deduced from these proportions. There is also the possibility discussed earlier, of some small bias in the samples which, if it is present, would have depressed the calculated under-registration by a few per cent.

As explained earlier, the extension of similar calculations to the above for higher age groups is precluded by lack of information on the marital conditions of migrants. Of necessity, therefore, the assumption has to be made that under-registration of marriage at the older ages, is proportionately, on the same scale as for ages under 20. Whilst a number of arguments can be advanced for expecting differential behaviour as between young and old age groups in this matter, in practice, and for many purposes, no great harm will arise from assumptions only established for the young, since the overwhelming bulk of marriages occur at the young ages in Ceylon—in 1900–02, for instance, more than two-thirds of brides were under 25 years of age.

For years not covered above, under-registration was estimated by interpolation (or extrapolation) on a linear trend from the adjacent determined values.

These corrections were applied to the recorded number of marriages before employing them in the remainder of this section. Census populations, where they are used, have been corrected for under-estimation by the application to the individual marital conditions of the factors already derived for all marital conditions combined.

Having corrected the basic data in this manner we are in a position to make a closer study of the marriage habits and examine the trend in marriages.

### Trend in Marriage

Trend in marriages is composed of four distinguishable factors, namely, (a) the proportion of the population who ever marry ; (b) the age at first marriage ; (c) the rate of dissolution of marriage by death or divorce ; (d) the rate of remarriage.

Statistics relating to remarriage are so inadequate that it is impossible to study first and subsequent marriages separately. The number of remarriages is, however, relatively small. Even among registered marriages, the proportion of first marriages was 70 per cent in 1949, and marriages of widows are likely to be less common among the population prone not to register their marriages. Hence, in spite of our failure to isolate first marriages, the results of our analyses will be heavily biassed towards first marriages, and will probably show the general trend of such marriages with a fair degree of accuracy. In any event the data are not of such quality that, unsupported, they will indicate other than broad trends.

Divorce is not common in Ceylon and most marriages are therefore ended by the death of a partner.[1] Allowance for mortality may be made by considering the marriages in a life table population.

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[1] " The total number of divorced persons formed only a small proportion of the population—about 18 in every ten thousand." *Census of Ceylon*, 1946, Vol. 1, Part 1, p. 196.

The main problems in the measurement of marriage trend are, therefore, first, the measure of changes in the overall attitude towards marriage as revealed by the proportions ever-married at different ages, and secondly, the age at which people marry for the first time.

**Proportion of Ever-married**

Table 1 gives the proportion of ever-married (i.e. the married, widowed and divorced) according to census returns.

TABLE 1—PROPORTION EVER-MARRIED BY AGE AND SEX

| | | Male | | | | Female | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Age* | 1901 | 1911 | 1921 | 1946 | 1901 | 1911 | 1921 | 1946 | *Age* |
| Less than 15 | ·0007 | ·0002 | ·0001 | ·0000 | ·0144 | ·0067 | ·0045 | ·0000 | < 15 |
| 15– | ·0701 | ·0218 | ·0147 | ·0130 | ·5189 | ·3342 | ·2791 | ·2470 | 15– |
| 20– | ·5163 | ·3880 | ·3539 | ·3750 | ·8194 | ·7863 | ·7623 | ·7792 | 20– |
| 30– | ·8132 | ·7840 | ·7762 | ·8269 | ·8841 | ·8873 | ·8929 | ·9445 | 30– |
| 40– | ·8699 | ·8690 | ·8740 | ·9295 | ·8993 | ·9076 | ·9182 | ·9628 | 40– |
| 50– | ·8813 | ·8879 | ·9007 | ·9328 | ·9093 | ·9198 | ·9315 | ·9661 | 50– |
| 60+ | ·8763 | ·8987 | ·9066 | ·9400 | ·9149 | ·9263 | ·9386 | ·9664 | 60+ |

*Source :* Compiled from the Census Reports after correction for under-enumeration.

The proportion of ever-married for ages below 30 show a decline in this century, while the proportions above 30 show a rise. This rise in the proportion of ever-married may, however, be fictitious, resulting from faulty enumeration. We have noted before that, prior to 1946 when customary marriages were enumerated separately, the enumerators often returned as unmarried those who had not registered their marriages. The rise in the trend in the proportion of ever-married may be entirely due to this factor. The declining trend in the proportion of ever-married in the younger age groups could for the same reason be taken to be steeper than that shown in the table.

**Proportion of Ever-Married According to Gross Nuptiality**

The proportions ever-married according to gross nuptiality may be compared with those derived from censuses. The census proportions are the accumulated result of marriage habits over the past 30 years or so. The proportions according to gross nuptiality are the results that would have been obtained had current marriage rates held throughout these years[1]. It will be noticed that the proportions according to gross nuptiality are subjected to a greater degree of temporary fluctuation than

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[1] The method of computing the proportions of ever-married according to gross nuptiality is described in Appendix A.

the census proportions. In finding the long period trend, therefore, we should allow for this temporary rise or fall in the proportions of ever-married according to gross nuptiality.

TABLE 2—PROPORTION EVER-MARRIED ACCORDING TO GROSS NUPTIALITY

| Age | Males | | | | Females | | | | Age |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | 1900–02 | 1910–12 | 1920–22 | 1945–47 | 1900–02 | 1910–12 | 1920–22 | 1945–47 | |
| Less than 15 | ·0252 | ·0090 | ·0037 | ·0061 | ·4783 | ·3435 | ·3055 | ·2636 | < 15 |
| 15– | ·4280 | ·2751 | ·2792 | ·1985 | ·9778 | ·8382 | ·7791 | ·7381 | 15– |
| 20– | ·9003 | ·7630 | ·7137 | ·6560 | ·9994 | ·9919 | ·9590 | ·9676 | 20– |
| 25– | ·9973 | ·9957 | ·9000 | ·9534 | ·9998 | ·9949 | ·9748 | ·9887 | 25– |
| 30– | ·9998 | ·9983 | ·9334 | ·9840 | ·9999 | ·9990 | ·9804 | ·9922 | 30– |
| 35– | ·9999 | ·9990 | ·9468 | ·9907 | 1·0000 | ·9995 | ·9825 | ·9933 | 35– |
| 40– | 1·0000 | ·9993 | ·9524 | ·9936 | 1·0000 | ·9999 | ·9834 | ·9935 | 40– |
| 45– | 1·0000 | ·9995 | ·9560 | ·9946 | 1·0000 | 1·0000 | ·9844 | ·9937 | 45– |
| 50– | 1·0000 | ·9996 | ·9584 | ·9951 | 1·0000 | 1·0000 | ·9845 | ·9938 | 50– |

The decline in the trend below the age of 30 is revealed in this table also. But in all higher age groups both for males and females the proportions show a decline during 1900–1922 and a sharp rise in 1945–47. The pronounced decline in the proportions of ever-married in 1920–22, may be explained by the fall in the marriage rate due to the postponement of marriages following the malaria and the influenza epidemics. Otherwise, little change is shown during this century except in the fall of the proportions married in early youth.

Combining these two tables and taking account of the factors causing difference between them, we could, perhaps, conclude that the customary universality of marriage has undergone but little change in the present century. The only noticeable change has been the rise in age of first marriages, both for males and females.

**Marriage Rates**

In order to examine contemporary marriage habits, the marriage rate of a period may be computed by dividing the average annual number of marriages by the mean of the non-married population aged 15 to 60 years at the beginning and at the end of the period. Marriage rates thus estimated are given below :

TABLE 3—MARRIAGE RATE

| Period | Male | Female |
| --- | --- | --- |
| 1900–09 | ·1207 | ·1495 |
| 1910–19 | ·0963 | ·1246 |
| 1920–29 | ·0872 | ·1138 |
| 1930–39 | ·0684 | ·0916 |
| 1940–49 | ·0749 | ·1023 |
| 1950 | ·0766 | ·1056 |
| 1951 | ·0874 | ·1088 |

*Source :* Computed from the Registrar-General's figures after correction for under-registration and the census figures of non-married after correction for under-enumeration.

The rates for both males and females show a declining trend till 1939, and then a sharp rise.   The decline in the trend may be explained by the increasing proportion of the younger age groups in the age-composition of the population and the rise in the age at first marriages.   The overall marriage rate does not take into consideration the changes in the age composition of the population, which may bring about a change in the marriage rate independent of any change in the marriage habit of the population.

Table 4 below gives the age-specific marriage rates of non-married population, which are free from this objection.

TABLE 4—AGE-SPECIFIC MARRIAGE RATES

| Age | Males | | | | Females | | | | Age |
|---|---|---|---|---|---|---|---|---|---|
| | 1900–02 | 1910–12 | 1920–22 | 1945–47 | 1900–02 | 1910–12 | 1920–22 | 1945–47 | |
| 15– | ·0103 | ·0036 | ·0015 | ·0025 | 0·3667 | ·02093 | 0·1759 | 0·1432 | 15– |
| 20– | ·2641 | ·1419 | ·1502 | ·0930 | ·3843 | ·3739 | ·3044 | ·3221 | 20– |
| 25– | ·3797 | ·3894 | ·2272 | ·3155 | ·2121 | ·1228 | ·1146 | ·2297 | 25– |
| 30– | ·3404 | ·1932 | ·0947 | ·2239 | ·1746 | ·0438 | ·0642 | ·0868 | 30– |
| 35– | ·3135 | ·1116 | ·0587 | ·1141 | ·1111 | ·0353 | ·0314 | ·0525 | 35– |
| 40– | ·2405 | ·1012 | ·0272 | ·0917 | ·1019 | ·0320 | ·0137 | ·0073 | 40– |
| 45– | ·1982 | ·0511 | ·0169 | ·0441 | ·0784 | ·0263 | ·0061 | ·0071 | 45– |
| 50– | ·1949 | ·0431 | ·0137 | ·0242 | ·0417 | ·0176 | ·0000 | ·0038 | 50– |
| 55– | ·1344 | ·0194 | ·0089 | ·0156 | ·0323 | ·0130 | ·0000 | ·0028 | 55– |

*Source :* Computed from the Registrar-General's figures after correction for under-registration and the census figures of non-married after correction for under-enumeration.   The age-distribution of marriages is obtained from samples.

The age-specific marriage rates show a decline in the age groups 15–24 years for males and 15–19 years for females.   For other age groups the rates declined until 1920–22 but rose sharply in 1945–47.   The sharp decline in 1920–22 and the rapid rise in 1945–47 may be explained by temporary factors.   1920–22 marriage rates must have been affected by a temporary postponement of marriage which followed the epidemics of the period.   Similarly the boom in marriage in 1942–47, observed in other countries also, could be explained by the improvement in health conditions after the 1935 malaria epidemic and the improvement in the economic situation after the depression of 1937 with the starting of the war.

An important feature of Table 4 is the relatively low marriage rates in 1945–47 at the oldest ages, showing that marriages at the older ages are less common today than 50 years ago.   In the early part of the century and before, it was not uncommon to hear of old men marrying girls 30 or 40 years  younger than themselves.   Widows rarely agreed to remarry and old spinsters were still more rare.   If a man of advanced age wanted to marry, he had, therefore, to seek the hand of a young maiden, whose parents or guardians would agree to the marriage from financial considerations. The views of daughters were not considerations to be taken into account in matters of marriage.   Such marriages are rare today, and the older men show a more

enlightened attitude towards marriage, and also young brides have some say in the selection of their future husbands. These are symptomatic of the change in the attitude towards marriage and the relation between the sexes that is spreading over the country.

A second reason for the decline in marriage rates at the older ages is the decline in mortality, leading to fewer widowers and widows available to marry, except at extreme old age when remarriage is less common.

## Nuptiality Tables

The device of nuptiality tables, explained in Appendix A, provides measures of marriage intensity freed from the effects of the population's age structure, and thus making comparison more correct. Gross nuptiality tables show the way in which a population of 100,000 will gradually get married, on the assumption that no one dies and that the current marriage rate operates throughout. Table 5 shows gross nuptiality for Ceylon in the present century.

TABLE 5—GROSS NUPTIALITY

| Age | Males | | | | Females | | | | Age |
|---|---|---|---|---|---|---|---|---|---|
| | 1900–02 | 1910–12 | 1920–22 | 1945–47 | 1900–02 | 1910–12 | 1920–22 | 1945–47 | |
| 15 | 5,031 | 1,803 | 739 | 1,219 | 95,652 | 68,700 | 61,099 | 52,724 | 15 |
| 20 | 75,532 | 51,420 | 54,364 | 37,253 | 4,261 | 30,243 | 33,622 | 42,180 | 20 |
| 25 | 18,931 | 46,146 | 32,526 | 54,262 | 61 | 497 | 2,352 | 3,719 | 25 |
| 30 | 465 | 411 | 4,735 | 5,214 | 17 | 112 | 809 | 492 | 30 |
| 35 | 36 | 96 | 1,954 | 911 | 5 | 73 | 309 | 206 | 35 |
| 40 | 4 | 50 | 724 | 426 | 3 | 56 | 120 | 24 | 40 |
| 45 | 1 | 17 | 403 | 142 | 1 | 40 | 51 | 23 | 45 |
| 50 | 0 | 11 | 300 | 65 | 0 | 24 | 49 | 12 | 50 |
| 55 | — | 4 | 185 | 38 | — | 16 | 46 | 6 | 55 |

The generalisations which could be drawn from these features are—

(1) marriages below 25 years for males and 20 years for females are declining. Since a large proportion of marriages are first marriages, it could be argued that the age at first marriage has gradually risen during the century both for males and for females ;

(2) marriages between the age of 25 and 34 years among males and 20 and 30 years among females have increased, perhaps, in consequence of (1) ;

(3) marriages at 35 years of age and above for males and 30 years and above for females have become less common today than they were during the twenties.

## Net Nuptiality

Gross nuptiality tables are based on the assumption of no mortality. An alternative device—net nuptiality tables—may be constructed, starting from 100,000 births

and assuming both current nuptiality and mortality to continue. Table 6 shows the results of such calculations for Ceylon.

TABLE 6—NET NUPTIALITY

| Age | Males | | | | Females | | | | Age |
| | 1900–02 | 1910–12 | 1920–22 | 1945–47 | 1900–02 | 1910–12 | 1920–22 | 1945–47 | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 3,356 | 1,127 | 495 | 947 | 64,757 | 46,716 | 41,242 | 41,968 | 15 |
| 20 | 48,339 | 30,389 | 35,011 | 28,200 | 2,752 | 19,446 | 21,585 | 32,436 | 20 |
| 25 | 11,472 | 25,381 | 19,971 | 39,720 | 36 | 295 | 1,409 | 2,722 | 25 |
| 30 | 261 | 206 | 2,742 | 3,661 | 9 | 60 | 452 | 342 | 30 |
| 35 | 18 | 43 | 1,055 | 608 | 2 | 36 | 161 | 136 | 35 |
| 40 | 2 | 19 | 359 | 267 | 1 | 25 | 58 | 15 | 40 |
| 45 | 1 | 5 | 179 | 82 | — | 16 | 22 | 14 | 45 |
| 50 | 0 | 3 | 115 | 34 | — | 8 | 20 | 7 | 50 |
| 55 | — | 1 | 58 | 17 | — | 5 | 16 | 3 | 55 |

Table 6 shows the same trend as Table 5, viz. a decline in nuptiality in early youth and an increase in the middle age group.

Tables 5 and 6 show the trend in nuptiality at particular ages, as if changes at one age are independent of those occurring at other ages. The marriages in an age group, in fact, depend to a large extent on the marriages in the lower age groups. Moreover, we do not get a picture of the whole by considering the nuptialities in fragments. Nuptiality tables are best considered, therefore, when the nuptiality of individual age groups are cumulated, as shown in Tables 5A and 6A. Starting from 100,000 births, Table 5A shows the number married at successive ages under current nuptiality, assuming mortality to be nil. Table 6A is similar except that current mortality is assumed, and the Table shows the number married and surviving.

TABLE 5A—GROSS NUPTIALITY : CUMULATED

| Age | Males | | | | Females | | | | Age |
| | 1900–02 | 1910–12 | 1920–22 | 1945–47 | 1900–02 | 1910–12 | 1920–22 | 1945–47 | |
|---|---|---|---|---|---|---|---|---|---|
| 15 | 5,031 | 1,803 | 739 | 1,219 | 95,652 | 68,700 | 61,099 | 52,724 | 15 |
| 20 | 80,563 | 53,223 | 55,103 | 38,472 | 99,913 | 98,943 | 94,721 | 94,904 | 20 |
| 25 | 99,494 | 99,369 | 87,629 | 92,734 | 99,973 | 99,440 | 97,073 | 98,623 | 25 |
| 30 | 99,959 | 99,780 | 92,364 | 97,948 | 99,991 | 99,552 | 97,882 | 99,115 | 30 |
| 35 | 99,995 | 99,876 | 94,318 | 98,859 | 99,996 | 99,625 | 98,191 | 99,321 | 35 |
| 40 | 99,999 | 99,926 | 95,042 | 99,285 | 99,999 | 99,681 | 98,311 | 99,345 | 40 |
| 45 | 100,000 | 99,943 | 95,445 | 99,427 | 100,000 | 99,721 | 98,362 | 99,368 | 45 |
| 50 | 100,000 | 99,954 | 95,745 | 99,492 | 100,000 | 99,745 | 98,411 | 99,380 | 50 |
| 55 | 100,000 | 99,958 | 95,930 | 99,530 | 100,000 | 99,761 | 98,457 | 99,386 | 55 |

TABLE 6A—NET NUPTIALITY : CUMULATED

| Age | Males | | | | Females | | | | Age |
|---|---|---|---|---|---|---|---|---|---|
| | 1900–02 | 1910–12 | 1920–22 | 1945–47 | 1900–02 | 1910–12 | 1920–22 | 1945–47 | |
| 15 | 3,356 | 1,127 | 495 | 947 | 64,757 | 46,716 | 41,242 | 41,968 | 15 |
| 20 | 51,695 | 31,516 | 35,506 | 29,147 | 67,509 | 66,162 | 62,827 | 74,404 | 20 |
| 25 | 63,167 | 56,897 | 55,477 | 68,867 | 67,545 | 66,457 | 64,236 | 77,126 | 25 |
| 30 | 63,428 | 57,103 | 58,219 | 72,528 | 67,554 | 66,517 | 64,688 | 77,468 | 30 |
| 35 | 63,446 | 57,146 | 59,274 | 73,136 | 67,556 | 66,553 | 64,849 | 77,604 | 35 |
| 40 | 63,448 | 57,165 | 59,633 | 73,403 | 67,557 | 66,578 | 64,907 | 77,619 | 40 |
| 45 | 63,449 | 57,170 | 59,812 | 73,485 | — | 66,594 | 64,929 | 77,633 | 45 |
| 50 | — | 57,173 | 59,927 | 73,519 | — | 66,602 | 64,949 | 77,640 | 50 |
| 55 | — | 57,174 | 59,985 | 73,536 | — | 66,607 | 64,965 | 77,643 | 55 |

In both tables a decline is shown until 1945, when a sharp rise is recorded in all age groups except 15–24 in the case of males and 15–19 in the case of females. Thus, Tables 5A and 6A bring out clearly the significant features in the marriage trends of Ceylon during this century. The first is the general decline, broken by the sharp rise at the end of the Second World War. Measured by net nuptiality, the number married rose above the 1900 position, the greater rise than that shown in the gross nuptiality tables being due to mortality improvement.

The other important feature, the rise in average age of marriage is shown by a decline in the number of males married under 25 and of females under 20, is coupled with a rise at older ages.

It should be remembered that in the last century it was the object of parents to get their daughters married as soon after puberty as possible. The average age of brides at marriage in Ceylon is still low by Western standards, and the trend mentioned for age at marriage to rise is therefore a tendency to move towards Western levels.

## The Average Age and Modal Age at Marriage

Further proof of the decline in nuptiality in the lower age groups is available in the mean age of registered marriages published every year by the Registrar-General. It is reasonable to assume that the mean age at marriage of registered and un-registered marriages together, would be lower than that of the registered alone. Secondly, the trend in the mean age of registered marriages is modified considerably by the trend in registration itself. As the custom of registration spreads into the backward sections of the community, the mean age of registered marriages is lowered, by the mere fact of increase in registration alone. Thirdly, the mean age is the mean of all marriages and not of first marriages alone. The effect of including second and higher order marriages with the first marriages is to push up the mean age. We have noted before that the proportions of marriages at higher ages which may reasonably be assumed to be higher order marriages are declining. The effect of

this decline in the proportions of higher order marriages on the trend of mean age at marriage is to lower it and give it a downward slope. These considerations suggest that the mean age of all marriages—registered and un-registered—are lower, but rising more steeply than the figures shown in Table 7.

TABLE 7—MEAN AND MODAL AGE OF MARRIAGES

(Registered according to the General Marriage Registration Act)

| Period | Mean Age | | Modal Age | |
| --- | --- | --- | --- | --- |
| | Male | Female | Male | Female |
| | Years | Years | Years | Years |
| 1900–09 | 26·89 | 20·50 | 24·60 | 19·83 |
| 1910–19 | 27·14 | 20·56 | 24·85 | 19·44 |
| 1920–29 | 27·27 | 21·03 | 26·03 | 21·46 |
| 1930–39 | 27·49 | 21·19 | 28·29 | 22·59 |
| 1940–49 | 28·14 | 21·77 | 27·43 | 22·34 |
| 1950 | 28·20 | 22·10 | 25·50 | 22·50 |

Source : Registrar-General's Reports and the samples referred to on pages 75–76.

The modal age is perhaps a better indication of the prevailing habits relating to first marriages than the mean age. Second or higher order marriages occurring at high ages, influence the mean age more than the modal age, though both are raised by the inclusion of re-marriages above the values strictly applicable to first marriages.

The modal age shows a rise until 1940 and then a fall. This fall may perhaps be attributed to the marriage boom already noted and which is an international phenomenon, for an increase in marriage intensity is frequently associated with a lowering in age at marriage.[1] The mean age, it may be noted, is too insensitive to show this fall.

The mean age at first marriage can be computed from census tabulations by age and conjugal condition by a method developed by Hajnal.[2] The method consists in finding the total number of years lived in a single state by a generation from birth to age 50 years, and dividing this total by the number who have married by

[1] " An increase in nuptiality is normally accompanied by a fall (a decrease in nuptiality by a rise) in the average age of marriage." J. Hajnal in " Aspects of Recent Trends in Marriages in England and Wales ", Population Studies Vol. I, p. 77.

[2] John Hajnal, " Age at Marriage and Proportion Marrying ": Population Studies, Nov. 1953, Vol. VII, No. 2.

that age.   The result is the mean age at first marriage.   Table 7A shows the mean
age at first marriage obtained by this method.

TABLE 7A—MEAN AGE AT FIRST MARRIAGE OBTAINED FROM THE CENSUS DATA BY
HAJNAL'S METHOD

|  | Male | Female |
|---|---|---|
|  | Years | Years |
| 1901 | 23·91 | 19·41 |
| 1911 | 27·35 | 20·80 |
| 1921 | 28·44 | 21·41 |
| 1946 | 27·82 | 22·87 |

The mean age at first marriage for each year shown in this Table reflects
the marriage habits of the previous 35 or 40 years.   Tables 7 and 7A are not, therefore,
comparable.   However, the trend is similar in both, and leaves no doubt that age
at first marriage has risen during this century.[1]

## Percentage of Marriages under 21 Years of Age

Further evidence of the rise in age at marriage during the century is provided by
the percentages who marry under 21 years of age, derived from marriage registrations.

TABLE 8—PERCENTAGE MARRYING UNDER 21 YEARS OF AGE

| Year | General Marriages | | Kandyan Marriages | |
|---|---|---|---|---|
|  | Male | Female | Male | Female |
| 1896 | 6·6 | 73·9 | 11·0 | 62·8 |
| 1901 | 4·7 | 50·6 | 12·2 | 64·8 |
| 1906 | 3·6 | 51·9 | 13·1 | 71·5 |
| 1911 | 2·5 | 49·4 | 12·1 | 71·7 |
| 1916 | 2·9 | 49·9 | 11·5 | 72·3 |
| 1921 | 2·2 | 46·4 | 11·4 | 72·9 |
| 1926 | 1·8 | 45·3 | 10·3 | 72·6 |
| 1931 | 1·8 | 46·1 | — | — |
| 1936 | 1·4 | 40·0 | — | — |
| 1941 | 1·1 | 33·1 | — | — |
| 1946 | 0·7 | 33·5 | 4·8 | 67·9 |
| 1951 | 0·6 | 32·0 | 6·9 | 56·5 |

*Source :* Registrar-General's Reports.

[1] John Davy remarked in 1821, "When a young man has reached the age of 18 or 20, he is consi-
dered marriageable, and it is the duty of the father to provide him with a proper wife." *Interior
of Ceylon*, 1821, p. 285.   The modal age of 27 years in 1940–49 shows a significant rise over the age
at marriage in 1821, if Davy's statement is true.

The rise in the percentages of Kandyans marrying under 21 years until 1921 is probably due to an improvement in the quality of marriage registration, particularly a decrease in registrations delayed for a number of years.

It is interesting to compare the marriage pattern of Ceylon with those of India and of England. Comparative figures for these three countries are given in Table 9 which shows the percentage of single women in various age groups.

TABLE 9—PERCENTAGE OF SINGLE WOMEN IN VARIOUS AGE GROUPS

| Age | India | Ceylon | England and Wales |
|---|---|---|---|
| | 1931 | 1946 | 1931 |
| 15–19 | 12·7 | 75·4 | 98·2 |
| 20–24 | 4·7 | 29·4 | 74·2 |
| 25–29 | 1·8 | 11·8 | 40·6 |
| 30–34 | 1·5 | 6·6 | 24·9 |
| 35–39 | 1·1 | 4·3 | 20·6 |
| 40–44 | 1·0 | 4·0 | 18·1 |
| 45–49 | 0·8 | 3·4 | 16·8 |
| 50–54 | 0·8 | 3·6 | 15·9 |
| 55+ | 0·7 | 3·1 | 15·7 |

*Source :* Demographic Year Book, 1949–50. U. N. O.

The percentage of women who are single is higher in Ceylon than in India, particularly in the younger age groups. Not only is there a higher proportion of women who never marry—the proportion of single women aged 50 years and more is about 8 per thousand in India, 36 per thousand in Ceylon and 159 per thousand in England and Wales—but marriage tends to take place rather later. Using Hajnal's method of computation, the average age of women at marriage is 15·9 years in India, 23 years in Ceylon and 27·6 in England and Wales.

**Summary of Conclusions**

The conclusions drawn from the statistical material, examined against the background of social change, may conveniently be re-stated here. They are :

(1) Marriages are no less popular today than at the beginning of this century. The proportion who get married at some time in their lives show but a slight decline.

(2) Average age at first marriage has generally risen for both males and females.

(3) A marriage boom in the war and post-war period has not only increased the frequency of marriages, but also lowered the age of first marriages below trend, though only to a small extent.

(4) The decline in mortality has led to an extension of the life of marriage-partnerships.

(5) Changes in the marriage habits of the people have been brought about by economic necessity and education. Trade cycle, morbidity and mortality produce a cyclical variation in marriages.

Trade cycles have affected the income of the population and have increased or decreased their power of accumulating dowries. Epidemics have caused a similar variation as marriages are postponed or cancelled due to illness or death in the family.[1]

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[1] See Chapter on Fertility, p. 104ff.

# NUPTIALITY TABLES AND PROPORTIONS OF EVER-MARRIED

ALL-AGES marriage rates are affected by changes in the age composition of the population at risk of marriage. For example, if the proportion in the older age groups increase, the all-ages marriage rate will decline without any change in the marriage rates at the various ages, because the all-ages rates will be weighted more by the older groups whose marriage rates are lower. It is therefore desirable to devise a measure which will be independent of these changes in the age composition. Nuptiality tables are constructed with this object in view.

Gross nuptiality tables show the number who would be married at successive ages if a population starting from a given base and free of mortality, were subjected to current age-specific marriage rates.

Net nuptiality tables are similar except that mortality is assumed according to current age-specific rates.

The method of computation of such tables is given below:

### Number of Marriages

The total number of marriages for three years centred round the census, and adjusted for under-registration by the methods described earlier, was used in computing the nuptiality tables. The marriages of a single year are unsuitable for the purpose, being more liable to suffer from the influence of temporary factors.

### Age Distribution at Marriage

These marriages are allocated to the various age groups according to the age distribution for registered marriages determined from the sample described on page 74ff.

### Population exposed to Risk

To determine age-specific marriage rates, it is necessary to relate the marriages at each age to the population from which sprang the bride or bridegroom, as the case may be—the population " exposed to risk ". It would have been better for our purpose, if we could have taken first marriages only and have related them to the single population, but the limitations of the available data did not permit this. The appropriate population exposed to risk to associate with the marriages we have taken, including first and subsequent marriages without distinction, is the total non-married population, i.e. the single, widowed and divorced together.

We have already seen that, particularly in the earlier censuses, the enumerators had a tendency to record persons whose marriages were not registered as unmarried. By dividing the corrected population by the census proportion of married, we may, therefore, have over-estimated the non-married population and thus have under-estimated the marriage rates.

### Life Table Population

In Ceylon, sufficient data are not available to permit the computation of separate life tables for the married and non-married. We have, therefore, of necessity had to employ general life tables in the computation of net nuptiality.

### The Method of Computation

The method of computation is illustrated by a worked example for the period 1900–02.

$$
\begin{array}{lll}
\text{Number of marriages registered in 1900} & = & 28,192 \\
\text{Do.} \quad\quad \text{do.} \quad\quad \text{in 1901} & = & 23,736 \\
\text{Do.} \quad\quad \text{do.} \quad\quad \text{in 1902} & = & 27,816 \\
\hline
\text{Total} \quad\quad = \quad 79,744
\end{array}
$$

Degree of under-registration = 71·94 per cent.

Hence corrected number of marriages = 79,744 ÷ (1 — ·7194)
= 284,191

## Age Distribution at Marriage

In view of the very great mis-statement of age at marriage, the sample age distribution is graduated graphically and the corrected marriages are distributed over the ages accordingly.

| Age | Per cent. (Graduated) | | Number married 1900–02 | |
| --- | --- | --- | --- | --- |
| | Male | Female | Male | Female |
| | | | ('000) | |
| 15– | 2·29 | 38·87 | 6·51 | 110·46 |
| 20– | 30·42 | 29·10 | 86·45 | 82·70 |
| 25– | 31·30 | 9·88 | 88·95 | 28·08 |
| 30– | 12·23 | 7·82 | 34·76 | 22·22 |
| 35– | 7·95 | 4·56 | 22·59 | 12·96 |
| 40– | 5·34 | 3·91 | 15·18 | 11·11 |
| 45– | 3·98 | 2·93 | 11·31 | 8·33 |
| 50– | 3·50 | 1·30 | 9·95 | 3·69 |
| 55– | 2·13 | 0·98 | 6·05 | 2·79 |
| 60– | 0·86 | 0·65 | 2·44 | 1·85 |
| | 100·00 | 100·00 | 284·19 | 284·19 |

## Number of Non-Married

| Age | Proportion non-married according to 1901 Census | | Corrected Population (000) | | Estimated non-married (000) | | Graduated Female |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | Male | Female | Male | Female | Male | Female | |
| 15– | ·9314 | ·4967 | 236 | 221 | 220 | 110 | 110 |
| 20– | ·5013 | ·2418 | 217 | 204 | 109 | 49 | 76 |
| 25– | ·3230 | ·2619 | 179 | 164 | 58 | 43 | 43 |
| 30– | ·2303 | ·3113 | 148 | 136 | 34 | 42 | 40 |
| 35– | ·2090 | ·4008 | 114 | 96 | 24 | 38 | 37 |
| 40– | ·2135 | ·4800 | 98 | 95 | 21 | 46 | 34 |
| 45– | ·2340 | ·5786 | 73 | 65 | 17 | 38 | 32 |
| 50– | ·2711 | ·6584 | 66 | 59 | 18 | 39 | 31 |
| 55– | ·3350 | ·7434 | 49 | 42 | 16 | 31 | 29 |
| 60– | ·4046 | ·8372 | 39 | 33 | 16 | 28 | 26 |

## Probability of Remaining Non-Married

The probability of remaining non-married is computed by using the formula—

$$P_x = \frac{3P_x - 2\cdot5m_x}{3P_x + 2\cdot5\,m_x}$$

where $P_x$ is the non-married population of age $x$ to $x + 5$ ;

$m_x$ is the marriages of age $x$ to $x + 5$

$P_x$ is the probability of non-married persons aged $x$, remaining non-married for the next 5 years.

7—J. N. B 59926 (10/56)

The $P_x$ values are used to compute the gross nuptiality table as follows—

### GROSS NUPTIALITY TABLE 1900–02 : FEMALES

| Age (x) | Probability of remaining non-married for the next 5 years (i.e. $p_x$) | Proportion remaining non-married at age x | Proportion married at age x to x+5 according to gross nuptiality |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| 15 | ·043478 | 1·000000 | ·956522 |
| 20 | ·020071 | ·043478 | ·042605 |
| 25 | ·306931 | ·000873 | ·000605 |
| 30 | ·392268 | ·000268 | ·000163 |
| 35 | ·565217 | ·000105 | ·000046 |
| 40 | ·594096 | ·000059 | ·000024 |
| 45 | ·672129 | ·000035 | ·000011 |
| 50 | ·811321 | ·000024 | ·000005 |
| 55 | ·850742 | ·000019 | ·000003 |
| 60 | ·887644 | ·000016 | ·000002 |
|  |  | ·000014 |  |

Column (3) is the cumulative product of Column (2).
Column (4) is the successive difference of Column (3).

### NET NUPTIALITY TABLE AND PROPORTION EVER-MARRIED

**Females : 1900–02**

| Age | Average survivors from 1,000 births according to the life table of 1900–02 | Marriages in the life table population | Proportion of single | Proportion of ever-married |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |
| 15– | 677 | 647·57 | ·521739 | ·478261 |
| 20– | 646 | 27·52 | ·022176 | ·977824 |
| 25– | 600 | 0·36 | ·000571 | ·999429 |
| 30– | 549 | 0·09 | ·000187 | ·999813 |
| 35– | 502 | 0·02 | ·000082 | ·999918 |
| 40– | 456 | 0·01 | ·000047 | ·999953 |
| 45– | 411 | 0·00 | ·000030 | ·999970 |
| 50– | 362 | — | ·000022 | ·999978 |
| 55– | 311 | — | ·000018 | ·999982 |
|  |  |  | ·000015 | ·999985 |

Column (2) is 1/5 of the $l_x$ values in the life table.
Column (3) is the product of Column (2) and the 4th Column of the Gross Nuptiality Table.
Column (4) is the average of the two successive values of Column (3) of the Gross Nuptiality Table.
Column (5) = 1—Column (4).

# TREND IN FERTILITY

## Introduction

IN the Census Report of 1946 a chapter is devoted to the study of the trend in fertility, in which the conclusion is drawn that the fertility of Ceylon women is declining, and is moving towards the familiar pattern of the small families of Western countries.[1] The cause of this decline is attributed to the use of birth control methods. This conclusion, if true, is certainly very significant, for in no other Asian country except Japan is fertility known to be declining.[2] Ceylon, however, lacks the industrial basis which caused this decline in Japan, and it would be an example to all other Asian countries, if she could show the way in which the threat of over-population could be met without an economic and cultural revolution.

Our investigation unfortunately shows that Ceylon has no cause for complacency or gratification in this matter. Whatever decline in fertility has occurred has been entirely due to the epidemics and to the raising of the age of first marriages, and not to the cultural change in favour of small families.

## The Investigation : Nature of the Basic Data

We have already pointed out some of the weaknesses of the data available in Ceylon for the analysis of fertility. The Registrar-General's birth statistics suffer from various degrees of under-registration. The births are not classified by age group of mothers, by fathers' occupation, by income, or, by duration of marriage and birth order. Moreover, there is a lag in registration, and the Registrar-General's Report gives the statistics of registration only. If the incidence of births and this lag in registration remain constant from year to year then birth occurrences will, numerically, equal birth registration. But if either changes abruptly, as the incidence of births have varied in recent years, the measurement of the fertility trend from registrations alone may be distorted.

The fertility data which can be gathered from the census reports are also defective. The number of children under 5 years of age are over-enumerated in the 1901 and previous censuses, and under-enumerated in all subsequent censuses, and the female population suffers from a serious degree of under-enumeration in all censuses. Moreover the degree of error is not the same for the rural and urban population ; and there is no information on occupational fertility.

In view of these defects in the data, the measures that we may obtain will inevitably have a degree of uncertainty about them. However, these difficulties may to some

---

[1] *Census of Ceylon*, 1946, Vol. 1, Part I, p. 69.

[2] For example, in India where the question has been carefully studied, fertility does not show any appreciable trend over the last fifty years. e.g. Kingsley Davis *The Population of India and Pakistan*, pp. 68–69.

extent be overcome by basing a number of more or less independent analyses on different sources of data and examining the extent to which they support one another.

### Number of Births

There is doubt as to the accuracy of the intercensal population estimates prepared by the Registrar-General and the doubt would also attach to birth-rates based on them.

A method of correcting the number of births for the under-registration has been described earlier.[1] The annual average number of births, corrected for under-registration, are shown in Table 1 for periods from 1900. These new statistics show to some degree the trend in fertility in Ceylon during the last fifty years. The data prior to 1900 are so defective that no case can be seen for including them.

TABLE 1—NUMBER OF BIRTHS AND INDEX

| Period | Annual average Number of Births registered | Annual average Number of Births corrected for under-registration | Index of Col. 3 (1900–04=100) | Per cent of preceding period of Col. (3) |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |
| 1900–04 | 141,095 | 169,141 | 100 | — |
| 1905–09 | 146,528 | 174,288 | 103 | 103 |
| 1910–14 | 155,452 | 180,005 | 106 | 103 |
| 1915–19 | 173,482 | 189,195 | 112 | 105 |
| 1920–24 | 177,560 | 186,675 | 110 | 99 |
| 1925–29 | 203,386 | 213,519 | 126 | 114 |
| 1930–34 | 203,838 | 213,571 | 126 | 100 |
| 1935–39 | 204,277 | 213,344 | 126 | 100 |
| 1940–44 | 227,112 | 236,221 | 140 | 111 |
| 1945–49 | 269,091 | 279,736 | 165 | 118 |
| 1950 | 304,639 | 316,921 | 187 | 113 |

Source : Computed from the data published in the Registrar-General's Reports. Male births are corrected by the method described in Appendix B, Chapter 3; female births are taken as 96·6 per cent of corrected male births ; and the total births are shown in column 3.

The data in the 2nd, 3rd and 4th columns show a fairly systematic rise throughout the present century, except for the period 1920–24, when a small and temporary decline is shown. The explanation of this departure from trend may lie with the influenza and malaria epidemics of the period 1919–1923, leading to a decline in the female population of reproductive age and, at least temporarily, impairing the ability of the survivors to reproduce satisfactorily.[2] Fertility may also have been affected indirectly by marriages being postponed due to illness or deaths in the family. It is likely that the effects of these epidemics lasted for a number of years, and the fertility for the entire quinquennium was affected.[3]

[1] Vide pp. 65–66.

[2] The statistics of still births are so defective in Ceylon that they could not be used in our analysis at all. They not only suffer from being under-reported, but also from being wrongly reported as deaths and births. These are also reported sporadically, so that their trend cannot be determined with any degree of certainty.

[3] See page 104ff for a fuller discussion of the effects of epidemics on fertility.

After 1925 the recovery in fertility must have been rapid, for the number of births of the quinquennium 1925–29, lie on the extrapolated trend line of the periods before 1920.

During the thirties, however, the number of births remained more or less constant. The population was rising all this time and a decline in fertility is therefore implied.

After 1940, a rising trend was again established, and not only of births but also the rate of increase show a sharp rise, reflecting the boom in births of this decade. The absolute number in 1950 show a rise but the rate of increment show a decline which, if continued, will closely resemble the European pattern of recent years.

### Crude Birth Rate

The Annual average crude birth rate for quinquinnal periods are given below in Table 2. The rates rise slowly from 1867 to 1900 but the sex ratio of registered births, shown in Chapter 3, suggest that there was under-registration during this period. It is not safe, therefore, to draw conclusions from the rates before 1900.

From 1900, the trend in the birth rate shows a decline until 1915–20, rises until 1925–29, declines again until 1935–39, and then rises again.

Diagram 1 shows that the direction of movement of the rate of increment of births (i.e. Column (5) of Table 1) and that of the birth rates are in broad outline, very much alike. The only periods in which they differ is in 1910–14 to 1915–19, when the increment rate of births rises, whilst the birth rate declines : and also in 1920–24 when the former declines, and the latter rises.

TABLE 2—CRUDE BIRTH RATE AND INDEX

| Period | Crude Birth Rate (Registered Births) | Index | Corrected Index |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| 1867–69 | 18·67 | 53 | |
| 1870–79 | 27·48 | 71 | |
| 1880–89 | 28·83 | 75 | |
| 1890–99 | 35·76 | 93 | |
| 1900–04 | 38·62 | 100 | |
| 1905–09 | 37·43 | 97 | |
| 1910–14 | 37·46 | 97 | |
| 1915–19 | 37·00 | 96 | |
| 1920–24 | 38·50 | 100 | 81 |
| 1925–29 | 40·62 | 105 | 86 |
| 1930–34 | 37·80 | 98 | 80 |
| 1935–39 | 35·64 | 92 | 75 |
| 1940–44 | 37·34 | 97 | 79 |
| 1945–49 | 39·60 | 103 | |
| 1950 | 40·30 | 104 | |

*Source :* Compiled from the data published in the Registrar-General's Annual Reports.

*Note.*—The last column is obtained by reducing the 3rd column by 18·30 per cent. in the excess of the degree of under-enumeration of the 1921 census over the 1911 census. See Text p. 97.

DIAGRAM 2—CRUDE BIRTH RATE, INCREMENTS OF BIRTHS
AND CORRECTED BIRTH RATE

Index

Increments
of Births

Crude Birth Rate

Corrected Birth
Rate

120-

115-

110-

105-

100-

95-

90-

85-

80-

75-

70-

65-

60-

55-

50-

1867-69   1870-79   1880-89   1890-99   1900-04   1905-09   1910-14   1915-19   1920-24   1925-29   1930-34   1935-39   1940-44   1945-49   1950

Period
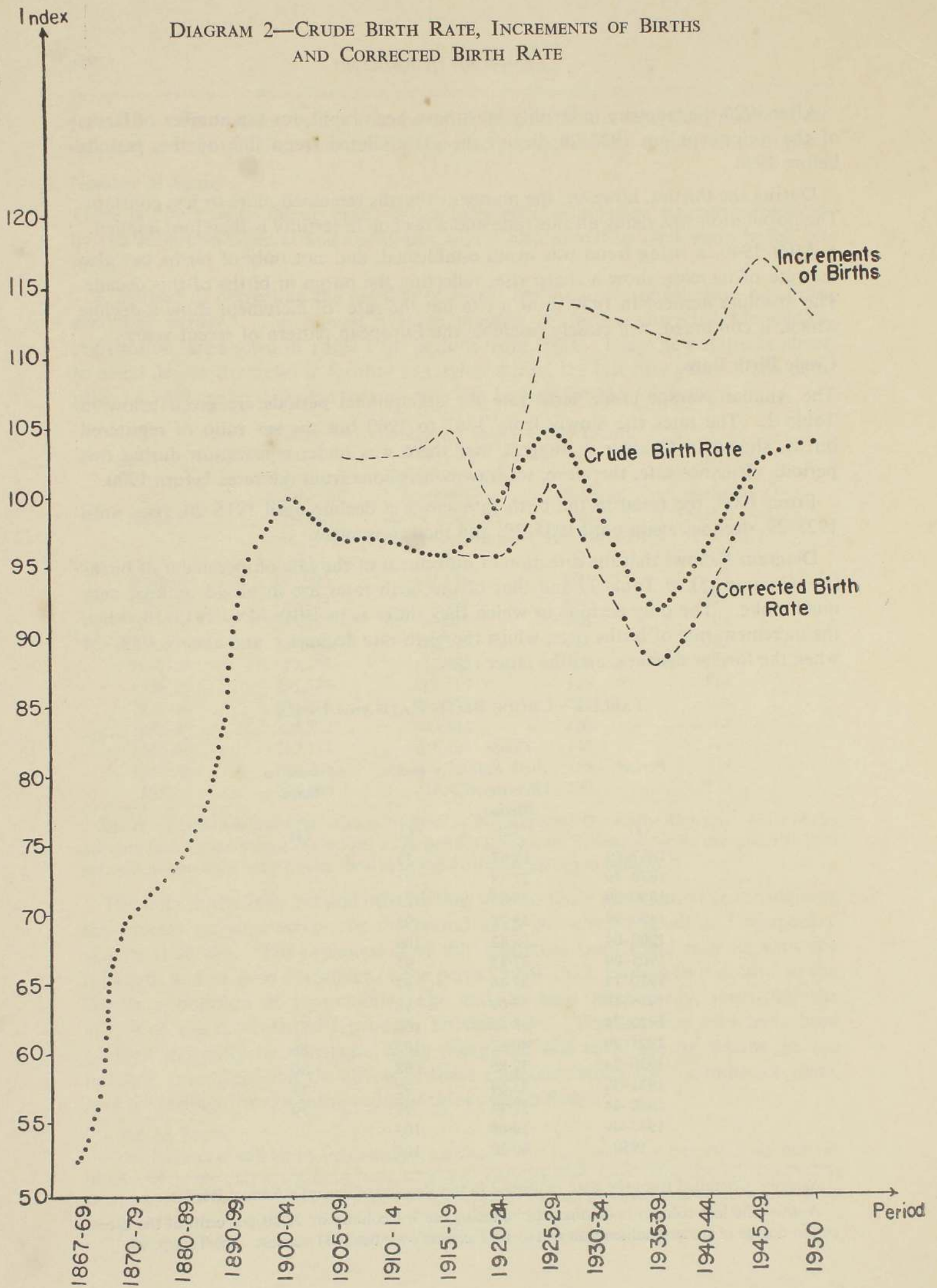
It may be mentioned that the decline in the birth-rate from 1910–14 to 1915–19 was due to a greater rise in population than the rise in births.[1] The rise shown in the birth rate from 1914–19 to 1920–24 is unexpected. The ravages of the influenza and malaria epidemics would suggest a decline in the birth-rate instead of a rise. The explanation would appear to lie in the under-enumeration of the 1921 census which exceeded that of the 1911 census. The post-censal estimates, which were of course based on the enumerated population until the 1946 census provided a new base, will similarly be deficient.

According to our population estimates, under-enumeration in the 1921 census exceeded that of the 1911 census by 18·30 per cent. Hence by reducing all the rates of the 1921–1945 period by this amount, we can correct them for this upward bias. The corrected rates, shown in the last column of Table 2 and by the serrated line in Diagram 2 are seen to follow more closely the trend in the increment of births.

Table 3 below gives the birth-rate computed on the basis of population corrected for under-enumeration, and births corrected for under-registration, the methods of correction used being those discussed in earlier chapters.

### TABLE 3—CORRECTED BIRTH RATE

| Period | Birth Rate |
|---|---|
| 1900–02 | 40·94 |
| 1910–12 | 37·59 |
| 1920–22 | 34·55 |
| 1930–32* | 34·69 |
| 1940–42* | 34·65 |
| 1945–47 | 37·05 |

The changes in the direction of movement of the corrected birth-rates are similar to those of the increment of births and the rates given in Table 2. Ignoring minor fluctuations, the general trend may be summarised as a steep fall from the turn of the century until the First World War, a relatively stable rate between the wars, and a sharp rise starting early in the Second World War, which by 1945–47 had carried the rate up to the 1910–12 value.

### Births per Woman of Age 15–40 Years

A better measure of the trend in fertility is provided by relating the births to the section of the population responsible for them—the women aged 15–40—instead

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[1] The population rose, according to the Registrar-General's estimates, by 109 per cent whilst the births rose by 105 per cent during this period.

* The population of 1931 and 1941 were estimated by methods discussed in Chapter 3.

of to the whole population without distinction of age. Such ratios are shown in Table 4. Broadly they reproduce the trend shown by the crude rate in Table 3. The final rise, however, is now seen to start in 1931.

TABLE 4—BIRTHS PER WOMAN OF AGE 15–40

| Period | Birth per woman | Index |
|--------|-----------------|-------|
| 1900–02 | ·201 | 100 |
| 1910–12 | ·177 | 88 |
| 1920–22 | ·161 | 80 |
| 1930–32* | ·164 | 82 |
| 1940–42* | ·171 | 85 |
| 1945–47 | ·179 | 89 |

*Source :* Computed by using corrected population figures, and corrected births.

**Number of Children of Age 0–4 Years per Woman of Age 15–40**

An independent check of the foregoing conclusions is provided by analysing census data, corrected for under-enumeration, to show the number of children aged 0–4 years per woman aged 15–40 years. These ratios are given in Table 5.

TABLE 5—NUMBER OF CHILDREN 0–4 YEARS PER WOMAN 15–40 YEARS

| Year | Proportion of Children |
|------|------------------------|
| 1881 | ·813 |
| 1891 | ·793 |
| 1901 | ·762 |
| 1911 | ·698 |
| 1921 | ·604 |
| 1931 | ·655 |
| 1941 | ·579 |
| 1946 | ·662 |

*Source :* Computed by using corrected population figures.

In interpreting this table, it must be remembered that the number of children aged 0–4 per woman is affected not only by fertility but also by the mortality and migration experienced in the preceding five years. The decline in the 1921 and the

* The population of 1931 and 1941 were estimated by methods discussed in Chapter 3.

1941 ratios could thus be attributed to the influenza and malaria epidemics of 1919 and 1935. Otherwise the general trend in fertility shown by this table is similar to that shown in the previous tables.

### Gross and Net Reproduction Rates [1]

The distribution of births by age of mother was not available in Ceylon until 1948, when it was determined for the first time by the Registrar-General. A random sample of over 10,000 was taken from the birth returns and the distribution obtained has been used to compute Gross and Net Reproduction Rates. The method of computation is given in the appendix to this chapter. The Gross Reproduction rates are given in Table 6. The rate for 1920–22 shows a low figure, no doubt due to the fall in fertility following the influenza epidemic. Otherwise, the

#### TABLE 6—GROSS REPRODUCTION RATE

| Period | Gross Reproduction Rate | Index |
|--------|-------------------------|-------|
| 1900–02 | 2·404 | 100 |
| 1910–12 | 2·108 | 88 |
| 1920–22 | 1·913 | 80 |
| 1930–32 | 1·963 | 82 |
| 1940–42 | 2·039 | 84 |
| 1945–47 | 2·162 | 90 |

trend may be regarded as falling until the First World War, remaining steady until the Second World War and then rising sharply to above the 1910–12 rate. The trend in fertility shown by this more refined measure thus follows the now familiar pattern shown in the previous tables.

Table 7 gives the net reproduction rates for the census years and shows somewhat similar trend. The improving mortality since 1900, however, leads to one outstanding difference ; the initial decline has become more gentle, whilst the final rise has

#### TABLE 7—NET REPRODUCTION RATE

| Period | Net Reproduction Rate | Index |
|--------|-----------------------|-------|
| 1900–02 | 1·442 | 100 |
| 1910–12 | 1·263 | 88 |
| 1920–22 | 1·163 | 81 |
| 1945–47 | 1·595 | 111 |

[1] Recent criticisms of these rates have dislodged them from the pedestal they occupied when they were first popularised by Kuczynski. These criticisms are mainly directed against their use as a measure of the long term trend in fertility. They can be used with less objection as a record of current reproductive performance of women, and it is in this sense that we have used them here.

become steeper. In consequence the 1945–57 rate is raised above the 1910–12 rate, and indeed above that of 1900–02.

### Fertility of Married Women

We have seen in the chapter on marriages that there has been little change in the marriage habits of the population—except for a rise in the age at first marriages—from the beginning of the century to the early years of the Second World War, coupled with a decline in the general intensity of marriage over the same period. Since 1940 Ceylon has experienced a boom in marriages which has both increased the frequency of marriages and also lowered the age of first marriages. The trend in marriage and birth rates have thus moved together, whilst the age at first marriage has followed complementary trend, rising as the rates have fallen, and falling as the rates have risen. We may consider the extent that the overall fertility trend may be attributed purely to these changes in marriage habits. First, consider the ratios of births per married woman aged 15–40, shown in Table 8.

TABLE 8—BIRTHS PER MARRIED WOMAN 15–40 YEARS

| Year | Births per Married woman | Index | Index of births per woman (Married and non-married together) |
|---|---|---|---|
| 1900–02 | ·3061 | 100 | 100 |
| 1910–12 | ·2749 | 90 | 88 |
| 1920–22 | ·2591 | 85 | 80 |
| 1945–47 | ·2703 | 88 | 89 |

The index rate when births are related to the married women at the reproductive ages shows a similar decline from 1900–02 to 1920–22, to that, shown in the last column of Table 8 for total fertility (i.e. births per woman at the reproductive ages, but without distinction of marital condition). Admittedly the decline is shallower, but only slightly so—the fall in the 20 years is 15 points as compared with 20 points. This shows that, disregarding age, the decline in fertility from 1900–02 to 1920–22 is only to a trivial extent due to a decline in marriage. In contrast the rise from 1920–22 to 1945–47 is reduced to a mere 3 points, compared with the 9 points rise in the total fertility index. This shows that the apparent rise in fertility from 1920–22 to 1945–47 is in main attributable to an increase in the proportion married, that is to say it suggests, not that married women are having larger families, but that more women are marrying.

The indices employed in Table 8, must be interpreted with some reserve. Although, in their calculation, attention has been restricted to women at the reproductive ages, within these ages all women have been treated as equal. In fact higher birth rates may be expected from the younger than the older women within this range.

More refined analyses are provided, firstly, by comparing the age-specific birth rates, and secondly, by computing the gross reproduction rates of married women only.

## Age-specific Birth Rates

Table 9 gives the age-specific birth rates based on the corrected number of women of all marital conditions and corrected births. Table 9A gives the indices of these rates with the 1910–12 rate taken as 100.

TABLE 9—AGE-SPECIFIC BIRTH RATES

| Age | 1900–02 | 1910–12 | 1920–22 | 1930–32 | 1940–42 | 1945–47 |
|---|---|---|---|---|---|---|
| 15–19 | ·0341 | ·0337 | ·0326 | ·0330 | ·0310 | ·0332 |
| 20–24 | ·1587 | ·1548 | ·1423 | ·1465 | ·1456 | ·1575 |
| 25–29 | ·1465 | ·1219 | ·1126 | ·1160 | ·1224 | ·1306 |
| 30–34 | ·0880 | ·0700 | ·0626 | ·0669 | ·0705 | ·0735 |
| 35–39 | ·0472 | ·0354 | ·0282 | ·0265 | ·0339 | ·0327 |
| 40–44 | ·0058 | ·0057 | ·0043 | ·0036 | ·0043 | ·0050 |

*Source :* Computed by using corrected births and population figures.

TABLE 9A—INDEX OF AGE-SPECIFIC BIRTH RATES

| Age | 1900–02 | 1910–12 | 1920–22 | 1930–32 | 1940–42 | 1945–47 |
|---|---|---|---|---|---|---|
| 15–19 | 103 | 100 | 97 | 97 | 91 | 99 |
| 20–24 | 103 | 100 | 92 | 95 | 94 | 102 |
| 25–29 | 120 | 100 | 92 | 95 | 100 | 107 |
| 30–34 | 126 | 100 | 89 | 96 | 101 | 105 |
| 35–39 | 133 | 100 | 80 | 75 | 96 | 92 |
| 40–44 | 102 | 100 | 75 | 63 | 75 | 88 |

Attention should be drawn to a number of defects from which these two tables suffer. Firstly, over or under-statement of age has not been corrected in computing these rates, so that undue concentration in some age groups may have occurred. Secondly, the distribution of births has been made according to the sample of 1948. The sampling fluctuation, therefore, may cause some erratic movements in the rates. Thirdly, even ignoring these fluctuations the validity of applying the distribution of 1948 to the births of say, 1910–12 or 1900–02 may be questioned. Since marriages were generally at an earlier age in 1900, using the 1948 birth distribution in the computation of the age-specific birth rates the lower age groups in the table get under-weighted whilst the older age groups get over-weighted. This, perhaps, accounts for the high rates in the age groups 25 to 39 in 1900–02. Keeping these defects of the table in mind, we may note :

(1) the age-specific birth rates for the age group 15–19 and 20–24 years have generally tended to decline until the onset of the Second World War.

(2) In the age groups from 25 to 39 years, the age-specific birth rates for 1940–42 are generally similar to those for 1910–12, and some doubt attaches to the accuracy of the 1900–02 rates.

Thus we are able to conclude that the decline in fertility during the period 1910 to 1940, that we noticed earlier, was mainly due to the decline in the birth rate of women in the two age groups 15–19 and 20–24 years. The fertility in other age groups shows little overall change. The decline in the birth rate in the two lower age groups is, no doubt, due to the rise in the age of marriage. Thus, the change in the trend in fertility, could perhaps be attributed to the rise in the age of first marriages.

The gross reproduction rate computed with the number of married women, instead of all women, as the base, further strengthens this conclusion.

### TABLE 10—GROSS REPRODUCTION RATES OF MARRIED WOMEN

| Period | G. R. R. | Index | Index of total fertility of married women | Index of total fertility of all women |
|---|---|---|---|---|
| 1900–02 | 3·465 | 100 | 100 | 100 |
| 1910–22 | 3·139 | 91 | 90 | 88 |
| 1920–22 | 3·053 | 88 | 85 | 80 |
| 1945–47 | 3·263 | 94 | 88 | 89 |

The gross reproduction rate of married women for the year 1900–02 may be over-estimated for the reasons mentioned above, and the rate for the years 1920–22 will have been depressed by the effects of epidemics. Taking these factors into account, the rate over the entire period shows little change. We could, therefore, regard the fertility of married women as unchanged during the century. The change in the fertility of " all women " which we noticed earlier, must, therefore, be attributed to the changes in the age of first marriage and health conditions and to epidemics. There is little evidence of family planning and use of contraceptives.

### The Average Age at Marriage and Fertility

The association of average age at marriage with fertility can be seen from Diagram 3. It will be seen that the average age at marriage generally moves in a direction opposite to the gross reproduction rate, or, the age-specific birth rates.

### TABLE 11—AVERAGE AGE OF MARRIAGE, GROSS REPRODUCTION RATE AND AGE-SPECIFIC BIRTH RATES

| Period | Average age of marriage | Index | Period | G. R. R. | Index | 15–19 years | Index | 20–24 years | Index |
|---|---|---|---|---|---|---|---|---|---|
| 1899–01 | 18·5 | 97 | 1900–02 | 2·404 | 114 | ·0346 | 103 | ·1587 | 103 |
| 1909–11 | 19·0 | 100 | 1910–12 | 2·108 | 100 | ·0337 | 100 | ·1548 | 100 |
| 1919–21 | 19·9 | 105 | 1920–22 | 1·913 | 91 | ·0326 | 97 | ·1423 | 92 |
| 1929–31 | 22·2 | 116 | 1930–32 | 1·963 | 93 | ·0330 | 97 | ·1465 | 95 |
| 1939–41 | 23·2 | 121 | 1940–42 | 2·039 | 97 | ·0310 | 91 | ·1556 | 94 |
| 1944–46 | 22·5 | 118 | 1945–47 | 2·162 | 103 | ·0332 | 99 | ·1576 | 102 |

*Note :* The comparison is made with a year's lead in the average age of marriage.

DIAGRAM 3—INDICES OF AVERAGE AGE AT MARRIAGE OF FEMALES.
GROSS REPRODUCTION RATE AND AGE-SPECIFIC BIRTH
RATE OF AGE 15-19 AND 20-24 YEARS

Index

120-

115-

110-

105-

100-

95-

90-

Age at Marriage

Gross Reproduction Rate

Birth Rate 15-19 years

Birth-Rate
20-24 yrs.

1899-01    1909-11    1919-21    1929-31    1939-41    1944-46    Period
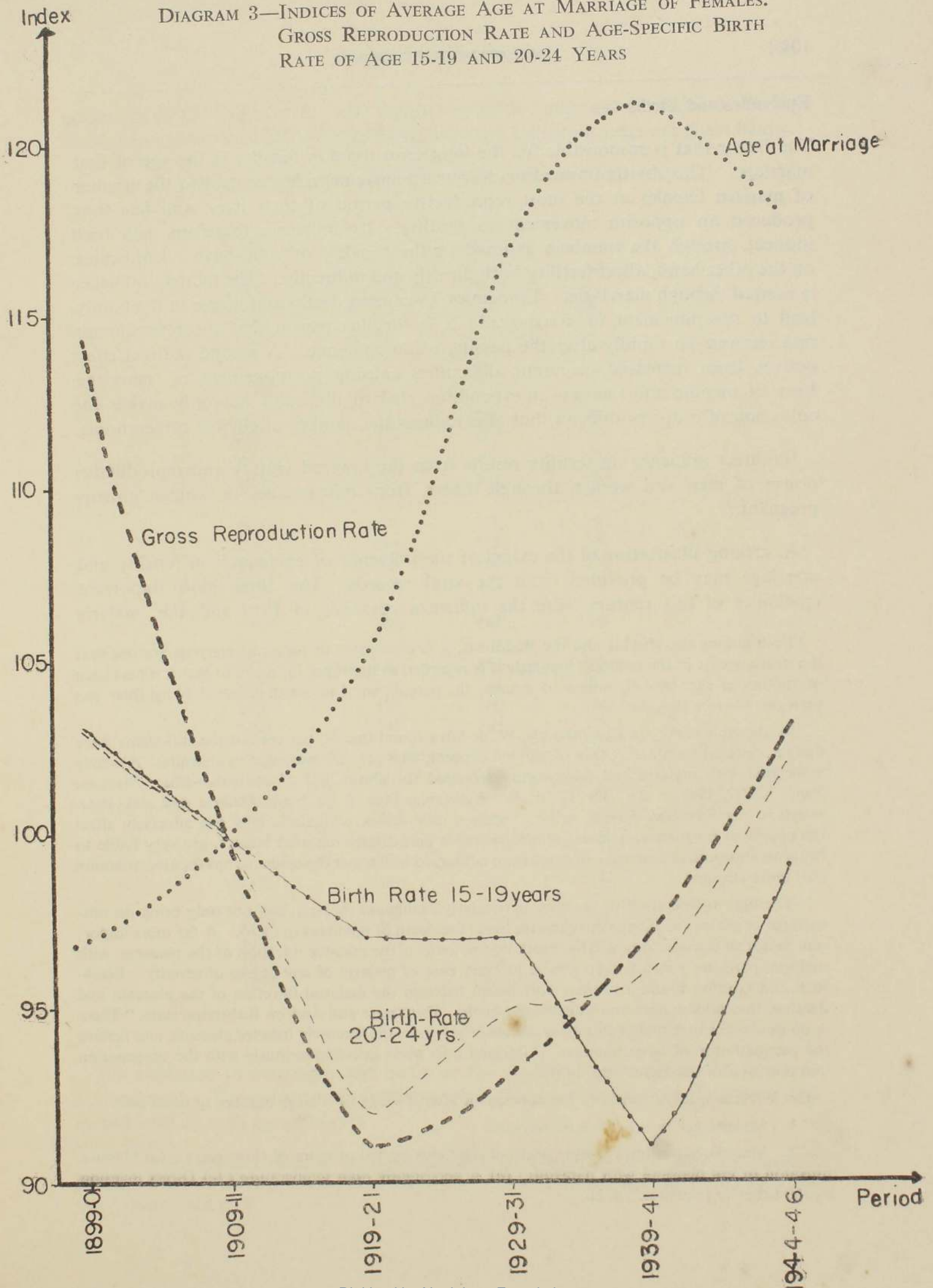
## Epidemics and Births

The factor that is responsible for the long term trend in fertility is the age of first marriage. This, by its upward or downward movement, has controlled the number of married females at the most reproductive period of their lives, and has thus produced an opposite movement in fertility. Its influence, therefore, has been indirect, through the numbers exposed to the " risk " of child-birth. Epidemics, on the other hand, affect fertility both directly and indirectly. The indirect influence is exerted through marriages. Epidemics, by causing deaths and illness in the family, lead to postponement of marriages.[1] It is for this reason that the reproduction rate recovers so rapidly after the passing of an epidemic. A second indirect effect derives from increased economic difficulties causing postponement of marriage. Loss of income and increase in expenditure due to ill health not only makes the collection of a dowry difficult, but also reduces the number of eligible bridegrooms.

Its direct influence on fertility results from the lowered vitality and reproductive power of men and women through illness, from miscarriages in women already pregnant.[2]

A striking illustration of the extent of the influence of epidemics on fertility and marriage may be provided from the vital records. The three most important epidemics of this century were the influenza epidemic of 1919 and the malaria

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[1] Both among the Hindus and the Buddhists, it is customary to postpone marriage for one year if a death occurs in the family. Similarly it is regarded as improper for a son to marry if his father or mother is seriously ill, unless of course, the parents want to see their last duty by their son performed before they die.

[2] In a sample survey in Colombo Dr. W. de Silva found that 60 per cent of the still-births were due to maternal " states ". Out of this 60 per cent, 40·8 per cent were due to anaemia. Anaemia associated with malaria and hookworm accounted for about half of the still-births. *Sessional Paper* XXIII, 1943, p. 23. Dr. G. A. W. Wickramasuriya in his book *Malaria and Ankylosto-miasis in the Pregnant Woman* writes, " while a mild attack of malaria may not adversely affect the course of pregnancy, a severe attack, or more particularly repeated attacks, are very liable to bring an abortion, miscarriage, or premature labour, to which fact the epidemic has focused attention still more strongly . . . .

" The high temperature of malaria, particularly malignant malaria, can not only bring on miscarriage or premature labour but can also cause the death of the fœtus in utero. A far more important factor in causing intra-uterine death of the fœtus is the massive infection of the placenta with malarial parasites which is seen almost in every case of malaria of any degree of severity. Blacklock and Gordon found a positive correlation between the malarial infection of the placenta and death of the child in utero and shortly after birth. Thompson and Andrew Robertson state, " There is no doubt but that toxic substances are absorbed from the intensely infected placenta, and further the accumulation of large numbers of infected cells must interfere seriously with the oxygenation and nutrition of the fœtus." pp. 14–15.

Dr. Wickramasuriya comes to the conclusion after a study of a large number of cases that :

" 1. Malaria *per se* is a powerful oxytotic.

" 2. Malaria causes intra-uterine death of the fœtus by one or more of three ways : (a) Massive infection of the placenta with parasites ; (b) A persistently high temperature ; (c) Direct invasion of the fœtus by parasites." p. 26.

epidemics of 1911 and 1935. The number of births, marriages and deaths during these three epidemics and in five preceding and five following years are given below.

TABLE 12—NUMBER OF BIRTHS, DEATHS AND MARRIAGES

| Year | Deaths | ('000) Births | Marriages |
|---|---|---|---|
| 1907 | 119 | 130 | 19 |
| 1908 | 118 | 161 | 21 |
| 1909 | 123 | 149 | 20 |
| 1910 | 110 | 157 | 22 |
| 1911 | **143** | **156** | **21** |
| 1912 | 134 | **138** | 22 |
| 1913 | 120 | 162 | 25 |
| 1914 | 136 | 162 | 23 |
| 1915 | 110 | 161 | 29 |
| 1915 | 110 | 161 | 29 |
| 1916 | 120 | 175 | 25 |
| 1917 | 113 | 184 | 25 |
| 1918 | 149 | 183 | 22 |
| 1919 | **168** | **161** | **19** |
| 1920 | 133 | **164** | 22 |
| 1921 | 141 | 184 | 23 |
| 1922 | 127 | 180 | 24 |
| 1923 | 142 | 181 | 23 |
| 1931 | 117 | 199 | 25 |
| 1932 | 111 | 199 | 25 |
| 1933 | 115 | 209 | 26 |
| 1934 | 127 | 207 | 28 |
| 1935 | **204** | **193** | **24** |
| 1936 | 123 | **192** | 27 |
| 1937 | 124 | 216 | 31 |
| 1938 | 122 | 208 | 31 |
| 1939 | 129 | 212 | 30 |

*Source :* Registrar-General's Reports.

The reduction in marriages and births in the epidemic years cannot be regarded as accidental. The reduction in fertility seems to last for two years before resuming its old level or even exceeding it[1].

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[1] " In Ceylon possibly owing to the enfeeblement of the population by an unhealthy season, a high death rate in one year is often followed by a low, and not a high birth-rate in the following year." Turner *ibid.* p. 26.

In these outstanding cases the depression of birth and marriage records in a year of high mortality is clearly seen from a casual examination of the data. But by careful analysis the effect of health conditions on marriages and births can be detected, not only in years of serious epidemics, but in all the years. A measure of the relationship may be seen from the correlation between birth, death, and marriage rates. Correlation coefficient computed for the deviations from an 11 year moving average for the years 1900 to 1949, are given below.

| Correlation between death rate and : | Correlation Coefficient | Significance P less than : |
|---|---|---|
| (1) birth rate with a year's lag | 0·5652 | 0·001 |
| (2) birth rate of the same year | 0·3355 | 0·05 |
| (3) marriage rate | 0·6050 | 0·001 |

Epidemics and health conditions thus play a significant role in determining fertility in Ceylon. It may be suspected that a substantial proportion of the population live at a marginal level of nutrition and health. The hormone output and general vitality of these persons are such that they exist on the margin between sterility and fecundity as much as on the margin of life and death, and a slight change in the health conditions or in the economic situation may suffice to tip the balance, resulting in the booms and depressions in fertility that we have noticed[1].

1 Carr-Saunders believes that the lower fertility of primitive peoples is due to lower vitality resulting from hard conditions of life. See his *Population Problem*, pp. 99ff. Ample evidence of the relationship of fecundity to living conditions are available. Kriger in his *Die Menstruation* gives the following table with regard to the age of menstruation, (quoted in Carr-Saunders, ibid. p. 92, and Bowen, p. 138).

Effect of Economic Status Upon Beginning of Menstruation

| | Brienne de Boisement | | Tilt | | Kreiger | | Rain | |
|---|---|---|---|---|---|---|---|---|
| | years | months | years | months | years | months | years | months |
| Upper Class | 13 | 8 | 13 | 5½ | 14 | 1⅛ | 14 | 3 |
| Middle Class | 14 | 5 | 14 | 3½ | 14 | 4 2/6 | 15 | 3½ |
| Lower Class | 14 | 1 | — | — | 16 | 8⅛ | 16 | 5¼ |

" Kriger also reports that Mayer found the average age at which menstruation begins among women of the upper classes to be 14·69 years and among poor women 16·0 years. Furthermore good living conditions prolong the period during which women are capable of bearing children. Menstruation comes to an end sooner among labouring than among wealthier classes." (Ezra Bowen, " A Hypothesis of Population Growth" New York, 1931, p. 128). Marshall in his *Physiology of Reproduction*, p. 595, says, " There is every reason for supposing that the process of growth and menstruation can be very largely influenced both by sufficiency of food supply on the one hand and by artificial stimulation on the other."

" Better food and generally improved conditions of living increase the life span, lengthen the period of fecundity in women, increase the size of litters among lower animals and speed up the œstrus cycle." Nature : *Reproduction, Lactation and Vitamin E*, Vol. 122, p. 138.

Charles Darwin says in his *Descent of Man*, p. 132, " There is reason to suspect that the reproductive power is actually less in barbarians than in civilized races. It is highly probable that savages, who suffer much more hardship and do not obtain so much nutritious food as civilised men, would actually be less prolific."

Radhakamal Mukerjee, in his book " The Political Economy of Population " mentions a case of decrease in fertility in India due to malnutrition. " Intensive study of vital statistics over a period of 60 years in certain congested districts in the United Provinces also show that there is a distinct tendency towards fall in birth rate. In Jaunpur, United Provinces for instance, the average birth-rate fell from 36 between 1901–1911 to 28 between 1919 and 1927 and between 1928 and 1938 it remained stationary at that figure. Such diminution of birth rate is not due to deliberate family limitation at all, but to a combined effect of several biological factors. Malnutrition lowers fertility and has profound effects on the organs of generation of animals. This has been demonstrated by laboratory experiments of Stieve and others. A chronic deprivation of wheat, milk and vegetables which are rich in vitamin E, and which are gradually replaced in the diet of the masses by millets and other cheap food grain may be presumed to reduce fertility, apart from its unfavourable effects on the physiological systems." pp. 193–194.

Huxley believes, however, that " In man the innate primitive fecundity is highly excessive for keeping a stable population". (" A Survey of Data Respecting Animal Populations " in " Population " Vol. 1, No. 1, June, 1933, p. 34.) In the same article he mentions that " As with most herbivores, under favourable food conditions there is with the rabbit a great increase of both fecundity and fertility . . . . It has been shown that the Canadian snowshoe rabbit in unfavourable conditions may produce only a fifth of the normal number of offspring." p. 31.

## Family Building Pattern in Ceylon

The Census Report of 1946 shows the number of children born by age of mothers,[1] from which the average number of children born to women at different ages, shown in Table 13, has been derived.

TABLE 13—NUMBER OF CHILDREN EVER BORN PER WOMAN ; 1946

| Age | Number of Children ever-born | | |
|---|---|---|---|
| | Registered married women | Customary married women | All-women |
| 15–19 | 0·53 | 0·52 | 0·13 |
| 20–24 | 1·29 | 1·45 | 0·95 |
| 25–29 | 2·39 | 2·63 | 2·17 |
| 30–34 | 3·45 | 3·57 | 3·22 |
| 35–39 | 4·45 | 4·38 | 4·13 |
| 40–44 | 4·94 | 4·64 | 4·47 |
| 45–49 | 5·30 | 4·71 | 4·68 |
| 50–54 | 5·35 | 4·76 | 4·61 |
| 55–59 | 5·56 | 4·92 | 4·77 |
| 60–64 | 5·53 | 4·75 | 4·64 |
| 65+ | 6·40 | 4·59 | 4·59 |

*Source :* Computed from Table 45, Census of Ceylon, Vol. I, Part II, 1946.

The proportion of illegitimate born is shown in the Census Report to be extremely small, a bare 0·5 per cent of total births. It is possible of course that the statistics of illegitimate births are incomplete. In any case, the liberal marriage rules take away much of the social significance generally attached to illegitimate births. We will therefore ignore these in our analysis.

Table 13 shows that, up to age group 30–34, the customary married women had the larger families, whilst for the older age group they had the smaller. Before searching for an explanation of this somewhat unexpected reversal, we must first be clear as to the significance of the data shown in Table 13.

" Periodic fluctuations on this scale certainly do not occur in man ", because, the " innate primitive fecundity is highly excessive " in him.   This, however, may not be true of the vast millions in Asia, whose level of nutrition is extremely low. It is difficult for a Westerner, accustomed as he is to a high standard of living for several centuries, to conceive of the low plain of existence in which millions in Asia live today.   " The specially dangerous feature of the domestic economy of many of the people is the lack of any reserve at the back of their low standard of diet.   They are brought very near to starvation point by any small disturbance of their normal equilibrium such as the death of a man, sickness or unemployment, bad weather conditions, even a small fine in the Court, an invasion of their small patch of cultivation by deer, wild boar, and elephant or a neighbour's cattle   .   .   .   .   Then the morning meal may be reduced to a small quantity of weak plain tea with a suspicion of sugar in the palm of the hand touched by the tongue to get an impression of sweetness and later to nothing.   The midday meal becomes a small quantity of boiled breadfruit, jak, pawpaw, or some jungle fruit." (Report on the *Relief of Distress due to Sickness and Shortage of Food*.   Sessional Paper V 1936, p. 4).   It is not likely that those who live on this scale will have an innate highly excessive fecundity :

Josue de Castro in his *Geography of Hunger*, says " Dr. Ancel Keys and his co-workers at the University of Minnesota registered the dramatic decline in sexual interest among a group of boys who submitted voluntarily to an experiment in semi-starvation.   These investigators state that at the end of six months of hunger sexual interest was extinct in almost all the individuals   .   .   .   .

" The loss of libido through starvation is due in part to the individuals' exclusive mental concentration on the search for food, and in part to the absence of that stimulus normally provided by the hormones that control sexual reaction.   The genital glands of men and women suffer acutely from sharp restriction of nutriment and their production of hormones is at length paralysed.   " *Geography of Hunger.*" 1952.

1 The Census of Ceylon, 1946, Vol. 1, Part II, Table 45, pp. 195-6.

First, the customary married women would in general be expected to be of a lower social class than the registered married women.

Secondly, the experiences at successively older ages in the Table are not those of a generation as it passes through life, but of different generations. Thus the substantial increments shown at successive ages up to 55–59 do not of course represent the additions arising from further child-bearing at these advanced ages, but the larger families borne by the earlier generations.

Thirdly, the women who have contributed to the table are not all the members of each generation, but only those who survived until the 1946 census.

We may now proceed to consider possible explanations of the reversal to which attention was drawn above. It is not unreasonable to assume that a higher mortality was suffered by the women with larger families. Biological reasons could be suggested for this—that the strain of child-bearing weakened them—and economic reasons—that the larger families and higher mortality are experienced by the lower social classes. The older women have both been at risk of death for longer than the younger women and also, belonging to earlier generations, they lived through the earlier years when mortality was higher.

The combination of these factors would tend, particularly with the older women and the customarily married women to depress the average family size as shown by the families of those surviving and remaining widowed at the census of 1946.

It will be observed that in the age group below 35 years the customary married group has a slightly higher fertility than the registered married group, which is to be expected from a backward group unless it is on a marginal fecundity level. It would, however, be reading too much into this difference, to attribute this to the use of contraceptives by the socially more advanced class. There is no evidence to show that contraceptives are used on an extensive scale. Institutional and religious pressure, ignorance, lack of ambition, poverty and the feudal attitude all combine to prevent extension of contraceptive practice even among the middle classes. We are inclined to attribute this lower fertility of the higher classes more to economic and social factors than to anything else.

Table 14 below gives the number of children ever-born per mother. The numerators in these ratios are the same as those of Table 13. The denominators differ in that they exclude infertile women among the married. (Since illegitimate births are negligible, we may assume all mothers to be married.)

In Table 14, as in Table 13, the ratios of customary married are higher than those of the registered married up to the age of 35 years, and lower afterwards. The explanation is, of course, the same as before.

The point of difference that we note between Table 13 and Table 14 is that the ratios after the age of 55 years fall in all the three columns of Table 13, while in Table 14 it rises for registered married mothers and all-mothers, and remains almost constant for the customary married mothers. The decline in these ratios after the completion of fertility at the age of (say) 45 years could only be explained, as

stated before, by the higher mortality of women of higher fertility. The effect of this greater mortality of the more fertile women is that in each successive age group the proportion of mothers with larger number of children declines, so that the fertility of the remaining women is lower.

TABLE 14—NUMBER OF CHILDREN EVER-BORN PER MOTHER

| Age | Registered married | Customary married | All-mothers |
|---|---|---|---|
| 15–19 | 1·30 | 1·30 | 1·30 |
| 20–24 | 1·99 | 1·85 | 1·89 |
| 25–29 | 3·11 | 2·93 | 2·98 |
| 30–34 | 4·16 | 4·06 | 4·03 |
| 35–39 | 4·97 | 5·08 | 4·94 |
| 40–44 | 5·36 | 5·67 | 5·39 |
| 45–49 | 5·55 | 5·99 | 5·62 |
| 50–54 | 5·60 | 6·12 | 5·70 |
| 55–59 | 5·74 | 6·30 | 5·82 |
| 60–64 | 5·60 | 6·34 | 5·75 |
| 65+ | 5·62 | 6·45 | 5·96 |

*Source* : Computed from Table 45, Census of Ceylon, 1946, Vol. I, Part II.

The continuing rise in family size shown in Table 14, but only to age group 55–59 in Table 13, derives from the exclusion of infertile women from Table 14. We have seen that completed fertility has undergone a gradual decrease over a long period prior to 1946. It follows that the number of children ever-born per mother has also declined, so that at the 1946 Census, the older age groups showed larger number of children than the younger age groups. The effect of this decline is best seen in the registered married mothers because, firstly, mortality is not high enough in this group to obliterate the effect of fertility ; and secondly, in Table 14, we considered only mothers, infertile married, and spinsters being excluded. The mortality of the former being greater than that of the latter, their proportion declines in Table 13 with advance in age, so that the ratio of children per woman declines. In Table 14 only mothers are included so that the group becomes more homogeneous and the changes in fertility become more noticeable.

It becomes clear from the foregoing discussion that had the mortality effect been altogether eliminated the rise in the ratios of Table 14 would have been still more marked. The ratios, therefore, should be regarded as " net " of mortality, in the same sense as the net reproduction rate is regarded " net ". In other words, they are the resultant of the joint effect of fertility and mortality, and not of fertility alone.

To observe the change in the trend of completed fertility, therefore, we should do well to take the ratio of children born to mothers instead of all women. For in the former the distortion produced by mortality is much less than in the latter.

Since all women can in practice be regarded as no longer productive after the age of 44 years, the number of children born per woman in any age group higher than 44 years, shows their completed fertility achievement, subject to any influence mortality may have had on the records. Thus we can deduce the following table from such statistics.

TABLE 15—COMPLETED FERTILITY

| Reproductive Period | Number of Children ever-born per mother | Index |
|---|---|---|
| 1895–1925 | 5·96 | 100 |
| 1905–1935 | 5·76 | 97 |
| 1915–1945 | 5·50 | 92 |

The decline would have been greater but for the decline in mortality which counteracts it to some extent in the manner described above. Even so the decline in completed fertility cannot be regarded as very steep and could possibly be explained mainly by the rise in the age of first marriages. This rise removes a portion of the potentially most fertile period of a woman's married life, and thus tends to reduce the ultimate size of her family.

It should be stressed that the value of the figures in Table 15 lies not in their absolute magnitude but more in their relative values as an indication of the trend in fertility. The heavier mortality of mothers denies significance to these quantities in their absolute sense, and thus the true completed fertility of the generations represented will be higher than that indicated.

At the younger ages, the rate of family building is so rapid that, as an approximation, generation differences may be ignored. Table 13 may then be employed, at these younger ages, to indicate broadly the way in which families are built up [1].

### Infertility among the Married

Table 16 gives the proportion of women who never bore a child.

TABLE 16—PROPORTION OF WOMEN WITH NO CHILD EVER-BORN

| Age | Proportion among registered married | Proportion among customary married | Proportion among all-women |
|---|---|---|---|
| 15–19 | ·590 | ·601 | ·900 |
| 20–24 | ·306 | ·269 | ·499 |
| 25–29 | ·184 | ·156 | ·272 |
| 30–34 | ·147 | ·140 | ·204 |
| 35–39 | ·125 | ·119 | ·164 |

[1] It is interesting to note that John Davy's figure of completed fertility in 1821 is not much different from ours. " Their families are generally small, one woman rarely bearing more than four or five children ; a fact that does not at all agree with the assertion that has been made that the women of Ceylon are remarkably prolific." (ibid. p. 287).

If Davy's assertion is true, then very little change in completed fertility during the last 125 years would be indicated.

| Age | Proportion among registered married | Proportion among customary married | Proportion among all-women |
|---|---|---|---|
| 40–44 | ·128 | ·135 | ·172 |
| 45–49 | ·116 | ·152 | ·167 |
| 50–54 | ·126 | ·150 | ·188 |
| 55–59 | ·127 | ·143 | ·180 |
| 60–64 | ·127 | ·152 | ·197 |
| 65+ | ·163 | ·183 | ·229 |

Computed from Table 45, Census of Ceylon, 1946, Vol. I, Part II.

The conclusions to be drawn from Table 16 are the same as those from Tables 13 and 14. Fertility is seen to be greater among the customary married than among the registered married, who can be regarded as a socially higher class than the former. The proportion of infertile women in the higher age groups rises in all classes of women because of the higher differential mortality of fertile women, especially in the customary married group.

The percentage of married women who remain infertile all their life may be taken as 12 per cent. i.e. the proportion at the 40–44 age group.

### Rural and Urban Fertility

The terms " rural " and " urban " are apt to be misleading as applied to Ceylon, for the difference between a rural and an urban area in Ceylon is a difference in degree rather than in kind. Except for Colombo, there are no cities in Ceylon in the Western-sense of the term. The other urban areas and towns can only be called so by courtesy, and are in fact glorified villages with, perhaps, a few more schools, dispensaries, shops and houses than are found in villages proper. In no urban area, except Colombo, do we find industrial workers—that important social class that distinguishes an urban area. Most of the people in the so called urban areas have some link with agriculture and are more rural than urban in their outlook. Moreover, the status of urbanity is bestowed by the authorities merely as a political favour. In any case, the urban population is small—only 15 per cent of the total population, and the country's production centres are not located in the urban areas but in rural plantations.

The economic structure of Ceylon, however, cannot remain as it is today, and, sooner or later, she must develop an industrial structure of some sort if she is to survive. The urban areas will then become real urban areas and the differential attributes of rural and urban areas will gain in importance.

Table 17 shows the available measures of fertility in urban and rural areas.

### TABLE 17—RURAL AND URBAN FERTILITY

| Area | Crude Birth Rate | Births per woman 15–44 years 1945–47 | Births per married woman 1946 | Children ever-born per woman 15–44 years | Children ever-born per married woman 15–44 years | Per cent. ever married at age 45–49 1946 |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Urban | 31·2 | ·148 | ·243 | 3·54 | 3·79 | 93 |
| Rural | 37·9 | ·181 | ·263 | 4·86 | 4·98 | 97 |
| Ratio of rural to urban | 1·22 | 1·22 | 1·08 | 1·38 | 1·31 | 1·04 |

*Sources :* Computed from data published in the Census of Ceylon, 1946, Vol. I, Part II.

Rural fertility thus appears to be higher than urban, but again early marriages may be responsible. It will be noticed that the difference in fertility between the rural and urban females is always less for the married than for all-women, because there are proportionately more married women in the rural areas, as shown in the last column of Table 17. The earlier marriage of rural women is indicated by the following statement showing percentages married in the age group 15–19, extracted from the 1946 census.

### PER CENT MARRIED OF AGE 15–19 FEMALES, 1946

| | |
|---|---|
| Total | 24·63 |
| Urban | 21·03 |
| Rural | 25·29 |

### Fertility by Social Classes

No detailed information with regard to differential fertility by social (or occupational) classes is available for Ceylon. A recent census was taken of the central and local government employees in which the number and age of children ever-born to the married employees was collected.[1] The report of this census gives a frequency table of the number of children ever-born, from which the average number of children ever-born to the different classes of employees may be obtained and compared with a similar average for the whole population.

The Report classified the employees into three groups, viz., the Central Government employees, (except the school employees), the Central Government school employees, and the local government employees. The income range of the first group lies between Rs. 30 and Rs. 2,500, of the second group between Rs. 30 and Rs. 800, and of the third group between Rs. 30 and Rs. 1,600. These income ranges are very wide, and unfortunately the data are not given for sub-groups with narrower income ranges.

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[1] Report on the Census of Government and Local Government Employees. 1951.

The frequency of high incomes is, however, small, and the average is located nearer the lower limit. The average number of children ever-born per married employee that we have computed from this report can, therefore, be regarded as applicable to the lower income groups of each of the three classes rather than the higher.

TABLE 18*—FERTILITY OF GOVERNMENT EMPLOYEES

| | Central Government employees | School employees | Local Government employees |
|---|---|---|---|
| 1.  *Average number of children ever-born per married employee* | | | |
| Male Employee | 2·61 | 2·67 | 2·81 |
| Female Employee | 2·40 | 2·28 | 2·77 |
| 2.  *Modal income* | Rs. 44 | Rs. 65 | Rs. 37 |
| 3.  *Education* | | | |
| Proportion with no English education | 46% | 75% | 65% |
| Education below junior school certificate standard (Sinhalese) | 76% | 25% | 84% |
| (Tamil) | 93% | 91% | 96% |
| 4.  *Occupational strata* | | | |
| Proportion of minor employees and labour grade | 48% | — | 64% |
| Skilled, clerical and untrained and lower trained teachers | 35% | 68% | 24% |
| Higher grade employees | 17% | 32% | 12% |

*Source :* Computed from the data published in the Census of Government and Local Government Employees, 1951.

In spite of the weakness of the data and the form in which they were presented, it is possible to deduce some significant conclusions with regard to the difference in fertility of the various social strata given in the table. These are :

(1) The Central Government employees, who have the lowest proportion of unskilled labourers, have a lower fertility than the local government employees who have the highest proportion of unskilled labourers and the lowest modal income. The school employees have the highest modal income, and their fertility in the case of females is the lowest. In the case of males, it is about the same as the government employees, perhaps because of the larger rural composition of this group. In education we find the local government employees to be below all the others.

(2) In all the groups the fertility of female employees is lower than the fertility of male employees.

* The ratios in this table can only be regarded as indicators of the difference in fertility of the various groups. Since the ratios are affected by mortality, and the age and sex composition of the employees, their efficacy as a fertility measure is somewhat limited.

(3) The proportion of employees who have no children is also higher among the female employees than among the male employees.

(4) According to the census report of 1946, the number of children ever-born to married females is 3·27. The fertility of married female employees therefore, is less than the fertility of married females for the whole of Ceylon, but the married women employees may well be younger on average.

Thus the differential fertility, as far as it is suggested by this table, is not different in pattern from that of the occupational strata of other countries. The unskilled, less educated and lowest income group shows the highest fertility, the skilled, more educated and higher income group have a lower fertility, and the employed females show, for obvious reasons, a lower fertility than the rest of the females.

## Summary of Conclusions

It is useful to restate the more important conclusions reached in the preceding sections : They are :

(1) The trend in fertility showed a decline from the beginning of this century till about the forties.

(2) The fertility of married women did not vary substantially during this period.

(3) The decline in fertility may, in the main, be attributed to the decline in marriages in the lower age groups.

(4) The rise in marriages during the war and post-war years has led to the recent baby-boom.

(5) Fertility is affected by epidemics and economic conditions.

(6) Fertility of urban women is lower than that of rural women. Women of higher income groups and those who are working have a lower fertility.

# COMPUTATION OF GROSS REPRODUCTION RATE

**Births by Age of Mothers**

In 1948 the Registrar-General of Ceylon collected, for the first time, information on the age of mothers at child-birth. The local registrars were asked to take down the age of mothers when the birth of children was registered, and to enter this information on the return sheets which were sent to the Registrar-General's office at the end of each month. The Registrar-General did not, however, tabulate this information. The monthly return sheets were bound, as usual, and kept in his shelves, arranged district by district and in order of months. I was granted permission to extract a sample from these returns.

The following selection procedure was adopted. One sample was chosen from each of the 20 districts of Ceylon. Since each district had 12 volumes of monthly returns and the months could be regarded as independent in respect to the age distribution of mothers at child-birth, one volume was selected out of the twelve by use of Tippett's random numbers. From each volume selected, and starting from an arbitrary page, the mother's age was extracted from the appropriate number of consecutive entries. It was decided to take a sample of about 10,000 births, i.e. about 3·5 per cent of total births in 1948. The number of the entries chosen from each district was proportional to the population of the district. In actual practice the sample was over-drawn by 597 births, from an over-anxiety to avoid falling short of 10,000. The sample distribution is given below :

| Age of mother | Number of births | Per cent. |
|---|---|---|
| Under 15 | 20 | 9·43 |
| 15–19 | 979 | |
| 20–24 | 4,232 | 39·93 |
| 25–29 | 3,139 | 29·62 |
| 30–34 | 1,563 | 14·75 |
| 35–39 | 592 | 5·59 |
| 40–44 | 68 | 0·68 |
| 45 and over | 4 | |
| | 10,597 | 100 |

Mean = 25·9485
Standard error of the mean = 0·0537

**Computation of Gross Reproduction Rate**

The number of births to mothers under 15 years and over 44 years in the sample being small, they were included in the adjacent age groups.

The 1945–47 births were assumed to follow the 1948 sample distribution. For the years prior to 1945-47, three age distributions were constructed, based on three different assumptions. The first assumption was that the distribution of births by maternal age was determined by the age distribution of brides. This assumption gave a lower weight to the higher age groups, because marriages are not as frequent as births at the higher ages within the reproductive ranges.

The second distribution was obtained by modifying the 1948 distribution for other years to allow for changes in the age structure of women at the reproductive ages. This assumption failed to produce convincing results because it ignored the rise or fall in the age at marriage, which altered the proportion of the female population who are married, and thus potential mothers.

The third assumption was that the 1948 sample distribution applied throughout the century. The gross reproduction rates obtained on the basis of these three assumptions are given below :

| Period | Weighted according to change in the proportion of marriages | | Weighted according to change in the proportion of female population | | Constant weight according to the 1948 sample | |
|---|---|---|---|---|---|---|
| | Rate | Index | Rate | Index | Rate | Index |
| 1900–02 | 2·9570 | 100 | 2·3540 | 100 | 2·4040 | 100 |
| 1910–12 | 2·0740 | 70 | 2·1020 | 89 | 2·1075 | 88 |
| 1920–22 | 1·9137 | 65 | 1·9180 | 81 | 1·9130 | 80 |
| 1930–32 | 1·9780 | 67 | 2·0040 | 85 | 1·9625 | 82 |
| 1940–42 | 2·0725 | 70 | 2·0635 | 88 | 2·0385 | 85 |
| 1945–47 | 2·1622 | 73 | 2·1622 | 92 | 2·1622 | 90 |

It will be observed that, except in 1900–02, the values obtained by the different methods are very similar, and all methods show little change since 1910–12. We have mentioned earlier that the data for 1900–02 is not entirely satisfactory, and it may be that a change of the magnitude shown did not in fact occur.

The absolute values of the gross reproduction rate cannot, in any event, provide a true measure of the long-period trend in fertility, in which we are mainly interested here. All that is wanted is an indication of the *direction* of movement in fertility to support or otherwise the other evidence we have examined. So far as the direction in fertility trend is concerned, all the indices give substantially the same indication, and it is difficult to choose from them. We have in fact used in our analysis the constant weight distribution because it is the simplest to compute.

The method employed is illustrated in the following worked example for 1920–22.

### COMPUTATION OF GROSS REPRODUCTION RATE : ILLUSTRATION : 1920–22

Based on assumption 1, i.e. the distribution of births by age of mothers differs from the 1948 sample, only by the proportionate change in the percentage in the distribution of marriages in 1920–22 relative to 1945–47.

| Age | Females | 3 x females | Proportion of marriages in 1945–47 | Proportion of marriages 1920–1922 | Col. (5) ÷ Col. (4) | Proportion of births in 1948 sample | Col. (6) × Col. (7) | Correction to make total of proportions in Col. (8) = 1 i.e. Col. (8) ÷ Σ Col. (8) | Distribution of female births. Total births [272,635 Col. (8) ÷ x Col. (9) ] | Age Specific birth-rate. Col. (10) ÷ Col. (3) |
|---|---|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| | ('000) | | | | | | | | | |
| 15–19 | 263 | 789 | ·2065 | ·4310 | 2·0872 | ·0943 | ·1968 | ·2305 | 62,842 | ·0796 |
| 20–24 | 255 | 765 | ·5570 | ·3996 | 0·7174 | ·3993 | ·2865 | ·3355 | 91,469 | ·1196 |
| 25–29 | 239 | 717 | ·1240 | ·0884 | 0·7129 | ·2962 | ·2112 | ·2474 | 67,450 | ·0941 |
| 30–34 | 214 | 642 | ·0813 | ·0460 | 0·5658 | ·1475 | ·0835 | ·0978 | 26,664 | ·0415 |
| 35–39 | 180 | 540 | ·0228 | ·0221 | 0·9693 | ·0559 | ·0542 | ·0635 | 17,312 | ·0320 |
| 40–44 | 145 | 435 | ·0029 | ·0092 | 3·1724 | ·0068 | ·0216 | ·0253 | 6,898 | ·0159 |
| | | | | | | | ·8538 | 1·0000 | 272,635 | ·3827 |

Gross Reproduction Rate = ·3827 × 5 = 1·9135.

To obtain the gross reproduction rate according to assumption 2, replace proportion of marriages in 1945–47 and in 1920–22, by proportion of females in 1946 and in 1921 respectively in Cols. (4) and (5) and proceed as above.

To obtain gross reproduction rate according to assumption 3, omit Cols. (4), (5), (6), (8) and (9) and multiply the ratios of Col. (7) by 272,635( the total births) to obtain the distribution of births and proceed as above.

## CHAPTER 6

## MORTALITY TREND IN CEYLON

When studying the trend in mortality we must remember the defective nature of death registration in Ceylon, which cannot be measured in quantitative terms. The usual methods of measuring deaths from census and migration figures do not yield useful results because of the unreliability of these statistics. Whilst we cannot use the corrected population figures since we used the deaths in their calculation. The most that can be done, therefore, is to make a qualitative evaluation of the death statistics from a study of their general trend.

Table 1 gives the annual average crude death rates for each decade from 1871 to the present. The trend shows a rise followed by a decline.

### TABLE 1—CRUDE DEATH RATE (ANNUAL AVERAGES)

| Decade | Crude Death Rate based on Census Population* | Mean Death Rate based on Corrected Population† |
|---|---|---|
| 1871–1880 | 22·8 | 19·5 |
| 1881–1890 | 24·0 | 21·8 |
| 1891–1900 | 27·0 | 24·4 |
| 1901–1910 | 28·7 | 29·9 |
| 1911–1920 | 30·8 | 26·6 |
| 1921–1930 | 26·2 | |
| 1931–1940 | 23·0 | 22·4‡ |
| 1941–1950 | 19·6 | |

On the basis of the census population figures, uncorrected for under-enumeration, the rising trend in the death rate continued until the decade 1911–1920 ; on the basis of the corrected population figures the rise ended a decade earlier, 1901–10. A study of external evidence such as economic development, the rise in export and income, governmental stability and the expansion of health services, point to a declining rather than an increasing death rate, at least from the beginning of the century. It is probable, therefore, that the rise in the rate as calculated from 1900 to 1910 is due to an improvement in registration rather than an increase in the true death rate itself.

*Based on Registrar-General's figures.

†Based on corrected population figures and obtained by the formula : Deaths ÷ ½ (Population at the beginning of the period + Population at the end of the period).

‡ 1921–46.

The reality of the apparent rise in mortality prior to 1910 is open to doubt, but there can be no doubt about its subsequent fall. This becomes evident from a consideration of the absolute numbers of deaths.

### TABLE 2—NUMBER OF DEATHS

| Decade | Number of Deaths ('000) |
|---|---|
| 1971–1880 | 58·8 |
| 1881–1890 | 69·2 |
| 1891–1900 | 89·6 |
| 1901–1910 | 110·3 |
| 1911–1920 | 132·9 |
| 1921–1930 | 128·9 |
| 1931–1940 | 129·5 |
| 1941–1950 | 114·8 |

The maximum in the number of deaths was reached in the decade 1911–1920. Since then the absolute number of deaths has been declining generally, despite a rapid rise in the population.

## Sex and Age-Specific Death Rates

It is interesting to note the relative fall in the death rates of the various age and sex groups.

### TABLE 3—SEX AND AGE-SPECIFIC DEATH RATES PER 1000 POPULATION.

#### (BASED ON CORRECTED POPULATIONS)

| Age | 1900–02 | | 1910–12 | | 1920–22 | | 1945–47 | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| 0– | 67·0 | 68·1 | 74·9 | 71·6 | 80·9 | 83·9 | 53·5 | 54·5 |
| 5– | 12·2 | 13·7 | 13·9 | 15·9 | 13·5 | 15·0 | 6·2 | 7·2 |
| 10– | 9·1 | 8·3 | 8·4 | 7·2 | 6·5 | 6·9 | 3·0 | 3·4 |
| 15– | 8·4 | 7·0 | 8·3 | 8·2 | 6·9 | 6·9 | 3·9 | 4·8 |
| 20– | 8·5 | 12·2 | 10·7 | 14·5 | 8·7 | 15·0 | 5·4 | 9·3 |
| 25– | 13·3 | 17·7 | 11·7 | 17·8 | 10·6 | 14·1 | 6·8 | 10·2 |
| 35– | 20·0 | 18·0 | 20·8 | 19·6 | 14·5 | 13·8 | 10·6 | 10·2 |
| 45– | 26·5 | 21·8 | 31·8 | 23·4 | 24·3 | 18·4 | 15·3 | 11·8 |
| 55– | 38·4 | 33·1 | 44·3 | 41·7 | 41·6 | 34·4 | 28·9 | 23·6 |
| 65– | 96·3 | 102·0 | 124·7 | 132·3 | 135·6 | 147·5 | 92·8 | 98·7 |

### TABLE 4—INDEX OF AGE-SPECIFIC DEATH RATES (1900–02 RATES AS BASE)

| Age | 1900–02 | | 1910–12 | | 1920–22 | | 1945–47 | |
|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| 0– | 100 | 100 | 112 | 105 | 121 | 123 | 80 | 80 |
| 5– | 100 | 100 | 114 | 116 | 111 | 109 | 51 | 52 |
| 10– | 100 | 100 | 92 | 87 | 71 | 83 | 33 | 41 |
| 15– | 100 | 100 | 99 | 117 | 82 | 108 | 47 | 68 |
| 20– | 100 | 100 | 126 | 119 | 102 | 106 | 63 | 76 |
| 25– | 100 | 100 | 88 | 100 | 80 | 80 | 51 | 58 |
| 35– | 100 | 100 | 104 | 109 | 72 | 77 | 53 | 57 |
| 45– | 100 | 100 | 120 | 107 | 92 | 84 | 58 | 54 |
| 55– | 100 | 100 | 115 | 126 | 108 | 104 | 75 | 71 |
| 65– | 100 | 100 | 129 | 130 | 141 | 145 | 96 | 97 |

DIAGRAM 4—INDEX OF AGE-SPECIFIC DEATH-RATE, 1945–47

Death Rate: Index

Female death rate

Male death rate
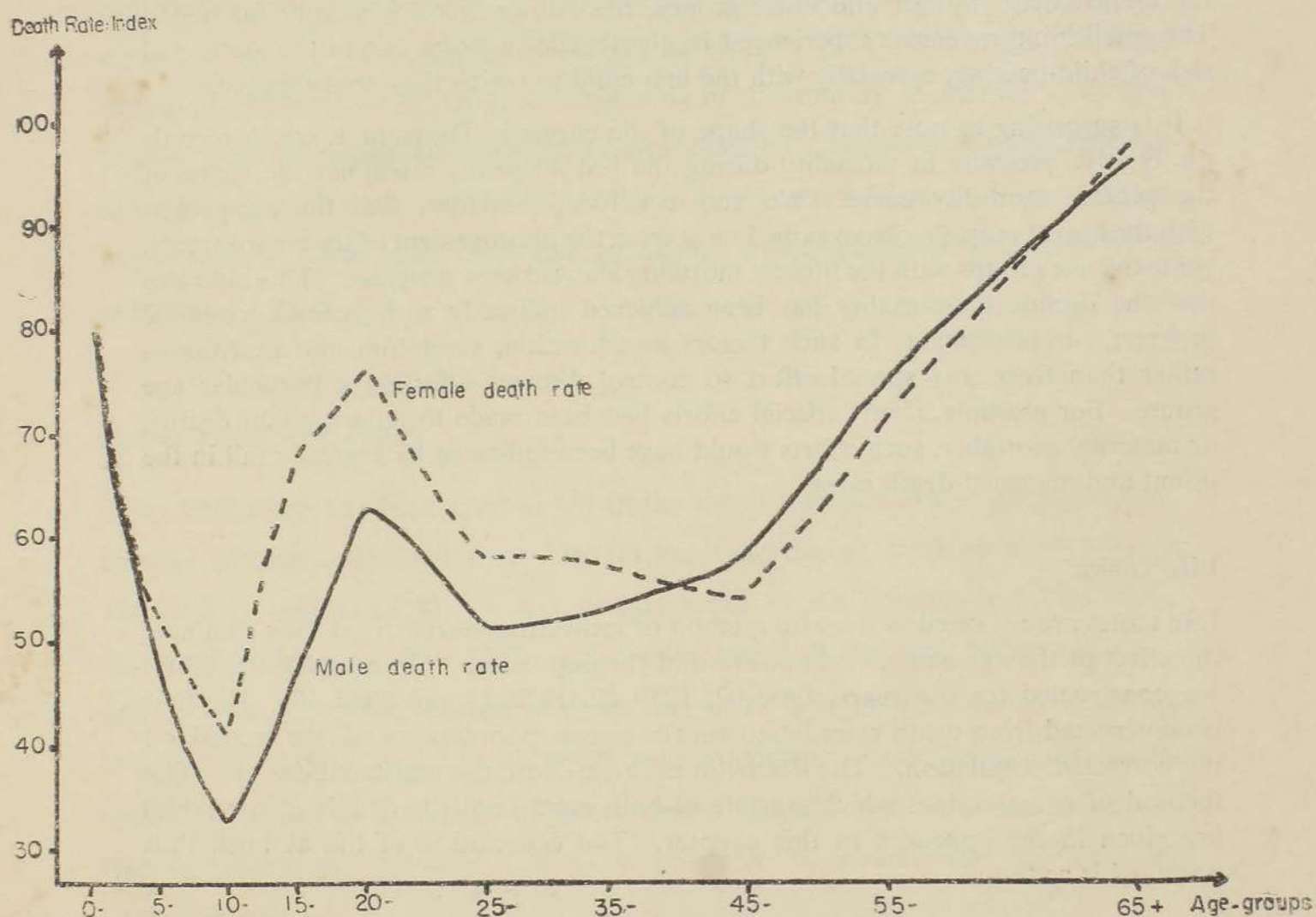
Age-groups

Firstly, it will be observed that for the age groups below 45 years, the male mortality shows a greater proportionate decline than female mortality, while above 45 years the reverse is the case.

Secondly, the fall is least in the highest and the lowest age groups, namely, 65 years and over and 0–4 years, and in these groups the fall is almost equal for males and females. Thus, although the decline in infant mortality is great, it is not as high as in the other age groups, and much improvement has yet to be made. The small improvement in the age group 65 years and over, is perhaps, due to the " generation factor ", and further improvement may be seen as later generations, who enjoyed better health in their youth, reach this group.

Thirdly, the age group 10–14 years shows a greater fall than any other group for both males and females, the fall being greater for males than for females.

Fourthly, mortality in the age groups from 15 to 24 has declined rather less than the immediately younger and older groups, the fall again being greater for males. The smaller improvement experienced by the females may be due to the additional risk of child-bearing, especially with the first child to which they are subjected.

It is surprising to note that the shape of the curves in Diagram 1, which records the relative progress in mortality during the last 45 years, resembles the shape of the general mortality curve. We may conclude, therefore, that the age-groups with the lowest mortality have gained most from the improvement of the environment, while the age groups with the highest mortality showed least progress. This indicates that the decline in mortality has been achieved indirectly with general economic progress,—improvements in such factors as education, sanitation and nutrition— rather than from any special effort to control diseases affecting a particular age group. For example, if any special efforts had been made to reduce infant deaths, or maternal mortality, such efforts would have been indicated by a greater fall in the infant and maternal death rates.

## Life Tables

Life tables are regarded as a useful method of measuring mortality, as they eliminate the effect of the age and sex composition of the population. Two sets of life tables are constructed for the years 1900–02, 1910–12, 1920–22 and 1945–47. The first is constructed from death rates based on the census population and the second on the corrected population. The deaths in both cases are the registered deaths. The method of construction, which is same in both cases, and the details of the tables are given in the appendix to this chapter. The expectation of life at birth thus obtained is as follows :—

TABLE 5—EXPECTATION OF LIFE AT BIRTH [1]

| Years | Census population basis | | Corrected population basis | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| 1900–02 | 36·41* | 34·16* | 37·00 | 37·64 |
| 1910–12 | 33·43 | 29·30 | 35·65 | 36·42 |
| 1920–22 | 35·45 | 30·97 | 37·48 | 38·99 |
| 1945–47 | 46·82 | 44·80 | 47·21 | 48·66 |

[1] The census figures give a lower expectation for females than males, while the corrected figures give the reverse, and are thus more in conformity with international experience and justifies our suspicion that females in Ceylon are seriously under-enumerated. Our correction process for under-enumeration in the censuses gets indirect support from this result.

* 1893–1900—Life table computed by the Registrar-General, and published in the Census Report, 1901.

The higher value in 1900–02 is perhaps due to a greater degree of under-registration of deaths in the earlier period. Taking the 1910–12 figure as the basis for comparison, the progress made during the last thirty years could be viewed with some satisfaction. The expectation of life at birth in 1945–47 is about the same as that in England and Wales at the beginning of this century so that, in mortality, Ceylon might be considered to be half a century behind. However, it is encouraging to note that, whereas the expectation of life in England and Wales rose by some six years between 1848 and 1900, that in Ceylon it has increased by almost twice in the last 35 years.

## Recent Trend in Mortality

Since 1947 there has been a rapid fall in the death rate in Ceylon. The absolute number of deaths declined from 136,000 per year during 1943–46 to 95,000 in 1947–50,—a decline of 30 per cent despite a rise in the population. The death rate declined from $21 \cdot 2$ to $13 \cdot 2$—a decline of about 36 per cent during the same period. The low point reached in death rate of $12 \cdot 6$ in 1950 is unprecedented in the history of Asia, and has attracted wide attention. Prof. Cullumbine, in an exhaustive study of mortality in recent years, remarks that " the general death rate has fallen precipitously", and he goes on to characterise this fall as " revolutionary ".[1]

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*[Continued from page 120]*

Prof. Cullumbine computed life tables for Ceylon for the years 1945–47 and obtained expectations of $47 \cdot 2$ years for males and $42 \cdot 5$ for females (*vide The Ceylon Journal of Medical Science* Vol. VII, Parts 3 and 4). The Census Report of 1946 gives the expectation of life for 1921 and 1946, as follows :

|          | 1921          | 1946          |
|----------|---------------|---------------|
| Male     | $34 \cdot 60$ | $47 \cdot 19$ |
| Female   | $31 \cdot 84$ | $43 \cdot 81$ |

The accuracy of these figures cannot be judged because in neither case is there a description of the method of computation.

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[1] *The Ceylon Medical Journal* Vol. VII parts 3 and 4, p. 245.

In tracing the cause of this "revolutionary" decline in mortality, Prof. Cullumbine states, " The intelligent use of D. D. T. has reduced the mortality and morbidity from malaria to remarkably low levels.  This has brought, too, a decrease in maternal and infant mortalities and a fall in the death rates from many other causes such as pneumonia, dysentery &c."[1]  Again, " The efficacy of D. D. T. is altering the mortality pattern of Ceylon from that typical of the tropics to one typical of the more advanced Western peoples living in temperate climate. " [2]

Having arrived at this conclusion Prof. Cullumbine proffers his advice to the " swarming millions of Asia " as follows, " What has happend in Ceylon is also happening or can happen in the other countries in the East.  There are hopes of improved health and of increased expectation of life for the swarming millions of Asia  .   .   .   "

Over this period of 12 years mortality certainly has fallen surprisingly.  But the fall is seen to be even more startling when it is realised that it is in the main concentrated in the last 4 of the 12 years, indeed mortality rose during the war and was higher in 1945 than it has been in 1937.

In order to examine the question more fully, we have derived the trend in the death rates during the period 1910 to 1946 by first obtaining 11 year moving averages of the death rates, and then fitting a second degree parabola to these moving averages by the method of least squares.  The equation of the trend thus obtained is—

$$D = 28 \cdot 08 - 0 \cdot 3300t - 0 \cdot 0022t^2$$

where $D$ is the annual death rate  per 1000 population and  $t$  the calendar year measured from the year 1926 as the origin.  The trend values for the years 1947 to 1950 obtained from this equation are as follows :—

| Year | Observed death rates | Trend death rates | Deviation |
|------|------|------|------|
| (1) | (2) | (3) | (4) |
| 1947 | 14·3 | 18·18 | −3·88 |
| 1948 | 13·2 | 17·76 | −4·56 |
| 1949 | 12·6 | 17·33 | −4·73 |
| 1950 | 12·6 | 16·90 | −4·30 |

[1] ibid p. 244.                    [2] ibid p. 142.

DIAGRAM 5—DEATH RATE AND ITS TREND
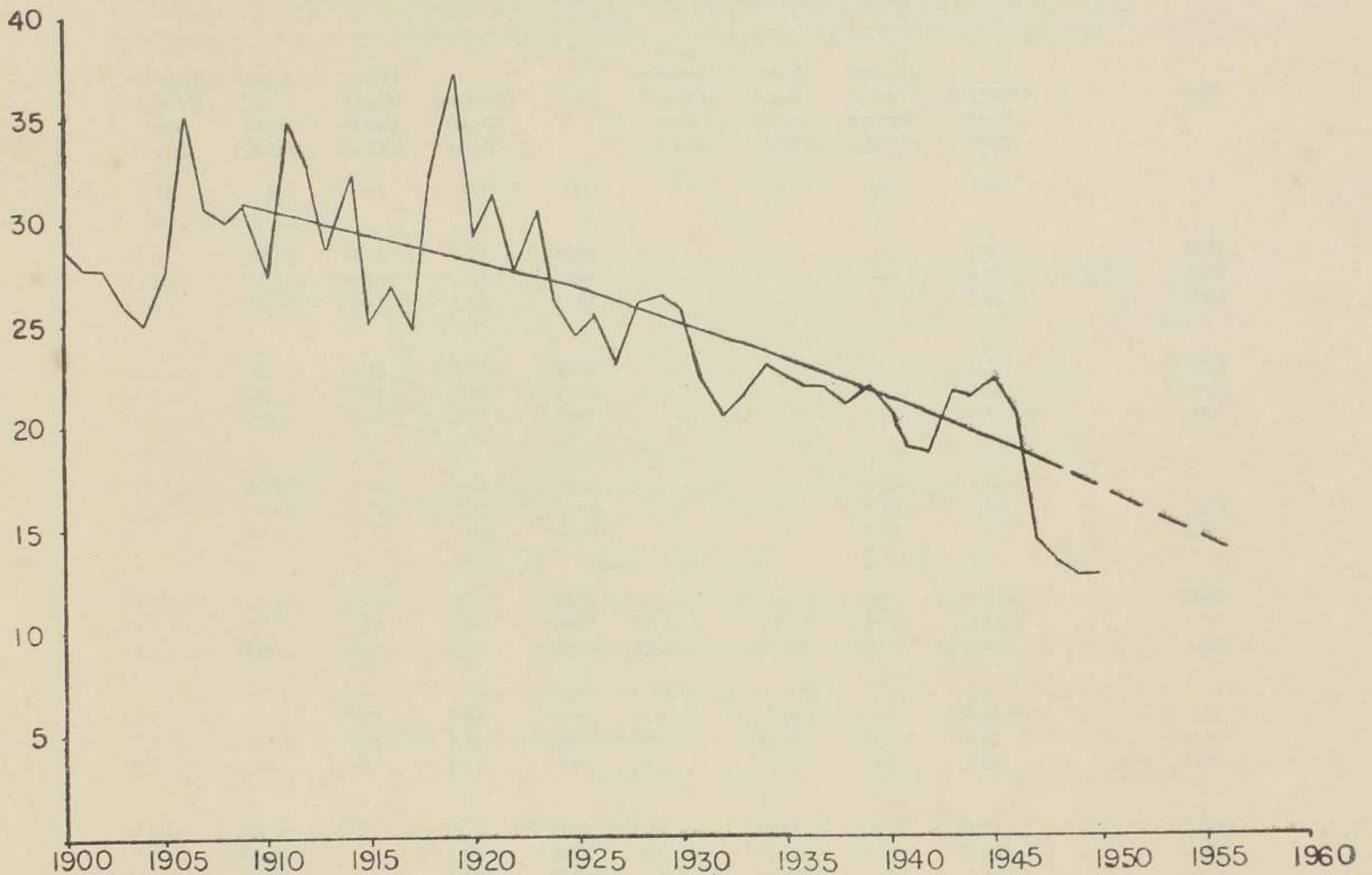


Diagram 5 shows the trend death rates and the corresponding observed death rates. If random and cyclic factors were absent, and if the factors which determined the trend during 1910–1946, and only those were in operation in 1947–50 also, then we would have obtained the death rates given in Column (4) of the table below. As there was no D. D. T. spraying in the period 1910–46, the trend values during 1947–50 are independent of it. The deviation of the observed from the trend values do not appear to be very revolutionary or precipitous. In fact, negative deviations from the trend of similar amounts have been experienced several times before as shown in Table 6.

It must be remembered, however, that the trend is an extrapolated one, and therefore suffers from a certain degree of unreality, and moreover it has no lower asymptote as the observed death rates must have. The comparison of the observed death rates and the trend death rates should not, therefore, be taken more than a few years beyond 1946.

The significant feature is that the negative deviation of the observed death rates from the trend has never persisted for more than three years in any of the previous cycles. In the recent example it has already persisted for four years suggesting

## TABLE 6—OBSERVED AND TREND DEATH RATES : 1900–1950

| Year | Observed Death Rates | 11 year Moving Average of Col. 2 | Least s. q. trend of Col. 3 | Deviation of Col. 4 from Col. 2 | Year | Observed Death Rates | 11 year Moving Average of Col. 2 | Least s. q. trend of Col. 3 | Deviation of Col. 4 from Col. 2 |
|---|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (1) | (2) | (3) | (4) | (5) |
| 1900 | 28·7 | — | — | — | 1930 | 25·4 | 24·8 | 24·72 | + 0·68 |
| 1901 | 27·6 | — | — | — | 1931 | 22·1 | 24·6 | 24·37 | — 2·27 |
| 1902 | 27·5 | — | — | — | 1932 | 20·5 | 24·3 | 24·02 | — 3·52 |
| 1903 | 25·9 | — | — | — | 1933 | 21·2 | 24·1 | 23·66 | — 2·46 |
| 1904 | 24·9 | — | — | — | 1934 | 22·9 | 23·7 | 23·30 | — 0·40 |
| 1905 | 27·7 | 28·8 | — | — | 1935 | 36·6 | 23·2 | 22·93 | +13·67 |
| 1906 | 35·1 | 29·3 | — | — | 1936 | 21·8 | 22·6 | 22·56 | — 0·76 |
| 1907 | 30·7 | 29·8 | — | — | 1937 | 21·7 | 22·3 | 22·18 | — 0·48 |
| 1908 | 30·1 | 29·9 | — | — | 1938 | 21·0 | 22·4 | 21·80 | — 0·80 |
| 1909 | 31·0 | 30·4 | — | — | 1939 | 21·8 | 22·4 | 21·42 | + 0·38 |
| 1910 | 27·3 | 30·4 | 30·80 | — 3·50 | 1940 | 20·6 | 22·3 | 21·03 | — 0·43 |
| 1911 | 34·8 | 30·4 | 30·53 | + 3·27 | 1941 | 18·8 | 20·8 | 20·64 | — 1·84 |
| 1912 | 32·4 | 29·4 | 30·27 | + 2·13 | 1942 | 18·6 | 20·2 | 20·24 | — 1·64 |
| 1913 | 28·4 | 20·5 | 30·00 | — 1·60 | 1943 | 21·4 | 19·4 | 19·84 | + 1·56 |
| 1914 | 32·2 | 30·2 | 29·72 | + 2·48 | 1944 | 21·3 | 18·6 | 19·43 | + 2·07 |
| 1915 | 25·2 | 30·1 | 29·44 | — 4·24 | 1945 | 22·0 | 17·8 | 19·02 | + 2·98 |
| 1916 | 26·8 | 30·4 | 29·16 | — 2·36 | 1946 | 20·3 | — | 18·60 | + 1·70 |
| 1917 | 24·7 | 29·8 | 28·87 | — 4·17 | 1947 | 14·3 | — | 18·18 | — 3·88 |
| 1918 | 31·9 | 29·6 | 28·58 | + 3·32 | 1948 | 13·2 | — | 17·76 | — 4·56 |
| 1919 | 37·6 | 29·3 | 28·28 | + 9·32 | 1949 | 12·6 | — | 17·33 | — 4·73 |
| 1920 | 29·6 | 28·6 | 27·98 | + 1·62 | 1950 | 12·6 | — | 16·90 | — 4·30 |
| 1921 | 31·2 | 28·6 | 27·67 | + 3·53 | — | — | — | — | — |
| 1922 | 27·5 | 28·3 | 27·36 | + 0·14 | — | — | — | — | — |
| 1923 | 30·3 | 28·4 | 27·05 | + 3·25 | — | — | — | — | — |
| 1924 | 25·8 | 27·8 | 26·73 | — 0·93 | — | — | — | — | — |
| 1925 | 24·3 | 26·7 | 26·41 | — 2·11 | — | — | — | — | — |
| 1926 | 25·3 | 26·1 | 26·08 | — 0·78 | — | — | — | — | — |
| 1927 | 22·6 | 25·1 | 25·75 | — 3·15 | — | — | — | — | — |
| 1928 | 26·0 | 24·5 | 25·41 | + 0·59 | — | — | — | — | — |
| 1929 | 26·1 | 23·8 | 25·07 | + 1·03 | — | — | — | — | — |

that it may be of a more permanent nature. However, it appears rather an over-simplification of the situation to say that the new era in vital statistics in Ceylon has been ushered in suddenly with the D. D. T. spray. We are inclined to believe that the low death rate of today has been the result of a number of factors of which D. D. T. spraying is one, which have been operating with a cumulative effect (as shown by the slight negative curvature of the trend). The operation of this process

has probably been accelerated recently by the improvement in curative and preventive medicine, in the political status of the country and in the economic situation generally.[1]

## Infant Mortality

Infant mortality is one of the most sensitive measures of health conditions in a country.[2] In an epidemic year, the infant death rate rises much more than the adult death rate, because infants fall easy victims to epidemics, particularly in countries where infant care is not well developed. Conversely, the decline in infant death rate when conditions improve is also rapid. Infant mortality rate, therefore, shows greater variability than the general death rate.[3]

An accurate measurement of infant mortality in Ceylon is not readily available. The first difficulty arises from under-registration of both births and deaths, particularly infant deaths. Secondly, an accurate measurement of infant mortality requires that infant deaths should be related to appropriate births, since not all the infants dying in a year will have been born in that year.[4] If the incidence of both births and infant deaths remains constant, no error will arise from calculating infant mortality as the ratio of infant deaths to the births of a year, but such conditions do not hold in Ceylon.

The third source of error lies in the registration of still births. Registration of such births is compulsory in some urban areas of Ceylon where the services of medical practitioners are available but in rural areas they may or may not be reported, and the classification made by rural registrars may not be quite accurate.

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[1] The mid-year estimated populations are used to calculate the death rates. Since prior to 1946, the mid-year estimates were based on the 1921 census figures, the higher degree of under-enumeration in this census has resulted in an over-estimate of the death rates. The degree of under-enumeration in the 1946 census was much less. Hence the difference in the death rates before and after 1946 are, to some extent at least, due to the greater degree of under-enumeration in the 1931 census than in that of 1946.

[2] " In contrast to deaths at older ages, infant deaths, at least those taking place after one month of age, are more responsive to improvement in environmental conditions, hence infant mortality rates serve as one of the best indices to the general ' Healthiness ' of a society ". *Summary of International Vital Statistics*, 1937–1944, National Office of Vital Statistics, U. S. A. p. 32.

[3] The other cause of the greater variations in infant mortality rates which is mentioned in the book cited above is the year to year variation of the completeness of registration of births and deaths. In the case of Ceylon such variability in the efficiency of the registration machinery is unlikely.

[4] R. R. Kuczynski : *The Measurement of Population Growth.*—Oxford University Press 1936. p. 171. *see* also Vasilios G. Valaoras *Refined Rates for Infant and Childhood Mortality* : *Population Studies* Vol. IV, 1950–51. pp. 253–266.

The infant mortality rates of Ceylon based on registered births and deaths are given in Table 9. The three year averages for the beginning of each decade are given below.

### TABLE 7—INFANT DEATH RATE PER 1000 LIVE BIRTHS

| Period | Death Rate |
|---|---|
| 1890–92 | 159 |
| 1900–02 | 174 |
| 1910–12 | 203 |
| 1920–22 | 187 |
| 1930–32 | 165 |
| 1940–42 | 133 |
| 1950 | 84 |

The trend in infant mortality as shown by these rates is a rise until 1910–12, followed by a decline, but we have reason to doubt the accuracy of these rates. The rise up to 1912 is particularly suspect for it is possible that during the early years there was a greater improvement in death registration than in birth registration, which would account for such a trend. Similarly a relatively greater rate of improvement in birth registration after 1910 might cause a decline in the trend for at least a few years.

The objection that these rates are affected by under-registration of births and deaths can be overcome by correcting the birth and death figures for under-registration. We have already devised a method for correcting the under-registration of births near about census years. The degree of under-registration that we have noted are as follows :

### TABLE 8—UNDER-REGISTRATION OF BIRTHS

| Period | Degree of Under-registration of Births Per cent. |
|---|---|
| 1900–02 | 19 |
| 1910–12 | 20 |
| 1920–22 | 6 |
| 1945–47 | 7 |

We may assume a uniform rate of change from one period to the next, and thus interpolate the degree of under-registration of births and correct the birth figures accordingly.

Unfortunately, we have not been able to evolve any such definite method for the correction of deaths. We have only been able to reach the general conclusion that the death statistics before 1910 are unreliable. Hence we shall exclude the period prior to 1910 from our computations.

We may generally assume death registration to be more complete than birth registration, hence the rates obtained by using registered births and deaths will give generally an over-estimate of infant mortality. Expressed algebraically, if the registered deaths are $D$, and the true deaths are $rD$, ($r > 1$, $r$ being the correcting factor for under-registration of deaths) and $B$ is the registered births, and $krB$ the true births, ($kr$ being the correcting factor for under-registration of births, ($kr > r > 1$), then the true death-rate, $rD/krB$, is less than the death rate obtained by using registered deaths and births i.e.,

$$\frac{D}{B} > \frac{D}{kB}$$

Hence the rate $D/B$ can be taken as an upper limit of the true infant mortality rate (so far as the assumption that under-registration of births is greater than under-registration of deaths is valid).

A lower limit of the infant mortality rate as defined by $D/kB$ is obtained if the registered births alone are corrected for under-registration, i.e. if the rate $D/krB$ is used. Thus the limits of the infant mortality rate corrected for under-registration are :

$$\frac{D}{B} > \frac{rD}{krB} > \frac{D}{krB}$$

where $D$ is the registered deaths,

$\qquad B$ is the registered births,

$\qquad r$ is the factor of correction for under-registration of deaths,

and $kr$ is the factor of correction for under-registration of births.

Since $r$ is not known, we may estimate infant mortality as the mean of these two limits, i.e., as

$$\frac{rD}{krB} = \frac{1}{2} \left( \frac{D}{B} + \frac{D}{krB} \right)$$

The rates based on registered deaths and births ($D/B$), on registered deaths and corrected births ($D/krB$) and the average of these two rates ($\frac{1}{2}(D/B + D/krB)$) are given in Table 9.

The trend line is obtained by using 7 year moving average of the rates $\frac{1}{2}(D/B + D/krB)$, and is shown in Diagram 6.

According to Table 1, the turning point in the trend begins somewhere in the decade 1910–19, but according to Table 9, it is not until 1921 that the trend takes a decisive downward turn. Both the tables however, show a rapid decline in the nfant mortality trend since 1920–22.

## Table 9—Infant Mortality Rate

*(per 1,000 live births)*

| Year | Infant Death Rates based on registered births and deaths | Infant Death Rates based on corrected births | Average of Col.(2) and Col. (3) | 7 Year moving average of Col.(4) | Year | Infant Death Rate based on registered births and deaths (Contd.) | Infant Death Rate based on corrected births (Contd.) | Average of Col.(2) and Col. (3) | 7 Year moving average of Col.(4) |
|---|---|---|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (1) | (2) | (3) | (4) | (5) |
| 1910 | 176 | 147 | 161 | — | 1931 | 158 | 148 | 153 | 164 |
| 1911 | 218 | 183 | 200 | — | 1932 | 162 | 151 | 156 | 176 |
| 1912 | 215 | 182 | 198 | — | 1933 | 157 | 147 | 152 | 173 |
| 1913 | 189 | 163 | 176 | 181 | 1934 | 173 | 162 | 167 | 171 |
| 1914 | 213 | 185 | 199 | 182 | 1935 | 263 | 246 | 254 | 171 |
| 1915 | 171 | 151 | 161 | 179 | 1936 | 166 | 155 | 160 | 171 |
| 1916 | 184 | 166 | 175 | 181 | 1937 | 158 | 148 | 153 | 170 |
| 1917 | 174 | 158 | 166 | 182 | 1938 | 161 | 150 | 155 | 164 |
| 1918 | 188 | 172 | 180 | 180 | 1939 | 166 | 155 | 160 | 145 |
| 1919 | 223 | 208 | 215 | 183 | 1940 | 149 | 139 | 144 | 140 |
| 1920 | 182 | 172 | 177 | 187 | 1941 | 129 | 121 | 125 | 137 |
| 1921 | 192 | 181 | 186 | 189 | 1942 | 120 | 112 | 116 | 134 |
| 1922 | 188 | 177 | 182 | 181 | 1943 | 132 | 123 | 127 | 130 |
| 1923 | 212 | 200 | 206 | 181 | 1944 | 135 | 126 | 130 | 124 |
| 1924 | 187 | 176 | 181 | 178 | 1945 | 140 | 131 | 135 | 118 |
| 1925 | 172 | 162 | 167 | 176 | 1946 | 141 | 132 | 136 | 114 |
| 1926 | 174 | 164 | 169 | 176 | 1947 | 101 | 94 | 97 | 107 |
| 1927 | 161 | 152 | 156 | 171 | 1948 | 92 | 86 | 89 | — |
| 1928 | 177 | 167 | 172 | 167 | 1949 | 87 | 81 | 84 | — |
| 1929 | 187 | 176 | 181 | 165 | 1950 | 84 | 78 | 81 | — |
| 1930 | 175 | 165 | 170 | 163 | | | | | |

## Infant Mortality from Life Tables

The infant mortality rates calculated above attempt to correct the errors caused by under-registration of deaths and births. It does not overcome the other objection raised at the beginning of this chapter, that is to say that, correctly, infant deaths should be related to the appropriate births. The infant mortality rate calculated from the life table meets both these objections.

The life table rates computed from registered births and deaths are given below.

## Table 10—Infant Mortality Rates per 1,000 Births

*(From Census-Basis Life Table)*

| Period | Death Rates | | |
|---|---|---|---|
| | Males | Females | Average * |
| 1893–1901 | 124 | 117 | 121 |
| 1910–1912 | 201 | 202 | 201 |
| 1920–1922 | 178 | 228 | 203 |
| 1945–1947 | 140 | 149 | 144 |

* Weighted in the ratio of male to female births, *i.e.* 508 males, 492 females.

This table gives the turning point in the trend somewhere in the decade 1910–1919. These death rates are, however, not corrected for under-registration of births and deaths.

The second set of life tables, based on corrected births but uncorrected deaths, gives the following infant mortality rates.

DIAGRAM 6—TREND IN INFANT MORTALITY : (7 YEAR MOVING AVERAGE OF CORRECTED DEATH RATE)
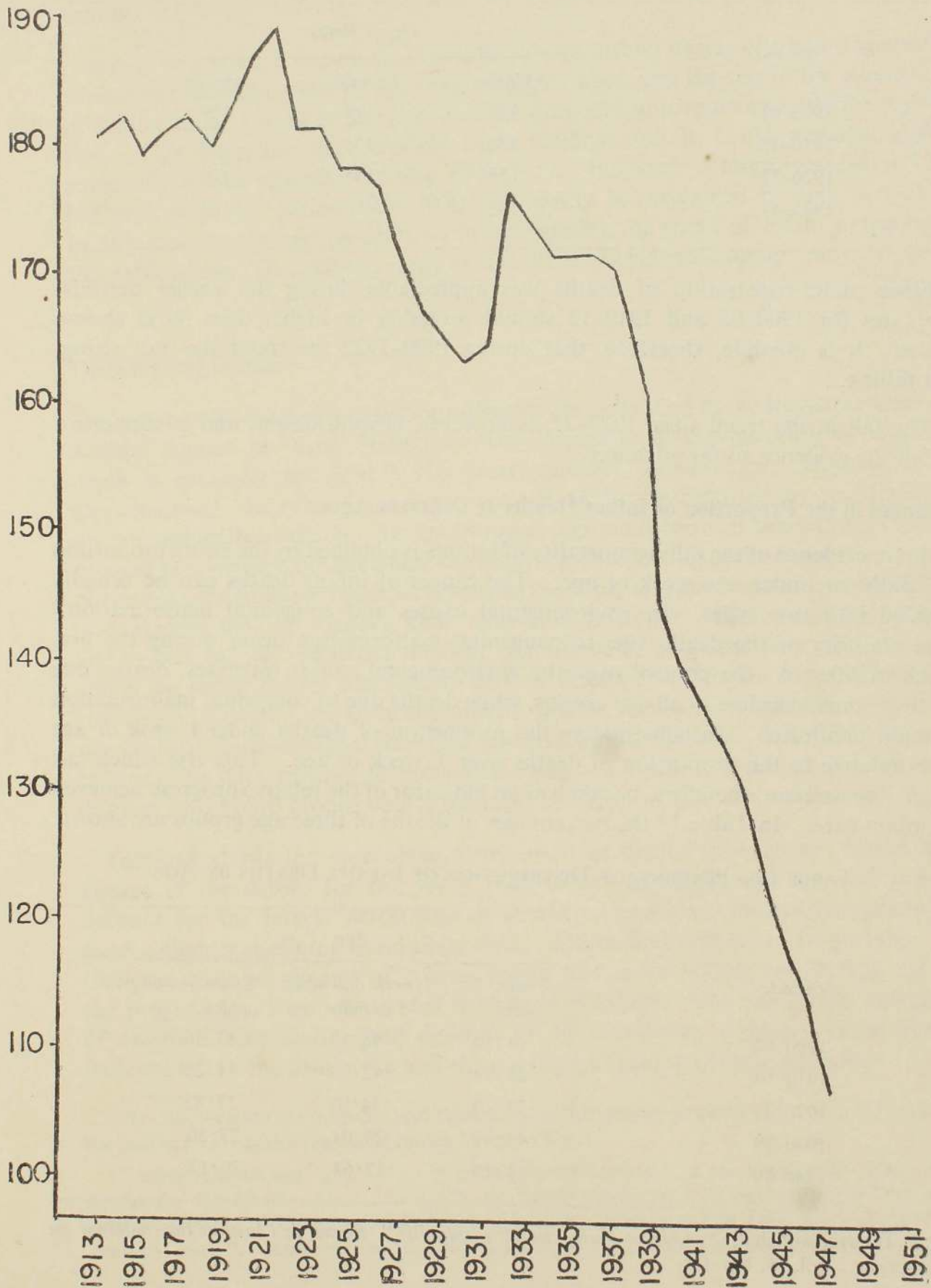
TABLE 11—INFANT MORTALITY RATES PER 1,000 BIRTHS (FROM LIFE TABLES BASED
ON CORRECTED BIRTHS BUT UNCORRECTED DEATHS)

| Period | Death Rates | | |
| | Males | Females | Average |
| --- | --- | --- | --- |
| 1900–02 | 139 | 119 | 129 |
| 1910–12 | 144 | 131 | 138 |
| 1920–22 | 156 | 144 | 150 |
| 1945–47 | 101 | 100 | 101 |

Since under-registration of deaths was appreciable during the earlier periods,
the rates for 1900–02 and 1910–12 should probably be higher than those shown
above. It is possible, therefore, that during 1900–1922 the trend was not rising,
but falling.

The fall in the trend since 1920–22, is however, beyond doubt, and is supported
by all the evidence so far advanced.

## Changes in the Proportion of Infant Deaths at Different Ages

Indirect evidence of the falling mortality of infants is obtained by the rising proportion
of deaths at under one week of age. The causes of infant deaths can be broadly
divided into two types, viz. environmental causes and congenital malformation.[1]
The majority of the deaths due to congenital malformation occur during the first
week of life. As the control over the environmental causes increases, deaths due
to these causes decline in all age groups, while deaths due to congenital malformation
remain unaffected. In consequence the proportion of deaths under 1 week of age
rises relative to the proportion of deaths over 1 week of age. This rise which has
been observed can, therefore, be taken as an indicator of the relative progress achieved
in infant care. In Table 12 the percentages of deaths of three age groups are shown.

TABLE 12—PERCENTAGE DISTRIBUTION OF INFANT DEATHS BY AGE

| Decade | Age | | |
| | Under 1 week | 1 week and under 3 months | 3 months and under 1 year |
| --- | --- | --- | --- |
| 1900–09 | 14·50 | 48·14 | 37·36 |
| 1910–19 | 22·99 | 42·73 | 34·28 |
| 1920–29 | 27·20 | 34·97 | 37·83 |
| 1930–39 | 44·69 | 28·01 | 27·30 |
| 1940–49 | 41·19 | 32·64 | 26·17 |

[1] J. Bourgeois-Pichat, " *Analyse de la mortalite infantile* " *Revue de l'Institut International de
Statistique.* Vol. 18. No. 1/2.

The rise in the percentage of deaths under 1 week of age and the fall in the percentages of the age groups 1 week–3 months and 3 months–12 months, support our belief that infant mortality has been falling right from the beginning of this century.

It may be argued, however, that there has been a greater degree of under-registration of deaths under one week of age than of higher ages, and the rise in the percentages of deaths under 1 week of age is due to the gradual improvement in relative registration. This argument has certainly some validity, and it could perhaps, explain some of the rise especially during 1900–1919. But such a large increase as 17·49 per cent over the period 1920–1939 can hardly be explained by this fact alone. In any case, we should be cautious in interpreting the trend of infant mortality by this table alone. It has value only as one piece of evidence among many.

## Diseases and Deaths

The numbers of deaths from various diseases are published in the Registrar-General's Annual Report on Vital Statistics. The international classification of causes of death is generally followed.[1] No great accuracy, however, is claimed for the classification.[2] In rural areas the causes of death are reported by registrars who are not medically qualified. In urban areas registered medical practitioners are appointed as registrars, but even here the accuracy of reporting of the cause of death cannot be expected to be very high, as very often the patients are not treated by such medical practitioners but, by quacks and 'ayurvedic doctors'. Even when the patients are treated by the registered medical practitioners, diagnosis may not be correct. Often the social stigma attached to certain diseases lead to the suppression of the true cause of death. In an urban area, a sample survey revealed a death-rate from tuberculosis six times higher than that reported by the registrar. It is futile, therefore, to study the data relating to individual causes of death. The classification of the diseases into broad groups could, perhaps, be expected to be more accurate.

Table 14 shows the percentage distribution of deaths between the fifteen broad groups of the causes for the years 1943–1950. Infectious and parasitic diseases account for the largest percentage of deaths, even today, though the percentages show a slightly declining trend since 1946. Infant deaths show a rising trend. The rising percentages do not of course, imply that more infants are dying, but that the progress has been less in this field than in others. The rise in the percentages of deaths due to senility and diseases of the circulatory system may be expected with the fall in the death rate and the consequent ageing of the population.

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[1] The classification has been changed three times in this century so that it is not possible to compare the deaths from various classes of causes beyond 1930.

[2] " Some reliance can  .  .  .  .  be placed on the statistics for the towns and estates, but the figures for the Island  .  .  .  .  which are largely based on information supplied by persons entirely ignorant of Western medicine, are unreliable, or too vague in many cases to be of much practical value ". Report of the Registrar-General on Vital Statistics, 1914. p. L 13.

The defect of Table 14 is that it merely shows the improvement in one group of diseases relative to the others, so that if one group shows a rise others must show a fall. Table 15, which gives the death rate per million population, and Table 16, which expresses these rates in the form of indices, provide a better comparison of the groups over the period and with each other.

These tables show that the greatest progress has been made in the control of skin diseases and in the diseases of the digestive system, the death rates having fallen to about half the 1943 rate. In all other diseases except cancer and tuberculosis the death rate has nevertheless been considerably reduced during the period.

TABLE 13—DEATHS BY CAUSES

| Cause of death | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 |
|---|---|---|---|---|---|---|---|
| 1. Infectious and parasitic diseases | 23,410 | 23,672 | 26,282 | 28,673 | 17,192 | 15,837 | 14,594 |
| 2. Cancer and other tumours | 803 | 834 | 847 | 829 | 881 | 947 | 1,059 |
| 3. Rheumatism, diseases of nutrition and of endocrine glands and vitamin deficiency diseases | 9,595 | 12,329 | 11,026 | 9,041 | 7,457 | 6,977 | 7,571 |
| 4. Diseases of the blood and blood forming organs | 2,690 | 2,948 | 2,973 | 2,833 | 2,100 | 1,955 | 2,109 |
| 5. Diseases of the nervous system | 15,383 | 15,416 | 16,710 | 16,442 | 11,172 | 11,082 | 10,911 |
| 6. Diseases of the circulatory system | 3,126 | 3,505 | 4,028 | 3,380 | 3,152 | 3,322 | 3,599 |
| 7. Diseases of the respiratory system | 13,275 | 13,559 | 14,062 | 14,494 | 11,584 | 11,203 | 10,101 |
| 8. Diseases of the digestive system | 10,173 | 9,328 | 9,006 | 8,759 | 6,407 | 6,569 | 6,710 |
| 9. Diseases of the genito-urinary system | 1,956 | 2,139 | 2,128 | 1,769 | 1,579 | 1,543 | 1,472 |
| 10. Diseases of pregnancy, child-birth and puerperium | 3,321 | 3,179 | 3,940 | 3,987 | 2,863 | 2,377 | 1,906 |
| 11. Diseases of the skin and cellular tissues | 1,471 | 1,334 | 1,578 | 1,088 | 915 | 707 | 625 |
| 12. Diseases peculiar to the first year of life | 17,342 | 16,417 | 18,290 | 18,948 | 14,884 | 14,407 | 13,579 |
| 13. Senility and old age | 8,151 | 8,306 | 9,324 | 8,386 | 7,010 | 6,918 | 7,770 |
| 14. Death by ill-defined causes | 16,684 | 17,263 | 19,000 | 13,759 | 7,739 | 6,475 | 6,490 |
| 15. Deaths by violence | 3,497 | 3,589 | 3,564 | 3,392 | 3,488 | 3,212 | 3,245 |
| Total | 131,061 | 133,985 | 142,931 | 135,937 | 98,544 | 93,711 | 91,889 |

TABLE 14—PERCENTAGE DISTRIBUTION OF DEATHS BY CAUSES

| Cause of Death | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 |
|---|---|---|---|---|---|---|---|
| 1. Infectious and parasitic diseases | 17·87 | 17·70 | 18·41 | 21·12 | 17·46 | 16·92 | 15·83 |
| 2. Cancer and other tumours | 00·61 | 00·62 | 00·59 | 00·59 | 00·61 | 0·90 | 1·14 |
| 3. Rheumatism, diseases of nutrition and of endocrine glands and vitamin deficiency diseases | 7·33 | 9·23 | 7·73 | 6·65 | 7·58 | 7·45 | 8·20 |
| 4. Diseases of the blood and blood forming organs | 2·10 | 2·01 | 2·08 | 2·08 | 2·13 | 2·10 | 2·93 |
| 5. Diseases of the nervous system | 11·75 | 11·53 | 11·71 | 12·12 | 11·35 | 11·84 | 11·82 |
| 6. Diseases of the circulatory system | 2·39 | 2·64 | 2·82 | 2·49 | 3·20 | 3·55 | 3·89 |
| 7. Diseases of the respiratory system | 10·14 | 10·15 | 9·86 | 10·68 | 11·77 | 11·97 | 10·96 |
| 8. Diseases of the digestive system | 7·77 | 6·99 | 6·30 | 6·45 | 6·51 | 7·03 | 7·26 |
| 9. Diseases of the genito-urinary system | 1·50 | 1·61 | 1·49 | 1·30 | 1·61 | 1·65 | 1·59 |
| 10. Diseases of pregnancy, child-birth and puerperium | 2·54 | 2·39 | 2·76 | 2·93 | 2·91 | 2·56 | 2·05 |
| 11. Diseases of the skin and cellular tissues | 1·13 | 1·00 | 1·10 | 0·80 | 0·93 | 0·75 | 0·68 |
| 12. Diseases peculiar to the first year of life | 13·24 | 12·28 | 12·80 | 13·96 | 15·13 | 15·39 | 14·72 |
| 13. Senility and old age | 6·22 | 6·23 | 6·54 | 6·17 | 7·12 | 7·39 | 8·41 |
| 14. Death by ill-defined causes | 12·74 | 12·91 | 13·32 | 10·14 | 7·86 | 6·93 | 7·02 |
| 15. Deaths by violence | 2·67 | 2·71 | 2·49 | 2·50 | 3·54 | 3·43 | 3·50 |
| | 100·00 | 100·00 | 100·00 | 100·00 | 100·00 | 100·00 | 100·00 |

## TABLE 15—DEATH RATES BY CAUSES (PER MILLION POPULATION)

| Cause of Death | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 |
|---|---|---|---|---|---|---|---|
| 1. Infectious and parasitic diseases | 3,816 | 3,772 | 4,046 | 4,283 | 4,499 | 2,235 | 2,000 |
| 2. Cancer and other tumours | 131 | 133 | 130 | 124 | 128 | 137 | 147 |
| 3. Rheumatism, diseases of nutrition and of endocrine glands and vitamin deficiency diseases | 1,564 | 1,964 | 1,697 | 1,350 | 1,084 | 985 | 1,037 |
| 4. Diseases of the blood and blood forming organs | 438 | 470 | 458 | 423 | 305 | 275 | 289 |
| 5. Diseases of the nervous system | 2,508 | 2,456 | 2,572 | 2,456 | 1,624 | 1,564 | 149 |
| 6. Diseases of the circulatory system | 510 | 558 | 620 | 505 | 458 | 469 | 493 |
| 7. Diseases of the respiratory system | 2,164 | 2,160 | 2,165 | 2,165 | 1,684 | 1,581 | 1,384 |
| 8. Diseases of the digestive system | 1,685 | 1,486 | 1,386 | 1,308 | 931 | 927 | 919 |
| 9. Diseases of the genito-urinary system | 319 | 341 | 328 | 264 | 229 | 218 | 202 |
| 10. Diseases of pregnancy, child-birth and puerperium | 541 | 506 | 606 | 595 | 416 | 335 | 261 |
| 11. Diseases of the skin and cellular tissues | 240 | 213 | 243 | 162 | 133 | 100 | 86 |
| 12. Diseases peculiar to the first year of life | 2,827 | 2,616 | 2,816 | 2,830 | 2,165 | 2,033 | 1,861 |
| 13. Senility and old age | 1,329 | 1,323 | 1,435 | 1,252 | 1,019 | 976 | 1,065 |
| 14. Death by ill-defined causes | 2,720 | 2,751 | 2,925 | 2,055 | 1,125 | 914 | 889 |
| 15. Deaths by violence | 570 | 572 | 549 | 507 | 507 | 453 | 445 |

## TABLE 16—INDEX OF DEATH RATES BY CAUSES

| Cause of Death | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 |
|---|---|---|---|---|---|---|---|
| 1. Infectious and parasitic diseases | 100 | 99 | 106 | 112 | 65 | 59 | 53 |
| 2. Cancer and other tumours | 100 | 101 | 99 | 95 | 98 | 105 | 111 |
| 3. Rheumatism, diseases of nutrition and of endocrine glands and vitamin deficiency diseases | 100 | 126 | 108 | 86 | 69 | 63 | 66 |
| 4. Diseases of the blood and blood forming organs | 100 | 107 | 105 | 97 | 70 | 63 | 66 |
| 5. Diseases of the nervous system | 100 | 98 | 103 | 98 | 65 | 61 | 59 |
| 6. Diseases of the circulatory system | 100 | 109 | 122 | 99 | 90 | 92 | 97 |
| 7. Diseases of the respiratory system | 100 | 100 | 100 | 100 | 78 | 73 | 64 |
| 8. Diseases of the digestive system | 100 | 90 | 84 | 79 | 56 | 56 | 55 |
| 9. Diseases of the genito-urinary system | 100 | 107 | 103 | 83 | 72 | 68 | 63 |
| 10. Diseases of pregnancy, child-birth and puerperium | 100 | 93 | 112 | 110 | 77 | 62 | 48 |
| 11. Diseases of the skin and cellular tissues | 100 | 89 | 101 | 67 | 55 | 42 | 36 |
| 12. Diseases peculiar to the first year of life | 100 | 92 | 100 | 100 | 77 | 72 | 66 |
| 13. Senility and old age | 100 | 100 | 109 | 94 | 77 | 73 | 80 |
| 14. Death by ill-defined causes | 100 | 101 | 107 | 75 | 41 | 34 | 33 |
| 15. Deaths by violence | 100 | 100 | 96 | 89 | 89 | 79 | 78 |

## TABLE 17—MATERNAL DEATHS PER 1,000 LIVE BIRTHS

| Year | 1937 | 1938 | 1939 | 1940 | 1941 | 1942 | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 | 1950 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rate | 19·9 | 20·1 | 18·2 | 16·1 | 15·3 | 14·4 | 13·3 | 13·7 | 16·5 | 15·5 | 10·6 | 8·3 | 6·5 | 5·7 |
| Index | 150 | 151 | 137 | 121 | 115 | 108 | 100 | 103 | 124 | 117 | 80 | 62 | 49 | 43 |

## Maternal Death Rates

Table 17 gives the maternal deaths per 1,000 live births and the corresponding indices with 1943 as base. The trend here shows a steady decline broken only by the malaria epidemics of 1945 and 1946.

## The Parasitic and Infectious Diseases

Parasitic and infectious diseases are the biggest killers in Ceylon. Hence it may be fruitful to discuss them in greater detail, remembering, of course, the limitations of the data relating to particular causes of death. Table 18 gives the death rates.

from the principal diseases in this group, and Table 19 expresses the rates in the form of indices. It will be noticed from these tables that tuberculosis of the respiratory system has recently replaced malaria as the chief cause of death. Table 19 shows that while all other infectious and parasitic diseases have been increasingly brought under control, tuberculosis alone shows a tendency to increase. To what extent the increases in tuberculosis and cancer are genuine, can of course, be doubted. The effectiveness of the treatment available in the public institutions either free or at moderate cost, may have caused more cases to be traced and diagnosed. The social stigma attached to tuberculosis in Ceylon affects not only the infected person but also their entire family, and not only does social intercourse become difficult, but the rate of dowry is altered to great disadvantage. The family may, therefore, consider it unwise to reveal the infection of one of its members, especially when the probable success of treatment is doubtful.

In all other diseases the decline is remarkable, and the honour is shared by recent development of effective drugs and preventive measures.

Before concluding this chapter, it is necessary to emphasise that the death rates from various diseases or groups of diseases that we have examined relate to all-ages. It may be considered, therefore, that they do not relate, correctly, deaths to the number exposed. For example, the death rate from old age and senility relates deaths from these causes to the total population, only a small part of which is exposed to this risk. In other words, these rates ignore the age and sex distribution of the population. Secondly, they do not take into consideration the geographical, racial and other factors which considerably affect the probability of death. These rates, therefore, should be regarded as general indicators rather than accurate measures of the trend in mortality.

**Conclusion**

The progress in the cure and prevention of diseases in Ceylon cannot be doubted. The movement which started on a rudimentary scale about a hundred years ago, made slow and halting progress till 1939, when a large measure of self-government was granted to Ceylon. Since then the growth in public health services has been spectacular. Today an efficient organisation has been established, with a hierarchy of medical officers, apothecaries, nurses and mid-wives &c., and a net-work of hospitals, dispensaries, clinics, and maternity homes have covered the whole island. Special squads have been organised, trained and equipped to combat the spread of particular diseases such as malaria, filaria, tuberculosis &c. Institutions have been built to maintain the flow of trained personnel for replacement and expansion.

The numbers of doctors, nurses, hospital-beds &c. per head of population though low by Western standards compare very favourably with other Asian countries.[1]

TABLE 18—DEATH RATES PER MILLION FROM IMPORTANT INFECTIOUS AND PARASITIC DISEASES

| Cause of death | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 |
|---|---|---|---|---|---|---|---|
| 1. Typhoid and para-typhoid | 187 | 251 | 227 | 194 | 157 | 121 | 119 |
| 2. Tuberculosis of the respiratory system | 517 | 500 | 503 | 542 | 510 | 532 | 530 |
| 3. Dysentery | 361 | 314 | 298 | 272 | 135 | 101 | 97 |
| 4. Malaria | 1,100 | 892 | 1,312 | 1,879 | 662 | 472 | 329 |
| 5. Influenza | 351 | 355 | 258 | 234 | 190 | 160 | 134 |
| 6. Ankylostomiasis | 238 | 260 | 280 | 200 | 155 | 129 | 116 |

TABLE 19—INDEX OF DEATH RATES PER MILLION FROM IMPORTANT INFECTIOUS AND PARASITIC DISEASES

| Cause of death | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 |
|---|---|---|---|---|---|---|---|
| 1. Typhoid and para-typhoid | 100 | 134 | 121 | 104 | 84 | 65 | 64 |
| 2. Tuberculosis of the respiratory system | 100 | 97 | 97 | 105 | 99 | 103 | 102 |
| 3. Dysentery | 100 | 87 | 83 | 75 | 37 | 28 | 27 |
| 4. Malaria | 100 | 81 | 119 | 171 | 60 | 43 | 30 |
| 5. Influenza | 100 | 101 | 73 | 67 | 54 | 46 | 38 |
| 6. Ankylostomiasis | 100 | 105 | 118 | 84 | 65 | 54 | 49 |

The maintenance and expansion of this vast organisation uses a large proportion of public revenue. The table below shows the rapid expansion of per capita expenditure on health in Ceylon during the last 14 years. It is this liberal grant of money that has enabled the health authorities to expand their organisation and activities and to combat disease and death so effectively. On malaria control alone the expenditure per head of protected population was Rs. 0·65 per year during 1947–49.

The future trend in the death rate will be determined by the size of the funds available for health work. Since infectious and parasitic diseases are the major causes of death, constant vigilance is necessary to keep these diseases under control ; and this in turn requires the maintenance at a high level of efficiency of a vast army of medical and other health officials. Both the knowledge and the health organisations necessary to keep the death rate down are available in Ceylon at present ;

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[1] The ratios in Ceylon are as follows :—1 doctor per 7,992 population, 1 nurse per 676 population and 1 hospital-bed per 550 population.

the crucial issue, then, is the national and public income.   This is the most vulnerable front, and the whole edifice of an imposing structure of health organisation may crumble through the collapse of financial support.

TABLE 20—PUBLIC EXPENDITURE ON HEALTH

| Year | Rs. (Millions) | Per cent. of Total Expenditure | Per Capita Expenditure Rs. |
|------|------|------|------|
| 1937 | 11·6 | 10·7 | 2·02 |
| 1938 | 12·7 | 11·0 | 2·19 |
| 1939 | 13·6 | 10·7 | 2·30 |
| 1940 | 13·5 | 11·0 | 2·27 |
| 1941 | 14·0 | 11·0 | 2·33 |
| 1942 | 14·9 | 9·7 | 2·47 |
| 1943 | 16·1 | 8·7 | 2·63 |
| 1944 | 18·7 | 8·8 | 2·99 |
| 1945 | 22·3 | 8·7 | 3·43 |
| 1946 | 29·5 | 9·3 | 4·41 |
| 1947 | 38·2 | 9·4 | 5·71 |
| 1948 | 53·3 | 8·5 | 7·52 |
| 1949 | 58·8 | 10·7 | 8·05 |

*Source :* Ceylon Year Book, 1950.

## Comparison with England and Wales

### AGE-SPECIFIC DEATH RATES

A simple method was used to find the period in the history of English and Ceylonese age-specific death rates, which could be regarded as equivalent.   The method consists in computing the total over all ages of the proportionate deviations of the age-specific death rates of England and Wales, from the Ceylon rates for the periods being compared.   Thus, if the age-specific death rates of England and Wales of any period $I$ be denoted by $E_I$ and of Ceylon for a period with which comparison is being made is denoted by $C_p$, then

$$d = \Sigma \left| \frac{C_p - E_I}{C_p} \right|$$

will give us a basis of comparing the age-specific death rates of these two periods. For that combination of $P$ and $I$ for which $d$ is minimum, $C$ and $E$ could be taken as equivalent, i.e. $C_p$ *Equiv.* $E_I$.

For example, the values of $d$ for different values of $P$ with $I$ taken as 1848–50, are as follows :

For,

$$C_{1900\text{--}02} \text{ and } E_{1848\text{--}50}, d = 1 \cdot 921$$

$$C_{1910\text{--}12} \text{ and } E_{1848\text{--}50}, d = 1 \cdot 904$$

$$C_{1920\text{--}22} \text{ and } E_{1848\text{--}50}, d = 1 \cdot 209$$

$$C_{1945\text{--}47} \text{ and } E_{1848\text{--}50}, d = 1 \cdot 607$$

We can, therefore, regard the period 1920–22 in the history of Ceylon death rates to be comparable to that of English death rates of 1848–50. In a similar manner the following equivalents were obtained :

$$C_{1920\text{--}22} \text{ Equiv. } E_{1848\text{--}50}$$

$$C_{1945\text{--}47} \text{ Equiv. } E_{1896\text{--}1900}$$

$$C_{1948} \quad \text{Equiv. } E_{1921\text{--}25}.$$

In other words, Ceylon was making a very slow progress in combatting deaths till 1920–22, and did not reach the English standard of 1948–50 until then. Progress since then has been more rapid, and the English standard 50 years later in 1896–1900 was reached in 25 years i.e. in 1945–47. Since 1946 the progress has been phenomenal as mentioned earlier, and twenty-five years of progress by the English standard has been achieved in about three years. Today the death rate of Ceylon could be regarded as equivalent to that of England in 1921–25.

The progress, however, has not been uniform over all the age groups. The table below gives the death rates by age and sex of various equivalent periods.

TABLE 21—AGE-SPECIFIC DEATH RATES : ENGLAND AND WALES AND CEYLON

| Age | Males | | Females | | Males | | Females | |
|---|---|---|---|---|---|---|---|---|
| | Ceylon | England and Wales | Ceylon | England and Wales | Ceylon | England and Wales | Ceylon | England and Wales |
| | 1920–22 | 1846–50 | 1920–22 | 1846–50 | 1945–47 | 1896–1900 | 1945–47 | 1896–1900 |
| 0– | 80·9 | 74·0 | 83·9 | 64·0 | 53·5 | 62·0 | 54·5 | 53·0 |
| 5– | 13·5 | 9·5 | 15·0 | 9·2 | 6·2 | 4·1 | 7·2 | 4·2 |
| 10– | 6·5 | 5·4 | 6·9 | 5·7 | 3·0 | 2·3 | 3·4 | 2·4 |
| 15– | 6·9 | 7·4 | 6·9 | 8·1 | 3·0 | 3·6 | 4·8 | 3·4 |
| 20– | 8·7 | 10·0 | 13·0 | 9·6 | 5·4 | 4·9 | 9·3 | 4·1 |
| 25– | 10·6 | 11·0 | 14·1 | 11·0 | 6·8 | 6·5 | 10·2 | 5·6 |
| 35– | 14·5 | 14·0 | 13·8 | 14·0 | 10·6 | 11·0 | 10·2 | 9·1 |
| 45– | 24·3 | 19·0 | 18·4 | 17·0 | 15·3 | 18·0 | 11·8 | 14·0 |
| 55– | 41·6 | 33·0 | 34·4 | 30·0 | 28·9 | 34·0 | 23·6 | 27·0 |

TABLE 21—AGE-SPECIFIC DEATH RATES : ENGLAND AND WALES AND CEYLON—(*contd.*)

| Age | Males | | Females | |
|---|---|---|---|---|
| | *Ceylon* | *England and Wales* | *Ceylon* | *England and Wales* |
| | 1948 | 1921–25 | 1948 | 1921–25 |
| 0– | 46·9 | 27·0 | 41·1 | 22·0 |
| 5– | 3·8 | 2·6 | 4·3 | 2·4 |
| 10– | 1·9 | 1·7 | 1·9 | 1·7 |
| 15– | 2·6 | 2·7 | 3·4 | 2·6 |
| 20– | 3·9 | 3·5 | 6·2 | 3·1 |
| 25– | 4·5 | 4·1 | 7·4 | 3·6 |
| 35– | 6·5 | 6·5 | 7·6 | 51·0 |
| 45– | 11·5 | 12·0 | 9·5 | 8·8 |
| 55– | 38·9 | 25·0 | 42·4 | 19·0 |

*Sources :* For Age-Specific Death Rates for England and Wales *Population Studies.* Vol. IV, pp. 132–178, article by Logan. " *Mortality in England and Wales from 1848–1947.*

*For :* Ceylon, up to 1945–47 from Table 4 and for 1948 *Ceylon Medical Journal*, ibid p. 125–26 Cullumbine.

It is evident from this table, that except for the mortality of infants and children and of older age groups, Ceylon has reached the level of English mortality in 1921–25. In infant mortality Ceylon is still another decade behind England. The high death rates calculated for females in Ceylon in 1948 may be partly due to the under-estimation of the female population, which was not allowed for by Prof. Cullumbine in his estimates. Under-estimation of females, however, cannot account for the whole of the higher female mortality, especially in the reproductive age-groups and in other years for which corrections have been made. We can, therefore, argue that progress in maternal care is still lagging far behind the general progress in health-care. It must be pointed out that the women of Ceylon have a higher fertility than the British women and therefore suffer the risk of maternal death more frequently. So long as fertility remains high, Ceylon female mortality will remain higher than that of England. However, the big difference between the two countries in female mortality cannot be explained alone by differences in fertility. The female death rate in Ceylon in 1948 of the age group 15 years to 44 years can be regarded as equivalent to the 1896–1900 rates of England and Wales as shown below.

TABLE 22—DEATH RATES OF FEMALES

| Age | Ceylon | England and Wales | |
|---|---|---|---|
| | 1948 | 1871–75 | 1896–1900 |
| 15– | 3·36 | 5·9 | 3·4 |
| 20– | 6·19 | 7·4 | 4·1 |
| 25– | 7·35 | 9·2 | 5·6 |
| 35– | 7·57 | 12·0 | 9·1 |

## Causes of Death

The table below gives the death rates from various diseases in Ceylon and England and Wales for equivalent periods.

TABLE 23—DEATH RATE PER MILLION BY CAUSE

| Disease | Ceylon Death Rate | | Death Rate of England and Wales | |
|---|---|---|---|---|
| | Year | Death rate | Equiv. year | Death rate |
| Infectious and parasitic diseases | 1943 | 3816 | 1901–10 | 3282 |
| | 1949 | 2000 | 1921 | 2038 |
| Diseases of the respiratory system | 1943 | 2164 | 1921 | 2209 |
| | 1949 | 1384 | 1947 | 1238 |
| Diseases of the digestive system | 1943 | 1658 | 1901–10 | 1484 |
| | 1949 | 1490 | 1921 | 1309 |
| Diseases of the nervous system | 1943 | 2508 | 1890–1900 | 3029 |
| | 1949 | 1490 | 1921 | 1309 |
| Cancer | 1943 | 131 | 1848 | 220 |
| | 1949 | 145 | 1947 | 2023 |
| Diseases of the genito-urinary system | 1943 | 1329 | 1931 | 731 |
| | 1949 | 1065 | 1947 | 620 |
| Diseases of child-brith and pregnancy | 1943 | 541 | 1848–72 | 217 |
| | 1949 | 261 | 1947 | 43 |

Infectious and parasitic diseases were the chief causes of death in England and Wales till the second decade of the 20th century. In Ceylon, even today, this class of disease accounts for the largest number of deaths. The Ceylon death rate from these diseases in 1943 was about equivalent to the English rate of 1901–10. During the last few years, however, Ceylon has made remarkable progress in the control of infectious diseases, and the death rate has fallen to the level of England and Wales in 1921. Similar progress has been made with diseases of the nervous and respiratory systems, and the Ceylon death-rate is today about the same as the English rates in the third decade of this century. In 1943 Ceylon's position in the control of the diseases of the respiratory system was comparable to that of England in 1921, but by 1949 Ceylon had made rapid progress, and reached the present English level.

The death rate due to cancer and genito-urinary diseases is rising in England. The death rate due to cancer shows a small rise in Ceylon, which may be due to better diagnosis. The genito-urinary diseases show a decline in Ceylon.

The progress is least impressive in infant death rates and death rates due to diseases associated with pregnancy and child-birth. In the former, even the English 1848–72 level has not yet been reached, and in the latter, Ceylon has yet to reach the 1921 level of England and Wales. In view of the close association between infant and maternal mortality and malnutrition[1] and general sanitation, further progress in this field seems more to be a question of economic and cultural progress than of medical care.

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[1] See Toverud : The influence of nutrition on the course of pregnancy. *Milbank Memorial Fund Quarterly*, January, 1950. See also ; Reference Nos. 29 and 97.

# ABRIDGED LIFE TABLES FOR CEYLON : 1900–1947

The first life table for Ceylon was calculated in 1888, and published in the Registrar-General's Report for the year 1887. This life table was not very accurate, a fact which was recognised by the compiler who remarked " Such an extended series of observed facts does not exist in Ceylon to serve as the basis of a life table."[1]

A second life table was computed for the period 1893–1901 and was published in the Census Report for 1901. Under the circumstances its achievements were commendable, although by present standards it shows many shortcomings. Since 1901 there has been no official attempt to construct a life table for Ceylon, though data of a better standard have been available.

I have constructed two sets of life tables : the first set is from the census population and the second from the corrected figures. In both cases the registered deaths are used. The method of construction is described below.

### Nature of the Basic Data

The system of vital registration in Ceylon dates back to the period of Dutch rule, when a registration scheme was embodied in the so-called *school thombos* or parish registers. A first attempt to introduce a general system of vital registration was made in 1847 under British rule, but the Department of Registration of Marriages, Births and Deaths was not created until 1867, and it was not until 1893 that failure to register was made a punishable offence.

An examination of birth and death statistics and the census population figures shows that they are undependable prior to 1900, and under-registration of deaths existed to a significant degree till 1910. In a previous chapter we have discussed in detail the question of under-registration and under-enumeration, and have obtained methods for correcting them.

The serious errors in the enumerated population by age are shown by the following extract from a table in the *Census Report* of 1921. There is a high preference for ages ending in the digit 0 and 5, a small preference for ages ending in even numbers and women's ages seem to be stated even more inaccurately than those of men.

In order to reduce the error due to mis-statement of ages, quinquennial age groups have been used. From this point of view, decennial groups would have been even better, but they are not as suitable for life table construction as the variation in mortality over age groups of ten years is too large. I have taken ages ending in 0 and 5 as the lower limit of each age group, primarily to facilitate international comparisons in the life tables produced, although it might have been preferable to take these ages as the centres of the groups to minimise the effect of age mis-statement. In an abridged life table the errors due to this procedure are unlikely to be serious.

#### TABLE 1—POPULATION AGED 28–38 YEARS BY SINGLE YEARS OF AGE, 1921

| Age | Males | Females | Age | Males | Females |
|---|---|---|---|---|---|
| 28 | 61,086 | 52,137 | 34 | 14,146 | 9,198 |
| 29 | 16,161 | 11,120 | 35 | 89,059 | 68,840 |
| 30 | 98,478 | 101,072 | 36 | 23,590 | 15,570 |
| 31 | 12,140 | 7,627 | 37 | 14,991 | 8,324 |
| 32 | 32,290 | 22,275 | 38 | 35,440 | 23,663 |

### Treatment of the Data

Deaths have been taken for three years centred round the census. In the Registrar-General's report, deaths of persons aged over 25 years are tabulated in groups of 10 years. In order to split these into

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[1] Quoted in the *Census Report*, 1901.

five-year groups I have interpolated, using Everett's formula to second differences. The figures have not been graduated in any other way. Deaths of persons of unspecified ages have been distributed *pro rata*.

## Exposed to Risk

The Registrar-General makes an annual estimate of the mid-year population. I have assumed that the age and sex distribution of the population remains unchanged in the short interval between the census date and the mid-year, and have applied the sex-age distribution of the Census to the Registrar-General's mid-year estimate. For the first set of life tables, three times the figure in each age group has been taken as the population exposed to risk.

For the second set, the difference between the census figures and the mid-year estimates has been taken as the increase during this short period. This increase is then distributed *pro rata* amongst the corrected figures. Three times this figure is taken as the number exposed to risk.

In the Census Reports, and in the corrected figures, persons aged over 65 or 70 years have generally been tabulated as one group. In order to obtain figures for the different age groups at advanced ages I have divided these groups by a graphical method.

To obtain the figures for the population exposed to risk during the first year of life, I have preferred to use the figures of births during three years, with the census year as centre. I have used corrected birth figures for the second set of life tables. As some of the deaths under the age of one year which occurred during the period considered are deaths of infants born in previous years, and as other infants do not complete their first year of life within that period, some adjustment had to be made. For England and Wales, Kuczynski [1] uses the factor $0.7b_0 + 0.3b_{-1}$ where $b_0$ denotes births in the current year, and $b_{-1}$ births of the previous year. I have used Valaoras [2] method for obtaining the separation factors. Valaoras' equation probably does not fit exactly into Ceylon data ; but since the alternative is to choose some arbitrary seperation factors Valaoras' method is, perhaps, preferable.

## Method of Compilation

For ages 1–4 years I have followed Kuczynski and have assumed that

$$l_5 = \frac{3P_{1-4} - 1 \cdot 2D_{1-4}}{3P_{1-4} - 2 \cdot 8D_{1-4}} l_{x-1}$$

For other age groups I have used the formula

$$p_x = \frac{3P_x - 2 \cdot 5D_x}{3P_x + 2 \cdot 5D_x}$$

Where $P_x$ is the mid–year population aged $x$ to $x + 5$ and $D_x$ the number of deaths in the age group.

The values of $p_x$ were graduated graphically and a smooth curve obtained. $q_x$ and related functions were calculated from the graduated values of $p_x$.

## Life Tables for the First Year of Life

Infant life tables were prepared following Kuczynski's method. The deaths, corrected by using Valaoras' separation factors were distributed back among the age groups under one *pro rata*.

In Ceylon deaths of infants are not recorded by separate weeks or months. In 1910–12 and 1920–22 such deaths were divided into only three groups. In 1945–47 five groups were tabulated, but no figures existed giving the number of deaths for each day during the first week of life. I

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[1] R. P. Kuczyncki, *The Measurement of Population Grouth*, p. 178.

[2] Varilios G. Valaoras Refined Rates for Infant and child-hhood Mortality; *Population Studies*, Vol. IV. pp. 253 ft.

have used graphic interpolation and graduation to obtain these figures. This procedure is, of course, somewhat arbitrary, especially during the first week of life, for which I have assumed the following distribution.

### TABLE 2—PERCENTAGE DISTRIBUTION OF DEATHS DURING FIRST WEEK OF LIFE

| Age in days | Kuczynski | Ceylon |
|---|---|---|
| 1 | 50·07 | 48·14 |
| 2 | 15·66 | 21·50 |
| 3 | 12·80 | 13·33 |
| 4 | 8·14 | 7·50 |
| 5 | 5·62 | 4·50 |
| 6 | 4·42 | 3·33 |
| 7 | 3·29 | 1·70 |
| | 100 | 100 |

As infant care in Ceylon is much less developed than in England, we may legitimately expect a less rapid decline in infant deaths than in England. Thus the percentage of deaths during the first day of life is smaller than in England, and I have chosen an arbitrary smooth curve which brings out this fact. I should point out that a small variation in the percentages which I have arbitrarily assumed will not lead to any significant alterations in the basic features of the life tables.

## Abridged Life Tables of Ceylon; "A"—based on Census Population

### TABLE 3—EXTRACTS FROM LIFE TABLE FOR 1893–1901

| Age | $L_x$ | | $P_x$ | |
|---|---|---|---|---|
| | Males | Females | Males | Females |
| 0 | 1000 | 1000 | 0·8764 | 0·8834 |
| 1 | 876 | 883 | 0·9661 | 0·9610 |
| 5 | 764 | 750 | 0·9814 | 0·9796 |
| 10 | 717 | 695 | 0·9895 | 0·9894 |
| 15 | 680 | 662 | 0·9901 | 0·9916 |
| 20 | 647 | 635 | 0·9902 | 0·9898 |
| 25 | 613 | 595 | 0·9874 | 0·9830 |
| 30 | 574 | 540 | 0·9860 | 0·9782 |
| 35 | 533 | 483 | 0·9831 | 0·9775 |
| 40 | 483 | 430 | 0·9774 | 0·9768 |
| 45 | 425 | 381 | 0·9709 | 0·9742 |
| 50 | 362 | 332 | 0·9649 | 0·9706 |
| 55 | 299 | 283 | 0·9585 | 0·9660 |
| 60 | 238 | 234 | 0·9510 | 0·9555 |
| 65 | 182 | 178 | 0·9417 | 0·9300 |
| 70 | 132 | 112 | 0·9308 | 0·8802 |
| 75 | 89 | 50 | 0·9157 | 0·7990 |
| 80 | 54 | 13 | 0·8841 | 0·7204 |
| 85 | 26 | 2 | 0·8414 | 0·6414 |
| 90 | 9 | 0 | 0·7613 | 0·5552 |
| Expectation of life at birth | | | 36·41 | 34·16 |

## TABLE 4—ABRIDGED LIFE TABLE FOR MALES

| Age | 1910–12 | | | 1920–22 | | | 1945–47 | | |
|-----|---------|---|---|---------|---|---|---------|---|---|
| | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ |
| 0 | 0·7989 | 1000 | 823 | 0·8216 | 1000 | 837 | 0·8597 | 1000 | 888 |
| 1 | 0·8919 | 799 | 3023 | 0·8836 | 822 | 3025 | 0·9237 | 860 | 3307 |
| 5 | 0·9312 | 713 | 3440 | 0·9348 | 726 | 3512 | 0·9697 | 794 | 3910 |
| 10 | 0·9439 | 664 | 3425 | 0·9580 | 679 | 3322 | 0·9840 | 770 | 3819 |
| 15 | 0·9472 | 624 | 3049 | 0·9565 | 650 | 3180 | 0·9789 | 758 | 3748 |
| 20 | 0·9425 | 593 | 2881 | 0·9487 | 622 | 3030 | 0·9730 | 742 | 3658 |
| 25 | 0·9338 | 559 | 2703 | 0·9394 | 590 | 2861 | 0·9672 | 722 | 3549 |
| 30 | 0·9216 | 522 | 2508 | 0·9286 | 554 | 2672 | 0·9604 | 698 | 3421 |
| 35 | 0·9055 | 481 | 2292 | 0·9146 | 515 | 2463 | 0·9531 | 670 | 3273 |
| 40 | 0·8853 | 436 | 2054 | 0·8991 | 471 | 2235 | 0·9413 | 639 | 3101 |
| 45 | 0·8629 | 386 | 1797 | 0·8805 | 423 | 1990 | 0·9257 | 501 | 2895 |
| 50 | 0·8391 | 333 | 1530 | 0·8542 | 373 | 1727 | 0·9049 | 557 | 2651 |
| 55 | 0·8100 | 279 | 1264 | 0·8263 | 318 | 1453 | 0·8752 | 504 | 2362 |
| 60 | 0·7641 | 226 | 998 | 0·7767 | 263 | 1168 | 0·8305 | 441 | 2018 |
| 65 | 0·6931 | 173 | 732 | 0·6898 | 204 | 863 | 0·7376 | 366 | 1591 |
| 70 | 0·5881 | 120 | 476 | 0·5550 | 141 | 548 | 0·6647 | 270 | 1124 |
| 75 | 0·4904 | 70 | 263 | 0·4744 | 78 | 288 | 0·5934 | 180 | 715 |
| 80 | 0·3826 | 35 | 119 | 0·4046 | 37 | 130 | 0·5485 | 107 | 412 |
| 85 | 0·2741 | 13 | 42 | 0·3379 | 15 | 50 | 0·5025 | 58 | 220 |
| 90 | 0·1716 | 3 | 11 | 0·2914 | 5 | 16 | 0·4420 | 29 | 106 |
| 95 | 0·0675 | 1 | 2 | 0·1938 | 1 | 4 | 0·3472 | 13 | 44 |
| 100 | 0·0166 | 0 | 0 | 0·0326 | 0 | 0 | 0·0525 | 5 | 5 |

## TABLE 5—ABRIDGED LIFE TABLE FOR FEMALES

| Age | 1910–12 | | | 1920–22 | | | 1945–47 | | |
|-----|---------|---|---|---------|---|---|---------|---|---|
| | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ |
| 0 | 0·7983 | 1000 | 835 | 0·7719 | 1000 | 848 | 0·8509 | 1000 | 914 |
| 1 | 0·8368 | 798 | 2933 | 0·8538 | 772 | 2862 | 0·9202 | 851 | 3268 |
| 5 | 0·9181 | 668 | 3203 | 0·9260 | 659 | 3174 | 0·9648 | 783 | 3846 |
| 10 | 0·9442 | 613 | 2981 | 0·9588 | 610 | 2989 | 0·9815 | 755 | 3743 |
| 15 | 0·9426 | 579 | 2812 | 0·9509 | 585 | 2854 | 0·9725 | 742 | 3657 |
| 20 | 0·9262 | 546 | 2629 | 0·9337 | 556 | 2690 | 0·9597 | 721 | 3533 |
| 25 | 0·9065 | 506 | 2410 | 0·9202 | 620 | 2494 | 0·9504 | 692 | 3374 |
| 30 | 0·8927 | 458 | 2169 | 0·9097 | 478 | 2282 | 0·9442 | 658 | 3197 |

### TABLE 5—ABRIDGED LIFE TABLE FOR FEMALES—(*contd.*)

| Age | 1910–12 | | | 1920–22 | | | 1945–47 | | |
|---|---|---|---|---|---|---|---|---|---|
| | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ |
| 35 | 0·8841 | 409 | 1927 | 0·9014 | 435 | 2067 | 0·9401 | 621 | 3012 |
| 40 | 0·8771 | 362 | 1697 | 0·8951 | 392 | 1858 | 0·9358 | 584 | 2825 |
| 45 | 0·8662 | 317 | 1480 | 0·8895 | 351 | 1659 | 0·9299 | 546 | 2636 |
| 50 | 0·8488 | 275 | 1270 | 0·8735 | 312 | 1464 | 0·9176 | 508 | 2435 |
| 55 | 0·8072 | 233 | 1054 | 0·8383 | 273 | 1254 | 0·8978 | 466 | 2212 |
| 60 | 0·7231 | 188 | 811 | 0·7740 | 229 | 1015 | 0·8559 | 418 | 1942 |
| 65 | 0·6103 | 136 | 548 | 0·6696 | 177 | 739 | 0·7740 | 358 | 1588 |
| 70 | 0·5076 | 83 | 313 | 0·5271 | 119 | 453 | 0·6814 | 277 | 1165 |
| 75 | 0·4245 | 42 | 150 | 0·3268 | 63 | 207 | 0·5903 | 189 | 751 |
| 80 | 0·2743 | 18 | 57 | 0·0758 | 20 | 55 | 0·4937 | 112 | 416 |
| 85 | 0·1634 | 5 | 14 | 0·0187 | 2 | 4 | 0·4018 | 55 | 193 |
| 90 | 0·0699 | 1 | 2 | 0·0098 | 0 | 0 | 0·2834 | 22 | 71 |
| 95 | 0·0391 | 0 | 0 | 0·0039 | 0 | 0 | 0·1232 | 6 | 18 |
| 100 | 0·0123 | 0 | 0 | — | — | — | 0·0111 | 1 | 1 |

## " B " Life Tables Based on Corrected Population

### TABLE 6—MALES

| Age (Years) | 1900–02 | | | 1910–12 | | | 1920–22 | | | 1945–47 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ |
| 0 | 0·8612 | 1000 | 931 | 0·8562 | 1000 | 928 | 0·8440 | 1000 | 922 | 0·8995 | 1000 | 950 |
| 1 | ·8804 | 861 | 3239 | ·8734 | 856 | 3208 | ·8926 | 844 | 3195 | ·9139 | 899 | 3443 |
| 5 | ·9407 | 758 | 3679 | ·9327 | 748 | 3613 | ·9346 | 753 | 3644 | ·9694 | 822 | 4047 |
| 10 | ·9554 | 713 | 3487 | ·9588 | 697 | 3415 | ·9680 | 704 | 3464 | ·9851 | 797 | 3955 |
| 15 | ·9588 | 681 | 3337 | ·9593 | 669 | 3276 | ·9660 | 681 | 3350 | ·9787 | 785 | 3883 |
| 20 | ·9583 | 653 | 3199 | ·9478 | 641 | 3124 | ·9574 | 658 | 3222 | ·9699 | 768 | 3784 |
| 25 | ·9355 | 626 | 3030 | ·9431 | 608 | 2954 | ·9483 | 630 | 3070 | ·9646 | 745 | 3660 |
| 30 | ·9192 | 586 | 2810 | ·9187 | 573 | 2750 | ·9369 | 598 | 2894 | ·9535 | 719 | 3511 |
| 35 | ·9045 | 538 | 2563 | ·9008 | 427 | 2503 | ·9299 | 560 | 2702 | ·9483 | 685 | 3338 |
| 40 | ·8887 | 487 | 2299 | ·8762 | 474 | 2226 | ·9036 | 521 | 2478 | ·9285 | 650 | 3134 |
| 45 | ·8753 | 433 | 2029 | ·8522 | 416 | 1925 | ·8851 | 471 | 2218 | ·9169 | 603 | 2892 |
| 50 | ·8436 | 379 | 1745 | ·8254 | 354 | 1617 | ·8380 | 416 | 1914 | ·8802 | 553 | 2601 |
| 55 | ·8241 | 319 | 1457 | ·8010 | 292 | 1317 | ·8108 | 349 | 1580 | ·8647 | 487 | 2270 |
| 60 | ·7584 | 263 | 1158 | ·7470 | 234 | 1023 | ·7056 | 283 | 1207 | ·7969 | 421 | 1892 |
| 65 | ·7140 | 200 | 856 | ·7158 | 175 | 751 | ·6470 | 200 | 822 | ·7338 | 336 | 1454 |
| 70 | ·6115 | 143 | 574 | ·6100 | 125 | 504 | ·4885 | 129 | 481 | ·6826 | 246 | 1023 |
| 75 | ·5521 | 87 | 338 | ·5524 | 76 | 296 | ·3848 | 63 | 218 | ·5961 | 163 | 651 |
| 80 | ·4015 | 48 | 169 | ·4021 | 42 | 148 | ·2786 | 24 | 78 | ·5401 | 97 | 374 |
| 85 | ·3036 | 19 | 63 | ·3020 | 17 | 55 | ·2039 | 7 | 20 | ·5098 | 52 | 198 |
| 90 | ·2279 | 6 | 18 | ·2255 | 5 | 16 | ·1382 | 1 | 4 | ·4560 | 27 | 97 |
| 95 | ·1576 | 1 | 4 | ·1573 | 1 | 3 | ·0999 | 0 | 0 | ·3620 | 12 | 42 |
| 100 | ·1120 | 0 | 1 | ·1120 | 0 | 0 | ·0208 | 0 | 0 | ·0100 | 4 | 11 |

## TABLE 7—FEMALES

| Age (Years) | 1900–02 | | | 1910–12 | | | 1920–22 | | | 1945–47 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ | $p_x$ | $l_x$ | $L_x$ |
| 0 | 0·8808 | 1000 | 940 | 0·8686 | 1000 | 934 | 0,8556 | 1000 | 928 | 0·8995 | 1000 | 950 |
| 1 | ·8725 | 881 | 3299 | ·8974 | 869 | 3296 | ·8980 | 856 | 4060 | ·9139 | 899 | 3443 |
| 5 | ·9335 | 768 | 3715 | ·9234 | 779 | 3748 | ·9275 | 768 | 3702 | ·9694 | 822 | 4048 |
| 10 | ·9606 | 717 | 3516 | ·9646 | 720 | 3535 | ·9656 | 713 | 3502 | ·9851 | 797 | 3955 |
| 15 | ·9656 | 689 | 3386 | ·9598 | 694 | 3402 | ·9627 | 688 | 3376 | ·9787 | 785 | ·3883 |
| 20 | ·9415 | 665 | 3230 | ·9299 | 666 | 3215 | ·9369 | 682 | 3208 | ·9699 | 768 | 3784 |
| 25 | ·9155 | 326 | 3000 | ·9145 | 620 | 2966 | ·9316 | 621 | 2997 | ·9646 | 745 | 3660 |
| 30 | ·9150 | 574 | 2746 | ·9104 | 567 | 2707 | ·9313 | 578 | ·2792 | ·9535 | 719 | 3511 |
| 35 | ·9136 | 525 | 2511 | ·9063 | 516 | 2459 | ·9308 | 538 | 2607 | ·9483 | 685 | 3338 |
| 40 | ·9040 | 479 | 2282 | ·8932 | 468 | 2213 | ·9178 | 504 | 2418 | ·9285 | 650 | 3134 |
| 45 | ·8963 | 433 | 2055 | ·8891 | 418 | 1972 | ·9118 | 463 | 2212 | ·9169 | 603 | 2892 |
| 50 | ·8661 | 388 | 1812 | ·8376 | 371 | 1706 | ·8900 | 422 | 1994 | ·8802 | 553 | 2601 |
| 55 | ·8465 | 336 | 1533 | ·8104 | 311 | 1408 | ·8410 | 376 | 1729 | ·8647 | 487 | 2270 |
| 60 | ·7745 | 285 | 1264 | ·7195 | 252 | 1082 | ·7500 | 316 | 1382 | ·7969 | 421 | 1892 |
| 65 | ·6991 | 221 | 937 | ·6384 | 181 | 742 | ·6481 | 237 | 976 | ·7336 | 336 | 1454 |
| 70 | ·6538 | 154 | 638 | ·6055 | 116 | 465 | ·5591 | 153 | 598 | ·6626 | 246 | 1023 |
| 75 | ·5553 | 101 | 392 | ·5790 | 70 | 277 | ·4567 | 86 | 313 | ·5961 | 163 | 651 |
| 80 | ·4798 | 56 | 207 | ·5215 | 41 | 154 | ·3700 | 39 | 134 | ·5401 | 97 | 374 |
| 85 | ·4380 | 27 | 96 | ·4818 | 21 | 78 | ·2987 | 14 | 47 | ·5098 | 52 | 198 |
| 90 | ·3996 | 12 | 41 | ·4120 | 10 | 36 | ·2377 | 4 | 13 | ·4560 | 27 | 97 |
| 95 | ·3347 | 5 | 16 | ·3535 | 4 | 14 | ·1888 | 1 | 3 | ·3620 | 12 | 42 |
| 100 | ·2843 | 2 | 5 | ·2938 | 1 | 5 | ·1577 | 0 | 1 | ·0100 | 4 | 11 |

## TABLE 8—EXPECTATION OF LIFE AT BIRTH

| Period | Male | | Female | |
|---|---|---|---|---|
| | Census-basis | Corrected population basis | Census-basis | Corrected population basis |
| 1900–02 | 36·41* | 36·99 | 34·16* | 37·64 |
| 1910–12 | 33·43 | 35·65 | 29·30 | 36·42 |
| 1920–22 | 35·45 | 37·48 | 30·97 | 38·99 |
| 1945–47 | 47·82 | 47·21 | 44·80 | 48·66 |

* 1893—1900.

## *APPENDIX B*

## REFINEMENT OF INFANT MORTALITY MEASURES

Decline in infant mortality is regarded as an important index of social progress. The available data, however, do not permit an accurate measurement of infant mortality to be calculated readily. The conventional measure, which we will call crude infant mortality, is obtained simply by dividing the deaths under one year of age occurring in a given year by that year's births. In addition to the defects in the original data, which result from under-registration and the complication of still births, the crude rate is defective so far as it suffers from an upward bias when births show a decline, and a downward bias in the opposite case. This bias derives from the fact that some of the infants dying in a calendar year were born in the preceding year. These deaths enter into the numerator of the crude rate while the births to which they should be related do not. An obvious way of eliminating this error would be to separate the infant deaths occurring in a calendar year into two components according to whether the infants dying were born in the same year or in the preceding year. Unfortunately, not many countries keep such records of infant deaths by year of birth. Various attempts have been made to produce accurate measures of infant mortality employing such data as are available in the various countries. The rapid fluctuations in the incidence of births after the war of 1914–1918, led the Registrar-General of England and Wales to evolve a method in 1920.[1] Similar birth fluctuations in America in the war of 1939–1945 led Moriyama and Greville to examine the problem afresh and develop methods on similar principles.[2] Meanwhile taking advantage of more detailed data becoming available, a rather different principle was developed in England and Wales.[3]

Moriyama and Greville suggest that in most circumstances it may be adequate to use a simplified method, essentially depending on the assumption of a slow change in the separation factor (i.e. in the ratio of deaths of infants in a calendar year who were born in the preceding year to the total infant deaths in the calendar year). This assumption, as Valaoras points out, is not always correct.

" The size of the separation factor depends not only on the level of the infant mortality rate b ut also on the amount of change in the number of live births from year to year. The gradual decline of infant mortality establishes the long term trend of the separation factor, while the change occurring in the number of births are responsible for important deviations of the separation factor from its true line. Since such refinements are mainly designed to adjust the infant mortality rate at the time of important changes in the number of births, it is evident that the use of an appropriate value, or the value of the previous year will still allow a rather wide margin of error in the adjusted value." [4]

Valaoras developed a relationship between crude infant mortality rate and the separation factors by observing the relationship between the two in the Scandinavian countries over a long period when the infant mortality had declined from 80 to about 30 per 1,000 live births. The relationship that he arrives at is—

$$\log (y - 50) = 1 \cdot 490173 - 0 \cdot 005153x$$

where  $y$  = separation factor, and

$x$  = crude infant mortality rate.

1 Eighty-third Annual Report of the Registrar-General of England and Wales, 1920, p. XXVII *et seq.*

2 Moriyama and Greville : Effect of Changing Birth Rates Upon Infant Mortality. U. S. Vital Statistics Special Reports. Vol. XIX, No. 20, 10th September, 1944, pp. 401–412.

3 Report of the Registrar-General, England and Wales, Medical, 1940–1945, p. 28.

4 Vasilios G. Valaoras. Refined Rates for Infant and Childhood Mortality. *Population Studies*, Vol. IV, 1950–51, pp. 253–266.

## Application to Ceylon

An attempt was made to test the relative suitability of the English Registrar-General's method mentioned above and Valaoras' method for the Ceylon data.

### THE DATA USED

The main difficulty that was met with was the absence of suitable data on which the methods could be directly applied. Various assumptions had to be made in order to convert the data into a form suitable for the application of the methods.

### QUARTERLY BIRTHS

In view of the marked seasonal variation in births and deaths of infants, it was felt that quarterly rates should be computed in the first instance. Quarterly birth rates are available in the Ceylon Registrar-General's Annual Reports from 1916 onwards except the last war years. The annual births were distributed over the quarters in proportion to the rates. This involved some error from the rates being contracted. As a check the quarterly births obtained in this way were compared to the quarterly figures for those years for which they were available, and the discrepancy was found never to exceed one per cent.

### QUARTERLY DEATHS

Quarterly death rates are available in the Registrar-General's Reports for the years 1917 to 1928. The annual infant deaths were distributed *pro rata* to obtain quarterly infant deaths for these years.

The infant deaths were given in two age groups only until 1937, namely deaths under 3 months, and death at age 3 months and over. In 1937 the 3–12 months class was subdivided into three more classes, namely, 3–6 months, 6–9 months and 9–12 months. In order to obtain the deaths for these groups for the years 1917 to 1928 we adopted the simple device of distributing the deaths for the age group 3–12 months according to the average distribution of 1937–1941. These proportions were as follows :—

| Age Group | Per cent. of Deaths 3–12 Months of Age |
|---|---|
| 3–6 months | 43·38 |
| 6–9 months | 32·14 |
| 9–12 months | 24·48 |
| | 100·00 |

The infant mortality of the period 1937–1941 however, was much less than in the period 1917–1928. A fall in infant mortality generally results in lowering the proportion of deaths above 3 months of age relative to the proportion of deaths below that age. It is likely, therefore, that this method of distribution gives too low a weight to the higher age groups.

The distribution of quarterly infant deaths by age groups are not available. We can, however, obtain estimates of quarterly deaths by age groups, by making a simple assumption, viz., that the distribution of births by age in each calendar quarter follows that of the calendar year of which the quarter forms a part.

Denote by Q the deaths at all ages under 1 year in a calendar quarter, and by A the deaths in the calendar year of which the quarter is a part. Denote by $d_x$ the deaths in the quarter at age x to x–3 months, and by $D_x$ the deaths in the year at the same age. Then we may estimate $d_x$ from—

$$d_x = D_x. Q/A.$$

The number of quarterly deaths having been separated in this manner into 4 age groups, the births to which the deaths of any age group in any quarter should be related were computed by the method

developed by the English Registrar-General. For example, if $B_0$ is the number of births in any quarter and $B_{-1}$ in the preceding quarter, then the appropriate number of births which should be related to the deaths under 3 months of age may be assumed to be $(0 \cdot 7B_0 + 0 \cdot 3B_{-1})$.[1] Similarly the appropriate number of births which should be related to the deaths in 3—6 months of age are $\frac{1}{2} (B_{-2} + B_{-1})$ and so on.

The mortality of an age group in any quarter is then obtained by dividing the deaths by the related births. The infant mortality rate for the quarter is obtained by adding the mortality of the individual age groups and the average of the four quarters gives the annual infant mortality.[2]

A second set of infant mortality rates is obtained by using Valaoras' method. The crude infant mortality rates are substituted in his equation and the separation factors are obtained. The annual deaths are then divided into two groups according to the separation factors and related to the respective year's births. The two rates thus obtained are combined by the formula—

$$q^t = 1 - (1 - \dot{q}^t)(1 - \ddot{q}^t)$$

Where $q^t$ is the infant mortality of the calendar year t, $\dot{q}^t$ is the infant mortality in the calendar year t of the survivors of the preceding year's births and $\ddot{q}^t$ is the mortality in calendar year t of the infants born in the year t.

The three sets of infant mortality rates and their indices are shown in Table 1 below and are illustrated in a diagram.

### TABLE 1—CRUDE AND REFINED INFANT MORTALITY RATES, 1918–1928 CEYLON

| Year | Crude Infant mortality Rate | Index | R. G's method | | Valaoras' method | |
|---|---|---|---|---|---|---|
| | | | Rate | Index | Rate | Index |
| 1918 | 188 | 100·0 | 188 | 100·0 | 187 | 100·0 |
| 1919 | 223 | 118·6 | 215 | 114·4 | 209 | 111·8 |
| 1920 | 182 | 96·8 | 184 | 97·9 | 185 | 98·9 |
| 1921 | 192 | 102·1 | 198 | 105·3 | 208 | 108·0 |
| 1922 | 188 | 100·0 | 188 | 100·0 | 186 | 99·5 |
| 1923 | 212 | 112·8 | 211 | 112·2 | 212 | 113·4 |
| 1924 | 186 | 98·9 | 188 | 100·0 | 186 | 99·5 |
| 1925 | 172 | 91·5 | 174 | 92·6 | 179 | 95·7 |
| 1926 | 174 | 92·6 | 178 | 94·7 | 179 | 95·7 |
| 1927 | 160 | 85·1 | 162 | 86·2 | 160 | 83·6 |
| 1928 | 177 | 94·1 | 178 | 94·7 | 180 | 96·3 |

The period 1917 to 1928 has been generally a period of rising births. Hence we could expect the crude infant mortality rate to have a downward bias. The infant mortality rates obtained by the two refined methods generally give values higher than the crude rates. The values obtained by the method of Valaoras differs little from the values given by the Registrar-General's method except for the years 1919, 1921 and 1925 when the difference between them exceed more than 5 points.

The trend of all the rates, however, differs little from each other and when we are concerned with long period changes, the crude rate seems to serve our purpose equally well as the more refined rates.

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1 The separation factor used by English Registrar-General is about $0 \cdot 8$; we have arbitrarily taken it to be $0 \cdot 7$ for Ceylon. The infant mortality in Ceylon being higher, the separation factor is likely to be lesser than that of England and Wales.

2 If desired the annual rate may be obtained as a weighted mean of the quarterly rates, but the method is complex and normally gives a trivial advantage.

Diagram 7 —Infant Mortality Rates : 1918–1928



Legend:
—— Crude Rate
- - - Registrar General's Rate
-..-.. Valaoras' Rate
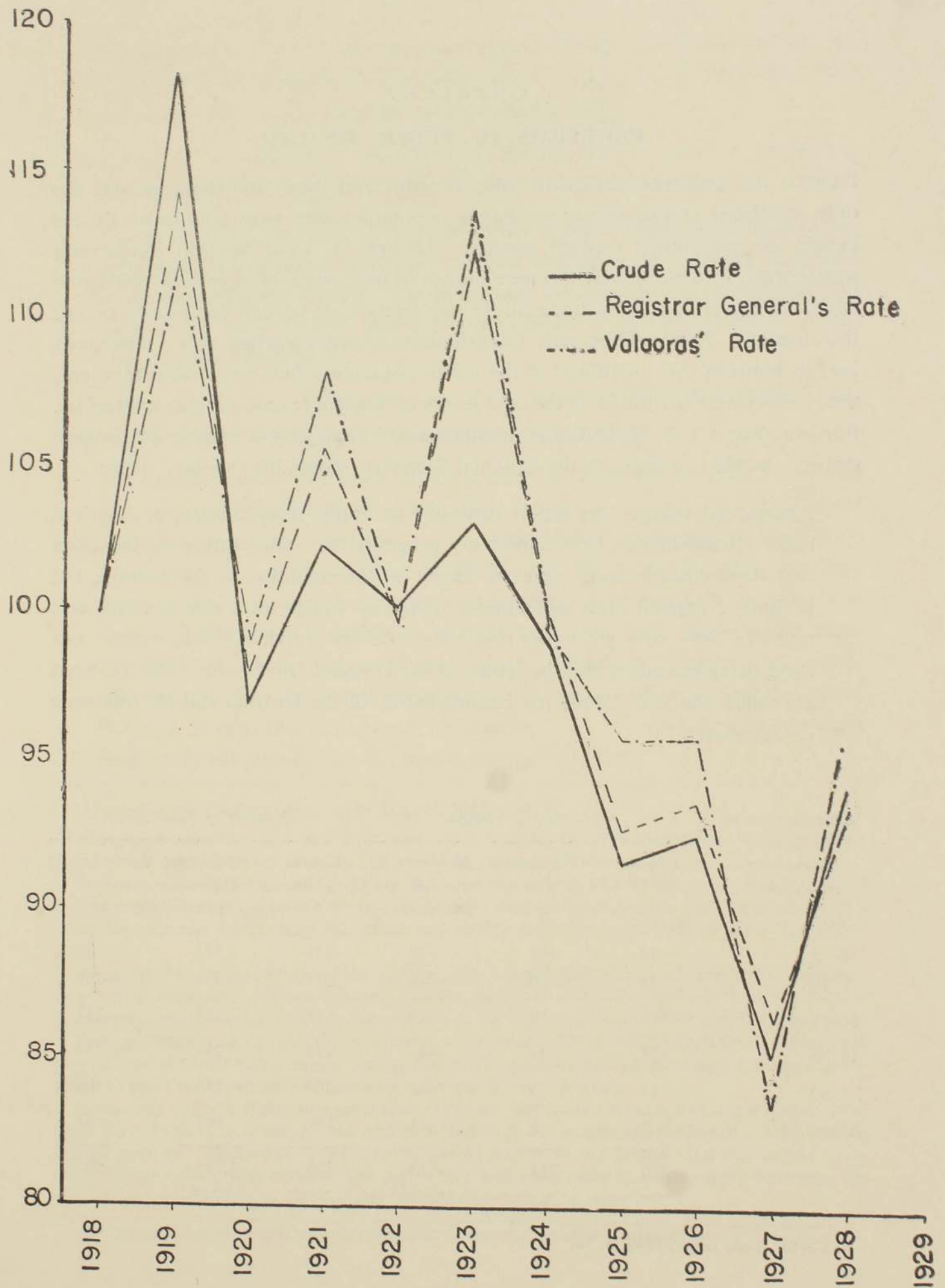
## PROBLEMS OF PUBLIC HEALTH

DURING the early years of British rule the army and the estate labourers were the only privileged classes among the native population who were able to obtain the benefit of government medical services. Though the Civil Medical Department was created in 1859, its activities were limited to the control of large scale epidemics, particularly small-pox, and the health service rarely went beyond vaccination against this disease.[1]  Many of the early English administrators worked with a missionary zeal to improve the conditions of the native population but, more often than not, their efforts were frustrated by the cold response they got from the higher authorities. For example, Mr. P. A. Dyke, an administrator in charge of a number of northern districts, wrote in a letter to the Colonial Secretary, dated 5th October, 1863 :

" Abandoned villages, the report furnished of deaths from cholera, and various other circumstances, have shown me generally for some years past, the effect that these circumstances were producing on the condition of the country, but in June, I entered on a comparison village by village, of a census which was taken in 1839, with great care (the name of every individual man, woman and child being recorded) and the return of the Division Officers for 1862 for what are called the nine Vanny (or inland) Pattus of the District, and the following is the result :

| Classification of Villages by Number of Adult Males | Number of Villages | | | Number of Adult Males | | |
|---|---|---|---|---|---|---|
| | Census 1839 | Division Officers returns | Increase (+) or Decrease (−) | Census 1839 | Division Officers returns | Increase (+) or Decrease (−) |
| 1– 5 | 62 | 101 | +39 | 221 | 373 | +152 |
| 6–10 | 74 | 60 | —14 | 577 | 411 | —166 |
| 11–15 | 48 | 29 | —19 | 611 | 374 | —237 |
| 16–20 | 25 | 11 | —14 | 438 | 294 | —144 |
| 21–30 | 11 | 9 | — 2 | 264 | 156 | —108 |
| Above 30 | 6 | 3 | — 3 | 239 | 147 | — 92 |
| | 226 | 213 | —13 | 2,350 | 1,755 | —595 |

[1] Ceylon Year Book, 1949, p. 50.

" I fervently hope  .  .  .   of inducing some concessions with the view of altering, as far as may be possible, the condition of the people, and of checking a rapid progress of the country towards absolute depopulation." [1]

Governor G. R. Robinson, in his address to the Legislative Council on October 2, 1867, spoke about the sanitary condition of Jaffna district as follows :

" The (Cholera) Commission found in Jaffna a dense population living in ill-constructed, ill-ventilated, and over crowded houses, surrounded by impurities which contaminated the soil, the water, and the air, and which rendered the inmates the ready victims and sure propagators of disease whenever it was brought within their reach." [2]

Insanitary conditions of living were not solely responsible for the epidemics, the food that the people were obliged to eat being equally to blame.

" The ordinary diet of the lower orders consists of three meals in the day.   The first meal consists of cold rice water, with rice in it  .  .  .   The second meal consists of hot curry and rice  .  .  .   The third or evening meal consists of hot curry and rice, the remains of which form the morning meal, next day. Some of the very poor classes who cannot afford three meals in the day, take their cold rice in the morning, go to their work, and have their evening meal at about 6 o'clock on their return from work.   There are a class of low coolies, generally called by the people pariahs, who eat carcasses of dead animals, putrid fish, rats, or any other offal, that is obtainable  .  .  .   I do not think it is from choice they eat putrid food, but they cannot afford other." [3]

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[1] Quoted in the Cholera Commission Report, 1867, p. 159.

[2] The impression that one gets from even a cursory visit to the extensive slum areas of Jaffna today is not much different from that described by Governor Robinson in 1867.

The destruction of irrigation works created conditions of chronic famine in the rural areas of northern districts, and the people flocked to the cities and the coastal areas, where they eked out a miserable existence by catching fish, crabs and turtles, and doing occasional jobs for the landed class.

When the Portuguese conquered the northern districts, the descendants of the ejected peasants— now turned fishermen—became Roman Catholics, partly to avoid the cruel repression of the new conquerors, and partly to escape the oppression of the upper castes who were also the upper class.

Their conversion to Christianity was however, nominal, instead of changing their pagan ways they converted Christ into a pagan, placing him in the chariot where Krishna used to sit and continuing to pull the ancient holy vehicle with equal gusto and reverence.

It was only in 1949, eighty-two years after Governor Robinson's speech, that a small number of these slum dwellers were moved out and provided with better accommodation in a new housing scheme near by.  Meanwhile, other families moved into their old houses, and the ancient slums continued as before, with children and pigs vying with each other in fouling their doorsteps, the shallow and open drains in front of their houses and even the roads.

[3] Evidence given by Manikavasagar Modlier before the Cholera Commission, 1867, p. 46.

Conditions were, perhaps, a little better in the wet zone where nature protected the people with her bounty. The need for medical and sanitary services however, could not be exaggerated. Yet very little was done for the native population, who had to fend for themselves as best they could, with the help of village quacks, who often killed rather than cured. Nevertheless, the authorities were greatly concerned for the health of the estate coolies.[1] Whatever benefit the native population did gain from the Government's health service was mostly indirect. For example the coolie sheds, built at intervals of about five miles along the road used by the immigrants, were often provided with some medical facilities. The quarantine camps protected not only the estate coolies, but also the general public, from infection brought in by the immigrants from India.

However, the entry into the field of politics and administration of educated Ceylonese brought a change in outlook and the medical services were gradually extended to the native population.

An important step towards the development of a public health service was taken in 1913 with the establishment of a sanitary department attached to the medical service.

In 1915 the Rockefeller Foundation started work with a team of health workers attempting to combat hookworm infection in a selected area. The main difficulties they had to face arose from traditional habits with regard to personal hygiene, and the absence of public consciousness of the seriousness of the disease and its mode of propagation. Though but little progress was made towards eradication of the disease, the organisational and field experience of this pioneering team was of immense value in subsequent work.

**Health Units**

The idea of a composite health unit for rural areas, covering all aspects of health work, grew out of this pioneering experiment of the Rockefeller Foundation. 1926 saw the formation of the first Health Unit which started its work in a selected area. Gradually there was built up a net-work of Health Units covering the entire rural area.

The activities of these units include health education, health surveys, maternity and child welfare work, school health work, sanitation and, control of communicable diseases, including vaccination against small-pox, anti-typhoid inoculation and mass treatment for hookworms and other helminthic intestinal parasites. The team, as it is now organised consists of a full-time doctor with a number of nurses and mid-wives. The team is provided with a hospital and with all the technical facilities

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[1] For example, six commissions were appointed before the beginning of this century, to examine various questions relating to health and medical services. Of these, three were concerned with the native population, namely the Cholera Commission of 1867, and Bubonic Plague Commission of 1887, and the Commission to Enquire into the Fever Epidemic of Gall of 1895, their appointment being occasioned by public concern over the severity of these epidemics. The remaining three for the Cooly Mortality Commission of 1862, the Medical Treatment of Coolies Commission of 1872, and the Anaemia and Beri Beri Commission of 1887, were concerned with estate labourers, and it was their recommendations which resulted in the establishment of a comparatively efficient medical service for the estates.

necessary for such health work. The teams are so located that a nurse is provided for every 8,000 persons, a mid-wife for every 4,000 persons, and a sanitary inspector for every 8,000 to 10,000 persons.

The development of medical facilities for the people has advanced rapidly in the present century. For example, in 1914 there were 498 doctors, in 1949 there were 900 ; in 1914 there were 11,713 population per doctor ; in 1949 7,992. The number of hospitals has increased during this period from 80 to 256, and the number of dispensaries from 427 to 960.

The total number of employees of the medical department today is 12,401 on the curative side and 2,076 on the preventive side.

While the 1949 figures are impressive compared with the 1914 figures, they fall short of the standard that may be regarded as satisfactory or adequate. Compared with the level attained in Western countries, the public health service has yet a long way to go. The population:doctor ratio in Great Britain today is about 1,000, compared with 7,992 in Ceylon.

In a tropical country, such as Ceylon, morbidity per head of population is greater than in a temperate country like England. The provision of a health service per head up to the English standard would not, therefore, be adequate in Ceylon. The urgency of further extension and better organisation of medical and public health services can best be realised by considering the morbidity from the important diseases prevalent in Ceylon today.

## Morbidity

No adequate statistics of morbidity are available in Ceylon. The hospitalisation statistics, which are generally used to indicate morbidity, suffer from the defect that their trend is affected by the increasing advantage being taken of the available hospitals and government dispensaries. For those diseases where the hospitalisation statistics show a declining trend, we may argue that morbidity is indeed declining, but where the trend shows a rise, the evidence is inconclusive.

Furthermore, the hospitalisation statistics do not differentiate between continuing illness and new patients. It is likely that the improved treatment, not only cures, but cures more quickly. If so, the figures of consultations would include a larger proportion of new patients in recent, than in the earlier, periods. A decline in hospitalisation may, therefore, result from a decline, not in incidence, but in duration of sickness. It may however, be argued that a measure of morbidity should take into consideration duration as well as incidence. For example, a person suffering from a disease for two months may be regarded as equal to two persons each suffering for one month. If the purpose of the morbidity statistics is to show the loss to the national economy through loss of productive labour time and the burden of sick dependents, then the measure should be devised in such a way as to reflect both incidence and duration. Furthermore, the loss to the national economy will not be as great if an old person falls ill as it would be if the patient were young. Hence the morbidity measure should take account also of age and sex. It is difficult to interpret precisely, the hospitalisation statistics of Ceylon in the absence of this information.

In some cases, of course, the change in the trend in morbidity has been so pronounced that some inferences may be drawn from the statistics despite their defects.   But where the trend is not so pronounced we should be cautious in drawing conclusions.

Table 1 below gives the hospitalisation figures for the years 1914–1916, 1945 and 1949 and the number of registered deaths.   In comparing the hospitalisation and death statistics, we should remember that (1) the diagnosis of cause of registered deaths is less dependable than that of hospital cases, (2) according to the extent that sufferers from a particular disease remain out of hospital, the hospital cases will or will not show the prevalence and incidence of the disease in the country as a whole ;   and (3) the population has been expanding, but the increasing number of hospitals has more than kept pace, while their popularity has grown.

These factors should be borne in mind when considering the incidence of the principal diseases shown in Table 1.

### TABLE 1—HOSPITAL ADMISSIONS AND DEATHS

| Diseases | 1914–16 (Annual Average) | | 1945 | | 1949 | |
|---|---|---|---|---|---|---|
| | Deaths | Hospital Cases | Deaths | Hospital Cases | Deaths | Hospital Cases |
| 1. Malaria | 20,590 | 728,364 | 8,521 | 106,283 | 2,401 | 39,332 |
| 2. Pneumonia | 4,258 | — | 6,954 | 18,935 | 4,448 | 28,454 |
| 3. Diarrhoea | 13,289 | 4,578 | 7,325 | 11,642 | 5,069 | 13,507 |
| 4. Ankylostomiasis | 2,403 | 6,529 | 1,819 | 10,647 | 850 | 13,227 |
| 5. Anaemia | — | — | 2,851 | 4,368 | 1,834 | 8,714 |
| 6. Tuberculosis | 4,380 | 1,524 | 3,666 | 6,433 | 4,135 | 7,473 |
| 7. Enteric Fever | 279 | 418 | 1,478 | 5,789 | 872 | 6,255 |
| 8. Dysentery | 4,726 | 3,604 | 1,938 | 10,069 | 708 | 5,178 |
| 9. Diabetes | — | — | 632 | 1,176 | 494 | 4,360 |
| 10. Cancer | 422 | 276 | 847 | 2,845 | 1,059 | 3,474 |
| 11. Cholera | 47 | 49 | — | 711 | — | 1 |
| 12. Small-pox | 90 | 344 | — | 19 | — | 2 |

Sources :  Deaths—Registrar-General's Annual Reports.

Hospital Admissions—Civil Medical Officer's Reports—1914–16. Administrative Reports of the Medical and Sanitary Services, 1945 and 1949.

### Malaria

Both the registered deaths and hospitalisation figures show a decline in the case of malaria.   The decline is so pronounced that there can be no doubt that morbidity from this disease has declined considerably.

Additional evidence is provided by the results of sample surveys showing the spleen rate.

## SPLEEN RATE

| Year | Spleen Rate * |
|------|---------------|
| 1914 | 43·9 |
| 1938 | 21·2 |
| 1941 | 18·4 |
| 1948 | 5·2 |

*Source :* Annual Reports of the Medical and Sanitary Services.

* A certain external symptom of malaria is the easily detected enlargement of the spleen. The spleen rate is the percentage of the sample population who were found to have enlarged spleen. The sample population was large but care was not taken to produce a good sample design.

The near eradication of malaria is, perhaps the greatest single achievement of the public health workers of Ceylon, and the officials engaged are hopeful that malaria will be eliminated from Ceylon in the near future. In their joint report for 1949, the Superintendent of Anti-Malarial Campaign and the Acting Medical Entomologist said :

" If the present methods could be continued for a period of five years the vector species would be reduced to still lower levels. There is no reason to consider the present scheme of anti-malaria work carried out in Ceylon will not lead to malaria eradication within a reasonable period of time at a cost which this country can incur without serious financial embarrassment."

Such optimism in the health workers is admirable, but for evolving a long term national health policy, it may lead to dangerous complacency. The danger may come from economic factors. If the population continues to expand at the present rate, and if the national economy remained stagnant, as it is today, or if a depression —the signs of which are not altogether absent at this moment—develops on a full scale, then serious under nourishment of the people, with a consequent reduction of their vitality, could not be prevented. At the same time, the high degree of efficiency of the organisation set up to combat malaria will be impaired for want of further funds. If these circumstances combine with the misfortune of a prolonged drought, as it did during the 1935 malaria epidemic then it is doubtful how far malaria could be prevented from returning.

The anti-malarial work today is centred round D. D. T. spraying. This is essentially a temporary palliative and cannot be regarded as a radical solution. So long as the irrigation and drainage system is not resuscitated, the potential danger will always be present. A new vector species may develop, the existing species may acquire immunity to D. D. T. spraying, or the system of control may fail, which would at once lead to reappearance of malarial fever.

11—J. N. B 59926—(10/56)

It should be noticed that though the incidence of deaths from malaria has declined and is now less than that from diarrhoea, pneumonia or tuberculosis, yet hospital admissions of malaria cases are still more numerous than those of any other cause.

" One should be rather cautious in predicting future trends, particularly when the important predisposing factors, malnutrition, under-nourishment and hookworm infection, continue as before to sap the vitality of the people. Moreover, *A. Culicifacies*, the only known vector has recently been found to breed in thick jungles well away from any human habitation, the danger continues to lurk ." [1]

**Tuberculosis**

The common view today is that the incidence of tuberculosis is increasing. This was also the view in 1910 when the first Tuberculosis Commission was appointed to investigate the causes for the spread of tuberculosis.

" From the returns furnished by the Registrar-General it would appear that the tuberculosis of the lungs is on the increase in Ceylon, particularly in large towns.

" The reports and the evidences of the medical men tend to show that comparatively few persons come under their treatment for phthisis, which may be explained by the fact that the poor cannot afford to employ qualified doctors, they are, however, nearly all of opinion that phthisis is on the increase, and that the acute cases, commonly called " galloping consumption " are more common here than in England." [2]

The Report of the International Bank for Reconstruction and Development, 1952, states : " But there may well be also a real increase in the incidence of the disease, as most of the predisposing causes—malnutrition, overcrowding, unsanitary conditions, ignorance and poverty—are found in many densely populated areas." [3]

The data that we have at our disposal however, gives conflicting evidence. Hospital admissions were more numerous in 1949 than in 1914, but we do not know whether this increase is due to more hospitals, more people coming forward for treatment, or more attacks. The number of registered deaths shows a slight fall in 1947 compared with 1914–16. Meanwhile the population has increased from five millions to seven millions. Judging by the deaths alone we should conclude that the disease was declining. Unfortunately in Ceylon tuberculosis is a disease in which a social stigma is attached, not only to the patient, but also to the other members of the family. Hence, the data relating to deaths from tuberculosis are most unreliable. In a sample survey in 1948, $2 \cdot 2$ per cent. of the sample population was found to be infected with tuberculosis and the death rate was found to be 470 per 100,000. According to cause of death given at death registration, the death rate of this sample only was 60 to 80. [4]

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[1] Report of the Bank of International Reconstruction and Development, pp. 739–740.

[2] ibid, p. 5.

[3] ibid, p. 741.

[4] *Ceylon Year Book*, 1950, p. 57.

Due to the presence of extensive malnutrition resulting from an inadequate and unbalanced diet and the wide spread prevalence of hookworm disease, the recent congestion in the cities, and the deterioration in housing and sanitary conditions, an increase in the morbidity of tuberculosis at least in the cities, is only to be expected. The Year Book for 1950 says : " It is reasonably calculated that while there are at least 70,000 persons in Ceylon suffering from open pulmonary tuberculosis, the actual number of total cases is over 100,000 ".[1]

Whatever the case may be, the fact that the recent fall in the deaths shown by most other diseases is not shared by tuberculosis, is a matter of serious concern. Mass radiography and B. C. G. vaccination compaigns have recently been launched, but the scale of operation is inadequate for the achievement of immediate success.

### Ankylostomiasis

After malaria and tuberculosis, the greatest cause of anxiety to the public health authorities in Ceylon is Ankylostomiasis or the hookworm disease. The deaths from this cause shows a decline over the period 1914–1946, though hospital admissions show an increase. It is generally believed that extensive infection prevails in hookworm disease.

" It is estimated that 88 per cent of the people in Ceylon harbour hookworms. Though we do not come across advanced cases of hookworm disease at present, thanks to the Rockefeller Foundation which started a campaign in Ceylon in 1915, yet the infestation is still fairly high in remote areas to cause physical and mental retardation in children. Along with hookworm, round worms play an important part in lowering the health of the school going population in rural areas . . .

" I have not the shadow of doubt that round worm infestation in pre-school children is one of the most important causes of the high mortality in the age group." [2]

In a sample survey of 89,910 school children it was found that 22 per cent were infected with hookworm.[3]

The Report of the International Bank of Reconstruction and Development states :

" The debilitating hookworm is believed to affect nearly nine people out of ten ".[4] Whatever may be the exact proportion infected by hookworm, its wide prevalence cannot be denied.

The attack of hookworm disease does not lead to immediate death but works slowly to sap the vitality of the body, and reduce to a still lower level the nutritional value of the peoples' diet, which in many cases is already barely adequate. The symptoms of malnutrition and anaemia appear and the body is less able to offer

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[1] *ibid*, p. 57.

[2] Dr. C. T. Williams. *Journal of British Medical Association* (Ceylon Branch), Vol. XLIII, No. 2.

[3] *Cumpston Report*, 1950, p. 48.

[4] ibid, p. 65.

resistance to other infection. In pregnant women it causes miscarriage and increases the dangers at child-birth, both to the child, and to the mother. It often leads to rickets and malformation of the pelvis, again causing difficulty at child-birth.[1]

In a sample investigation, 13·4 per cent of still births were found to be due to anaemia associated with hookworm infection.[2]

During recent years the medical authorities have become increasingly conscious of the menace of hookworm.

" The intestinal infections constitute a major public health problem in this country but unfortunately little heed has been paid to it. It is known that the body is unable to utilize to the full the food that is eaten when worm infection is present.

" We have, therefore, a combination of factors which account for the generally anaemic and lethargic condition of the vast majority of the people—a poor diet and intestinal infestation." So spoke Dr. W. G. Wickremesinghe in his address delivered to the Society of Medical Officers of Health, on September 29, 1945.[3]

The spread of hookworm infection among the estate labourers first drew the attention of the Government to this menace in about 1910. The boom in the rubber planting and the rapid expansion of plantations created an acute labour shortage and the planters had to make a big outlay to obtain labour. The absenteeism and deaths caused by the hookworm disease among the labourers, obtained at a high cost, was proving to be a source of financial anxiety to the planters. A commission was therefore appointed to investigate the matter who submitted their report in 1910. The investigation of this commission showed that the hookworm disease was widely prevalent among the estate workers and was spreading in the adjoining rural areas. The most important of its recommendations was that beta-naptha pills should be administered whenever hookworm infection was suspected. The commission noted the great difficulty of introducing sanitary latrines, and hoped that the planters would do so wherever possible.[4]

The disease, first traced among the estate labourers, gradually spread all over the country. The insanitary habits of the people, the absence of sanitary latrines and drainage, the absence of provision for supplying pure drinking water, the swarms of flies which are allowed to sit on the food, the habit of walking without shoes, these are some of the causes which are responsible for the spread of the disease. The

[1] " There is not any greater menace to the expectant mother and her unborn child than hookworm disease. The much dreaded eclampsia pales into insignificance when compared with the ravages of this disease." Dr. G. A. W. Wickramasuriya : *Malaria and Ankylostomiasis in Pregnant Women*, 1937, p. 93.

" There is a very heavy maternal and foetal mortality associated with the disease." ibid, p. 172.

" It has been suggested that the lack of proper dieting affects many girls with rickets, thus preventing normal pelvis development, and increasing the possibility of death at child-birth." Census of Ceylon, 1946, Vol. I, Part 1, p. 144.

[2] Sessional Paper XXIII, 1943, p. 23.

[3] Quoted in *Cumpston Report*, p. 50.

[4] *Ankylostomiasis in Ceylon.* Sessional Papers XI and XXXI, 1910.

mode of propagation of the hookworms ideally suited these conditions. The eggs of the worms discharged with the faeces of the infected person remain alive for a considerable period of time and, under suitable conditions, the larvae emerge from the eggs and enter the human body through the medium of water, food and drink, or directly penetrating through the skin of the feet.

It is clear, therefore, that the prevention of the disease is largely a question of sanitation. " Treatment of hookworm disease is necessary but permanent measures for its control are the construction, maintenance and the use of sanitary latrines." [1] It is equally necessary to educate the people in public health and the elementary principles of hygiene. The Cumpston Report laid great stress on this aspect of public health work, and said " I very strongly recommend that the Government through the Department of Health, and *with all the resources at its command,* put in motion a vigorous and sustained campaign which will not be allowed to cease until intestinal infections no longer cripple the community or exist at all." [2]

### Diarrhoea, Dysentery and Enteric Fever

Bad sanitary conditions and the absence of pure water supplies are responsible for the high morbidity in diarrhoea, dysentery and enteric fever. The number of deaths from these causes has declined considerably due chiefly to the effective drugs that are now available. The number of hospital admissions shows a decline only in the case of dysentery.

Only three out of forty-two recognised towns have a pipe-borne water supply. Even these were built before the turn of the century when the population of these towns was less than a quarter of what it is today. A sewage system exists only in some of the wards of the Colombo Municipality. The risk of infection in cities and other congested areas has therefore risen substantially.

Here again the main difficulty is economic. The supply of water is, unfortunately, not readily available for many of the towns and large capital expenditure would be required for the construction of water works or a sewage system.

### Cholera and Small-pox

Unlike India, Ceylon has not been ravaged by cholera and small-pox since the beginning of this century. The efficiency of the quarantine system and the care with which the vaccination against small-pox and inoculation against cholera is carried out, have succeeded in isolating Ceylon from the waves of epidemics which have swept the neighbouring sub-continent.

### Maternity and Child-Welfare Work

We have already seen that but little progress has been achieved in reducing maternal and infant death rates. A study of the causes of death among males and females

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[1] *Vide* Administration Report of the Medical and Sanitary Services, 1948. The Cumpston Report mentions a town where 50 per cent. of the houses have no latrines of any kind. (*Cumpston Report* p. 49). The population of this town was 22,908.

[2] ibid, p. 50.

shows that diseases due to malnutrition, hookworm and other intestinal parasites, influenza, cancer and diseases of the genito-urinary systems cause more deaths of females than males.

TABLE 2—DEATHS BY SEX AND SOME IMPORTANT CAUSES

| Causes | 1946 | | 1947 | | 1948 | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| Cancer | 420 | 609 | 396 | 685 | 454 | 520 |
| Diseases of the genito-urinary system | 846 | 923 | 768 | 811 | 726 | 817 |
| Influenza | 776 | 788 | 623 | 783 | 544 | 572 |
| Ankylostomiasis | 623 | 714 | 453 | 612 | 391 | 521 |
| Deaths from helminths | 1,730 | 1,968 | 1,269 | 1,513 | 1,431 | 1,667 |
| Mandama and rickets | 2,705 | 3,359 | 2,157 | 2,794 | 1,985 | 2,605 |

*Source :* Cullumbine Ibid. pp. 222, 235, 238, 239, 244.

We have seen that progress in combating the diseases has been rather slow. Cancer is believed to be increasing ; hookworm and other helminthic diseases have been steadily spreading with the increase in population and greater pressure on the sanitary services. Mandama and rickets are diseases of malnutrition which as we shall presently see, exists extensively in the island. In addition to these selective causes of death, there is the risk at child-birth, also caused largely by malnutrition and intestinal parasites. Together these causes have prevented a relative improvement in female mortality and a decline in the excessive masculinity of the population.

Prof. Cullumbine computed the age-specific death rates by causes for the urban areas on the basis of registered deaths and census populations.[1] He obtains higher mortality for females than males in almost all the important causes in the age groups under 15 years. In the age groups from 15 to 45 years, the female rates for bronchitis enteritis, influenza, dysentery and nephritis were slightly higher than those for males, but this may be due to greater under-enumeration of females, for which Prof. Cullumbine did not make any allowance. The female mortality from ankylostomiasis, phthisis and malaria, was too high at these ages to be explained by female under-enumeration. In the age group 45 years and over, female mortality is significantly higher only in cancer and nephritis.

The rise in the female death rate due to malaria and ankylostomiasis at the reproductive ages, is not surprising if we remember the extent to which these two diseases reduce the sufferers' vitality. The greater degree of malnutrition among the females, suggested by the higher female mortality from the above mentioned causes, and the absence of outdoor life in the case of Moslem women,[2] explains the higher female death rate from phthisis.

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[1] ibid. p. 197.

[2] " The returns show that Mohammadan (Moors and Malays) furnish more deaths from pythisis than the males of these communities, which is explained by the secluded condition under which the females of these races live." *Tuberculosis Diseases Commission,* 1910. p. 5.

The greater risk of deaths and illness of the females is reflected immediately in the higher mortality of infants and children. In addition to their low vitality at birth due to their mothers' poor health, the children themselves are subjected to serious malnutrition, and the risk of infection by hookworms, roundworms, malaria, dysentery and diarrhoea, shown by the table below.

TABLE 3—PRINCIPAL CAUSES OF INFANT MORTALITY PER 100,000 BIRTHS

| Causes | 1935–1939 | 1944–1946 | 1948 |
|---|---|---|---|
| Convulsions | 4,320 | 3,333 | 1,800 |
| Diarrhoea | 240 | 100 | 100 |
| Bronchitis | 220 | 133 | 100 |
| Pneumonia | 540 | 467 | 600 |
| Enteritis | 200 | 300 | 300 |
| Debility | 3,353 | 2,353 | 2,080 |
| Rata | 5,200 | 3,090 | 1,240 |
| Prematurity | 1,303 | 1,817 | 1,580 |

*Source :* Cullumbine, ibid. p. 202.

Convulsion is a symptom and generally results from high temperature and can, therefore, be associated with malaria and other fever.[1] Prematurity is closely associated with the condition of the mother which is affected by malaria, hookworm infection and by malnutrition and anaemia. Rata is a disease associated with malnutrition and so also is debility. The high death rate from pneumonia is also an indirect result of lower vitality.

The problems involved in maternal and infant care are, thus, twofold. (1) the normal pre-natal and post-natal care and assistance during delivery ; and, (2) the long range preventive measure to combat malaria, hookworm infection in mothers and children, roundworm infection in children and malnutrition.

So far as the first type of work is concerned, good progress has been made during recent years. The areas served by health unit midwives and nurses, and maternity clinics and homes cover almost the entire country. The women also have responded well to these measures and the little resistance that was offered by caste and racial prejudice has been overcome.

Malaria infection has also been brought very much under control. Hookworm and other intestinal parasites still persist and malnutrition remains a burning question. It is for this reason that Dr. J. H. L. Cumpston said in his Report, " In estimating the relative values of the maternal and child welfare work as against the sanitary measures designed to prevent intestinal infections, I cannot avoid the conviction that economically and dispassionately the balance of urgency is heavily on the side of measures against intestinal infections."[2]

### Malnutrition

The prevalence of malnutrition amongst large sections of the population has been revealed by a number of surveys carried out since 1936. The first of these surveys

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[1] Cullumbine, ibid, p. 243.

[2] Ibid, p. 50.

was carried out by Dr. Nicholls amongst the school children in 1935.   Dr. Nicholls selected a school of upper class children and a number of rural schools where peasants' children predominated.   The heights and weights of these two social classes were significantly different as is shown in Table 4.

## TABLE 4—HEIGHTS AND WEIGHTS OF SCHOOL CHILDREN

| Age | Average Height (Inches) | | | Average Weight (Lb.) | | |
|---|---|---|---|---|---|---|
| | Royal Preparatory School and College | Vernacular Schools | Difference | Royal Preparatory School and College | Vernacular Schools | Difference |
| 5 | 43·1 | 40·6 | + 2·5 | 37·7 | 33·4 | + 4·3 |
| 6 | 45·4 | 42·8 | + 2·6 | 45·0 | 38·0 | + 5·8 |
| 7 | 47·9 | 44·0 | + 3·9 | 45·0 | 38·0 | + 7·0 |
| 8 | 50·2 | 45·8 | + 4·4 | 52·1 | 41·9 | + 10·2 |
| 9 | 52·0 | 47·4 | + 4·6 | 55·7 | 44·5 | + 11·2 |
| 10 | 53·5 | 49·3 | + 4·2 | 61·5 | 49·1 | + 12·4 |
| 11 | 55·0 | 50·6 | + 4·4 | 65·8 | 51·1 | + 14·7 |
| 12 | 57·0 | 52·5 | + 4·5 | 74·5 | 55·9 | + 18·3 |
| 13 | 58·8 | 54·6 | + 4·2 | 80·4 | 59·3 | + 21·1 |
| 14 | 63·0 | 56·2 | + 6·8 | 98·0 | 67·3 | + 30·7 |
| 15 | 64·6 | 58·9 | + 5·7 | 105·5 | 77·0 | + 28·5 |
| 16 | 65·7 | 60·4 | + 5·3 | 112·0 | 84·2 | + 27·8 |
| 17 | 66·9 | 62·8 | + 4·1 | 120·0 | 98·2 | + 23·8 |
| 18 | 67·0 | 64·1 | + 2·9 | 123·0 | 105·2 | + 17·8 |

*Source :* Lucius Nicholls. A Nutritiona Survey of the Poorer Classes in Ceylon. *Ceylon Journal of Science*, Vol. IV, Part 1, April, 1936.

The superior height and weight of the upper class children may not be the result of one generation of good feeding.   The effect of nutrition, cannot however be negligible.

The second survey was also by Dr. Nicholls who kept an accurate record of food consumption of 16 labouring families over a long period and computed the calorific value of the food consumed.   From the data that he gives in the *Ceylon Journal of Science* referred above, it appears that the average calorific value of the diet per consumption unit is 2058 i.u. with a standard error of 55·47.   According to him 2,200 calories would be sufficient for the labouring class.[1]   Elsewhere, however he states, " Dr. W. R. Aykroyd of the Nutrition Research Laboratories of India estimates that an average Indian male of sedentary occupation requires some 2,150 calories a day, and an agricultural labourer doing moderate work requires 2,600 calories ".[2]

[1]   Ibid. p. 48.

[2]   *Nutrition in Ceylon*, Sessional Paper XXIX, 1937, p. 64.

Even if we take 2,200 calories as the minimum requirements, then the sample mean of 2,058 calories falls short of this low standard by 142 calories, or $2\frac{1}{2}$ times the standard error, a statistically highly significant result.   (P nearly 0·01.)

In the Sessional Paper XXIX of 1937, Dr. Nicholls mentions, " It is certain that many of the poorer classes in Ceylon do not obtain daily meals of these values. (i.e. 2,600 calories)."[1]

In a subsequent study conducted jointly by Dr. Nicholls and Dr. Nimalasuriya, the authors conclude that 35 per cent of the rural population are below the bare subsistence level in the calorific value of their diet and 26 per cent are on the border line.   55 per cent of the peasant families have a diet deficient in protein, calcium is low among 56 per cent and vitamin content is low in all.[2]

During recent years the Food and Agricultural Organisation of the United Nations has been taking an interest in the nutritional problems of Ceylon.   One of the acti- vities which is carried on on behalf of this organisation is to conduct sample surveys for measuring the nutritional value of diets consumed by Ceylon villagers.   One village Kololana, surveyed four times in the period 1940–1949, enables us to observe the changes in nutrition that have taken place during these years.

TABLE 5—DIETARY SURVEY OF KOLOLANA VILLAGE

|                          | 1940 | 1944 | 1945 | 1949 |
|--------------------------|------|------|------|------|
| Total proteins gm.       | 60·4 | 56·3 | 65·1 | 62·3 |
| Animal proteins gm.      | 18·5 | 11·8 | 22·1 | 21·1 |
| Energy Calories I.U.     | 2242 | 2056 | 2226 | 2400 |
| Calcium gm.              | 0·5  | 0·4  | 0·5  | 0·2  |
| Iron mgm.                | 16·6 | 14·7 | 13·4 | 13·6 |
| Cash value of diet cents | 17   | 38   | 52   | 49   |

*Source :* Report to Food and Agricultural Organisation of the United Nations Organisation, 1948 p. 2 and 1949 p. 40.

The decline in the dietary standard during 1944 may be attributed to the exigencies of the war.   Rapid improvement was noticed in 1945, when all the elements, except iron and calcium, showed substantial improvement.   In 1949, however, a deteriora- tion is noticeable.   The protein and calcium content of the diet showed a marked decline and iron was still below the 1940 level.   The only increase was in terms of calories.

It is not known how far these sample trends are applicable to the whole country. None of the reports give a detailed account of the methods used in selecting the sample or the general design of the samples.   If they do represent the general trend in the country, the decline in the protective qualities of the diet must give rise to considerable misgivings.

[1] Ibid. p. 64.
[2] Ceylon Journal of Science, 1941.

It must be remembered that the results of these diet surveys are based on the assumption that there is no wastage in the food value during consumption, but this is not so. The entire food value can rarely be assimilated. This is all the more so in a country like Ceylon, where intestinal parasites may reduce much of the value of the diet and increase the wastage. The inadequacy in nutrition may therefore, be taken as much greater than is indicated in the results of these surveys. It is for this reason that Dr. Cumpston said, " it is absolutely necessary that intestinal parasites and infections be eliminated before a true assessment of the degree of malnutrition related specifically to food deficiencies can be made." [1]

The problem of nutrition however, is not a problem of public health alone. It is, in a country like Ceylon, primarily an economic problem. Some improvement in the diet, perhaps, may be made by devising a more balanced diet and by making the public aware of the importance of considering the food value of their diet. But the scope of such improvement is very much limited by the smallness of the purse. Here again, the idealism of the public health workers may be foundered on the rock of economic stagnation. Even in the little village mentioned above, the changes in the contents of the diet could be seen to follow the economic trend, the post-war boom and the recent recession, as has been observed in the Report.[2]

### School Health Work

An important branch of work of the Medical and Sanitary Services, is the school health service. The work consists of health education, supervision of school sanitation, medical examination of school children and correction of common defects &c. Apart from the direct usefulness of such services, an indication of the health condition of the entire population of school age is made available by the school health surveys. For example in 1948, 70,836 children of all localities and of all social strata were examined. The defects found by such examination may therefore, be regarded as representative of the population of school age.

TABLE 6—DEFECTS AMONG SCHOOL CHILDREN

| Defect | Percentage to Scholars Examined |
|---|---|
| Hookworm | 19·8 |
| Teeth and gum | 19·7 |
| Malnutrition | 12·9 |
| Anaemia | 12·5 |
| Unvaccinated | 7·0 |
| Pendiculosis | 7·0 |
| Adenoids and Tonsils | 4·1 |
| Uncleanliness | 3·6 |

*Source :* Administration Report of the Medical and Sanitary Services, 1948.

[1] Ibid. p. 50.

[2] Report of F. A. O.  Ibid. p. 39

It should be mentioned that the examination is only superficial, and unless the symptoms are clearly evident, they will not be detected by such an examination. It is probable, therefore, that the defects such as hookworm or malnutrition exist in a greater proportion of school children than is indicated in the table.[1]

Out of the total of 70,836 children who were examined 56,511—or about 80 per cent were found to be defective in some way. The population under 15 years of age in 1946 was 2,323,000, eighty per cent of which would be 1,858,400. With the 900 doctors available, even to examine each child only once a month, each doctor would have to attend to 68 children per day.

## Conclusion

The death rate has been brought down to the low level of 12·6 per 1,000 population. Many diseases have been brought under control. Maternal mortality rate has been lowered to 5·7, the infant mortality rate has been brought down from 174 in 1900–02 to 84 in 1950. These are great achievements no doubt, but it is a matter of concern whether Ceylon can maintain, leave alone improve on, these low levels of mortality. As conditions of health that we have examined, show, additional difficulty arises from the rapid rise in population and the threatened decline in the prices of Ceylon's exports. The latter is the crucial factor in the whole picture. It has been so since the plantations began to dominate the economic life of Ceylon ; and it will be so as long as Ceylon does not free herself from that domination.

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[1] Williams, ibid.

# FOREIGNERS IN CEYLON AND CEYLONESE ABROAD

## Introduction

EVERYONE in Ceylon with the exception of the aboriginal Veddas, is an immigrant, or a descendant of an immigrant. The first arrivals were the Sinhalese from North India, followed by the Tamils from South India, who conquered the northern regions of the island and settled there permanently. Then came the Moor traders from Arabia and India. The Portuguese and the Dutch conquered the coastal districts of Ceylon in the 16th and 17th centuries and many of them settled in Ceylon and produced a hybrid community known as the Burghers. The Dutch were also responsible for the introduction of Malays whom they employed as mercenaries and later discharged in Ceylon. Despite centuries of co-habitation in the island, there has been little cultural unification and the groups have remained distinct from each other in many respects. In opposition to the later arrivals, however, they regard themselves as belonging to one group of the original inhabitants of the island. The new term ' Ceylonese ' was evolved to denote the unity of these diverse elements as opposed to the immigrants in the post-Dutch period. The problem of immigration in its modern context, therefore, is the opposition of those who arrived in the pre-British days to those who arrived after the British conquest.

Those who came after the British conquest consist predominantly of Indian Tamils and Britons. The latter, though small in number, dominated the island politically and dominate it economically even today. The former made their influence felt by their large numbers and poverty.

## Sources of Statistical Data

There are two principal sources of statistics of immigration and emigration and of the foreign population in Ceylon. The immigration and emigration statistics are published by the Registrar-General in his annual report. The statistics of foreigners in Ceylon are available in the Census Reports in the race statistics and the statistics of birth-place. Statistics of immigration and emigration suffer from serious under-estimation. Until recently no authority existed to control and record the migration movement except the quarantine authorities in the principal routes of entry into the island from India. The quarantine authorities, however, had little interest in the emigrating population, who, in consequence were very much under-estimated. Immigration through minor ports was not recorded at all. Until 1920, statistics of estate labourers alone were available. Statistics for earlier years, which were published in the Blue Book, were compiled by district administrative authorities who were asked to count the number of estate coolies passing through certain roads in their districts. Obviously this method of compilation was most inaccurate, and the data were frankly admitted to be little better than guesses.

The censuses for all the years except 1881 and 1931 collected and published some information about the birth-place of the population, and tables were compiled giving the composition of the population by country of birth. These statistics of foreign-born do not show solely the number of foreigners in the country, since they include foreign-born children of natives of the country who have migrated to Ceylon. Thus India-born would not necessarily mean Indian by nationality ; it may mean European, Sinhalese, Ceylon Tamil or any nationality born in India and migrating to Ceylon prior to the Census. Generally speaking, however, the majority of the population returned as India-born would be Indians, and in most cases we would be justified in using such statistics to determine the trend of the foreign population in Ceylon, especially as the number of Ceylonese who have migrated abroad in the past has been extremely small.[1]

In the absence of contrary evidence, we may assume the degree of under-enumeration of the native population and the foreign population to be equal.

The second source of information about the foreign population available in the Census Reports is the so called race statistics. The population of Ceylon has been divided into a number of ' racial groups ' for the purpose of the census, among which the Europeans and the Indian Tamils and the Indian Moors are deemed to be the foreign ' races '. Definition of the term ' race ' is obviously not easy, and it has been left entirely to the person enumerated to return himself as belonging to any race he likes. In a country where to some extent antagonism exists between the various racial groups, and where certain advantages may be obtained, or disadvantages avoided, some mis-statement must be expected, whatever the method of enumeration, and certainly the method chosen will have done nothing to combat this. The liability to such errors was recognised by the census authorities, for example, the Census Report of 1946 mentions that the proportion of foreign-born in 1946 was low partly because a large number of Indians have returned themselves as Ceylon Tamils in order to avoid the feared discrimination against Indians. These race-statistics must therefore be interpreted with caution.

The other sources of data derive from the various Immigration Commissions. Immigration Commissions were appointed in 1857, 1877, 1926 and 1938. I have been unable to trace the report of the 1857 Immigration Commission. The 1877 report does not give any statistical material ; in the 1926 report D. S. Senanayake's rider gives a table of immigration and emigration for the years 1911 to 1925

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[1] An example of a special circumstance which requires the modification of such an assumption occurred in 1946, when, because of the uncertainty of the political situation in Malaya, a number of Ceylonese families who had settled there in the latter part of the last century, returned to Ceylon. The proportion of Malay-born to total population thus rose from 21 per million in 1921 to 567 in 1946.

for both estate workers and others.   His source of information is not known.   The 1938 Immigration Commission Report gives the migration figures for the years 1921 to 1937, and also the occupational distribution of the Indian immigrants for the years 1933–1936.

**Proportion of Foreign-born**

Table 1 below gives the proportion of foreign-born to total population as enumerated in the censuses.

TABLE 1—PROPORTION OF FOREIGN-BORN TO TOTAL POPULATION

| Year | Per cent. |
|------|-----------|
| 1871 | 8·14 |
| 1891 | 8·91 |
| 1901 | 12·38 |
| 1911 | 11·61 |
| 1921 | 10·44 |
| 1946 | 5·66 |

The 1946 Census Report mentions that the proportion of foreign-born is probably an under-estimate, the true proportion being nearer 8 per cent.   The general trend shown in this table agrees with the fluctuations of the plantation industries.   The years 1880 to 1890 saw the collapse of the coffee plantations ; the tea plantations developed during the years 1890 to 1910 and rapid  expansion of rubber planting took place between 1901 and 1921.   It must be remembered that the children of the foreign-born are not themselves foreign-born so that, unless sustained by continual immigration, the foreign-born decline from mortality.   In developing the plantation industries the Ceylonese did not take any active part except by being deprived of their land and forced to build roads.   European management and capital developed the plantations with predominantly immigrated Indian labour.   Hence the rise in the proportion of foreign population with the growth of the plantation industries from 1891 to 1921.

Not only has the long-term trend in the foreign population been determined by the fluctuations in the plantation industries, but so has the year-to-year migrant movement, because the Indian estate labourers predominate amongst the migrants.

Table 2 shows the migration figures for the quinquennia from 1871 to 1949.   The close correspondence of the migration balance with the prosperity and depression of the plantation industries as outlined in Chapter 3 will be noticed.

TABLE 2—AVERAGE ANNUAL MIGRATION, 1871–1949

('000)

| Period | Immigration | Emigration | Balance of Immigration |
|--------|-------------|------------|------------------------|
| 1871–74 | 95 | 75 | 20 |
| 1875–79 | 119 | 90 | 29 |
| 1880–84 | 46 | 58 | —12 |
| 1885–89 | 61 | 52 | 9 |

| Period | Immigration | Emigration | Balance of Immigration |
|---|---|---|---|
| 1890–94 | 96 | 63 | 33 |
| 1895–99 | 122 | 94 | 28 |
| 1900–04 | 114 | 80 | 34 |
| 1905–10 | 97 | 66 | 31 |
| 1911–14 | 147 | 138 | 9 |
| 1915–20 | 152 | 145 | 7 |
| 1921–24 | 185 | 145 | 40 |
| 1925–29 | 267 | 222 | 45 |
| 1930–34 | 192 | 205 | —13 |
| 1935–39 | 163 | 170 | — 7 |
| 1940–44 | 142 | 154 | —12 |
| 1945–49 | 252 | 205 | 47 |

Compiled from the Registrar-General's Reports, and the Immigration Commission Report, 1926.

*Note.*—Up to 1910 the data represents only estate labour, which constitutes approximately half of the total immigration and emigration.

D. S. Senanayake publishes a table of immigration and emigration of both the estate labour and others in the 1926 Immigration Commission Report, already referred to. The Census Report, Vol. 1, Part 1, 1921, p. 17, also publishes the same figures for the years 1911 to 1920. The figures for the years 1911 to 1920 are taken from this table.

Table 3 gives a more detailed breakdown of the population of foreign-born as enumerated in the census reports.

This table shows clearly the overwhelming proportion of Indians amongst the foreign-born. Until 1921 the next largest group, but far less numerous than the Indians, were the British and Irish ; the Continental Europeans occupying the third position.

The decline in the proportion of the British in recent years has resulted from the passing of some plantations into Ceylonese and Indian hands.[1] The proportion of Indians also shows a decline from the excess of emigration during the 1930–36 depression and also during the war under the threat of Japanese invasion and bombing. The increase in the proportion of the other Commonwealth and European countries indicates an increase in the trading interests of these countries in Ceylon.

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[1] *Cf. Economic Development of Ceylon.* Report of a Mission Organised by the International Bank for Reconstruction and Development, 1953. p. 24.

### Table 3—Proportion of Foreign-born Enumerated in Ceylon to Total Population, by Country of Birth, 1871 to 1946

*(Number per million)*

| Birth-place | 1871 | 1891 | 1901 | 1911 | 1921 | 1946 |
|---|---|---|---|---|---|---|
| India | 80,574 | 87,959 | 122,442 | 114,627 | 102,476 | 54,937 |
| British Isle | 689 | 825 | 881 | 1,052 | 980 | 441 |
| Australia, New Zealand and South Africa | 13 | 19 | 35 | 56 | 53 | 108 |
| U. S. A. and Canada | 7 | 9 | 9 | 9 | 11 | 16 |
| Other European | 64 | 100 | 129 | 175 | 119 | 158 |
| Burma and Malaya | 18 | 49 | 121 | 71 | 119 | 639 |
| Others | 78 | 156 | 168 | 104 | 621 | 282 |
| All foreign-born | 81,443 | 89,117 | 123,785 | 116,094 | 104,379 | 56,581 |
| Ceylon-born | 918,557 | 910,883 | 876,215 | 883,906 | 895,621 | 943,419 |
| | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 | 1,000,000 |

*Source* : Compiled from the Census Reports

### The Europeans in Ceylon

A feature of the censuses of Ceylon, as already mentioned, is the inclusion of a question relating to 'race', Europeans being identified in the tabulations. The term "a European" is indefinite, and there are no external criteria by which a European can be unmistakably identified. Any fair-skinned person may pass as an European, and in fact many do, for the advantages of belonging to the dominating group are many. The number of Europeans may therefore be overstated in the censuses.[1]

A comparison of the number shown as European by race in the censuses, and as born in Europe, is made in Table 4.

### Table 4—Number of Europeans and Europe-born

| | | | Proportion of | Increase or Decrease over the Preceding Period of | |
|---|---|---|---|---|---|
| Year | Europeans | Europe-born | Europe-born to Europeans | Europeans | Europe-born |
| 1881 | 4,836 | — | — | — | — |
| 1891 | 4,678 | 2,783 | 59·5 | —158 | — |
| 1901 | 6,300 | 3,601 | 57·3 | +1,622 | +818 |
| 1911 | 7,592 | 5,039 | 66·4 | +1,292 | +1,438 |
| 1921 | 8,099 | 4,943 | 61·2 | +507 | —96 |
| 1946 | 5,418 | 3,989 | 74·0 | —2,681 | —954 |

[1] *Cf:* The Census Report, 1921, Vol. 1, Part 1, p. 192.

If we can rely on the data in Table 4, then we may, perhaps, conclude that, during the closing years of the last century and the early part of this century, Europeans showed some tendency to settle down in Ceylon and rear their families there. During 1901–11 rubber plantation boom, large numbers of fresh arrivals increased the proportion of Europe-born. Between 1911 and 1921 the war prevented any further increase in the number of Europe-born ; in fact, there was a decline of 96. The number of Europeans, however, increased by 507. This increase must therefore have been due either to immigration of Europeans born outside Europe, or to a rise in the number of Europeans born in Ceylon. In so far as the latter may be the case, it may be taken as an indication that Europeans were settling down in Ceylon.

After the second World War fear of the impending political changes led to a number of Europeans and fair-skinned Burghers and Eurasians emigrate to Australia and England, reducing both the number of Europeans and the Europe-born, the former proportionately greater than the latter, so that the ratio of Europe-born to Europeans rose in this period.

All these inferences are, of course, based on the assumption that the statistics are substantially correct. Alternatively, it is possible to explain the erratic changes in the relative increments of the Europeans and Europe-born by the assumption that the Europeans include a ' spurious ' group passing as Europeans, and that it is the relative change in the number in this group which causes the discrepancy in the movement of the two increments.

### The Europe-born by countries

A more detailed analysis of the Europe-born by sex and country is given in Table 5. The decline in the number of Britons and the increase in the Continentals during recent years is interesting, and is a pointer to the future economic trend of the commerce and trade of the island.

TABLE 5—EUROPE-BORN BY COUNTRIES AND SEX

| Birth Place | | | 1891 | 1901 | 1911 | 1921 | 1946 |
|---|---|---|---|---|---|---|---|
| *British Isles :* | | | | | | | |
| England and Wales | Males | | 1,114 | 1,510 | 2,102 | 2,043 | 1,781 |
| | Females | | 495 | 689 | 1,081 | 1,253 | 1,155 |
| | | Total | 1,609 | 2,199 | 3,183 | 3,296 | 2,936 |
| Scotland | Males | | 468 | 558 | 558 | 528 | — |
| | Females | | 145 | 170 | 209 | 241 | — |
| | | Total | 613 | 728 | 767 | 769 | — |
| Ireland | Males | | 168 | 164 | 173 | 133 | — |
| | Females | | 86 | 108 | 174 | 200 | — |
| | | Total | 254 | 272 | 347 | 333 | — |

| Birth Place | | 1891 | 1901 | 1911 | 1921 | 1946 |
|-------------|--------|------|------|------|------|------|
| France | Males | 95 | 119 | 166 | 137 | — |
| | Females | 43 | 51 | 86 | 58 | — |
| | Total | 138 | 170 | 252 | 195 | — |
| Germany | Males | 50 | 58 | 104 | 4 | — |
| | Females | 11 | 30 | 35 | 19 | — |
| | Total | 61 | 88 | 139 | 23 | — |
| Other Europeans | Males | 61 | 78 | 224 | 194 | 647 |
| | Females | 47 | 66 | 135 | 133 | 406 |
| | Total | 108 | 144 | 359 | 327 | 1,053 |
| TOTAL EUROPE-BORN | Males | 1,956 | 2,487 | 3,327 | 3,039 | 2,428 |
| | Females | 827 | 1,114 | 1,720 | 1,904 | 1,561 |
| | Total | 2,783 | 3,601 | 5,047 | 4,943 | 3,989 |

## Sex-ratio among the Europeans

The proportion of females amongst both the Europeans and the Europe-born has steadily risen since 1871 with the improvement of transport and communications and the amenities of life available in Ceylon.

TABLE 6—SEX-RATIO AMONG THE EUROPEANS AND THE EUROPE-BORN

| Year | Ratio of Females to Males | |
|------|-----------|-------------|
| | Europeans | Europe-born |
| 1871 | 0·50 | — |
| 1881 | 0·53 | — |
| 1891 | 0·57 | 0·42 |
| 1901 | 0·62 | 0·45 |
| 1911 | 0·63 | 0·52 |
| 1921 | 0·71 | 0·62 |
| 1946 | 0·76 | 0·64 |

## Influence of Europeans on Ceylon Society

The political, economic and social influence of the Europeans is far greater than their numbers suggest. Most of the leading business firms, banks, plantations and industrial enterprises belong even today to Europeans. The planter in the early days was a virtual monarch within his plantation area. The European government

administrators and the police officers were regarded with awe by the native population, and exercised a power which rivals that of the modern dictator. The rise of the nationalist movement and the growth of the trade unions amongst the labourers have considerably reduced the prestige and fear of the Europeans among the Ceylonese. The growth of a wealthy class amongst the Ceylonese themselves, aping the ways of the Europeans in their manner of living, dressing, eating and often in marrying and divorcing, has largely destroyed the sense of wonder and awe with which the common people once held the Europeans.

The decline of the influence of Europeans in the field of economics, however, has been much less than in the social and political fields. No statistics are available of firms and plantations belonging to, or managed by, Europeans ; neither do we have any information about the size of European investment in Ceylon. It is true that, during recent years, some estates and some business firms have passed into the hands of Ceylonese businessmen, yet their proportion is negligible, and even today the predominating economic influence is exercised by the Europeans. In the tea estates, export business and banking, European ownership and management predominates.[1] In coconut plantations and processing industries Ceylonese have largely replaced Europeans. In all other industries there is a certain degree of inter-mingling of Ceylonese and European ownership and management.

There is one field in which Europeans have exerted a particular influence on the course of development in Ceylon—the field of education. The European missionaries (and a small number of American missionaries too) have not only introduced Christianity into Ceylon, which to some extent helped the transformation of the medieval Ceylon society into a colonial one, but their influence has been felt more strongly through the spread of Western education in the mission schools which they started. The government's initiative in matters of education was limited to the primary stage and provision of financial aid to voluntary schools. The main burden of secondary education was thrown on to the missionaries, who took this opportunity to spread the British way of life and to a lesser extent Christianity too. The mission schools by charging a high fee, limited the opportunity of secondary education to the well-to-do classes. A class of intelligentsia was thus created in Ceylon, having a profound admiration for the British culture and the British ways of living and whose outlook was fundamentally pro-British, yet who were anxious for more administrative power and to that extent were mildly nationalistic. After a long period of training and apprenticeship, lasting several decades, it was to this pro-British nationalist class of the wealthier Ceylonese that the burden of political control and administration was passed. It was in the financial interests of this class of Ceylonese to maintain the colonial economic system of production set

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[1] The amount of foreign capital is estimated to be 85 per cent. *Post-war Development Proposals* p. 29. According to the Report of the International Bank for Reconstruction on Economic Development of Ceylon, the acreage of tea estates transferred from European to Ceylonese owners is as yet only 1 per cent of the total. The total acreage of the tea estates which passed from the hands of Europeans and Indians during 1948–1951 is 5,320 ; the acreage which passed from Ceylonese hands to Indians is 162. *Ibid.*, pp. 229–30.

up by the British, since they shared in its profits.[1]   Thus, unlike the situation in India, there was no industrial class in Ceylon which came into direct conflict with the British industrial interest.   The nationalist movement in Ceylon, in consequence, was never so intense, nor its feelings so bitter, as in India, and the Europeans did not incur the hatred of the local population as they did in India.[2]

### Indians in Ceylon

Indians form both the largest group of immigrants into Ceylon and the largest group of foreigners resident in Ceylon.   The most important group of Indians is the estate labourers, who constitute more than 60 per cent of Indians in Ceylon.

### Indian Estate Labourers : History of Indian Immigrant Labour

As the coffee plantations were opened by British capital and management during the thirties of the last century, Indian labourers were introduced into Ceylon.   Soon after the conquest of Kandy, the British administrators and civil servants, including the Governors, began to make gifts of the so-called Crown lands to themselves at a nominal cost of five shillings per acre.[3]   Any land to which the Sinhalese villagers could not establish a clear title was promptly usurped and sold to English planters. The land system prevailing under the Sinhalese kings had not required written documents to establish ownership, and the villagers thus found it difficult to establish their title to land.   They were expropriated *en masse*, and were deprived, not only of grazing, forest and ' chena ' land (i.e., forest land used for temporary cultivation), but often of land they had cultivated for generations.[4]

The land thus obtained almost free of cost, together with other concessions, tempted the coffee planters to invest their capital in a rapid and often reckless expansion of their plantations.   The need for labour was felt acutely, particularly with the abolition of slavery.   The low-country Sinhalese labour introduced to the Kandyan districts was found both costly and insufficient to meet the demand. The sugar planters of British Guiana, Trinidad and Mauritius, faced with a similar problem, had found a solution by obtaining indentured labour from South India. The destruction of irrigation systems, primitive methods of cultivation, a cruel system of land tenure introduced by the British, and an exploiting marketing and

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[1] " The Ceylon politicians at the helm of affairs   .   .   .   showed that their interests were, at the farthest converging with those of the Imperial power.   What they wanted was a greater leeway to employ their capital more profitably, and not to expropriate foreign capital.   Their demand was for freedom to give government jobs to the growing middle class—a middle class risen from and closely connected with the landed and plantation interests ; a freedom to work for a greater degree of Ceylonisation of the commercial interests, for the same purpose."—*The Working of the Donoughmore Constitution of Ceylon*, 1931–1947, by I. D. S. Weerawardena : Mss. thesis for Ph.D. 1951, pp. 347–48.

[2] See Bryce Ryan : *Caste in Modern Ceylon*, Rutgers University Press, New Jersey, 1953, pp. 149–50.

[3] *Cf.*   Evidence of Philip Anstruther before Select Committee on Ceylon, 1950. Third Report, pp. 738–740.   Also, Ferguson's *Ceylon Directory* : 1866–68, p. 280 and pp. 244–48.

[4] *Cf.*   Evidence of Tennant, Ackland and Layard before the Select Committee on Ceylon, 1850–51.   I. Vanden Driesen : Plantation Agriculture and Land Sales Policy in Ceylon—The First Phase, 1836–1886, and, Land Sales Policy and some Aspects of the Problem of Tenure—1836–1886 (Part II) in *The University of Ceylon Review*, 1956 and 1957.

financing system had reduced the South Indian peasantry to a semi-starved hungry mass who, despite their extreme conservatism and ignorance, migrated to foreign lands to survive.

Ceylon being a country nearer their home, these famished peasants poured into Ceylon in search of work in the coffee plantations. The first batch of South Indian indentured labour was introduced in 1828 by Governor Barnes to work in his plantation but all deserted within a year.[1] By 1839 the number of indentured labourers entering had risen to 2,432 and in 1841 an ordinance was passed enabling the planters to take criminal action against a labourer who broke his contract and deserted.[2] The nearness of the homeland prevented the indentured scheme from being as successful in Ceylon as in other Colonies. The planters soon evolved an alternative, the 'kangany' system of recruitment, which was cheaper than the indenture system and did not involve them in great loss through desertion. For the labourer, however, there was little to choose between the two, for under both he was reduced to virtual slavery. The working of the 'kangany' system may be described as follows : The planter sent a coolie of long standing to South India with a sum of money. There he recruited labourers for the estate, paid them advances to clear their outstanding obligations and brought them to the estate, paying their expenses on the way. " Every coolie, it will therefore be seen, begins his life in Ceylon more or less in debt."[3] The coolie-of-long-standing, in his function as a recruiter of labour, was called a *kangany*. Once the recruited labourers were brought into the estate, the kangany became their overseer. The labourers remained indebted to the kangany and the kangany to the estate. The estate authorities, however, paid the labourers direct and deducted a part of the loan advanced to them through the kangany. The account was kept by the kangany who charged interest on the advances made to the labourers. The labourers, ignorant as they were, were thus exposed to the unscrupulous rapacity of the kanganies. It is no wonder that, in one or two generations, many of the kanganies' descendants succeeded in transforming themselves into estate owners.

The burden of debt on the immigrant labourer soon expanded, and he became indebted to the boutique-keeper also, and to the local money-lender. It is strange indeed that despite the wide net cast by money-lenders of various types, the labourer often managed to save something, free himself of debt, and return to India, though it might take years for him to do so. The major part of his life he remained shackled by the bondage of debt, a virtual slave.[4]

This wage slavery could be perpetrated because of the patriarchal character of the kangany system of recruitment and the sense of honour of the labourer. The labourer generally belonged to the same village as the kangany and was often related

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[1] G. C. Mendis : Ceylon Under the British, 1944, p. 23.

[2] G. C. Mendis, *Ibid.*, p. 43.

[3] Labour Commission Report, 1908, p. VIII.

[4] " Of course under present circumstances it is a safeguard in many cases to have highly indebted coolies, because they cannot then leave an estate so easily." Rider by Mr. C. C. Mee to the Report of the Labour Commission, 1908, p. XXII.

to him.   He was reluctant, therefore, to leave the kangany and take up work with another.   Secondly, the high sense of moral obligation to repay the debt, prevented him from quitting.[1]

If he found the conditions of employment more attractive elsewhere, he could buy a ' *tundu* ', i.e., a discharge certificate from his employer, by paying the sum his kangany asserted to be his debt.   He was then free to join another estate.   If the other estate was very short of labour, it would, perhaps, agree to advance the money necessary to buy the ' *tundu* ', the labourer, in consequence, becoming more involved in debt.   Such a situation arose during the first rubber boom of 1908, when the shortage of labour was most acutely felt and the estates entered into competition with each other in paying advances and buying off the labour from each other.   Though the price of ' *tundu* ' soared sky-high during the boom, the wage rate remained at the 1870 level because planters preferred to make excessive advances and later write them off, than pay increased wages.   The former had the advantage of holding the labourers to the estate and the expenditure was incurred only once, while the latter would have been a recurring burden and a dangerous precedent.

The patriarchal loyalty and the medieval sense of honour of the labourers were often put to too great a strain and the labourers deserted the estate.   To prevent such offences developing on an extensive scale a system of registration was introduced, and the offence was made punishable by a month's rigorous imprisonment.   True the Ordinance No. 13 of 1889 gave the labourers the formal right to quit an estate after giving a month's notice despite his indebtedness, but this right remained a formality only, because it was impossible to get a job in any estate without a ' *tundu*.' The labourers could not even escape the hands of justice by leaving Ceylon and going back to their own country.[2]

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[1] " The foundation of the labour system is the family or patriarchal idea ; the creditor of the coolie is not the estate, but the Kangany : and the freedom of the coolie is absolute, his willingness to discharge his liabilities being dependent upon his sense of honour and the loyalty which he feels to his fellow labourers and his Kangany.   The Kangany cannot recover except by a long process ; but it is very curious how that sense of honour has prevailed." Evidence of Lord Stanmore, Committee on Emigration from India, 1910, p. 349.

[2] " Mr. Boswell : If you will excuse me, Sir, I think I ought to say that the Police and the Presidency use it (i.e., Mr. Boswell's register) and find it very useful.   They trace people over there with it.

The Chairman : You mean they use your register in order to trace people whom they want ?

Witness : Yes.

The Chairman : When he turns up, what action do you take ?

Witness : We try to get him through the headman of the village.   We ask him to interview the man in the presence of the agent or whoever comes out, and the coolie as a rule owns up his debt. In some instances he says, " I can't pay, I will pay half and give you a fresh pro-note."   In some instances he says, " I can't pay at all.   I will go back."

The Chairman : He goes back to Ceylon ?

Witness : Yes, he says he will go back to Ceylon.   In other cases he will do nothing, and the headman says, " You can't take him."   Then we get a warrant.

The Chairman : You get a warrant ?

Witness : Yes, a warrant is issued on this side and they arrest him there.

When the Ceylonese planters began to appear they did not always keep to this rule and often employed absconding labourers. This led to an increase in absconding and despite official adherence to the philosophy of Adam Smith, the Labour Commission of 1908, strongly recommended the planters to combine to prevent such mischief. In any case, the ignorance of the coolies of their legal rights and privileges can be judged from the fact that not until 1908, some twenty years after the law was passed, did they become aware of their right to resign and quit after a month's notice. Moreover, the housing of the workers in the ' coolie lines ' within the estates gave the estate authorities great power over them. Even today trade union officials find it difficult to contact the labourers unless they are approved by the estate superintendents.

Thus the kangany system had much to commend it to the planters as compared with the slave or indentured system. The cost of acquiring labour was less and, in addition, when the need for reducing employment came, the labourer had merely to be asked to keep away, whereas in the slave system he had to be sold in a depressed market, and in the indentured system he might not be discharged at all. The incentive to work was also greater as the labourer had always the hope that some day he might be able to save sufficiently to repay his debt, go back to his country, and perhaps buy a small plot of land, redeem his mortgaged holding, or start a small shop of his own. Under the indentured system home was far away and the period so long that he was likely to lose touch with his family. The indenture and the slave systems, of course, ensured a regular labour supply but so did the kangany system with the perennial hunger of the South Indian peasant. No wonder, therefore, that the Labour Commission of 1908, and the Sanders Commission of 1910 found the kangany system to be perfectly satisfactory.

During the days of coffee plantations, there was an annual influx to Ceylon from South India of many labourers, who stayed for a few months only, to pluck the coffee, most returning home as soon as the plucking was over. Thus, during the season, the labour force on the plantations was nearly doubled.

Most of the estate labourers travelled to Mannar by boat and walked to Kandy, a distance of 156½ miles. From Kandy they dispersed to the various estates. This journey was not only strenuous so that the labourers arrived " emaciated and tired ",[1] but was hazardous in many ways. The greatest enemy on the road was cholera, and the dead bodies of estate coolies were often to be found on the road. In the up-country distrits, exposure caused many deaths.[2] Gradually, however,

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Mr. Dunbar : It is having a wonderful effect in stopping bolting. " Labour Commission Report : 1908, Evidence, p. 546.

" A woman named Vallie was crimped from Palamcottah by a Rangweltenne coolie named Konduwa and was taken *via* Hatton to Lochnager estate, Matale, where she was sold to the head kangany for thirty rupees. I obtained a warrant against her and she was arrested . . . . ." *Ibid.*, p. 558. Evidence, By Mr. J. S. Patterson, a planter.

[1] *Cf.* Coolie Immigration Committee Report, 1877.

[2] *Cf.* The Cholera Commission Report, 1867.

" During the months of June, July and August of last year, the dead bodies of half-a-dozen coolies were found lying on the plain at different times, and there was no doubt that the deceased had met their death through exposure." Administration Report, 1867, p. 51.

conditions were improved, resting sheds were built every five miles, and some provision was made for medical care. In the early stages women were few among the immigrants because the risk and strain on the road was too great for them. But as the conditions improved, the proportion of women and children increased.

The other route followed by the Indian immigrants was by boat to Colombo. Most of those using this route were non-estate workers, traders &c. The small proportion of estate labourers who did use it preferred to walk to Kandy—a distance of 75 miles rather than to go by train, because they could thus save about 15 cents,[1] a striking indication of the extreme poverty to which they were reduced.

The boats which brought the immigrants have been described by the Coolie Immigration Commission of 1877 as follows : " The principal mode of transport is in small native sailing vessels, the majority of which are unfit to carry passengers. The holds of these vessels contain ballast consisting principally of sand on which the coolies, especially the women and children, lie ; it becomes polluted by vomit, excreta, &c., and is seldom changed at the end of each voyage. The small vessels are also defective in ventilation, and in rough weather when the hatches have to be closed the air between decks becomes most foul."

The difficult and insanitary conditions under which the immigrants had to travel not only inflicted great suffering on them, and caused heavy financial loss to the planters, but was also a source of infection and epidemics to the native population. Improvements were gradually introduced, the most important being the opening of a railway which linked India to Ceylon, but for the 23 mile sea crossing by ferry boat. A quarantine camp was also established en route.

The Indian estate labourers rarely settled permanently in Ceylon ; at the first available opportunity they returned to India. The Labour Commission of 1908 believed that only from 30 to 40 per cent of the immigrant labour remained permanently on the estates. It was the distress and the semi-famine conditions in South India which up-rooted them from their village and forced them to come to Ceylon in search of employment. " Owing to geographical situation of Ceylon annual immigration of Indians mainly regulated by conditions of plenty or scarcity in district of South India." [2]

### The Non-estate Indian Immigrants

No statistical record of the non-estate Indian immigrants was kept before 1921. It was commonly believed that such immigrants were numerically equal to the estate labourers.[3] In 1926 D. S. Senanayake compiled a list both of estate labourers and non-estate immigrants for the years 1911 to 1925. It is not known how he arrived at the figures and what sources he used.

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[1] Coolie Immigration Report, 1877. 15 cents was about two pence.
[2] Telegram to the Secretary of State, from the Governor of Ceylon, 1909, published in the Sanders Commission Report, p. 379, Part ii.
[3] Sanders Commission Report, p. 379.

There is no doubt, however, that during these years there has been a considerable immigration of Indians who entered occupations other than estate labour. The first exhaustive enquiry into the occupational distribution of Indian immigrants was made by the 1938 Immigration Commission. Some information on the occupation of the India-born population is available in the earlier census reports which devoted a chapter to natives of India. A census to census comparison of these figures, however, is difficult because of changes in the occupational classifications used.

TABLE 7—OCCUPATIONS OF THE INDIA-BORN POPULATION, 1891

| Occupational Class | Persons per 1,000 India-born |
|---|---|
| Professional | 15 |
| Domestic | 36 |
| Commercial | 68 |
| Agricultural | 726 |
| Industrial | 104 |
| Indefinite | 51 |
| | 1,000 |

The data supplied by the Immigration Commission of 1938, re-classified to permit comparison with the 1901 census data, is shown in Table 8.

In comparing the proportions of 1933–35 to 1901, we must remember that they do not represent exactly the same thing. The 1933–35 proportions are derived from the immigration statistics, collected at the port of entry ; the 1901 proportions, on the other hand, are of those resident in the country at the time of the census.

TABLE 8—OCCUPATIONS OF INDIA-BORN POPULATION, 1901, AND INDIAN IMMIGRANTS, 1933–35

| | Persons per thousand | |
|---|---|---|
| Occupational Class | 1901 India-born Residents | 1933–35 Indian Immigrants |
| The agricultural occupations | 795 | 28 |
| Unskilled non-agricultural labour | 55 | 242 |
| Commerce, transport and storage | 48 | 539 |
| Preparation and supply of material substance | 44 | 37 |
| Personal service | 36 | 95 |
| Government service | 13 | 6 |
| Professions | 5 | 11 |
| Others | 4 | 42 |
| | 1,000 | 1,000 |

The immigrants may include short-term seasonal workers who would make practically no impression on the census enumerated residents, and longer-term immigrants, who will nevertheless return in due course to their own land, and who would be enumerated at the censuses during their stay and, finally permanent immigrants who will be enumerated in the census for the rest of their lives. A feature of the census statistics is that they show occupations at the time of the census, thus taking account of any change of occupation—promotion, for instance—since arriving in the country. In addition the two sets of statistics relate to different periods.

It will be seen from Table 8 that in 1933–35 the inflow of immigrants was making a very small contribution towards the stock of agricultural labourers, whilst the greater part of the flow went into commerce, transport, storage and unskilled non-agricultural labour. This was the direct result of the depression which, during 1930–36, led to the closure of a large number of plantations, and to drastic reduction of labour in others. Meanwhile the situation in India was also difficult, so that the immigration flow, though exceeded by the emigration flow, declined little in absolute numbers. In the absence of jobs in the estates, the immigrants searched for sundry and unskilled jobs in the towns. The movement of the population during the depression followed the familiar pattern of movement during famine years, that is from rural to urban areas, the only difference being the fields were now not parched and dried up but were as green as the peasants could ever wish.

The details of the occupational distribution of Indian immigrants during the years 1933–35 are given in Table 9.

TABLE 9—OCCUPATIONS OF INDIAN IMMIGRANTS, 1933–1935

| | | | |
|---|---|---|---|
| I. | Agricultural occupations | | 6,320 |
| | Estate labourers | 5,454 | |
| | Farmers | 866 | |
| II. | Unskilled non-agricultural labour | | 54,255 |
| | Harbour workers | 6,160 | |
| | Railway | 1,831 | |
| | Latrine labourers | 5,923 | |
| | Engineering Department labour | 244 | |
| | Tappers | 2,734 | |
| | Rickshaw-pullers | 2,793 | |
| | Other labourers | 34,570 | |
| III. | Commerce, transport and storage | | 121,218 |
| | Skilled harbour workers | 1,651 | |
| | Skilled railway workers | 349 | |
| | Motor drivers | 682 | |
| | Total skilled transport workers | 2,682 | |
| | Shop-assistants | 41,589 | |
| | Traders | 76,947 | |

TABLE 9—OCCUPATIONS OF INDIAN IMMIGRANTS 1933–1935—(*contd.*)

| | | |
|---|---|---:|
| IV. | Preparation and supply of materials | 8,279 |
| | Blacksmiths | 130 |
| | Goldsmiths | 1,787 |
| | Potters | 344 |
| | Tailors | 1,828 |
| | Weavers | 622 |
| | Carpenters | 2,035 |
| | Butchers | 1,056 |
| | Fishermen | 477 |
| V. | Personal service | 21,241 |
| | Dhobies | 1,320 |
| | Barbers | 4,862 |
| | Hotel servants | 4,718 |
| | Domestic servants | 10,341 |
| VI. | Government service | 1,363 |
| VII. | Professions | 2,584 |
| | Teachers | 1,198 |
| | Actors and musicians | 1,386 |
| VIII. | Other occupations | 9,400 |
| | Total all occupations | 224,660 |

*Source :* Jackson Committee Report, 1938.

## The Geographical distribution of Indians

The census tabulations before 1911 did not distinguish Indians from the Ceylon Tamils and Ceylon Moors. Since 1911 the Indians, the majority of whom are Tamils and Moors, have been shown separately as Indian Tamils and Indian Moors. The tabulations also show their geographical location.

TABLE 10—GEOGRAPHICAL DISTRIBUTION OF INDIAN TAMILS AND INDIAN MOORS (PER CENT.)

| Year | In Colombo Town | In Plantation districts* | In the rest of the Island |
|---|---|---|---|
| *Indian Tamils :* | | | |
| 1911 | 10 | 63 | 27 |
| 1921 | 10 | 61 | 29 |
| 1946 | 8 | 62 | 30 |
| *Indian Moors :* | | | |
| 1911 | 49 | 30 | 21 |
| 1921 | 49 | 22 | 29 |
| 1946 | 54 | 21 | 25 |

* Kandy, Matale, Nuwara Eliya and Badulla districts. Compiled from the Census Reports.

In contrast to the change in the location of Europeans, the geographical distribution of the Indian Tamils shows little change between 1911 and 1946. The proportion of Europeans in the plantation districts declined because some of the plantations passed into the hands of Ceylonese and Indians. The number of plantations themselves were not greatly altered, so that in these areas the Indian population, mostly estate labourers, did not change.

The relative decline in the importance of Colombo in attracting Indians, may point to a significant change in the trend. It may be an indication that Indians are finding it increasingly difficult to retain their position in the trades and professions which have so far been their preserves.

### The Economic Aspect of the Indian Immigration Problem in Ceylon

The Indian estate labourers were brought into Ceylon by the English, not only because they were a cheaper and more efficient source of labour than the indigenous population, but also for political reasons. In the words of the Committee on Emigration from India, 1910 : " All the evidences which we have received go to show that the Indian indentured labourer, though resentful of anything which he considers injustice, is, if properly treated, perfectly docile and easily managed, and that after the expiration of their contracts the free immigrants and their descendants are orderly and law-abiding members of the community, requiring no special legislation or administrative provision for their governance. They seem to be content to pursue their avocations without troubling themselves to take part in political movements or agitation."[1]

The European planters always preferred the Indian labourers (whom they called the coolies—a term that came to be associated with great indignity and insult) to the Sinhalese because they were docile, more manageable and regular in their attendance and politically preferable to the Sinhalese, who still bore a grudge against the English for misappropriating their land.

It is not true that the Sinhalese labourers were displaced because they were less efficient than the immigrant Indians. Many of the planters, who employed Sinhalese labourers, gave evidence before the Labour Commission of 1908 that the Sinhalese labourers were as satisfactory as the Indian Tamils.[2] The Report on Immigration into Ceylon, 1938, investigated the question of the relative efficiency of Sinhalese and Indian labourers, and concluded that Sinhalese labourers refused to do certain types of labour as undignified and below their caste status. Otherwise their capacity to do hard work was not less than that of the Indian labourers. The Sinhalese labourers, however, refused to work where housing conditions were bad. During the early years housing conditions in the plantations were depressing and this may be one of the reasons why the Sinhalese labourers kept away from the plantations.

The need to work was also less pressing for the Sinhalese. His needs were few and he was able to meet them easily, thanks to the fertile soil with which he was blessed. Money-consciousness was unknown to him, he had no desire to become rich, and

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[1] *Ibid.*, p. 22.
[2] *Cf.* Mr. H. A. de Silva's Evidence, *Ibid.*, p. 338 ff.

not knowing the severity of famine conditions, as the Indian did, he had no incentive to save.   He preferred to work in his own field and live on whatever he produced, enjoying the company of his family in his own secluded home, in peace and without outside interference.   When the roads were built and the coffee plantations opened up, mostly on the land from which he had obtained his sustenance, he naturally felt aggrieved and took a hostile attitude towards plantations, the English planters and the ' Malabar ' (i.e. Indian Tamil) coolies who worked in the plantations.

" The contiguity of coffee estates to their lands and houses has necessarily circumscribed the boundaries within which their cattle used to graze before, and the wild range of patnas to which their cattle has free access had become from the same cause appropriated to other purposes and their buffaloes, upon straying into coffee estates, happened to be seized and impounded.   .   .   .   The general impatience which exists in the minds of all Kandyans of the presence of the British Government, and the causes which have operated in conjunction with that are in a great degree to be traced to the operation of coffee planting and the introduction not only of Europeans as settlers in the midst of their hills and forests, but likewise to that which has given them much offence, viz., the introduction of Malabar coolies, who came there in search of labour, that is which has chiefly affected the mass of the people.   .   .   .

" And they complain of the sale of the forests for the purpose of converting them into coffee estates.   All the Kandyan villages made free use of them for the purpose of pasturing their buffaloes, they were in fact an easement to their paddy land. But as soon as the demand for coffee land arose in Ceylon, Government necessarily asserted its claim to these forests and they were disposed off to the planters who obtained them for coffee planting.   The result of that has been likewise very distasteful to the mass of the people by the opening up of the roads.   .   .   .   The opening up of the roads has necessarily destroyed their privacy, but in addition to that, it has poured into the villages the low-country Cingalese, who come there as tradesmen and mechanics and of whom the Kandyans have a great dislike and still more, it has let in an influx of Malabar coolies who are wholly distasteful to the Kandyans."[1]

Similarly Lord Ackland in his evidence before the Select Committee said, " The natives became dissatisfied from the circumstances of the Europeans settling among them, and purchasing from the Government their land.   When I say their lands, I mean not merely the forest lands, but lands which the natives, although they hold no titles to them, were accustomed to consider their own, the channies and common lands.   .   .   .   The Governor, unless the natives could show a title to it was anxious to sell as much land as possible ; and I do not think in all cases as much leniency was shown towards the natives as perhaps ought to have been shown."[2]

This dissatisfaction and hostility against the English planters and Indian coolies broke out in an open revolt in 1848 in which several estates were sacked and burnt.

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[1] Select Committee Report : Vol. vm. Part I, 1850.   Tennent's Evidence, pp. 171–72.

[2] *Ibid.,* Vol. XII, p. 12.

In most cases the Indian coolies defended the estates and their employers, in many cases, they fought alone as the planters had fled.[1]

The Indian labourers thus incurred the hostility of the Sinahalese, not because they were competitors in the same trade—the Sinhalese never cared for jobs in the plantations—but because the Indian labourers were associated with the English planters who were the usurpers of their land.[2]

The Indian immigrant into Ceylon not only served the economic interest of the British planter, but he was also a defender and an ally in the midst of a hostile camp. Perhaps this was the reason why Gray, as Colonial Secretary, instructed Lord Torrington to 'plant' Malabars in Ceylon. Tennent says in his evidence before the Select Committee, " The project of planting Malabars in Ceylon is one which had been discussed previous to Lord Torrington's arrival in the island. He arrived with instructions from Lord Gray to make inquiry as to the practicability of doing that effectually and at the period of the rebellion when the certainty appeared great of a large extent of land being confiscated to the Crown, many public officers amongst the rest myself called Lord Torrington's attention to the fact as affording a possible opportunity of carrying out the intention of the Secretary of State." [3]

The conflict between the immigrant Indians and the Ceylonese in the economic field did not flare up until the end of the first World War when the national sentiment of the Ceylonese advanced rapidly and was demanding self-expression in every field. The feelings of the Sinhalese towards Indian immigrants was expressed by D. S. Senanayake in 1926 as follows, " There can be no doubt that unduly large numbers of Indians are coming into Ceylon every year in search of employment. . . . if the present rush continues this country will soon have more immigrant labourers than are necessary for its requirements (if indeed the

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[1] *Ibid.*, Vol. XII, Appendix. Mr. Hanna's letter, pp. 126–27.

[2] There were many other reasons why the Malabars were not looked upon by the Sinhalese with particular fondness. Historically the Malabars were the invaders of their land and caused the decay of the Sinhalese civilisation. Their religion and cultural habits were different from that of the Sinhalese. Also, the Malabar coolies were the carriers of cholera and small pox epidemics, and they annoyed the villagers by petty pilferings. " I have several times endeavoured to engage the attention of the Government to the depressed state of this country generally and to the extent to which it has suffered from the introduction of cholera into it year after year, by the Coolie Immigrants." Letter from a Government Agent published in the Cholera Commission Report, 1867, p. 156.

[3] Tennent's Evidence, *Ibid.*, Vol. XII, 1850, p. 253.

In reply to Tennent's proposal to grant land to Malabar coolies, Gray, the Colonial Secretary, wrote as follows : " I agree with Sir J. E. T. in thinking that it might be the means of inducing the coolies to bring over their families and to settle permanently in the country.

" But the object of holding out this inducement would be to obtain for the Colony a settled body of labourers. Great caution is necessary to prevent their losing that character at once.

" Experience has shown that a too great facility of obtaining land is in all countries the immediate cause of extreme difficulty in commanding the services of hired labourers. For this reason it is essential that the proposed allotments to the coolies should not be sufficiently large to induce them to devote the greater part of their time to cultivation on their own account." Gray's letter to Lord North, Governor of Ceylon, dated 7th August, 1847. Record Office, CO. 55/89, No. 67.

limit has not already been exceeded) and it will have to face the problem of their employment or repatriation. . . . Unless special steps are taken . . . this country will soon be swamped by Indian immigrants, mainly unskilled labourers. This free influx from the adjoining mainland must necessarily affect adversely not only the rates of pay and the prospect of employment of indigenous labour, but even of the needed immigrant labourers themselves." [1]

With the spread of English education, the educated youth amongst the Ceylonese found all avenues of employment more or less blocked, the only employment open to them being the few subordinate and clerical posts in the government departments.[2] All the commercial firms were largely monopolised by the Indian immigrants. In the field of business and trade they found the Indian traders, experienced and with vast resources, a rival against whom they had no chance. Naturally, their bitterness against the Indians rose higher and higher with every frustration that they met.[3]

The main difficulty was that the population had been increasing steadily since the beginning of the century, whilst the expansion of the economy had almost stopped some twenty years ago, so that the economic resources were increasingly strained. Over and above this, the depression of 1930–36 dealt a severe blow to the plantation economy of Ceylon, and the middle classes of Ceylon, along with all other classes, faced economic ruin. The small landowners were often completely ruined ; even the owners of large estates had to mortgage their properties. The Indian money-lenders—the Chetties—seized the opportunity to gain control of as much land as possible. The labour market, skilled and unskilled, was flooded with Indian immigrants who left the estates for Colombo and other towns in search of work. A crisis was impending when the great malaria epidemic broke out in 1935 amongst the under-nourished population, irrespective of nationality or race, reaping a harvest of 80,000 lives. The Indo-Ceylon conflict was, for the time being, ousted from the arena of public concern by the havoc wrought by the epidemic.

The question soon came to the forefront once more, and a committee was appointed to investigate and to make recommendations on methods of securing the greater employment of Ceylonese in place of the Indian immigrants. Its investigation revealed the complex nature of the problem, and showed the difficulty of reaching an easy solution.

While the increase in their numbers was sharpening the conflict between the Ceylonese middle and labouring classes and the Indians, a different attitude was developing amongst the wealther classes in Ceylon. From the beginning of this century, in some cases even earlier, the wealthier classes of Ceylonese were

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[1] Report of the Committee on Immigration of Indian Labour, 1926, pp. 8–9.

[2] *Cf.* Weerawardena, *Ibid.*, p. 33 ff., and Report of the Banking Commission, 1934, Sessional Paper XXII, p. 22.

[3] " Evidence before us supports the contention that the bulk of the superior staff are non-Ceylonese whilst in the case of other non-national firms there is a preponderance of non-Ceylonese in the entirety of their staffs." Report of the Committee on the Introduction of Legislation to Regulate Terms and Conditions of Employment of Mercantile Employees. Sessional Paper XV, 1951, p. 43, para 137. Needless to say most of the non-national non-European firms are Indian.

increasingly investing their wealth in plantations, first in coconut and then in rubber. During the last war, when it became clear that political power would pass into the hands of the Ceylonese, many of the European estate owners sold their plantations to the Ceylonese and left Ceylon. To a substantial degree the wealthy Ceylonese replaced the European planters, and became interested in maintaining the flow of cheap South Indian labour for estate work. The anti-Indian agitation thus came to be directed mainly against the non-estate immigrants, rather than against Indians as a whole.

Meanwhile the Indians had formed a strong organisation to safeguard their interest, the Ceylon Indian Congress. It claimed close association with the Indian National Congress, and used its prestige among the Indian estate workers to gain their support. Soon it succeeded in organising the estate labourers into a strong trade union. For the first time the planters, European and native, were faced with organised labour, and their reactions to it in the early stages were violent and crude. However, the wise and moderate leadership of the trade unions soon helped the labourers to win a number of notable successes and enhanced the union's prestige, not only amongst the labourers themselves, but also amongst the planters.

The leaders of the Ceylon Indian Congress, mostly merchants themselves, were opposed to the separation of the question of the estate workers from that of other Indians.[1] They realised that Indian estate workers were necessary to the Ceylonese planters, whilst the other Indian groups were not, and that the Ceylonese would be especially glad to get rid of the Indian merchants and money-lenders. Hence their effort to associate the interests of the other Indian groups with those of the estate labourers.

This is not the place to relate the story of the long drawn out tussle between the Ceylon Indian Congress and the Senanayake Ministry on the issue of immigrant Indians : suffice it to say that the tussle resulted in the victory of the Senanayake government who introduced legislation virtually stopping Indian immigration, other than for estate labour, and taking away the Indians' voting rights. The Immigrants and Emigrants Act of 1948, brought into force on November 1, 1949, requires that, " As from that date all persons other than citizens of Ceylon are required to possess national passports and, in addition, entry permits in the form of a *visa* or a permanent or temporary residence permit. . . .

" The immigration regulations did not affect estate labour which was permitted to move to and fro between India and Ceylon with certificates of identity issued to them on estates."[2]

A solution to the problem created by Indian immigration in Ceylon has thus been thrust willy nilly upon the Indians, and there remains nothing for them to do but to adjust themselves as best they can to the new situation. A few will, perhaps,

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[1] Report of the Committee on Immigration into Ceylon, 1938.

[2] Ceylon Year Book, 1950, p. 45.

be able to fulfil the difficult conditions necessary to acquire Ceylon citizenship and will finally settle down in Ceylon. The others will have to return to India sooner or later.

## Ceylonese Abroad

Very little information is available about the Ceylonese abroad and the emigration of Ceylonese nationals. None of the indigenous communities are migratory in character. They are attached to their land, and have had better fortune with it than have the South Indian peasants. The system of land tenure is not as cruel and burdensome as that of South India, nor is the crop failure so frequent. In Ceylon the population pressure in relation to agricultural production has been much less than in South India, and so far there has been no economic necessity for the agricultural population to migrate.

The new English-educated class, however, did not find adequate scope for satisfying their economic ambition in Ceylon, and if necessary, were prepared to go abroad when openings were available. Unfortunately, the opportunities for them abroad were not many and few countries wanted their services.

## Ceylonese in Malaya

Malaya was one of the few countries where the middle class Tamils found some opportunity of earning a better living than they could in Ceylon. It is generally believed that the emigration to Malaya began about the year 1867.[1] The 1891 and 1901 census reports mention some emigration from Ceylon to Malaya and Australia, but no figures were available till 1921 when the first complete census in Malaya was taken. In this census, however, the Ceylon Tamils were shown together with Indian Tamils. Of all other Ceylonese, only the Sinhalese were returned as a separate race. In the next census, in 1931, all Ceylonese were grouped together. In the 1947 census an attempt was made to split up the Ceylonese into their racial components, but did not meet with complete success as many of the Tamils and Sinhalese preferred to be returned simply as Ceylonese rather than as Ceylon Tamils or Sinhalese.

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[1] " The acute shortage of trained staff for administrative and clerical functions caused the Government of Malaya to appeal to the Government of Ceylon to send Ceylonese for service to Malaya, and from the year 1867 at the invitation and encouragement of the Malayan Government large numbers of Ceylonese subordinate officers, practically all of whom were Ceylon Tamils from Jaffna, secured employment in building roads, in surveying lands and in doing the work of clerks, dressers, &c." Report on the General and Economic Conditions &c. of Ceylonese in Malaya. Sessional Paper IX, 1946, p. 1.

Table 11 below gives the number of Ceylonese in Malaya as enumerated in the censuses.

TABLE 11—CEYLONESE IN MALAYA

|                   | 1947   | 1931   | 1921  |
|-------------------|--------|--------|-------|
| Ceylon Tamil      | 16,783 | ?      | ?     |
| Sinhalese         | 2,946  | ?      | 2,215 |
| Other Ceylonese   | 3,033  | ?      | ?     |
| *Total Ceylonese*: | 22,762 | 18,490 | ?     |

Source : Compiled from the *Malaya Census Reports.*

The increase between 1931 and 1947 of 23·1 per cent despite the disturbed political situation which caused the return to Ceylon of a large number of Ceylonese after the war, shows that the economic necessity for migration was acutely felt by the middle class during the 1931–35 depression.

About 88 per cent of the Ceylonese live in five States of the Malaya Federation— Perak, Selangor, Negri Sembilan, Pahang and Johore. Unlike the South Indians in Malaya, the Ceylonese do not work on the estates. They are mostly white-collar employees and traders. The Ceylon Tamils are mainly clerks in Government departments and the railways, and the Sinhalese are shopkeepers and traders.

The number of Ceylonese males and females in Malaya as enumerated in the 1947 census is given below :

TABLE 12—CEYLONESE IN MALAYA, 1947, BY RACE AND SEX

|                 | Federation of Malaya | Colony of Singapore | Grand Total | Ratio of females to males |
|-----------------|----------------------|---------------------|-------------|---------------------------|
| *Ceylon Tamils* |                      |                     |             |                           |
| Male            | 8,627                | 825                 | 9,452       |                           |
| Female          | 6,784                | 547                 | 7,331       |                           |
| Total           | 15,411               | 1,372               | 16,783      | 0·78                      |
| *Sinhalese*     |                      |                     |             |                           |
| Male            | 1,194                | 498                 | 1,692       |                           |
| Female          | 932                  | 322                 | 1,254       |                           |
| Total           | 2,126                | 820                 | 2,946       | 0·74                      |
| *Others*        |                      |                     |             |                           |
| Male            | 1,271                | 463                 | 1,734       |                           |
| Female          | 994                  | 305                 | 1,299       |                           |
| Total           | 2,265                | 768                 | 3,033       | 0·75                      |

Source : Compiled from the *Malaya Census Reports.*

## Ceylonese in Australia

The number of Ceylonese who are enumerated as such in the Australian censuses is very small. The birth-place statistics show a much larger number who were born in Ceylon. For example, the number of Ceylon-born was 638 in the 1933 census, whereas the number of Ceylonese was 274. It is probable that many of those who migrate to Australia from Ceylon—the majority of whom are fair-skinned Burghers—renounce their Ceylonese nationality and become naturalised Australians, or fail to give their race as Ceylonese. The number of Ceylonese enumerated in the Australian censuses is given below :

TABLE 13—CEYLONESE IN AUSTRALIA

|  | 1921 | 1933 | 1947 |
|---|---|---|---|
| *Full-blood* | | | |
| Male | 231 | 196 | 97 |
| Female | 38 | 78 | 53 |
| Total | 269 | 274 | 150 |
| *Half-caste* | | | |
| Male | 62 | 39 | 51 |
| Female | 49 | 37 | 53 |
| Total | 111 | 76 | 104 |

*Source :* Compiled from the Census Reports of Australia.

The decline in the number of full-blood and the increase in the half-caste Ceylonese during 1933 to 1947 is the result of the ' White-Australia ' policy pursued in that country in controlling immigration, and the emigration of Ceylon Burghers to Australia after the war.

A number of Ceylonese go to India and Europe every year on holiday and for study. This kind of short period emigration, however, does not create any complicated problem, as is the case in emigration for a living.

## Conclusion

The emigration from Ceylon is of negligible dimensions. Its character, however, is quite different from that of other Asian countries. Ceylon has exported mostly white-collar workers and not unskilled labour. Being educated, these emigrants have a greater power of assimilation of foreign culture and are more adjustable to it. Ceylonese emigrants have not, therefore, created the same type of problem as the Indians. Their small numbers have also helped in this ; for where the number is large a miniature reproduction of the national culture is facilitated, so that the desire to assimilate and understand the culture of the locality is decreased.

## CHAPTER 9

## RACE, RELIGION AND LITERACY

### Introduction

ALTHOUGH a substantial part of the Census and Registrar-General's Reports in Ceylon comprises of race statistics, yet the exact meaning of the term is not known. An effort to define it was made by Dr. Wijesekera in the 1946 Census Report which drew the sarcastic remark from Sir Ivor Jennings that it was " Less useful than the definition of an elephant as an animal with four legs." [1]  Race, as a biological concept is a myth.  The term ' race ' is used in Ceylon to signify not a biological but a social grouping and, like all social groupings, allocation of individuals into water-tight compartments is impossible and there is a wide border region where one group cannot be distinguished from the other.  Yet the social grouping represented by race is a real issue in contemporary Ceylon society and politics, and the space devoted to it in the Census and Registrar-General's Reports is a reflection of the importance attached to it.

It is interesting to note that the 1824 Census classified the population by caste and not by races ;  and the Europeans and the Burghers appeared as distinct castes. The Tamils and the Sinhalese were not returned as such but as members of their respective castes.  This shows that the people in 1824 were not so much conscious of race distinctions as they were of castes.  The word nationality was used in the earlier censuses until 1901.  The word race was used in place of nationality in the 1911 census.  Since then it has gained a general currency in Ceylon and is used now in all official and non-official literature.

The Census Reports prior to 1901 classified the population into seven groups, namely, the Europeans, the Sinhalese, the Tamils, the Moors, the Malays, the Veddas and the others.  The Census of 1901 further divided the Sinhalese into the low-country Sinhalese and the Kandyan Sinhalese.  The 1911 Censuses introduced more races and divided the Tamils into Ceylon Tamils and Indian Tamils, and the Moors into Ceylon Moors and Indian Moors.  The races thus classified are believed to be ethnological except the division of the Sinhalese between the low-country and the Kandyan Sinhalese.[2]  Whether they are truly ethnological or not there is a strong *belief* in their ethnological significance during the modern period of their history. The language, religion, and geographic location also have some significance in their classification.

The Sinhalese believe themselves to be the descendants of the ancient Aryan settlers. It is doubtful, however, how much Aryan blood still flows in their veins after centuries of admixture with the Veddas, the Dravidians, the Arabians, the Kaffeers and the

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[1] "The General Report on the Census" in *Ceylon University Review*. Vol. VIII. No. 4, Oct. 1950, p. 214.
[2] *Census of Ceylon*, 1946. Chapter VII, pp. 164–171, Vol. I, Part I.

Portuguese. This is equally true of the Tamils and the other races of Ceylon. No matter what the racial origin, little remains today of the original stock, except a belief in it.

There are three linguistic groups—the Sinhalese, the Tamil and the English-speaking groups. Sinhalese is spoken by the Sinhalese and a small number of those who claim to be Tamils. Tamil is spoken by the Ceylon Tamils, the Indian Tamils, the Moors (both Indian and Ceylon) and by a number of Sinhalese. English is the mother-tongue, not only of the English, the Burghers and the Eurasians, but also of many upper class Sinhalese and Tamils. Thus the races often cut across linguistic divisions. Similarly religion and location also show some degree of interpenetration, making the exact identification of the races difficult.

Sir Ivor Jennings believes the races to be an enlarged edition of endogamous castes.[1] Race as it is understood today in Ceylon, must necessarily contain within its fold a collection of castes, so long as castes exist. But the region of endogamy is not coterminous with race ; for, within the fold of a single race there exists a number of endogamous groups. Historically also caste and race cannot be regarded as synonymous. Caste system is a product of highly organised feudalistic society, where the pattern of living is stagnant and centres round a self-sufficient agricultural economy, with trade and exchange playing a minor part. Existence of a rigid caste system with endogamy and restriction of eating, is impossible in an industrial exchange economy. Race as a political concept, on the other hand, is modern and is similar to nationality in so far as it is based on language, locality and a cultural heritage, which gives the members of a race a feeling of unity and solidarity. In so far as the group does not want an independent state of its own, it falls short of becoming a fully-fledged nation.[2]

The term nationality, which was used in the earlier censuses in place of race, was dropped because it was felt that the term implied a separatist tendency in the group, and was thus objectionable to the growing all-Ceylon nationalism.

In any case, race-consciousness is entirely a product of this century, whilst caste-consciousness is rooted in the remote past. The classification of ' races ' as castes in the 1824 Census shows that race-consciousness was absent at that time. The growth of race-consciousness is essentially a product of the middle-class mind which used the cultural, religious and linguistic heritage of a group, irrespective of its caste composition, to whip up the feeling of unity of the group vis-a-vis the other similar groups, in order to enhance its own political and economic interests.[3] Race-consciousness, is thus, both a unifying factor, in so far as it brings the different castes together, and also a separatist factor, in so far as it prevents the unification of all the races together into a single nation.

The colonial economy that was introduced into Ceylon by British capital, did not destroy the ancient feudal system but merely adapted it to suit the needs of the

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[1] *Ibid*, p. 212.

[2] James Wilford Garner : *Political Science and Government*. New York, 1930, pp. 114 ff.

[3] I. D. S. Weerawardena, *Ibid*. p. 37.

new economy. It was by no means a mutation of the feudal system into a fully-fledged capitalistic economy. The value structure of the feudal age, with the hierarchy of castes as its pivot, remained intact. The growth of the middle class which followed the introduction of English education led to small additions and alterations in the value structure, so that the cultural pattern of the intelligentsia that developed was a queer mixture of enlightened democratic ideas and a quaint belief in the caste system, the astrologer and other medieval institutions, customs and attitudes. The average modern intellectual in Ceylon, as in India, is a living example of the co-existence of these incompatibles, without any realisation of the paradoxical position that such an intellectual outlook involves. Thus he believes both in nationalism and in the caste system at the same time without realising that they are contradictory in that the people cannot be united into a single nation if they are divided into castes. The concept of race has been evolved to hide this apparent contradiction in their outlook—a sort of a halfway house between caste and nation.

### Nature of Statistical Data Relating to Races

By its very nature, the concept of race presents great difficulty for accurate enumeration. The instruction given to the enumerators in the 1946 Census states, " Enter the race of each person as Low-country Sinhalese, Ceylon Tamil, Indian Tamil, Ceylon Moor, Indian Moor, Malay, English, Scotch, Irish &c. Do not use general terms such as British, Ceylonese &c. As a general rule the offspring of parents of different races will follow the father's race, but Burghers and Eurasians, or Euro-Ceylonese should be treated as separate races and described as Burghers and Eurasians and Euro-Ceylonese according to the statement of the persons themselves. In the case of a Sinhalese, you must state whether the person is a Kandyan Sinhalese or a Low-country Sinhalese. In the case of a Tamil or Moor you must state whether the person is a Ceylon Tamil or Moor, or Indian Tamil or Moor. In the case of an Indian who is neither Indian Tamil or Indian Moor state the particular race, such as Malayali, Borah, Parsee. Similarly in the case of an European the particular race should be stated, whether English, French, German, Russian &c. A person from the Dominions or from the United States may be allowed to describe himself as a Canadian, Australian, a New Zealander, a South African, or an American, as the case may be, if he prefers this to giving his original racial stock. Where a foreigner has been naturalised as a British subject, note to add in brackets after his race the letters N. B. S. thus : German (N.B.S.) "[1] The predicament of the enumerator who tried to put these instructions into practice may well be imagined.

Turner, the author of the 1921 Census Report, frankly admits the limitations of the race statistics thus : " The subdivision into classes by race introduces the possibility of additional errors, mainly on account of the difficulty of applying the definitions to mixed races and other marginal instances. This probably resulted, for example, in several Eurasians being returned as Europeans ; the fluctuating connotation of " Vedda " would tend to introduce error ; some enumerators distinguished Ceylon and Indian Tamils according to the birth-place instead of by

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[1] Census of Ceylon, Vol. I, Part 1, p. 301.

descent, while Malays have been confused with Malayalis, or Moors. Many of these errors were rectified after enquiry, but they were probably not entirely eliminated and their existence has to be allowed for."[1]

Not only were errors made unconsciously by the enumerators, but errors were introduced consciously by the enumerated in describing themselves incorrectly as belonging to a privileged group. For example : " at the 1921 Census about 92 per cent of those enumerated as Ceylon Tamils on estates were found on further enquiry to be Indian Tamils ".[2] The 1946 Report also mentions similar errors in the case of foreign born.[3]

In spite of these shortcomings in the data, I have been unable to correct them because, in the absence of an objective criterion for applying a correction process any attempt to correct the data would be highly conjectural and it might well be that the quality of the data was in fact worsened.

## Races of Ceylon

The number of the races as enumerated in the censuses are shown in Table 1.

### TABLE 1—RACES OF CEYLON

('000)

| Census Year | 1881 | 1891 | 1901 | 1911 | 1921 | 1946 |
|---|---|---|---|---|---|---|
| *Races* | | | | | | |
| 1. Sinhalese | 1,847 | 2,041 | 2,331 | 2,715 | 3,016 | 4,620 |
| Low-country | — | — | 1,458 | 1,717 | 1,927 | 2,902 |
| Kandyan | — | — | 873 | 998 | 1,089 | 1,718 |
| 2. Tamils | 687 | 724 | 952 | 1,059 | 1,120 | 1,514 |
| Ceylon Tamils | — | — | — | 528 | 517 | 734 |
| Indian Tamils | — | — | — | 531 | 603 | 780 |
| 3. Moors | 185 | 197 | 228 | 267 | 285 | 410 |
| Ceylon Moors | — | — | — | 234 | 252 | 374 |
| Indian Moors | — | — | — | 33 | 33 | 36 |
| 4. Burghers and Eurasians | 18 | 21 | 23 | 27 | 29 | 42 |
| 5. Malays | 9 | 10 | 12 | 13 | 13 | 23 |
| 6. Veddas | 2 | 1 | 4 | 5 | 5 | 2 |
| 7. Europeans | 5 | 5 | 6 | 8 | 8 | 5 |
| 8. Others | 7 | 8 | 10 | 13 | 22 | 40 |

*Source :* Census Reports.

[1] Census of Ceylon, 1921, Vol. I, Part I, p. 192.
[2] Census of Ceylon, 1921, Vol. IV, p. 232, footnote.
[3] Census of Ceylon, 1946, Vol. I, Part I, p. 219.

The percentage distribution of the races is given in Table 2 below.

### TABLE 2—PERCENTAGE DISTRIBUTION OF THE RACES

| Census Year | 1881 | 1891 | 1901 | 1911 | 1921 | 1946 |
|---|---|---|---|---|---|---|
| *Races* | | | | | | |
| 1.  Sinhalese | 66·91 | 67·86 | 65·77 | 66·13 | 67·04 | 69·41 |
|      Low-country | — | — | 40·90 | 41·81 | 42·83 | 43·60 |
|      Kandyans | — | — | 24·87 | 24·32 | 24·21 | 25·81 |
| 2.  Tamils | 24·90 | 24·01 | 26·69 | 25·79 | 24·89 | 22·74 |
|      Ceylon Tamils | — | — | — | 12·86 | 11·50 | 11·02 |
|      Indian Tamils | — | — | — | 12·93 | 13·39 | 11·72 |
| 3.  Moors | 6·69 | 6·56 | 6·44 | 6·49 | 6·38 | 6·14 |
|      Ceylon Moors | — | — | — | 5·68 | 5·65 | 5·61 |
|      Indian Moors | — | — | — | 0·81 | 0·73 | 0·53 |
| 4.  Burghers and Eurasians | 0·65 | 0·71 | 0·66 | 0·65 | 0·65 | 0·63 |
| 5.  Malays | 0·32 | 0·33 | 0·33 | 0·32 | 0·30 | 0·34 |
| 6.  Veddas | 0·08 | 0·04 | 0·06 | 0·13 | 0·10 | 0·04 |
| 7.  Europeans | 0·18 | 0·16 | 0·18 | 0·18 | 0·16 | 0·08 |
| 8.  Others | 0·27 | 0·28 | 0·27 | 0·31 | 0·48 | 0·62 |
| | 100 | 100 | 100 | 100 | 100 | 100 |

Table 2 shows clearly that the Sinhalese, both the Low-country and the Kandyan, are increasingly displacing members of the other races in the proportionate distribution of the races. In the case of the Europeans, the decline is not only in proportion but also in absolute numbers. In the case of most of the other races an increase is shown but at a slower rate than that of the Sinhalese. The increase in the Sinhalese race may not be entirely due to natural increase but may be partly due to ' conversion ' from other races. The Indian Tamils and the Indian Moors, the Burghers and Eurasians and the Europeans show a decline in proportion, due to the increase in emigration over immigration, or to the fall of immigration. The Ceylon Tamils and Ceylon Moors have declined in proportion because of a smaller natural increase than the Sinhalese. The Veddas have been mostly absorbed into other races. The Malays have more or less remained constant in proportion.

**Growth Rate of the Races**

The growth rate of the races between the years 1911 and 1946 are shown below in Table 3.

### TABLE 3—GROWTH RATE OF THE RACES, 1911–1946

| Race | Growth Rate (per cent) 1911–1946 |
|---|---|
| Low-country Sinhalese | 69·05 |
| Kandyan Sinhalese | 72·05 |
| Ceylon Tamils | 38·95 |
| Indian Tamils | 47·01 |

| Race | Growth Rate (per cent) 1911–46 |
|------|------|
| Ceylon Moors | 59·71 |
| Indian Moors | 0·86 |
| Burghers and Eurasians | 57·24 |
| Malays | 73·27 |
| Europeans | 28·64 |
| All races | 47·99 |

The high growth rates shown here for the Malays and the Kandyans may be partly due to the greater degree of under-enumeration amongst them in 1911, when they were rather backward compared to other races.

## Age Structure of the Races

A study of the age-structure of the population is important, because it enables us to surmise the trend in population growth and the relative change in the mortality, fertility and migration trends.

Table 4 shows the percentage distribution of the males and females of different races in the age groups 0–9 years, 10–59 years and 60 years and over.

### Table 4—Percentage Distribution of the Population of Ceylon by Races and Three Age Groups

| Race | Males 1911 | | | Males 1946 | | |
|------|------------|---|---|------------|---|---|
| | 0–9 years | 10–59 years | 60 years and over | 0–9 years | 10–59 years | 60 years and over |
| Low-country Sinhalese | 30 | 64 | 6 | 24 | 70 | 6 |
| Kandyan Sinhalese | 31 | 65 | 4 | 27 | 68 | 5 |
| Ceylon Tamils | 28 | 67 | 5 | 22 | 72 | 6 |
| Indian Tamils | 15 | 83 | 2 | 23 | 74 | 3 |
| Ceylon Moors | 32 | 64 | 4 | 25 | 70 | 5 |
| Indian Moors | 8 | 86 | 6 | 6 | 91 | 3 |
| Burghers and Eurasians | 27 | 67 | 4 | 22 | 72 | 6 |

| Race | Females 1911 | | | Females 1946 | | |
|------|--------------|---|---|--------------|---|---|
| Low-country Sinhalese | 31 | 64 | 5 | 25 | 69 | 6 |
| Kandyan Sinhalese | 32 | 64 | 4 | 29 | 67 | 4 |
| Ceylon Tamils | 28 | 67 | 5 | 24 | 70 | 6 |
| Indian Tamils | 20 | 79 | 1 | 29 | 69 | 2 |
| Ceylon Moors | 32 | 64 | 4 | 27 | 67 | 6 |
| Indian Moors | 23 | 72 | 5 | 28 | 67 | 7 |
| Burghers and Eurasians | 26 | 69 | 4 | 22 | 71 | 7 |
| Malays | 34 | 62 | 4 | 28 | 67 | 5 |

Source : Computed from the Census Reports.

Changes in the fertility and mortality, as shown by changes in these proportions, may be quite obscured by changes deriving from migratory movements. Attention may therefore be concentrated on the indigenous races for whom migration is at a minimum.

In all the indigenous races the 0–9 years age group has declined relative to the groups 10–59 years and 60 years and above. In the absence of other factors, this could be taken as an indication that the population is ageing, due to a decline in fertility, mortality, or both. Ageing of a population may result from mortality declining combined with a decline in fertility, or fertility remaining constant or even rising provided the rate was not too great relative to the decline in mortality. We will see later that there has been a slight decline in fertility for all the races due to a rise in the age of first marriages. Thus the ageing of the population can be regarded as the result of both declining fertility and mortality.

We may further note that the rise in the proportion in the age group 10–59 years has been generally greater than that of the age group 60 years and above and greater for males than for females. The former may be due to the generation factor, i.e. to the fact that health and mortality conditions are carried by a generation with it as it grows older, so that as health conditions improve and mortality declines the younger generations benefit more than the older. In other words, the mortality of the younger age groups declines more rapidly than the older age groups.

Under this hypothesis—of generation mortality—no doubt a decline in mortality at the older ages will be observed when those who experienced the better health service in their youth at last penetrate to the older ages.

Comparing the change in the populations of males with that of females we notice that, in the age groups 0–9 years and 60 years and above, both the sexes show about equal change. In the age group 10–59 years, however, males show a marked superiority over females, suggesting a slower improvement in female mortality in this age period.

### Marriages

Statistics of conjugal condition of the races are available for all census years except 1931 and 1946. Table 5 gives the proportion of ever-married to total population in the two age groups, 15–20 years and 45–54 years. The proportion for the other age groups will be found in Table 18 at the end of this chapter.

TABLE 5—PER CENT OF EVER-MARRIED TO TOTAL POPULATION :
AGE 15–19 YEARS AND 45–54 YEARS

| | Males | | | | Females | | | |
| | 15–19 years | | 45–54 years | | 15–19 years | | 45–54 years | |
| Race | 1901 | 1921 | 1901 | 1921 | 1901 | 1921 | 1901 | 1921 |
|---|---|---|---|---|---|---|---|---|
| Low-country Sinhalese | 3·6 | 0·1 | 83·8 | 86·2 | 38·2 | 13·6 | 86·0 | 90•0 |
| Kandyan Sinhalese | 8·1 | 1·6 | 85·1 | 85·4 | 41·3 | 31·0 | 91·6 | 92•9 |
| Ceylon Tamil * | 2·2 | 1·8 | 96·3 | 96·0 | 41·3 | 38·6 | 97·4 | 94•4 |
| Indian Tamil * | 4·4 | 3·2 | 91·8 | 93·9 | 45·6 | 44·1 | 96·2 | 97·3 |

| Race | Males | | | | Females | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | 15–19 *years* | | 45–54 *years* | | 15–19 *years* | | 45–54 *years* | |
| | 1901 | 1921 | 1901 | 1921 | 1901 | 1921 | 1901 | 1921 |
| Ceylon Moors* | 3·2 | 2·8 | 96·7 | 96·7 | 70·3 | 64·9 | 97·5 | 99·0 |
| Indian Moors* | 4·7 | 2·7 | 94·5 | 95·9 | 65·7 | 60·6 | 94·9 | 97·9 |
| Burghers | 1·4 | 0·7 | 89·8 | 82·8 | 20·5 | 9·0 | 88·6 | 83·6 |
| Malays | 8·3 | 2·4 | 96·4 | 96·3 | 77·4 | 42·1 | 99·9 | 98·1 |

*Source :* Compiled from the Census Reports.

\* 1911 and 1921 figures.   Classification first introduced in 1911.

During the periods covered by the table, all the races show a decline in the proportion ever-married in the age group 15–19 years, and generally more so in the case of females than males.   But the proportion in the higher age groups show little change.   This leads us to conclude that the age at first marriage has been raised for all races, though the universality of marriage at some stage or other in their life has remained almost unchanged.

## Fertility of the Races

In view of the substantial differences between the age structure of the various races, especially of the immigrating races, crude birth rates do not reflect even approximately, the trend in fertility.   For example, the European and the Indian races have a large proportion of males in the working age groups, giving the crude birth rate a downward bias.   Since the age of mothers at child-birth is not available, we are not able to compute age-specific birth rates and the gross and net reproduction rates.   The total fertility rate, i.e. the ratio of births to the number of women of reproductive age, say when 15 and 45 years, gives us a fair approximation which is sufficient for comparative purposes.   The total fertility rates of the races are given in Table 6.

TABLE 6—TOTAL FERTILITY RATES OF THE RACES

| Race | 1910–12 | 1920–22 | 1945–47 |
| --- | --- | --- | --- |
| Sinhalese Low-country and Kandyan | ·187 | ·184 | ·176 |
| Tamils | ·136 | ·157 | ·173 |
| Ceylon Tamils | — | — | ·158 |
| Indian Tamils | — | — | ·188 |
| Moors | ·139 | ·178 | ·192 |
| Ceylon Moors | — | — | ·190 |
| Indian Moors | — | — | ·262 |
| Burghers | ·133 | ·143 | ·127 |
| Malays | ·188 | ·235 | ·208 |
| Europeans | ·087 | ·088 | ·119 |

*Source :* Compiled from the Census Reports and Vital Statistics Reports which give detailed classification of births by races in 1945.

The contrary fertility trends of the Sinhalese on the one hand and the Tamils and the Moors on the other should be noted. The Tamils and Moors contain a large element of immigrant Indians who, in the early years, came to Ceylon for short periods to work in the estates. The expectant mothers among these immigrants would be left behind in India to give birth to their children there. These mothers often returned for temporary work in the estate leaving their children behind. The low fertility of the Tamils and Moors during 1910–12 and 1920–22 is attributable to this, rather than to a lower fertility. By 1945–47 this type of temporary migration was considerably reduced and many workers settled permanently in the estates. The births of Indian Tamils in Ceylon thus increased.

The classification of births of the Indian races was shown separately from only 1945–47. Comparing the fertility rates of the indigenous races for this period, the rate was highest among the Ceylon Moors and lowest among the Ceylon Tamils. Incidentally, the proportion of female literacy among the Ceylon Tamils is highest and Ceylon Moors lowest. Female education, if it does nothing else, at least raises the age of marriage of girls and therefore has a tendency to lower the fertility rate.

In view of the greater extent of under-registration of births in the earlier years, the trend of fertility shown by Table 6 may be incorrect. It is necessary, therefore, to marshal other evidences before arriving at any definite conclusion. An alternative measure of fertility may be obtained by computing the ratios of children under 5 years of age to women of reproductive age.

TABLE 7—RATIO OF CHILDREN OF 0–4 YEARS TO WOMEN OF AGE 15–45 YEARS

| Race | 1911 | 1946 | Difference |
|---|---|---|---|
| Low-country Sinhalese | 0·76 | 0·55 | —0·21 |
| Kandyan Sinhalese | 0·80 | 0·67 | —0·13 |
| Ceylon Tamils | 0·64 | 0·51 | —0·13 |
| Indian Tamils | 0·37 | 0·78 | +0·41 |
| Ceylon Moors | 0·75 | 0·62 | +0·13 |
| Indian Moors | 0·50 | 0·76 | +0·26 |
| Malays | 0·77 | 0·65 | —0·11 |
| Burghers | 0·56 | 0·47 | —0·09 |
| Europeans | 0·30 | 0·27 | —0·03 |

*Source :* Compiled from Census Reports.

The apparent rising trend of Indian races is spurious for the reasons previously mentioned. All the other races show a decline in fertility. The actual decline would have been greater but for the declining mortality of children during this period.

It is interesting to note that marital fertility, i.e. the ratio of births to the number of married women of age 15–45 years, shows an opposite trend to that of Table 7.

TABLE 8—MARITAL FERTILITY

| Race | 1901 | 1911 | 1921 |
|---|---|---|---|
| Sinhalese | 0·31 | 0·30 | 0·32 |
| Tamils | ·17 | ·19 | ·22 |
| Moors | ·24 | ·19 | ·32 |
| Malays | ·20 | ·32 | ·46 |
| Burghers | ·24 | ·27 | ·38 |
| Europeans | ·21 | ·16 | ·15 |

*Source :* Compiled from the Census Reports and the Registrar-General's Reports.

Table 8 shows a rising trend during 1901 to 1921, in fertility of married women of all races except the Europeans.

The decline in fertility of all women and the rise in fertility of married women can occur only when the proportion of women aged 15–45 who are married, is declining, in this case because the age of first marriage is rising.

## Mortality of the Races

The age-specific death rates of the races are given in Table 9. The figures in this table suffer from under-registration of deaths, under-enumeration of population and mis-statement of age. The first two errors are partially compensating. They cannot therefore be expected to give a correct measure, but as general indicators of differential racial mortality they have some value.

TABLE 9—AGE AND SEX SPECIFIC DEATH RATES OF THE RACES

| Age | | Males | | | | | | | | | | Females | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Races | | 0— | 5– | 10– | 15– | 20– | 25– | 35– | 45– | 55– | 60— | 0– | 5– | 10– | 15– | 20– | 25– | 35– | 45– | 55– | 60+ |
| Sinhalese | 1910–12 | 79 | 14 | 7 | 10 | 11 | 11 | 20 | 29 | 41 | 124 | 87 | 16 | 9 | 11 | 16 | 19 | 21 | 25 | 48 | 163 |
| | 1945–47 | 55 | 7 | 3 | 4 | 7 | 8 | 11 | 17 | 27 | 87 | 59 | 8 | 3 | 5 | 10 | 11 | 11 | 14 | 23 | 91 |
| Tamils | 1910–12 | 105 | 16 | 13 | 16 | 17 | 18 | 27 | 42 | 61 | 160 | 100 | 18 | 15 | 14 | 19 | 28 | 33 | 37 | 63 | 186 |
| | 1945–47 | 57 | 5 | 3 | 4 | 5 | 6 | 10 | 16 | 31 | 114 | 57 | 5 | 4 | 6 | 10 | 11 | 12 | 15 | 32 | 128 |
| Moors | 1910–12 | 71 | 11 | 7 | 9 | 11 | 12 | 20 | 33 | 45 | 113 | 88 | 12 | 8 | 14 | 18 | 19 | 21 | 27 | 50 | 162 |
| | 1945–47 | 61 | 7 | 4 | 6 | 6 | 7 | 12 | 24 | 39 | 114 | 74 | 7 | 4 | 10 | 15 | 14 | 15 | 18 | 30 | 113 |
| Malays | 1910–12 | 98 | 13 | 5 | 13 | 10 | 11 | 18 | 18 | 35 | 128 | 97 | 6 | 10 | 19 | 14 | 19 | 18 | 17 | 36 | 202 |
| | 1945–47 | 58 | 6 | 4 | 3 | 7 | 7 | 9 | 18 | 40 | 128 | 57 | 6 | 5 | 5 | 5 | 10 | 13 | 10 | 19 | 89 |
| Burghers and | 1910–12 | 73 | 6 | 5 | 7 | 11 | 11 | 16 | 20 | 39 | 97 | 71 | 8 | 5 | 7 | 10 | 13 | 15 | 15 | 16 | 132 |
| Eurasians | 1945–47 | 33 | 4 | 1 | 3 | 3 | 5 | 7 | 20 | 41 | 94 | 31 | 4 | 2 | 2 | 5 | 7 | 7 | 12 | 24 | 81 |

*Sources :* Computed from the Census Reports and the Registrar-General's Reports.

Table 9 shows that the Tamils who had the highest death rates in 1911, made rapid progress and now rank at about the same level as the Sinhalese. The Moors now have the highest death rates among the various races and the Burghers the lowest. The mortality of children under 5 years of age and of women of reproductive age, is high among all races and highest among the Moors. It should be noted in this connection that the age at first marriage is also lowest among them.

The infant mortality rates of the races are given below :

### TABLE 10—INFANT MORTALITY RATES OF THE RACES

| Race | 1910–12 | 1945–47 |
|---|---|---|
| Sinhalese | 190 | 124 |
| Tamils | 229 | 130 |
| Moors | 237 | 143 |
| Malays | 262 | 113 |
| Burghers | 182 | 76 |
| Europeans | 86 | 44 |
| All races | 202 | 127 |

*Source :* Compiled from Registrar-General's Reports.

Here the greatest progress is marked by the Malays and the Tamils and the least by the Moors.


## Maternal Mortality

In maternal mortality also, greatest progress is shown by the Malays and the Tamils, the Moors lagging far behind the others.

### TABLE 11—MATERNAL MORTALITY OF THE RACES

| Race | 1912 | 1947 |
|---|---|---|
| Sinhalese | 22·3 | 10·5 |
| Tamils | 25·0 | 9·7 |
| Moors | 28·6 | 15·4 |
| Malays | 25·9 | 4·8 |
| Burghers | 15·6 | 7·5 |
| Europeans | 22·5 | 0 |
| All races | 23·3 | 10·6 |

*Source :* Compiled from the Registrar-General's Reports.

Infant mortality and maternal mortality are comparatively sensitive indices of the social progress made by any community. Judged by this standard the Moors

appear to be the most backward of the races.   This high infant and maternal mortality of the Moors is not altogether unrelated to the similar high proportions of female illiteracy and early marriage amongst them.

## Location of the Races

One of the factors that perpetuates the racial distinctions in Ceylon and prevent their amalgamation, is the distinct geographical location of the races.   The southern and the south-western districts of Ceylon are inhabited by the low-country Sinhalese ; the Kandyans are concentrated in the central districts, and the Moors in the south-eastern and eastern districts.   For example, according to the 1946 Census, Chilaw, Colombo, Kalutara, Matara, Galle and Hambantota Districts account for 87·59 per cent of the low-country Sinhalese.   96·15 per cent of the Kandyan Sinhalese are accounted for in the districts of Kandy, Kurunegala, Badulla, Ratnapura, Kegalla, Matale, Nuwara Eliya and Anuradhapura.   The Indian Tamils are generally concentrated in the estate districts of Colombo, Kalutara, Kandy, Matale, Nuwara Eliya, Badulla, Ratnapura and Kegalla.   The largest concentration of the Ceylon Moors is to be found in the Batticaloa, Kandy and Colombo districts which account for about 52 per cent of them.   About 56 per cent of the Ceylon Tamils live in Jaffna District and 14 per cent in Batticaloa.   Indian Moors, who are mostly traders, have about half of their number in the Colombo District alone.   69 per cent of the Burghers and Eurasians live in the Colombo District.   The Colombo District is also the home of about 59 per cent of the Malays.

## Urbanisation of the Races

The proportion of the races who live in municipal and urban council areas are given below :

TABLE 12—PROPORTIONS OF RACES LIVING IN URBAN COUNCIL AND MUNICIPAL COUNCIL AREAS, 1946

| Race | Per cent |
|---|---|
| Low-country Sinhalese | 18·00 |
| Kandyan Sinhalese | 3·76 |
| Ceylon Tamils | 19·30 |
| Indian Tamils | 9·54 |
| Ceylon Moors | 28·67 |
| Indian Moors | 64·33 |
| Malays | 74·67 |
| Burghers | 77·80 |

*Source :* Census Report, 1946.

Malays and Burghers, who are mostly government and mercantile emp loyees show greatest urbanisation because of their profession.   This is true also of Indian

Moors who are mostly traders. The remaining races are mostly peasants and agricultural workers and are, therefore, rural.


## Religion

The principal religions in Ceylon are Buddhism, Hinduism, Mohammadanism and Christianity. The proportions of the adherents of these religions are given below.

TABLE 13—PERCENTAGE DISTRIBUTION OF THE POPULATION OF CEYLON BY RELIGION
1881–1946

| Religion | 1881 | 1891 | 1901 | 1911 | 1921 | 1946 |
|---|---|---|---|---|---|---|
| Buddhists | 61·59 | 62·40 | 60·05 | 60·25 | 61·57 | 64·51 |
| Hindus | 21·51 | 20·48 | 23·19 | 22·85 | 21·83 | 19·83 |
| Mohammadans | 7·17 | 7·05 | 6·90 | 6·91 | 6·72 | 6·56 |
| Christians | 9·71 | 10·04 | 9·79 | 9·96 | 9·86 | 9·06 |
| Others | 0·02 | 0·03 | 0·07 | 0·03 | 0·02 | 0·04 |
| | 100 | 100 | 100 | 100 | 100 | 100 |

*Source :* The Census Reports.

Until 1911, all the religious communities more or less maintained their positions relative to each other. Since 1911, however, Buddhism seems to be forging ahead of all the others. The Hindus, who consist of most of the Ceylon Tamils and the immigrant Indians, show a decline, perhaps not so much from conversion into other religions, as to the lower fertility and higher mortality of the Tamils, shown above, and also, due to the decline of the Indian immigration. The Muslims, mostly Moors lost ground because of their greater mortality. Christianity suffered a set-back with the resurgence of nationalism and lost many of its converts to the indigenous religious groups.


## Race and Religion

The religions, except Christianity, are closely related to race. For example, 98·91 per cent of the Buddhists are Sinhalese ; 97·59 per cent of the Hindus are Tamils ; 96·94 per cent of the Muslims are Moors and Malays. Among the Christians 57·25

per cent are Kandyans, 20·11 per cent are Ceylon Tamils and 10·47 per cent are Indian Tamils. Table 14 shows the percentage distribution of the races by religion.

TABLE 14—PERCENTAGE DISTRIBUTION OF THE RACES BY RELIGION 1946

| Religion | Race | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Low-country Sinhalese | Kandyan Sinhalese | Ceylon Tamils | Indian Tamils | Ceylon Moors | Indian Moors | Malays | Bur-ghers |
| Buddhists | 87·90 | 98·77 | 2·61 | 2·27 | 1·00 | 0·02 | 2·35 | 2·77 |
| Hindus | 0·10 | — | 80·59 | 89·33 | — | 3·03 | 3·34 | 0·01 |
| Muslims | 0·01 | — | — | — | 98·67 | 95·23 | 92·02 | 0·01 |
| Christians | 11·90 | 1·03 | 16·54 | 8·09 | 0·33 | 1·74 | 2·16 | 95·92 |
| Others | 0·09 | 0·23 | 02·6 | 0·31 | | | 0·13 | 1·29 |
| | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Source : Compiled from the Census Report, 1946.

Religion has thus become closely associated with race and both are integrated together into the cultural values of the people. In consequence, the rise of nationalism has also seen the rise of religious consciousness.

**Literacy**

The proportions of literates during 1881–1946 are given in Table 15.

TABLE 15—PERCENTAGE OF LITERATES TO TOTAL POPULATION OF AGE 5 YEARS AND OVER,   1881–1946

| Year | Per cent Literates | | | Average Annual increase | | |
|---|---|---|---|---|---|---|
| | Persons | Male | Female | Persons | Male | Female |
| 1881 | 17·4 | 29·8 | 3·18 | — | — | — |
| 1891 | 21·7 | 36·1 | 5·3 | 0·43 | 0·61 | 0·22 |
| 1901 | 26·4 | 42·0 | 8·5 | ·47 | ·59 | ·32 |
| 1911 | 31·0 | 47·2 | 12·5 | ·46 | ·52 | ·40 |
| 1921 | 39·0 | 56·4 | 21·2 | ·80 | ·92 | ·87 |
| 1946 | 57·8 | 70·1 | 43·8 | ·75 | ·55 | ·90 |

Source : Computed from the Census Reports.

The progress in literacy became really significant only after 1911 when the rate of increase was almost doubled. This was also the period of great nationalist and religious revival, when large numbers of Buddhist and Hindu schools were opened

14—J. N. B 59926 (10/56)

and began to compete with the Christian Mission schools which had monopolised the field for so long. Female education, which was negligible before 1911, began to acquire some significance in national life. Female education is a factor that has an important implication in the field of demography and population growth, and on the future well-being of the country. The rise in the age of marriage, and the consequent decline in fertility, for instance, derives from the spread of female education. But more important is the change in attitudes and values that is likely to follow from it. The process will be quickened if women enter into professions and industrial employment and take a share in the productive effort of the country.

### Literacy of the Races

Table 16 shows the percentage of literates of the races during 1911 and 1946. Unfortunately the 1946 Census classifies the Indian Tamils and Ceylon Tamils together and thus prevents comparison of the growth of literacy among these two races. It is known that the Ceylon Tamils have a much higher literacy than the Indian Tamils.[1] Similarly the Indian Moors, who have a much higher literacy than the Ceylon Moors, have been classified together.

TABLE 16—PERCENTAGE OF LITERATES OF THE RACES IN CEYLON, 1911–1946

| Race | Males | | Females | |
|---|---|---|---|---|
| | 1911 | 1946 | 1911 | 1946 |
| Low-country Sinhalese | 47·8 ⎤ | 72·6 | 17·5 ⎤ | 48·1 |
| Kandyan Sinhalese | 36·5 ⎦ | | 2·8 ⎦ | |
| Ceylon Tamils | 46·7 ⎤ | 62·9 | 11·2 ⎤ | 33·8 |
| Indian Tamils | 34·1 ⎦ | | 5·4 ⎦ | |
| Ceylon Moors | 31·7 ⎤ | 66·5 | 2·6 ⎤ | 22·6 |
| Indian Moors | 53·7 ⎦ | | 1·5 ⎦ | |
| Malays | 52·5 | 69·1 | 13·4 | 54·3 |
| Burghers and Eurasians | 69·7 | 86·8 | 67·5 | 82·1 |

*Source :* Compiled from the Census Reports.

It will be observed that the Ceylon Moors have the lowest and the Burghers the highest proportion of literates.

The term literacy as defined in the censuses is, however, ambiguous and may not represent the true state of affairs with regard to literacy. A better estimate of the contemporary position with regard to literacy can be obtained from a table of student

[1] Sir Ivor Jennings, *ibid*, p. 219.

population of age 5–24 years that has been published in the Census Report of 1946, Vol. IV. The proportions of persons of age 5–24 years who are students has been deduced from this table and given in Table 17.

TABLE 17—PERCENTAGE OF STUDENTS IN THE POPULATION OF AGE 5–24 YEARS
1946

| Race | Males | Females |
|------|-------|---------|
| Low-country Sinhalese | 54·3 | 57·4 |
| Kandyan Sinhalese | 32·1 | 27·3 |
| Ceylon Tamils | 43·5 | 39·6 |
| Indian Tamils | 15·8 | 13·5 |
| Ceylon Moors | 37·2 | 30·8 |
| Indian Moors | 9·7 | 2·6 |
| Burghers and Eurasians | 63·0 | 60·0 |
| Malays | 53·4 | 51·1 |
| Europeans | 40·2 | 38·4 |
| All Races | 41·4 | 41·0 |

*Source :* Compiled from Census of Ceylon, 1946, Vol. IV.

Table 17 shows the position of the races in the process of becoming literate, and has greater significance than the literate figures given in the previous tables. It shows the deplorable situation in which the Indian Tamils, who are mostly estate workers, are placed so far as education is concerned. The ratio is also low among the Indian Moors, not because they lack interest in education but because a proportion of their children are educated privately at home by " Moulvis ", and secondly, because they take up apprenticeship in their ancestral business very early in life. The Ceylon Moors are seen here to be taking big strides to catch up the others and to have passed the Kandyan Sinhalese already.

Indeed Ceylon is passing through a revolution in education which has affected all the indigenous races. The number of schools has increased with leaps and bounds since the war; and the number of pupils, both male and female, has increased even more. Education has been made free from the primary to the university stage. How far the government will be able to maintain the free system of education in the future, in the absence of any substantial expansion of the economy of the country, is doubtful. Even if it is short lived, it will have served its purpose in starting the ball rolling and bringing about a rapid change in the social outlook which will be of great demographic and social significance in the future.

## Conclusion

Race-consciousness, is thus a reality in Ceylon and modifies the demographic and economic characteristics of the groups considerably. The progressive content of racialism is often overlooked and misunderstood and it is condemned as

" communalism ", parochial narrowness, &c., which prevents the growth of a single national consciousness. In India a similar mistake was made by the Congress leaders when they failed to see the element of nationalism in the Moslem demand for more jobs, greater share in trade, and, finally, in an independent state of their own. They condemned the demand of the Moslems as communalism and tried to defeat and suppress it in direct struggle. The national enthusiasm of the Moslems was fanned by this opposition, as all nationalisms generally did, until they succeeded in carving out a state for themselves.

In Ceylon, nationalism expressed itself in the form of racialism for the simple reason that races were the immediate largest group with which an individual could easily identify himself in order to obtain the self-expression that he desired. Nationalism did not express itself through caste consciousness because the caste was too small a group to attract attention and to make its influence felt in political and social matters. Thus the growth of the national spirit saw the weakening of caste-consciousness and growth of race-consciousness.

It was logical to expect the racial consciousness to give way to national consciousness as its next stage of development. This, however, has not yet occurred except in the minds of a small section of the intelligentsia. The upper classes who alone obtained the benefit of English education, imbibed a spirit of nationalism, and demanded a greater share in administration. They appealed to the masses in terms of racialism, because racialism was a language which the masses more readily understood[1].

Unfortunately the races were not on an equal footing in English education. The Ceylon Tamils had the advantage of an earlier start, through the educational efforts of the missionaries. Even today the proportion of English educated is higher among the Tamils than among the Sinhalese. Thus, by the time the Sinhalese achieved education on any scale, they found but few opportunities for advancement still open. This resulted in a certain degree of inter-racial rivalry and prevented the growth of a single, monolithic national consciousness.

Yet the racial rivalry did not develop to the bitter struggle for power, as it did in India among the Hindus and the Moslems. The main reason for the spirit of toleration and accommodation that one finds in Ceylon, in spite of the under-current of racial rivalry, is mainly the consequence of the better economic conditions and relative prosperity that has followed the development of plantations in Ceylon. The economic situation that the races were faced with was not so desperate as that of Indian religious communities, and every one in Ceylon could afford to be generous to a point.

The second reason for the mildness of the racial rivalry was the smallness of the groups. In spite of the inter-racial rivalry, it was realised that no single group could exist independent of the others. This feeling created an accommodating spirit and a desire to compromise on the part of all groups.

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[1] " The bourgeois leaders of the different communities while apprehensive for their own share of the spoils of freedom, naturally cloaked their fears in the garb of racial appeal." I. D. S. Weerawardana, *ibid*, p. 37.

Thirdly, in spite of linguistic and religious differences and differences in location, the two principal races, namely, the Tamils and the Sinhalese, had lived together for centuries and had deeply influenced each other in shaping their cultural pattern. Their religion, language, customs and manners have much in common.

These were the factors that held the races together in Ceylon in the most crucial period of their history, despite their many differences. The common task of running the government and facing unsheltered, the adversities of the world, the spread of education and the increase in the power of understanding, a fair and generous treatment of the minority races and a quicker economic and cultural development of the country as a whole and the backward areas in particular, these may help the mutation of the race-consciousness into a united national consciousness in the future.

### TABLE 18—PERCENTAGES OF EVER-MARRIED BY AGE-GROUPS AND RACES

| Males Age Group | Low-country Sinhalese | | Kandyan Sinhalese | | Ceylon Tamils | | Indian Tamils | | Ceylon Moors | | Indian Moors | | Malays | | Burghers and Eurasians | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1901 | 1921 | 1901 | 1921 | 1911 | 1921 | 1911 | 1921 | 1911 | 1921 | 1911 | 1921 | 1801 | 1921 | 1901 | 1911 |
| 15– | 3·62 | 0·05 | 8·12 | 1·55 | 2·19 | 1·83 | 44·27 | 32·05 | 3·23 | 2·76 | 4·72 | 2·70 | 8·30 | 2·41 | 1·43 | 0·67 |
| 20– | 27·30 | 10·93 | 43·52 | 23·77 | 29·72 | 25·05 | 27·60 | 23·80 | 30·68 | 26·24 | 33·52 | 26·81 | 48·13 | 21·01 | 25·17 | 13·03 |
| 25– | 62·33 | 52·02 | 71·37 | 63·10 | 75·22 | 74·91 | 66·25 | 66·63 | 76·71 | 76·23 | 74·07 | 73·17 | 78·22 | 67·00 | 64·81 | 59·33 |
| 55– | 79·86 | 79·50 | 85·30 | 79·88 | 92·88 | 93·68 | 87·27 | 89·07 | 92·80 | 94·04 | 92·76 | 96·65 | 90·01 | 89·03 | 85·95 | 82·75 |
| 45– | 83·82 | 86·22 | 85·14 | 85·40 | 96·25 | 95·98 | 90·76 | 93·85 | 96·00 | 96·73 | 94·52 | 95·94 | 96·44 | 96·32 | 89·78 | 87·16 |
| 55+ | 87·52 | 88·82 | 87·91 | 88·97 | 96·64 | 96·53 | 92·43 | 94·24 | 97·19 | 97·30 | 96·39 | 96·83 | 95·02 | 95·71 | 90·62 | 88·83 |
| **Females Age Group** | | | | | | | | | | | | | | | | |
| 15– | 38·25 | 13·57 | 56·95 | 31·04 | 41·30 | 38·62 | 45·56 | 44·07 | 70·38 | 64·85 | 65·59 | 60·57 | 77·42 | 42·11 | 20·48 | 9·00 |
| 20– | 71·06 | 56·92 | 78·82 | 69·62 | 83·29 | 83·49 | 82·07 | 84·31 | 93·04 | 91·60 | 80·00 | 90·89 | 93·84 | 85·24 | 56·69 | 44·92 |
| 25– | 80·24 | 80·47 | 84·47 | 82·25 | 94·42 | 95·22 | 91·57 | 92·96 | 97·04 | 97·19 | 90·18 | 95·85 | 99·88 | 97·49 | 77·24 | 70·50 |
| 35– | 83·42 | 87·34 | 88·93 | 89·07 | 96·37 | 97·03 | 94·72 | 95·75 | 97·50 | 98·45 | 97·34 | 97·23 | 99·86 | 99·47 | 85·14 | 82·52 |
| 45– | 85·99 | 89·93 | 91·63 | 92·88 | 97·41 | 97·37 | 96·23 | 97·27 | 98·45 | 99·02 | 94·94 | 97·91 | 99·86 | 98·09 | 88·56 | 83·57 |
| 55+ | 87·06 | 91·70 | 97·60 | 94·91 | 97·33 | 97·35 | 96·51 | 97·15 | 98·15 | 98·64 | 98·40 | 98·10 | 99·88 | 99·70 | 88·67 | 85·01 |

*Source :* Compiled from the Census Reports.

## CHAPTER 10*

## THE ECONOMIC BACKGROUND

CEYLON is an agricultural country *par excellence,* yet the statistical data available relating to agriculture are far from satisfactory. This is not surprising, if we remember that the conduct of a population census is far easier than collecting agricultural statistics. Elsewhere I have discussed more fully the defects in the agricultural statistics of Ceylon [1]. It will suffice to repeat here the main sources and major limitations of agricultural statistics.

The oldest source is the Blue Books, where the crop acreage and the yield is given from 1826 until the present time. The figures shown in the Blue Books are very inaccurate, though they may indicate generally the trend.

The first attempt to conduct an agricultural census was made in 1901, but did not meet with success. Accurate figures for crop acreage were first compiled in 1921. In 1924 and 1929 partial crop censuses were conducted. The 1946 census also collected crop acreage and some other information about agriculture.

The administration reports of a number of departments, such as the Coconut Commissioner, the Rubber Commissioner, the Tea Commissioner, and the Internal Purchase Scheme, include the crop acreage figures for recent years. The method of compilation of these figures is not known and their accuracy may be doubted.

Occupational statistics have been collected at all the censuses, but the classification and the form of presentation have been changed frequently, so that they fail to provide a sequence of comparable figures from which the trend may be seen. Compilation of occupational statistics is not an easy matter, even in industrially advanced countries where the occupations are more clearly demarcated. In agricultural countries, with a high proportion of the population dependent on the land, the difficulties are multiplied by the absence of any well-defined occupation for a large section of the population. The 1901 Census Report states, "The tabulation and compilation of the occupation statistics was a work of almost inconceivable difficulty. It took up more time and labour and occasioned more trouble and anxiety than the work connected with any other of the census statistics. It was, indeed as the Census Commissioner of England and Wales has reported "The most laborious, the most costly, and after all, perhaps, the least satisfactory part of the Census".[2] The Census Report of 1921 states, "The great variety of different occupations, the difficulty of framing an unexceptionable classification of them, and of obtaining sufficiently precise information, either from the enumerator or the householder to enable specific occupations to be located in the classification, make the tabulation of the occupations a work of great complication and the results are, in most countries, probably subject to considerable error ".[3]

[1] N. K. Sarkar " Agricultural Statistics in Ceylon " *University of Ceylon Review,* 1949, pp. 129—134.

[2] Census of Ceylon, 1901, Vol. 1, Part I, p. 187.

[3] Census of Ceylon, 1921, Vol. 1, Part I, p. 72.

*Note.*—* Sections of this Chapter and also of Chapters 12 & 13 were originally published in an article in *Population Studies,* March, 1956. They are reproduced here with the permission of the Editor.

In spite of these weaknesses, a picture of the economic situation can be drawn with the help of these statistics and the descriptive materials available, which, though not accurate in detail, will yet provide a sufficiently clear outline of its broad features.

## The Expanding and The Decaying Industries

The source of strength and vitality of the ancient civilisation of Ceylon was based on her rice economy which depended on an ingenious and intricate system of irrigation works. The successive Tamil invasions from South India and the internal strife of political aspirants, disorganised and destroyed this irrigation system. Between the thirteenth and the nineteenth centuries until Britain conquered her, the history of the country had been one of uninterrupted decay.

It was from a strategic consideration that Britain conquered the country rather than from any economic motive. Geographically Ceylon was located centrally as a vital link between the East and the West.

It was not long before the British capitalists realised the potential of Ceylon as a profitable field of investment.[1] The kingdom of Kandy was annexed in 1815,[2] and Governor Barnes opened up his coffee plantation in Kandy in 1825.

In the early stages land was available free of cost; later a nominal charge of 5s was made. The greatest difficulty was labour and transport. The labour shortage was met by importing South Indian Tamil labour. Lack of roads was found to be less easy to overcome. The Kandy district where coffee flourished had been for so long a rice producing self-sufficient area with little use for roads and transport, indeed the needs of defence were better served if transport and communication were as difficult as possible.[3] The planters were able to grow large quantities of coffee at low cost, but the cost of transport was found to be prohibitive.[4] Roads became the crucial issue for the survival of the first experimental plantations and for further extension of British investments in Ceylon.

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[1] See the letter of Sir Alexander Johnston written to Sir Graves C. Haughton, M.A., F.R.S., Honorary Secretary to the Royal Asiatic Society, December 31, 1831, quoted in Chapter 2.

[2] When Kandy was annexed it could not have been realised that this would be the main centre of British investment. The surplus of rice was undoutedly the chief temptation, especially after experiencing the devastating famine of 1812–13. "The aquisition of the Candian country, and a free intercourse between the natives of the old and the new territory will be of infinite advantage to both parties, but more so to the former, in this particular ; for we know that the interior of the island produces already more rice than the natives of it can consume and that it is capable of producing much more". Anthony Bertolaccai, *ibid.* p. 200.

[3] See Knox. Historical Relations &c. 1681, p. 5.

[4] *Extracts of Letters from Ceylon on Courtship, Marriage &c. with a Peep into Jungle Life.* Published by J. & D. A. Darling, London, 1848, pp. 88–89.

The income of the government was barely enough to meet the routine expenditure of administration, and little was left for undertaking expensive public works. Governor Barnes and the subsequent administrators solved this difficulty by using the ancient system of service tenure to build the roads for the planters.[1]

The service tenure required the Sinhalese land-holders to work without pay on some form or other of public works, such as work in the royal household, in temples or on the building or maintenance of irrigation works. The period and the nature of the service depended on caste and status and, in exchange they enjoyed the tenancy to their land.[2] These services were tolerated by the Sinhalese, as military services and taxes are in modern states. Building roads for the planters, whom they had no reason to regard with particular favour, was not one of these accepted categories of service. Moreover, the ancient services were graded in such a way that no one was required to perform duties which militated against their caste dignity. In building roads no heed could be paid to caste scruples, and both high and low caste were required to work together. The system thus led to great discontent and, on the recommendation of the Colebrook Commission, was abolished in 1832. " It had, however, lasted long enough to enable a great deal of development to be made at a time when the reserves of the country would not have sufficed to pay for voluntary paid labour ".[3]

Once the problem of transport was solved and labour was obtained from South India, the growth of the plantation economy was spectacular as Table 1 shows.

TABLE 1—AREA UNDER ESTATES

| Year | Acres ('000) |
|------|--------------|
| 1857 | 81 |
| 1871 | 196 |
| 1881 | 321 |
| 1891 | 334 |
| 1901 | 460 |
| 1911 | 975 |
| 1921 | 1,093 |
| 1946 | 1,500 |

*Soures :* Ferguson's Ceylon Directory for the figures for 1857–1921 ; 1946 figures from Agricultural Census Reports.

[1] Sir Charles Collins, c.m.g., *Public Administration in Ceylon*, 1951, p. 55.
[2] Sydney D. Bailey, *Ceylon*, 1942, p. 35.
[3] Sir Charles Collins, *ibid*, p. 64.

The area of rice-cultivation, on which depended the vast majority of the native population, remained more or less stationary at a level of some 600,000 acres.

TABLE 2—AREA UNDER RICE-CULTIVATION

| Year | Acres ('000) |
|------|------|
| 1865 | 600 |
| 1875 | 564 |
| 1885 | 604 |
| 1895 | 650 |
| 1901 | 670 |
| 1910 | 678 |
| 1921 | 798 |
| 1946 | 621 |

*Source :* For 1865–1921 from Blue Books ; 1946 figures from census reports.

The figures in Table 2 cannot be regarded as very accurate, but are adequate to show that, considering the rise in population, rice cultivation has been a decaying industry. The vigour and expansion shown by the plantation industries was altogether lacking in rice production, little attention was paid to irrigation, the very life and soul of rice cultivation. An irrigation department was not even established until 1900,[1] and progress in irrigation was halting and extremely slow until recently.

The more important demographic problems facing Ceylon today are the result of the co-existence of these two systems of agriculture—the highly organised capitalistic plantation economy, and the primitive peasant economy—which are, more often than not, in competition. It is necessary, therefore, to subject these two systems to a closer analysis and to observe their interaction.

**Social Effects of Plantation Economy**

In the wake of plantation capital flowed British capital into the other enterprises in the country, helping to produce certain modernising effects on the economy and the cultural pattern of the country. For example, railways and roads were built and extended, the Colombo harbour was improved ; banks, insurance and commercial firms opened branches in Ceylon and played the role of a useful auxiliary to the plantation economy.

The plantation industry led to an increase in the number of Europeans, Eurasians and Indians, directly as employees and employers in the plantations, and indirectly in other commercial, banking and shipping firms. Thus the development of plantations was responsible for the increase of foreigners in the population, creating and accentuating the racial problems in the country.

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[1] Sir Charles Collins, *ibid.* p. 104.

The plantation industry led to a rise in income, not only of those directly participating in it, but, indirectly, to many others ; for example, the owners and employees of the exporting, importing and other commercial firms, banks, insurance companies &c. whose volume of trade and therefore of profits, increased with every increase in the output of the plantations. The government revenue also increased from the export and import duties, income tax and other taxes, and the field of governmental activity expanded leading to a rise in the number of government employees. Thus the large volume of investment in plantation industries generated, both directly and indirectly through the multiplier effects, an era of prosperity, in which some of the indigenous population also shared.

Once the country was opened up by British capital, a small number of the indigenous races took the opportunity to invest their own capital in developing plantations. A middle class thus grew in Ceylon quick to adopt the ways of the English and to educate their children in English schools.[1] The middle class intelligentsia was thus born and growing in number and wealth, they became politically vocal. It was through their agitation and intervention that the welfare activities of the government were gradually expanded.

One important direction in which the welfare activities of the state were directed, was the medical and sanitary services, through whose continuous efforts the death rate declined from 40 to 11 in the course of the last fifty years.

Meanwhile increasing education, especially among the females, led to a change in the cultural outlook in many directions, one of which was a rise in the age of first marriages. Fertility as a result showed a small decline till the recent marriage boom. The decline in mortality was, however, so much greater than in fertility that a rapid increase in population resulted.

Not many of the native population had the good fortune to share directly in the economic benefits introduced by the plantation economy. Most natives obtained some indirect benefit, but the price they had to pay was not small.

The vast majority of the native population were dependent on rice cultivation. With the on-rush of the plantation economy, this peasant sector was pushed into a neglected corner and left to decay for over a hundred and twenty-five years. Finally, when the scarcity of food directed attention to it, the damage done by the blind expansion of the plantations was found to be beyond repair.

The foundation of the ancient system of rice cultivation was based on the irrigation works and great care and attention was paid to water conservation. The system of irrigation and water conservation was constructed in such a way that the topography and the climate of the country was fully utilised for the purpose. The cap of dense forest at higher altitudes received the heavy monsoon rains, which then flowed

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[1] " The natives in the towns are rapidly adopting European habits, and many send their children to England for education or to take rank as Barristers, Physicians, and clergymen. " *The Ceylon Directory : Calendar and Compendium of Useful Information for* 1866–68. A. M. Ferguson, Colombo, p. 8.

down the slopes, often in underground streams, and were stored in tanks for the purpose of irrigation.[1] The forests of the hills thus played a vital role in the whole system, helping the rainfall and retention of water, preventing soil erosion and silting of the tanks. The plantations struck at this vital link of the system, destroyed most of the forests, altered the climate and rainfall and created a difficult problem from soil erosion and silting up of the irrigation tanks, canals and rivers.[2] There is now little chance of reviving the ancient irrigation system to its full stature, unless some of the plantations, particularly those in the catchment areas, are closed and reafforestation is undertaken. Some of the tanks which have been brought back into use even partially, are not receiving sufficient water to fill them, and are not sustaining cultivation of as large an area of land as they did in days gone by. This is one basic conflict between the rice-economy of the peasant sector and the plantation economy.

A second field of conflict is to be found in the conversion of rice lands into plantations, especially coconut and rubber plantations. Here the old history of higher capitalistic concerns destroying the small producer is seen to be repeated. Many of the rice lands of the peasants passed into the hands of the planters of coconut and rubber. The small peasants were uprooted and, in the absence of another occupation to which they could turn, were pressed into the remaining portion of the paddy lands.

Meanwhile the wealth generated in the plantation sector made the middle classes richer, sometimes directly because of their ownership of estate property, sometimes indirectly through commerce, trade, and employment in the government. Those who were able, thus, to gain access to the stream of wealth generated by the plantation economy, reinvested their enhanced capital, not only in plantation, but also in buying up rice fields from the peasants. These middle class rice-field owners, however, did not introduce capitalistic methods and superior techniques of production, but gave back the land to the peasants on a share-crop basis or annual rent. The number of landless peasantry was thus increased and added to the population pressure on land in the peasant sector.

The decline in the death rate and the consequent rise in population increased this pressure still more. The little land that was left to the peasants was divided and sub-divided with the passing of every generation ; the size of the plots became smaller

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[1] See R. L. Brohier : *Ancient Irrigation Systems of Ceylon*, Parts I, II and III. Government Press, Colombo.

[2] " There is little doubt that the serious effects of soil erosion have now reached the proportions of a major problem which this country will be soon called upon to face. The Report of the Soil Erosion Committee of 1931 has established this conclusively. The difficulties cannot be overcome merely by protective reservation of crown forests, for the reason that out of the area that should be so reserved, quite a small proportion only is at the disposal of the Government. With the exception of the Mahaveli-ganga, the rivers have their sources at an elevation of about 3,000 feet ; the bulk of the land adjoining these rivers belongs to private parties. For this unsatisfactory state of affairs the government has contributed not a little by the injudicious alienation of forests land for planting purposes." Sessional Paper XI, 1936, p. 5. See also Sessional Paper XVIII of 1951, p. 5.

[3] Dr. S. A. Wickramasinghe : *The Gal Oya Project and the Crisis of Agriculture*, p. 7.

and smaller and the holdings more and more fragmented. When the plots reached their limits of fragmentation, the peasants devised the *Kattamaru* and the *Tattumaru* systems of sharing the land among the co-owners. The land under the latter system was rotated as a whole, and under the former it was divided into as many shares as there were shareholders and the shares were rotated annually.

Thus, as the population pressure increased, the size of the plots became smaller and the technique became more inefficient and primitive, the plough, itself a primitive tool, gave place to a still more primitive tool, the mamoty or hoe.[1] The tenure system also became more and more complicated and a further hindrance to efficient production.

In this story of the increasing agony of the rice producer, the money lender and the trader did not fail to make their usual contribution. The " boutique " keeper (the shop keeper) and the " mudalaly " (the merchant) who combined the triple function of banker, buyer and seller to the peasants in one, thrived on the misfortune of the peasants by buying cheap, selling dear and lending at a high rate of interest.[2]

The social and economic forces that were released by the introduction of the dynamic capitalistic mode of agricultural production thus led to increasing population pressure on the peasant sector of the national economy and produced

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[1] The primitve nature of the technique used in cultivation can be seen from the table given below.

PADDY LAND CLASSIFIED BY METHOD OF CULTIVATION

| Method | Extent ('000 acres) |
|---|---|
| Mudding* | 100 |
| Ploughing | 365 |
| Mamoty | 146 |
| Mudding and ploughing | 52 |
| Mudding and mamoty | 37 |
| Ploughing and mamoty | 109 |
| Mudding, ploughing and mamoty | 25 |
| Tractor ploughing | 3 |
| Ploughing by tractor and buffaloes | 2 |
| Method not specified | 65 |

*Source :* The Census Report, 1946, Vol. 1, Part II, Table 71.

Note the insignificant amount cultivated by the tractor.

\* The water is allowed to stand on the plot of paddy field, the sides of which are raised a little by small clay walls. When the earth becomes soft, it is treaded over and converted into mud. The weeds are then cleared, and the seed-paddy is scattered in the soil thus prepared.

[2] Sessional Paper XVIII, 1951, p. 5 and Banking Commission Report, 1934, Sessional Paper XXII.

landlessness and impoverishment among the peasantry. On the other hand a rentier class was born, whose interest was limited to ownership and excluded the introduction of improved modes of production and management.

### Pressure of Population in the Peasant Sector

Thus the growth of population, the transference of land from the peasant sector to the plantation sector, the passing of ownership of peasant lands into the hands of middle classes, and the intrusion of the money-lenders and traders into the peasants' income, created and aggravated the problems of landlessness in the peasant sector.[1]

Every relevant measure shows clearly this increasing population pressure on the land. The simple, and commonly used, index of population per square mile, shown in Table 3, clearly indicates the increasing pressure.

TABLE 3—DENSITY PER SQUARE MILE OF LAND AREA

| Year | Population per square mile of net land area |
|------|---------------------------------------------|
| 1871 | 113 |
| 1881 | 122 |
| 1891 | 133 |
| 1901 | 161 |
| 1911 | 190 |
| 1921 | 212 |
| 1946 | 277 |

Note.—The corrected population is divided by the net land area of 25,036 square miles.

This is, however, a poor measure of population pressure on agricultural resources. Since the technique of cultivation has undergone very little change, a more satisfactory measure would be provided by relating the population dependent on the peasant sector to the land area cultivated in the sector, but this is prevented by lack of comparability in the occupational statistics shown in the census reports. For example, the 1946 census gives only the number of adults gainfully occupied, whilst the censuses of 1921, 1911 and 1901 show as a whole earners, adult or minor, and their dependents. The censuses of 1881 and 1891 showed all women and children who were not earners in a class of indefinite occupation.

We can, however, make an approximation to the population dependent on the peasant sector by equating it to the rural population. The majority of the rural population are undoubtedly dependent on agriculture, only a small section being dependent on trade, handicraft and other non-agricultural occupation. A measure

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[1] " Private capitalists began to buy up all available land and the villagers were unable to protect even their rights to the property which they owned. "
Sessional Paper XVIII, 1951, p. 12.

of population pressure on the agricultural land of the peasant sector cannot, therefore be provided with accuracy but the estimates shown in Table 4 will suffice to show the general trend.

TABLE 4—RURAL POPULATION PER ACRE OF NON-ESTATE CULTIVATED LAND

| Year | Total cultivated area | Estate Area | Peasant area | Rural Population |
|---|---|---|---|---|
| | ('000 acres) | ('000 acres) | ('000 acres) | ('000) |
| (1) | (2) | (3) | (4) | (5) |
| 1871 | 1,403 | 196 | 1,207 | 2,140 |
| 1881 | 2,506 | 321 | 2,185 | 2,479 |
| 1891 | 2,025 | 334 | 1,691 | 2,687 |
| 1901 | 2,248 | 460 | 1,788 | 3,158 |
| 1911 | 2,730 | 975 | 1,755 | 3,604 |
| 1921 | 2,829 | 1,093 | 1,736 | 3,918 |
| 1946 | 3,210 | 1,500 | 1,710 | 5,634 |

| Year | Estate Population | Population dependent on peasant sector | Ratio of rural population to Peasant area | |
|---|---|---|---|---|
| | ('000) | ('000) | pop. per acre | Index |
| (1) | (6) | (7) | (8) | (9) |
| 1871 | 124 | 2,016 | 1·67 | 161 |
| 1881 | 206 | 2,273 | 1·04 | 100 |
| 1891 | 262 | 2,425 | 1·43 | 138 |
| 1901 | 442 | 2,714 | 1·52 | 146 |
| 1911 | 513 | 3,091 | 1·76 | 169 |
| 1921 | 469 | 3,349 | 1·99 | 186 |
| 1946 | 851 | 4,783 | 2·80 | 269 |

Source : Col. (2) is obtained from the Blue Books and the 1921 and 1946 censuses.
        Col. (3) is obtained from the Ferguson's Ceylon Directory which compiled the data by direct enumeration.
        Col. (4) = Col. (2) — Col. (3).
        Col. (5) and (6) are obtained from the census reports.
        Col. (7) = Col. (5) — Col. (6).
        Col. (8) = Col. (7) ÷ Col. (4).

According to this Table the population pressure on the peasant sector during the last 75 years has more than doubled.

A second approximation to the trend in the population pressure on the peasant sector can be obtained by relating the rural population of the three original races of Ceylon (the Sinhalese, the Ceylon Tamils and the Ceylon Moors) to the cultivated land area in this sector. The other races are known to have interest only in the estates (Europeans and Indian Tamils) or are town dwellers (Europeans, Burghers,

Eurasians, Indian Moors and other Indians).[1] The ratio of the rural sections of these three races to the cultivated land in the peasant sector is given below in Table 5 and is computed in a similar way to that of Table 4.

TABLE 5—PROPORTION OF SINHALESE, CEYLON TAMILS AND CEYLON MOORS
RURAL POPULATION TO CULTIVATED LAND IN THE PEASANT SECTOR

| | | Rural | | | Ratio of Col. (4) to the cultivated land in the peasant sector given in Col. (4) of Table 4 |
|---|---|---|---|---|---|
| Year | Sinhalese | Ceylon Tamils | Ceylon Moors | Total | |
| | (1) | (2) | (3) | (4) | (5) |
| 1911 | 2,465 | 447 | 175 | 3,087 | 1·63 |
| 1921 | 2,657 | 437 | 188 | 3,282 | 1·86 |
| 1946 | 4,023 | 592 | 267 | 4,882 | 2·86 |

The density of population shown in Table 5 is much the same as that shown in Table 4.

Further indications of the increase in the pressure of population on the land is provided by two sets of sample surveys of villages—one during the years 1936–39 and the other during 1950.

The first set of village surveys was conducted by Prof. B. B. Das Gupta of Ceylon University.[2] The samples were selected by the " method of random sampling ", and formed about 1 per cent of the total number of villages of every district. Questionnaires and direct interviews to every household in the selected village was the method of investigation adopted. It is claimed by Prof. Das Gupta that the results obtained by the survey were accurate. The landlessness revealed by these surveys is given below :

TABLE 6—LANDLESSNESS IN VILLAGES

| District | Number of families surveyed | Number of families owning no land | Number of families owning under 1 acre | Number of families owning | |
|---|---|---|---|---|---|
| | | | | 1–5 acres | 5 acres and more |
| Chilaw | 340 | 181 | 89 | 52 | 18 |
| Puttalam | 173 | 89 | 28 | 43 | 13 |
| Matale | 692 | 262 | 142 | 228 | 59 |
| Kurunegala | 2,040 | 755 | 397 | 648 | 240 |
| Galle | 1,249 | 706 | 300 | 181 | 62 |
| Matara | 645 | 355 | 141 | 108 | 41 |
| Hambantota | 311 | 110 | 46 | 127 | 28 |
| | 5,450 | 2,458 | 1,143 | 1,387 | 461 |
| Per cent. | 100 | 45·09 | 20·99 | 25·45 | 8·47 |

*Source :* Compiled from Dr. B. B. Das Gupta's Rural Surveys.

[1] See Chapter 9—Race, Literacy and Religion, p. 190.
[2] Reports on the Economic Survey : Bulletins Nos. 5–14. Ministry of Labour, Industry and Commerce, 1937, Colombo.

" Land under 1 acre is generally not for agricultural purpose ; most often it is land where the house is built, with a back garden ". The extent of landlessness was thus 65 per cent. A condition leading Prof. Das Gupta to state " the Villager stands largely dispossessed in his own village ".

The second set of village surveys was conducted by the Department of Census and Statistics in 1950.[1] 108 villages with a population of 22,082 families were surveyed. " One village was selected from each Divisional Revenue Officer's division. The villages were purposely selected by the Divisional Revenue Officers as being representative of their divisions  . . . . The sample is sufficiently large to enable estimates to be made for the whole island with high precision ".[2]

This survey gives the percentage of families with no land at all as 38. Dr. Das Gupta's surveys give a percentage of 45. The difference is statistically significant, but the two samples are not exactly comparable. The first one was a random sample, while the second was a purposive one. It is not known what criterion of judgment the Divisional Revenue Officers used in selecting a representative village. In view of the political controversy that was raging at that time with regard to the achievement of the party in power, such a method of selection of the sample is to be highly deplored.[3]

Even so, if we take the families which have less than 1 acre to be landless for all practical purposes, the percentage of landlessness shown by this sample is 70·6. (In the 1936–39 sample it was 65 per cent.)

TABLE 7—OWNERSHIP OF LAND BY SIZE OF HOLDING

| Extent of land | Number of families | Per cent. |
| --- | --- | --- |
| No land | 8,314 | 37·7 |
| Less than 1 acre | 7,273 | 32·9 |
| 1–5 acres | 5,047 | 22·9 |
| 5 acres and over | 1,448 | 6·5 |
|  | 22,082 | 100 |

Source : Compiled from Sessional Paper XIII, 1952. p. 28.

The median size of holding according to this survey is 0·82 acres per agricultural family, 0·10 acre per non-agricultural family, and 0·29 for all families.

[1] Report on the Survey of Landlessness, S. P. XIII, 1952.

[2] Ibid, p. 1.

[3] N. K. Sarkar " The Budget Debate ", The Ceylon Economist, Vol. II, p. 51–52.

The 1946 Census gives the following average size of land ownership.

TABLE 8—AVERAGE SIZE OF LAND OWNERSHIP

| Class | Acres per holding |
|---|---|
| Paddy lands | 1·17 |
| Small–holdings (i.e. less than 20 acres) | 2·81 |
| B estates | 53·11 |
| A estates | 543·79 |

Source : Sessional Paper XIII, 1952, p. 28.

" An estate for census purposes, was defined as a holding which was 20 acres or more in extent, and was classified into ' A ' and ' B ' Classes—an ' A ' estate being regarded as one which employed ten or more resident labourers and had its census schedules filled up in English by the Superintendent or Person-in-Charge. The general enumerator was entrusted with the duty of filling up the schedules in respect of ' B ' estates. A ' small-holding ' was one which was below 20 acres in extent ".[1]

Additional evidence on the extent of the population pressure on land is available in the case of paddy cultivation. Paddy cultivation is the major occupation of the peasant sector and the size of paddy holdings thus provides a good guide to the concentration of population on land.

The 1946 Census Report gives the following distribution of paddy holdings.

TABLE 9—PADDY HOLDINGS

| Class | Number of holdings |
|---|---|
| Less than ½ acre | 242,690 |
| ½ acre and less than 1 acre | 253,823 |
| 1 ,, ,, ,, ,, 2 acres | 162,120 |
| 2 ,, ,, ,, ,, 5 ,, | 85,310 |
| 5 ,, ,, ,, ,, 10 ,, | 19,705 |
| 10 and over | 8,260 |
| | 771,908 |

| Median | 0·78 acres |
| Average | 1·17 acres |

Source : Sessional Paper XIII, 1952, p. 29.

This table gives the percentage of paddy holdings under 1 acre as 64·32. A holding was defined in the census " as a block of land on which there existed or

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[1] Census of Ceylon, 1946, Vol. I, Part 1, p. 251.

had previously existed any kind of cultivation,"[1] rather a different connotation of the term than that is generally in use.   In the sense in which it has been used in the Census of 1946, it merely indicates the extent of fragmentation of paddy lands. Table 8 nevertheless indicates the pressure of population on the land because it is this pressure which has led to fragmentation.

The pressure of population on paddy lands is also revealed in the results of a special investigation carried out by the Internal Purchase Scheme in 1946.   The distribution of paddy land ownership obtained by this investigation is given below.

TABLE 9A—PADDY LAND OWNERSHIP BY SIZE

| Class | | | | Number of Owners |
|---|---|---|---|---|
| Less than 2 acres | | | | 296,138 |
| 2 acres and less than | | 3 acres | | 55,469 |
| 3 | do. | 4 | do. | 25,423 |
| 4 | do. | 5 | do. | 16,582 |
| 5 | do. | 10 | do. | 12,104 |
| 10 | do. | 15 | do. | 5,255 |
| 15 | do. | 20 | do. | 2,637 |
| 20 | do. | 30 | do. | 1,658 |
| 30 | do. | 50 | do. | 735 |
| 50 and over | | | | 261 |
| | | | | 416,262 |

*Source :* Sessional Paper XIII, 1952, p. 38.

The Sessional Paper XIII of 1952 concludes, " The material reviewed in this report brings out forcibly the meagre extent of land possessed by the majority of the agricultural population and also the high percentage of the agricultural population which possesses no land whatsoever.[1]

It is believed by the Agricultural Department of the Government of Ceylon that 8 acres of land is adequate for a peasant family of 4 or 5 persons to produce an income which will ensure it a standard of living to which its members are accustomed.   It is under this belief that the government settles the colonists in new land with 5 acres of paddy land and three acres of high land.[2]   There is no statistical backing to this belief, which is, however, widespread both in the official circles and elsewhere. Assuming arbitrarily that this figure is overstated and that a family of 4 to 5 persons requires, not 8 but 5 acres of land for maintaining its traditional standard of living, then under the present methods of cultivation, the population that could be supported by the current land area of the peasant sector is 1,539,000.   The actual population

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[1] *Ibid*, p. 6.

[2] The Economic Development of Ceylon, p. 385, Sir Ivor Jennings " The General Report of the Census " *University of Ceylon Review*, 1950.

in the rural areas, exclusive of the estate population, is 4,783,000. Assuming 10 per cent of this population to be dependent on non-agricultural occupations, the surplus population in 1946 was 2,766,000 or, 615,000 families. The surplus families calculated in a similar way for earlier periods are shown in Table 10.

TABLE 10—ESTIMATED SURPLUS POPULATION IN THE PEASANT SECTOR

| Year | Cultivated area of the peasant sector | Number of persons supportable | Estimated rural population dependent on agriculture | Number of surplus | |
|---|---|---|---|---|---|
| | | | | Population | Families |
| | ('000 acres) | ('000) | ('000) | ('000) | ('000) |
| (1) | (2) | (3) | (4) | (5) | (6) |
| 1871 | 1,207 | 1,086 | 1,814 | 728 | 162 |
| 1881 | 2,185 | 1,967 | 2,046 | 79 | 18 |
| 1891 | 1,691 | 1,522 | 2,182 | 660 | 147 |
| 1901 | 1,788 | 1,609 | 2,443 | 834 | 185 |
| 1911 | 1,755 | 1,580 | 2,782 | 1,202 | 267 |
| 1921 | 1,736 | 1,562 | 3,014 | 1,452 | 323 |
| 1946 | 1,710 | 1,539 | 4,305 | 2,766 | 615 |

*Note.*—Col. (2) is obtained from Table 4.
 Col. (3) is obtained by assuming the minimum requirement of a family of 4–5 persons to be 5 acres.
 Col. (4) is obtained from Table 4 less 10 per cent.
 Col. (5)=Col. (4)–Col. (3).
 Col. (6)=Col. (5)÷4·5.

Table 10 brings out clearly the increasing pressure that is being exerted on the agricultural land in the peasant sector. The consequence of this fourfold increase in the number of surplus families on land during the period 1871–1946 has been, not only to reduce the share of employment and income of all, but also to bring about a qualitative deterioration in agriculture.

Those villages which were fortunate enough to have a plantation close by, obtained some relief in working in the plantations during the off season. In many cases in the wet zone, during years of boom, their earnings from the plantations were substantial and the fall in income in the peasant sector was often more than made good. During the years of depression, however, the suffering was unrelieved. In the dry zone there was no plantation or any alternative source of income, so that the deterioration in the economic position of the dry zone peasants was unchecked.[1] Generally speaking, " The villagers do not share much of this new wealth ", created by plantations.[2]

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[1] For a vivid description of the suffering of the peasants in the dry zone and the process of depopulation *see* Leonard Woolfe's realistic novel, *The Village in the Jungle*. First published in 1911.
[2] Das Gupta : *ibid.* Bulletin No. 11, p. 6.

The picture revealed here is by no means an exaggeration. P. Kandiah writes, " About 40 per cent of the population have no obvious occupation. They, it must be concluded, are forced on the land, without being either cultivators or workers. In other words, they are a burden on the land, a drag on its development." [1]

The Sessional Paper VII of 1937 says, "It remains substantially true that most villages of the wet zone have no further room for natural expansion. One consequence of this is that the village lands are being constantly subdivided into smaller holdings—so small that they cannot be worked economically, at any rate by the only methods which the villager understands.

" The pressure of population of land is becoming more and more severe. Landless villagers in the area of which we are speaking had until recent years, no difficulty in finding work on neighbouring tea and rubber plantations. But the advent of restriction and the policy of retrenchment adopted by most of the estates have greatly reduced this source of employment. [2]

The Kandyan Peasantry Commission reports " The wet zone is almost fully cultivated, a greater part of it consisting of plantations of over twenty acres in extent. The village area is comparatively densely populated. The villages are hemmed in on all sides by plantations and are found as a rule in a cluster at the bottom of the hills. Many tanks and ' pathanas ' which provided irrigation for the sowing of paddy, the main item of diet, have been partly silted up by soil erosion or absorbed by estates. The paddy area has not increased with the increase of population. The garden land available is not sufficient to meet other requirements. The spectacle is one of an expanding population and shrinking of land resources. The peasants are landless and the main problem is landlessness." [3]

The story of the destruction of peasant farming by capitalistic large scale production and the consequent suffering of the peasants is not new in the history of the world. What is most disconcerting is the fact that the capitalistic plantation economy also seems to have exhausted its original vitality and power of growth and is fast approaching a state of stagnation, so that the relief that the landless peasants could get from working in the neighbouring plantations is also vanishing. The acreage under plantation crops has increased only slightly since 1931. The output also shows little capacity to increase. For example, the prices of the exported articles, which are mostly plantation products, increased by 343·5 per cent during the period 1938–1950. Yet in spite of this great stimulus, the volume of export rose by 37·9 per cent only.

The position is still worse in the dry zone. " In the dry zone, apart from the Jaffna peninsula (where there is a plentiful supply of water underground) the deficient rainfall usually admits of only one cultivation season in the year. Thus there is chronic under-employment and, since the area of irrigable land is very limited, there are many

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[1] *Ceylon Economist*, Vol. I, No. 1, p. 37.

[2] *Ibid.* p. 11.

[3] Sessional Paper XVIII, 1951, p. 4.

landless men who have to depend for their livelihood on their chenas.[1]   The number of such landless men is said to be increasing.   Even in the irrigated areas crops are often ruined by drought, and it is hardly an exaggeration to say that the dry zone villager normally lives on the edge of destitution.   In a good year he can hold his own, in a bad year he starves."[2]

Kandiah says, " The picture of our agriculture is the simple one of inadequacy of cultivated land, of its continuing shrinkage in the face of an increasing population, of a resulting pressure on land which stands unrelieved either by extension of cultivated area, or by the movement of the population out of agriculture on to productive industry  .   .   .   .

" This fact is the core of our agricultural problem.   The other factors like primitive methods of production, absence of capital, fragmentation of cultivation, sub-division of holdings, low productivity of land, are largely a consequence, most often direct of this oppressive land hunger ".[3]

The vast number of rural proletariat who " have no obvious occupation" is the core of our demographic problem too.   The malnutrition that results under such a situation will some day or other inevitably break through the barricades built by the public health workers against death and disease.   So long as the economic situation remains as it is, so long as the plantation economy dominates the mind and thought of the people, and the peasant economy suffers a continual decay, so long can the low death rate of today be regarded as only a temporary victory.

## Colonisation Schemes

Efforts are being made in two directions to reduce this population pressure on the peasant sector.   The first is the so-called ' colonisation schemes ', the second is industrialisation.   The colonisation scheme consists in renovating some of the ruined ancient irrigation works, and making new ones, thereby reclaiming some of the land which is now forsaken.   A number of peasant families are then settled on this land, each family being given on the average 8 acres of land.   Some advance of capital and other facilities are also given to get them established on the land.

Not all of the colonisation schemes have met with success.   The main technical difficulty has been the scarcity of irrigation water.   The destruction of the forests in the catchment area, due to the opening up of plantations, have reduced the water supply and have led to soil erosion and quick silting of the tanks.[4]

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[1] *i.e.* temporary cultivation by clearing the forests, N.S.

[2] Sessional Paper, VII, 1937, p. 12.

[3] P. Kandiah, Land and Agriculture in Ceylon in *Ceylon Economist*.   Vol. 1, No. 2, p.169.

[4] The dangers of soil erosion, created by the opening up of the plantations, are listed by the Soil Erosion Committee as follows : " The devastating effects of soil erosion do not stop at internal destruction  .   .   .   .   water is removed rapidly instead of being temporarily detained  .   .   .   . in the flow of streams become irregular  .   .   .   .   chocking of irrigation channels and rivers, irrigation works destroyed by rush of water  .   .   .   .   agricultural works below the eroded land ruined by deposition of sand and silt  .   .   .   .   Damage to major and minor irrigation works .   .   .   .   silting of paddy fields and silting of tanks &c. "   Sessional Paper No. III, 1931.

A more fundamental difficulty to the colonisation schemes, as they are being carried out today, has been that, as a result of the small-holding settlement, the inefficient economy of the peasant sector has merely been transferred to the new soil. The problems that overwhelm the peasant economy have already begun to appear here and inevitable stagnation has followed.[1]

When we consider that there are still more than 3 million acres of cultivable land which is now mostly jungle, we realise the importance of colonisation as a means of relieving the population pressure on the peasant sector. Both the scale and the method of colonisation have been inadequate and defective so far, but that does not mean that the possibilities of colonisation as a solution to the problem of population and poverty have been exhausted.

If these 3 million acres are settled by the peasants, then the population pressure on the peasant sector would be immediately relieved. But taking a long range view, this would be merely a postponement of the issue. For, the factors that are responsible for the present crisis would still be there and will sooner or later produce the same situation. For example, the reproduction of the present-day village community in the new colony would necessarily imply the continuation of the same attitude towards marriage and fertility. The institutional factors responsible for high fertility will thus be replanted in the new area. What is more, the economic pressure which now acts to postpone marriage will be lessened. The consequence will be a rapid rise in population and population pressure on agricultural land once again.

The plea for large scale co-operative farming derives, therefore, not only from economic but from demographic consideration also. The ganging up of a large number of agricultural wage earners, that such co-operative large scale farming implies, has a much greater chance of altering the attitude and cultural pattern of the peasants, so that the small family and other urban traits may appear quickly.

### Industrialisation

The other escape from increasing population pressure lies in rapid industrial development. Ceylon has hardly any industry today, industries contributing a bare 5 per cent to her national output. Further, the major part of this 5 per cent is contributed by processing industries which can be regarded as adjuncts to agriculture rather than as industries proper.[2]

The obstacles to rapid industrialisation is scarcity of capital and trained labour. The sacrifice necessary to raise capital can be minimised, if foreign capital can be obtained,[3] but the political implications usually attached to foreign loans make them repugnant to the nationalistic sentiment of the people. In any case the political situation in South East Asia makes private capital investment from abroad unlikely. Greater reliance has to be placed therefore, on internal capital. The peasant sector

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[1] Sessional Paper VII, 1937, p. 17. Economic Development of Ceylon, pp. 30 and 390.
[2] Imogen Kannangara, " Industrial Production in Ceylon ", *Ceylon Today*, Vol. II, No. 9, p. 5.
[3] See Appendix.

cannot be expected to contribute the initial capital, though they may do so in effect once the process of rapid industrial development has started in earnest, by not increasing their consumption. The largest portion of the initial capital must come, therefore, from the plantation, the commercial and the employment sectors.

The importance, and the difficulty, of obtaining the initial capital for industrial development has been, perhaps, exaggerated.[1] The sterling-balances accumulated during the war years, have been almost exhausted in purchasing food and other consumption goods. A drastic reduction of foreign expenditure by utilising the machinery of exchange control and import control could still result in considerable saving of foreign exchange. The foreign currency reserves thus built up could be used to buy capital goods and the services of foreign skilled labour. Additional funds can be raised by more drastic taxation of higher incomes and by raising loans by issue of government guaranteed bonds. All these will necessarily involve a considerable lowering of the standard of living of the upper classes. A government closely associated with them and the plantation interests, and a people ignorant, apathetic, and resigned to their fate are the greatest institutional obstacles, rather than the scarcity of capital or trained labour, which prevent a quick solution to the economic and demographic problems of the country.[2]

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[1] See Maurice Dobb. Soviet Economic Development since 1917. Ragnar Nurkse, *Problems of Capital Formation in Under-developed Countries*, especially Chapter II and also my article in *Ceylon Economist*, Vol. I, pp. 315–321 and Vol. II, pp. 52–56.

[2] " Since . . . . it (i.e. ' tightening the belt in order to provide capital ') required a very strict limitation of personal consumption and the maintenance of a low standard of living, it is unlikely that the bourgeoisie which dominates Ceylon could or would apply the same policy." Sir Ivor Jennings, *The Economy of Ceylon*, 1951, p. 94.

1. The problem of finance is one of the stumbling blocks which delay the programme of rapid industrialisation of under-developed countries. The national income of these countries being small, raising capital in large amount presents great difficulty. We shall try to evaluate the relative merits of the different methods available for raising the necessary capital for financing industries.

2. Capital can be raised by one or more of the following methods :—

    A.  Internal Methods :   (i) Internal borrowing.

                                    (ii) Taxation.

                                      (iii) Forced saving.

    B.  External Method : External borrowing.

Each of the above methods has its subjective sacrifice or " real cost ". The gain from industrialisation will be measured by the increase in per capita income that may be effected by such a policy less the sacrifices involved. The increase in per capita income will depend on the marginal productivity of capital which may be taken to be independent of and unaffected by the method of raising capital. We can, therefore, assume the productivity of capital to be the same for any and every one of these methods. Their relative merits, therefore, depend on the relative sacrifices which will be necessary to raise capital. The methods whose marginal " cost " would be lower would be preferable to the methods whose marginal costs were higher. Thus a comparison of the subjective sacrifices involved in raising the capital by the various methods will enable us to determine their relative merits.

**Real Cost of Raising Capital**

3.1 In case of method (Ai), viz., internal borrowing, the money cost of raising capital is represented by the interest rate to be paid on the capital raised. Subjectively speaking, this money cost will represent the marginal time-preference or marginal waiting. Interest rate, thus, provides us with a money-measure of this subjective or real cost.

Let $x$ represent the levels of income and $u = f(x)$, represent the average utility of income. Let $\theta_1 u$ $(1 > \theta_1 > 0)$ measure the average time-preference, or the average subjective cost of raising a capital of a rupee at income level $x$. Evidently, the function $u = f(x)$, which we may call the income utility function, will be sloping downwards, positive and continuous. The marginal sacrifice of method (Ai) is, then :

$$\frac{d(\theta_1 u)}{dx} = R_1 = \text{Rate of interest} \quad . \quad . \quad . \quad (1)$$

3.2 In case of the second method (Aii), namely, taxation, we do not get any money measure of the subjective cost involved. If $u$ is the average utility of a rupee at income level $x$, then the subjective sacrifice of taking away the rupee would be $u = f(x)$.

But if we take the nation as a whole, then the subjective cost would be less than $u$. For, the rupee taken away by taxation is not lost to the nation (though it may appear to be so to the individual taxed) but is merely transferred to the state. The state, in its turn, can use the rupee in either of the following ways : (i) Spend the rupee in developing state enterprises ; (ii) give it free to private entrepreneurs as subsidy ; (iii) lend it to private entrepreneurs at market rate of interest ; or, (iv) at an interest rate lower than the market rate, in which case it is merely a combination of (ii) and (iii).

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[1] Reproduced from Indian Journal of Economics, July, 1948, with the permission of the editor.

Let $p$ be the average expected productivity of capital. Then the average cost of method (Aii) is :

$$u-p = \theta_2 u \text{ (say).}$$

The marginal cost of method (Aii) is, then,

$$\frac{du}{dx} - \frac{dp}{dx} = \frac{d(\theta_2 u)}{dx} \quad \ldots\ldots\ldots\ldots \quad (2)$$

But $\dfrac{dp}{dx}$ = marginal productivity of capital

= Interest rate $R_1$ (under conditions of equilibrium) ;

$$= \frac{d(\theta_1 u)}{dx}$$

$$\therefore \quad \frac{d(\theta_2 u)}{dx} = \frac{du}{dx} - \frac{d(\theta_1 u)}{dx}$$

$$= \frac{du}{dx} - R_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

3·3.  The actual value of $\theta_2 u$ and $\dfrac{d(\theta_2 u)}{dx}$ will depend on the tax-structure.  If the rupee

is taxed away from a richer man rather than from a poorer man, $\theta_2 u$ will be comparatively less. In an ideal tax system the marginal sacrifice of all citizens would be equal.

[Diagram I]
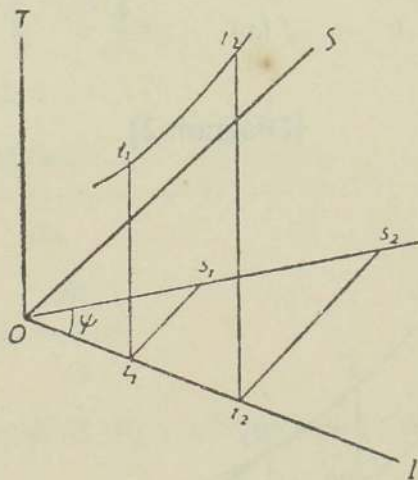


Thus, if the axis $OT$ in Diagram 1, measures the tax rate, the axis $OI$ the income-level and the axis $OS$ the corresponding sacrifices, then the curve, $t_1 t_2$ will measure the tax rate at different income levels $i_1, i_2$ and the curve $s_1 s_2$ the corresponding sacrifices.  In an ideal tax system, $t_1 t_2$ is such that—

$$\left[\frac{ds}{dI}\right]_{i_1} = \left[\frac{ds}{dI}\right]_{i_2} = \tan \psi = \text{constant}$$

$$\therefore \frac{d(\theta_2 u)}{dx} \text{ is least when } \frac{ds}{dI} \text{ is constant.}$$

4. Method (Aiii). For simplifying our analysis let us assume the society to be divided into two classes, the fixed income group and the variable income group. Forced saving results in transference of wealth, in general, from the fixed income group to the variable income group through the process of inflation. Suppose $u_a$ is the average utility of a rupee to the fixed income group and $u_b$ to the variable income group. Then the average subjective cost of method (Aiii) will be :

$$u_a - u_b = \theta_3 u \text{ (say)}, \quad \dots\dots\dots\dots\dots\dots (4)$$

where $u$ is the average utility of a rupee at the average income level of the entire community and is equal to

$$\frac{u_a + u_b}{2} = u$$

The marginal cost of method (Aiii) will be therefore,

$$\frac{d(ua)}{dx} - \frac{d(u_b)}{dx} = \frac{d(\theta_3 u)}{dx} \quad \dots\dots\dots\dots\dots (4a)$$

5. Method $B$, i.e. external borrowing : In case of external borrowing, the money measure of the cost of borrowing is the interest charges to be paid on foreign loans. Subjectively, it would mean the reduction in the real income, or, decrease in total utility of income necessitated by interest payment to foreigners. Thus if $u$ is the average utility per rupee at income level $x$, then the cost of foreign borrowing would be :

$$\frac{du}{dx} = f'(x) = R_2 \text{ (rate of interest)} \dots\dots\dots\dots\dots (5)$$

Thus we get four average cost functions corresponding to the four methods of raising capital, namely,

$$\theta_1 u = f_1(x)$$
$$\theta_2 u = f_2(x)$$
$$\theta_3 u = f_3(3)$$
$$\text{and} \quad u = f(x)$$

[Diagram 2]
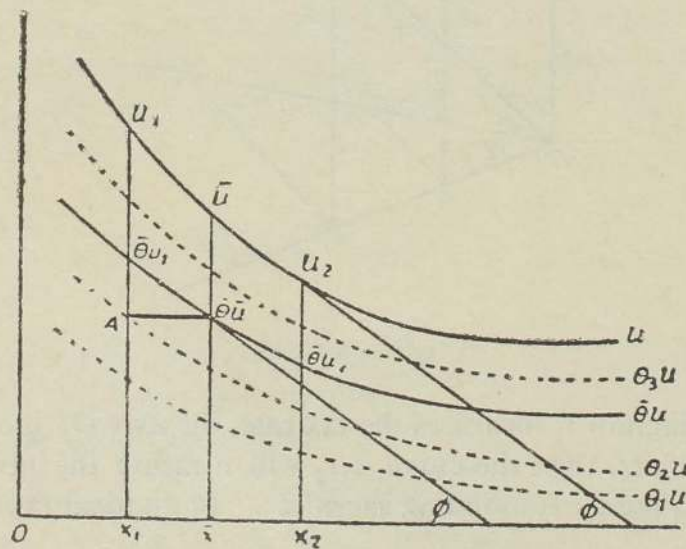


## Comparison of the Four Methods

6.1. We shall compare the internal methods as a whole with the external method first. The average of the average cost functions of the three internal methods would give us the average-cost

function of method (A). In order to avoid weighting let us assume all the three methods to be equally effective in raising funds. The average-cost function for method (A) is then :

$$\frac{\theta_1 u + \theta_2 u + \theta_3 u}{3} = \bar{\theta} u = F(x) \text{ say.}$$

where $\frac{1}{3}(\theta_1 + \theta_2 + \theta_3) = \bar{\theta}$

Now, $\theta_1$, $\theta_2$ and $\theta_3$ can all be taken to be constant, so long as taste and temperament remain constant. For $\theta_1$ depends on the ratio of time-preference to average utility and may be taken to be constant in short periods. $\theta_2 = \dfrac{u - p}{u}$ and $u = f(x)$ can be taken to be unaltered substantially and $p$ is taken as independent of the methods of raising capital. Therefore $\theta_2$ is also constant. $\theta_3 = \dfrac{u_a - u_b}{u}$ and $u_a$, $u_b$ and $u$ all will remain unchanged so long as taste and temperament remain unchanged. Therefore in short periods, $\theta_3$ can also be taken to be constant.

6·2. In order to find whether internal methods as a whole are more advantageous to external methods, we have to compare the two cost functions $F(x)$ and $f(x)$.

Now, suppose, the per capita income at the moment when industrialisation is started is $x_1$ and it rises after a period of industrialisation to $x_2$. If industrialisation is financed by internal methods, the cost has to be incurred at the beginning of the period when income is at $x_1$. The average cost of method (A) at this period will be :

$$\bar{\theta} u_1 = \left[ f(x) \right]_{x_1}$$

If industrialisation is financed by foreign borrowing, the interest payment is to be made at the end of the period when income-level is at $x_2$ ($x_2 > x_1$). The average cost of method (B) will be, therefore

$$u_2 = \left[ f(x) \right]_{x_2}$$

The marginal cost of method (A) is :

$$\frac{d(\bar{\theta} u_1)}{dx} = \bar{\theta} \frac{du_1}{dx}$$

The marginal cost of method (B) is $\dfrac{du_2}{dx}$

Therefore, external borrowing (method (B) ) will be more advantageous to internal methods so long as,

$$\bar{\theta} \frac{du_1}{dx} > \frac{du_2}{dx} \quad \cdot \ \cdot \ \cdot \ \cdot \ \cdot \ \cdot \ \cdot \quad (6)$$

Let $\bar{x}$ be a point such that,

$$\bar{\theta} \left[ \frac{du_1}{dx} \right]_{\bar{x}} = \frac{du_2}{dx} \quad \text{(See Diagram 2).}$$

$$\cdot \ \cdot \ \cdot \ \cdot \ \cdot \ \cdot \quad (7)$$

$$= \tan \varphi \text{ (say).}$$

Since the function $u = f(x)$ is sloping downwards and is continuous,

$$\bar{\theta}\,\frac{du}{dx} > \bar{\theta}\left[\frac{du}{dx}\right]_{\bar{x}}$$

for all values of $x < \bar{x}$ . . . . . (8)

$\therefore$  so long as the income-level does not rise above $\bar{x}$, it will be more advantageous to borrow from abroad than to raise the capital by internal methods.

The total net advantage of method (B) is given by :

$$-\int_{x_1}^{\bar{x}} \bar{\theta}\,\frac{du}{dx}\,dx$$

$$= -\bar{\theta}\int_{x_1}^{\bar{x}_1} \frac{du}{dx}\,dx$$

$$= -\bar{\theta}\int_{x_1}^{\bar{x}} du \;\backsimeq\; \bar{\theta}\,(u_1 - \bar{u})$$

$$\backsimeq \bar{\theta}\,u_1 A \quad \text{(see Diagram 2.)} \quad . \ . \ . \ . \quad (9)$$

The difference between $u_1$ and $\bar{u}$ will depend on the slope of the curve $u = f(x)$.  The greater is the slope, the greater would be the advantage of foreign loans.  The slope of the curve $u = f(x)$ would be greater for poorer countries than for richer countries.  Thus we conclude that *the poorer is the country the greater is the advantage of borrowing from abroad for industrial development as compared with internal methods of raising the capital.*

7·1.  Let us now compare the internal methods separately with the external method.  We have from equation (2),

$$\frac{du}{dx} - \frac{dp}{dx} = \frac{d(\theta_2 u)}{dx}$$

or  $$\frac{du}{dx} - \frac{d(\theta_1 u)}{dx} = \frac{d(\theta_2 u)}{dx} \ ... \ \text{since} \ \frac{dp}{dx} = \frac{d(\theta_1 u)}{dx}.$$

or,  $$\frac{du}{dx} - \theta_1\frac{du}{dx} = \theta_2\frac{du}{dx} \ ... \ \text{since} \ \theta_1 \ \text{and} \ \theta_2 \ \text{are constants}$$

$$\therefore \ \theta_1 + \theta_2 = 1 \ . \ . \ . \ . \ . \ . \ (10)$$

Now, if forced saving is not resorted to, the function $F(x)$ becomes,

$$\bar{\theta}u = F(x) = \frac{\theta_1 + \theta_2}{2}\,u = \tfrac{1}{2}u$$

$$\therefore \ \bar{\theta} = \tfrac{1}{2}$$

So that the condition given by (6) becomes,

$$\frac{1}{2}\frac{du}{dx} > \left[\frac{du}{dx}\right]_{x_2} \quad \ldots \ldots \ldots \quad (11)$$

In other words, so long as the marginal utility of income at $x_2$ (i.e. at the end of the period when interest payments are to be made) is less than half the marginal utility of income at $x_1$, foreign borrowing will be advantageous.

7·2.  If internal borrowing is alone taken resort to, then $\bar{\theta} = \theta_1$ and the required condition becomes :

$$\theta_1\frac{du}{dx} > \left[\frac{du}{dx}\right]_{x_2} \quad \ldots \ldots \ldots \quad (12)$$

In other words, so long as marginal time preference is greater than the marginal utility of income at $x_2$, foreign borrowing will be advantageous.

$$\text{But  marginal  time-preference} = \theta_1\frac{du}{dx}$$

$$= R_1$$

and,  marginal  utility  of  income  at  $x_2$

$$= \left[\frac{du}{dx}\right]_{x_2} = R_2$$

$\therefore$  The required condition becomes

$$R_1 > R_2$$

an obvious relation.

7·3.  If taxation alone is used to raise capital, then $\bar{\theta} = \theta_2$ and the condition becomes,

$$\theta_2\frac{du}{dx} > \left[\frac{du}{dx}\right]_{x_2}$$

$$\text{or, } (1 - \theta_1)\frac{du}{dx} > \left[\frac{du}{dx}\right]_{x_2}$$

$$\text{or, } \frac{du}{dx} > \left[\frac{du}{dx}\right]_{x_2} + \theta_1\frac{du}{dx}$$

$$\therefore \quad \frac{du}{dx} > (R_1 + R_2) \quad \ldots \ldots \quad (13)$$

In other words, the tax method will be more advantageous than foreign borrowing, so long as the marginal utility of income is less than the sum of internal and external rates of interest.   Thus

with high per capita income and high interest rates due to shyness of capital or other reasons, for example, tax method would be more advantageous.

8·1.   Let us now compare the relative merits of internal methods with respect to each other.

The marginal cost of method (Ai) $= \theta_1 \dfrac{du}{dx}$

The marginal cost of method (Aii) $= \theta_2 \dfrac{du}{dx}$

$\therefore$   method (Ai) will be more advantageous so long as,

$$\theta_1 \frac{du}{dx} < \theta_2 \frac{du}{dx}$$

or,   $\theta_1 < \theta_2$

But   $\theta_1 + \theta_2 = 1$

$\therefore$   if $\theta_1 > \frac{1}{2} > \theta_2$ the marginal cost of internal loan method would be greater than the marginal cost of taxation method, while the opposite is true if $\theta_1 < \frac{1}{2} < \theta_2$.   We have seen before, however, that

$$\theta_1 \frac{du}{dx} = \text{marginal time preference}$$

$$= \text{rate of interest}$$

Under conditions of equilibrium the rate of interest can be taken to be less than 50 per cent.

$$\therefore \ \theta_1 \frac{du}{dx} < \tfrac{1}{2}, \text{ in general,}$$

$$\therefore \ \theta_1 < \tfrac{1}{2} \text{ and } \theta_2 > \tfrac{1}{2}$$

In other words, the marginal cost of tax method will generally be higher than that of the loan method.

8·2.   We have, by relation (4),

$$\theta_3 u = u_a - u_b$$

But $u = \dfrac{u_a + u_b}{2}$

$$\therefore \ u = 2u - u_b$$

and $\theta_3 u = 2u - 2u_b = 2(u - u_b)$

$$\therefore \ \theta_3 \frac{du}{dx} = 2 \left\{ \frac{du}{dx} - \frac{du_b}{dx} \right\}$$

$$\text{Hence, } \theta_3 = 2 \left\{ 1 - \frac{\dfrac{du_b}{dx}}{\dfrac{du}{dx}} \right\}$$

$$\text{Let } \frac{du_b}{dx} \bigg/ \frac{du}{dx} = \frac{1}{\lambda} \text{ where } \lambda \text{ is the ratio of inequality of income.}$$

We have then,

$$\theta_3 = 2 \left( \theta_1 + \theta_2 - \frac{1}{\lambda} \right)$$

As inequality of income increases due to forced saving, $\lambda$, the ratio of inequality of income will become greater and greater and $1/\lambda$ will become smaller and smaller. So that in the limiting case,

$$\underset{Lt\frac{1}{\lambda}\to 0}{\theta_3} = 2 \left( \theta_1 + \theta_2 \right)$$

$$\therefore \ \theta_3 > \theta_1, \theta_2.$$

Thus if inequality of wealth and income is great the marginal cost of forced saving method will involve greater sacrifice than the other two methods.

8·3. It is often argued that if price-control is instituted along with creation of money, forced saving and inflation could be avoided. It is worth while to examine how far this contention is valid. Price control may be either universal or partial. That is, all prices including wages, rent, interest and commodity prices may be controlled ; or, prices of a few essential and important articles may be kept pegged. In case of universal price control, the newly created money may give employment to unemployed resources both human and material. But if they are already employed, the money will be ineffective, in the absence of a higher price stimulus, in diverting the resources from their existing employment into the desired channel. Hence new money can be effective only if there is unemployment, and secondly, if price control is partial. In the second case the new money will at once affect the prices of uncontrolled goods which will rise high. For, the new money will find its way into the pockets of the people as higher income. This increased money income will partly be spent on purchase of controlled goods, thus necessitating rationing sooner or later, and blocking the use of this increased income. Secondly the increased income may be spent on uncontrolled goods and/or in saving. If the former happens, the prices of uncontrolled goods will rise causing undesirable diversion of the resources into luxury and non-essential industries. In case of the latter, it will come back to the capitalists to be reinvested. Thus an inflationary spiral will be generated in either case leading to forced saving. Created money, however, will not have these effects, if there is considerable unemployment in the country.

### Conclusion

10·1. We can thus conclude that of the four methods of raising capital for financing industrial development, the least subjective sacrifice is needed if capital is borrowed from abroad, at least in the initial stages, when income is low and the marginal utility of income is high. The methods of internal borrowing, taxation and forced saving follow the external method in order of merit respectively.

10·2.   From the theoretical point of view, foreign borrowing may appear to be the best method of raising capital especially in poor countries.   But there are serious objections to foreign loans both economic and political.   Firstly the interest paid to foreigners go out of the country and, unless re-lent, cannot have a multiplier effect on the national economy.   Secondly, foreign loans borrowed by a weak country from a strong and wealthy country have many political and economic disadvantages.   It has been found, too often in the past, that such borrowing transforms the debtor-country into a clientele state of the creditor-country, so that it can no longer follow an independent political and economic policy of its own.   The borrower's economy develops under the influence of the foreign loan in a distorted and lopsided fashion and becomes an appendage to the economy of the lending country.   Great discretion is necessary, therefore, in borrowing and using foreign capital.

# THE FUTURE TREND IN POPULATION

WE have been considering, in the foregoing chapters, the trends of the various factors which determine population growth, such as marriages, births, deaths, migration and the economic situation. The light that has been thrown on the past behaviour of these variables may enable us to surmise the population trend in the future. We will, therefore, briefly recapitulate the conclusions drawn concerning the observed trend of these variables during the past years and try to assess their future possibilities.

## Marriages

The significant factors observed in the trend in marriages are—(1) a systematic rise in the age of first marriages. The mean age at marriage, the modal age at marriage, the age-specific marriage rates, the nuptiality tables, the proportion of ever-married both in the population as observed in the Censuses and also according to nuptiality tables—all support the conclusion that the age at first marriage has increased.

This rise in the age of first marriages, however, is not equal for all the races and for urban and rural population. Age at first marriage has risen more in those races which have a higher female literacy and which are more urban.

Furthermore, the improvement in the economic situation which followed the last great war, does not seem to have lowered the age of marriage in the age group below 20 years among the females and below 25 years among the males, though it has led to a rise in marriages in all other age groups (except the oldest age groups)[1]. These facts indicate a definite change in the attitude towards marriage. It is unlikely, therefore, that a further improvement in the economic position of the people will lead to the increase in the number of marriages in the lower age groups, though it may result in an increase of marriages in all other age groups. The spread of female education, and the increasing economic opportunity that may be made available to women, may lead not only to a rise in the age of marriage but also to fewer marriages.

## Mortality

Mortality has declined, at least since 1910. Since 1946, the decline has been more rapid.

The death rate of females and infants, however, has not recorded the same proportionate decline as other sex-age-groups. Since infant deaths constitute a large proportion of total deaths, an improvement in infant mortality would lead to a substantial improvement in the all-ages death rate. An improvement in maternal care and female education will lead to a decline in female and also infant mortality.

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[1] Prof. Bryce Ryan, however, believes that this rise in the age at first marriage is due to the difficulty of accumulating the dowry. Had it been the case, the age at marriage should have declined with the improvement of the economic situation since 1942. See Milbank Memorial Fund Quarterly, Oct., 1952, p. 366.

A survey of the public health problems, however, showed us the tenuous character of this improvement. Malnutrition was shown to be prevalent on a wide scale ; the high female and infant mortality, and the probable spread of tuberculosis, can largely be attributed to it. Malnutrition, however, is caused more by poverty than by ignorance. Here also, therefore, the future trend will be determined largely by economic factors.

## Fertility

We observed a declining trend in fertility till 1944, when a baby-boom occurred, following the marriage boom. The decline prior to 1945 was due to the rise in the age of first marriage and decline in the proportion married. The fertility within marriage did not show any clear trend, but, as far as could be seen, remained more or less constant. The fertility of urban women was found to be lower, both for all women and for married women, than that of rural females. The death rate and the conditions of health were also found to have a direct effect on fertility. It was suggested in this connection that some women might well exist at so low a level of nutrition as barely to be fecund.

The future trend of fertility will depend largely on the trend in the economic situation, what changes are brought about in it, and how it is brought about. For example, if an improvement in the economic condition of the people is brought about merely by extending the present types of economy, then the cultural values of the population will remain unaltered. The attitude towards marriage will, therefore, remain the same, while the ability to marry will rise. So that an increase in fertility will follow. Secondly, due to better nutrition and leisure and to the provision of better health services, the death rate will decline further. This will lead to a direct rise in fertility. Indirectly, it will mean a decrease in the dissolution of marriage by death, and therefore, larger number of children per married couple. Thirdly, females on the marginal level of fecundity (if such a group exists) will have a higher fecundity. Thus there would be an all round increase in fertility. That the 1946 baby boom was brought about by factors similar to these cannot be doubted. The high price for their produce that the peasants obtained led at once to a rise in marriages and fertility.

If the improvement in the economic situation is brought about in such a way that the cultural values are altered in the process, then instead of a rise in fertility, there may follow a decline. For example, economic condition may be improved by bringing about the long postponed industrial revolution in the country, so that a rapid development of industries and the resulting urbanisation of the population takes place quickly. In such circumstances, the attitude towards marriage is likely to be altered so that late marriage and fewer marriages may take place. The desire to rise in the social scale, or to attain a higher standard of material comfort, may lead to a postponement of marriage or even an abandonment of marriage. Industrialisation and urbanisation may lead to a greater spread of female education and the

opening of economic opportunities to women as an alternative to motherhood. These may not only lead to a decline in marriage but also to the spread of contraceptive practices and may thus add to the decline in fertility.

## Population Projection

The trends of these variables will, thus, be determined largely by the future economic situation. The future economic trend is, however, an extremely uncertain factor in all countries and much more so in Ceylon. In addition to the usual unpredictable economic variables, such as prices, costs, employment and the presence or absence of world depressions, &c., which are common to all countries, the question of success or failure and the tempo and scale of industrialisation introduces in Ceylon an additional element of uncertainty. Secondly the demographic variables in other countries are much more stabilised whilst in Ceylon they are in a transitional state. Ceylon is standing at a crossroad at present, so to speak, and it is impossible to predict in what direction her future development will lie. Population projections, which are regarded as conjectural even for countries such as Great Britain and the United States, would, therefore, be much more so for Ceylon. In the circumstances one may doubt the wisdom of making detailed and refined projections based on alternative assumptions with regard to mortality, fertility, marriages, &c., which have become almost routine for the demographers of the western countries. Nevertheless, some rough guide to the future population is necessary if an attempt is ever to be made to devise and apply an economic or demographic policy.

An easy and simple way of making such population projection is to assume the current growth rate to continue into the future. The estimates obtained on the assumption that the 1921–1946 growth rate will remain constant in the future are given below :

TABLE 1—FUTURE POPULATION OF CEYLON ESTIMATED ON THE BASIS OF CONSTANT POPULATION GROWTH RATE OF 1921–1946

| Year | Population ('000) |
|------|------------|
| 1951 | 7,614 |
| 1956 | 8,082 |
| 1961 | 8,579 |
| 1966 | 9,107 |
| 1971 | 9,667 |
| 1976 | 10,262 |

Such an overall population estimate, however, lacks the necessary detail for economic and social planning. For example, to plan for education an estimate of the future school population is necessary. Similarly, planning of employment,

medical service, level of consumption, needs of transport services, housing, &c. require estimates of the population by age groups. In order to obtain such an estimate by age group, we shall make the following assumptions :

(1) Mortality will continue to decline in an exponential trend, the rate of decline being derived from that observed in the period 1910–1947. That is to say, the terminal death rate $q_t$ of a specific sex-age group in year $t$ is given by—

$$q_t = ae^{-bt}$$

We may choose the origin of $t$ as 1946, when " $a$ " may be taken as the terminal death rate for 1945–47. " $b$ " will be chosen to reproduce the mortality trend of the period 1910–47.

(2) Fertility rates will continue to rise until 1951 on a linear trend through the rates of 1920 and 1947 ; thereafter, rates remaining constant until 1961 and subsequently declining on an exponential trend so that the age-specific fertility $F_t$ for an age group is given by—

$$F_t = Ae^{-Bt}$$

where $A$ is the age specific fertility rate of the age group for the years 1945–1947, and B will be chosen to reproduce the fertility trend of the period 1910 to 1921.

In making the projection we will ignore the migration factors which are likely to be of little consequence in the future.

The age and sex distribution obtained on the basis of these assumptions are shown in Table 3.

It must be remembered that the assumptions underlying this projection are somewhat arbitrary. In view of the uncertainty concerning the demographic and economic future of Ceylon, any assumption is bound to be so. The estimates are, therefore, intended only as a broad indication of the future population trend in Ceylon.

The total population obtained under these assumptions is shown in Table 2 (Projection 2) compared with that previously shown in Table 1 (Projection 1).[1]

TABLE 2—POPULATION PROJECTION FOR CEYLON : 1951–1976

| Year | Projection 1 | Projection 2 |
|------|--------------|--------------|
|      | ('000)       |              |
| 1951 | 7,614 | 8,199 |
| 1956 | 8,082 | 8,960 |
| 1961 | 8,579 | 9.813 |
| 1966 | 9,107 | 10,688 |
| 1971 | 9,667 | 11,546 |
| 1976 | 10,262 | 12,560 |

[1] A simple method of making a rough projection is to use the logistic curve. In the case of Ceylon, however, the logistic curve does not fit the data well, because of heavy immigration in the past. The projection given above are based on vital statistics and census data up to the year 1947.

## TABLE 3—POPULATION PROJECTION FOR CEYLON : 1951–1976

**Males :** ('000)

| Age Years | 1951 | 1956 | 1961 | 1966 | 1971 | 1976 |
|---|---|---|---|---|---|---|
| 0–4 | 674 | 742 | 803 | 835 | 862 | 967 |
| 5–9 | 535 | 572 | 630 | 652 | 679 | 701 |
| 10– | 441 | 496 | 552 | 602 | 633 | 659 |
| 15– | 425 | 431 | 440 | 532 | 584 | 613 |
| 20– | 405 | 410 | 416 | 527 | 513 | 551 |
| 25– | 325 | 352 | 378 | 380 | 385 | 497 |
| 30– | 291 | 317 | 344 | 369 | 371 | 374 |
| 35– | 256 | 278 | 302 | 328 | 352 | 357 |
| 40– | 230 | 247 | 268 | 291 | 316 | 340 |
| 45– | 192 | 215 | 230 | 250 | 272 | 295 |
| 50– | 160 | 187 | 209 | 225 | 244 | 267 |
| 55– | 108 | 138 | 161 | 181 | 194 | 211 |
| 60– | 81 | 95 | 121 | 141 | 159 | 171 |
| 65† | 138 | 158 | 185 | 227 | 276 | 326 |
| All ages | 4,261 | 4,638 | 5,039 | 5,440 | 5,840 | 6,329 |

**Females :** ('000)

| Age Years | 1951 | 1956 | 1961 | 1966 | 1971 | 1976 |
|---|---|---|---|---|---|---|
| 0–4 | 644 | 709 | 770 | 800 | 825 | 926 |
| 5–9 | 396 | 521 | 584 | 633 | 659 | 701 |
| 10– | 389 | 392 | 506 | 575 | 624 | 649 |
| 15– | 384 | 386 | 390 | 503 | 559 | 596 |
| 20– | 360 | 376 | 380 | 385 | 499 | 548 |
| 25– | 346 | 352 | 374 | 378 | 380 | 496 |
| 30– | 314 | 336 | 342 | 367 | 371 | 373 |
| 35– | 264 | 300 | 331 | 338 | 352 | 357 |
| 40– | 239 | 240 | 274 | 325 | 330 | 336 |
| 45– | 190 | 218 | 229 | 250 | 302 | 324 |
| 50– | 114 | 165 | 188 | 208 | 237 | 262 |
| 55– | 108 | 105 | 152 | 174 | 192 | 219 |
| 60– | 69 | 81 | 84 | 118 | 136 | 150 |
| 65† | 121 | 141 | 170 | 192 | 240 | 294 |
| All ages | 3,938 | 4,322 | 4,774 | 5,246 | 5,706 | 6,231 |
| Persons—All ages | 8,199 | 8,960 | 9,813 | 10,688 | 11,546 | 12,560 |

## The Growth Rate and the Age Structure of the Future Population

The percentage annual growth rate of the population according to the second projection is given below :

TABLE 4—PERCENTAGE ANNUAL GROWTH RATE OF PROJECTED POPULATION
(PROJECTION 2)

| Year | Per cent per Year |
|------|-------------------|
| 1946–1951 | 2·86 |
| 1951–1956 | 1·86 |
| 1956–1961 | 1·90 |
| 1961–1966 | 1·78 |
| 1966–1971 | 1.61 |
| 1971–1976 | 1·76 |

The projection produces a growth rate, showing a slightly declining trend. This decline, however, hides the high potentiality of the population in maintaining the growth rate, which is revealed by an examination of the age-structure of the population.

Table 5 shows the percentage distribution of the projected population in four age groups.

TABLE 5—PERCENTAGE DISTRIBUTION OF THE PROJECTED POPULATION BY
AGE-GROUPS

*Males*

| Age | 1951 | 1976 |
|-----|------|------|
| 0–4 years | 15·81 | 14·86 |
| 5–14 years | 22·91 | 21·67 |
| 15–64 years | 58·04 | 58·75 |
| 65 + years | 3·24 | 4·72 |
| | 100·00 | 100·00 |

*Females*

| Age | 1951 | 1976 |
|-----|------|------|
| 0–4 years | 16·35 | 15·28 |
| 5–14 years | 19·94 | 21·49 |
| 15–64 years | 60·64 | 58·08 |
| 65 + years | 3·07 | 5·15 |
| | 100·00 | 100·00 |

The proportion of the 0–4 year group is seen to show a small decline and the group 65+ years a rise in this table.  Thus according to this projection the burden of old age is likely to increase in the future.  This is likely to happen if mortality continues to decline, whatever the future population may be.  On the other hand, if fertility declines, the burden of young age is likely to fall.  This shift of the burden from the young age to the old age is not compensatory, but may involve a net loss.  For the burden of the young age is only a temporary burden and is better regarded as investment in future prosperity.  On the other hand  the expenditure on  old age has no direct return.  Indirectly, however, it may influence the incentives and wages of the workers and capital accumulation.

The proportion of the population of the school ages 5–14 years shows a small decline for males and a small rise for females.  In the working age groups of 15–64 years, the males show a constant proportion whilst the females show a small decline.  These changes are so small that they can be neglected.  Even if a higher decline in mortality and fertility is assumed, these proportions are likely to alter very little.  Thus Lorrimer's generalisation seems to be corroborated in the case of Ceylon that " the effects of a decline in mortality, without a decline in fertility, in accelerating the rate of population growth, may be reinforced over several decades by the persistence of a youthful age structure.  Under such conditions a considerable decline in fertility, though modifying the rate of increase that would otherwise result from a decline in mortality, may allow a continuation or even an acceleration of the initial rate of natural increase ".[1]  The age structure, thus, is likely to remain favourable to the maintaining of a high growth rate, whatever the mortality and/or fertility decline  may be.

The economic advantage that may be derived from such an age structure should not be overlooked.  Lorrimer calls the proportion in the age group 15–64  years an index of the efficiency of the age structure.  From this point of view the age structure of the population is likely to remain favourable to production as contrasted with consumption.  Since an able-bodied person can, given the opportunity, produce much more than he generally consumes, such an age structure consisting of a large proportion in the working age groups, has the potential power  of producing a large excess of wealth.  As we shall see later," giving the opportunity to work " is not an easy matter for Ceylon and requires a whole set of social and economic change.

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[1] Dr. F. Lorrimer : " Dynamics of age structure in a population with initially high fertility and mortality."  Population Bulletin No. 1, December, 1951.  United Nations, p. 41.

# ECONOMIC POLICY AND POPULATION POLICY

## Introduction

THE fact of greatest import in the field of demography and economics in Ceylon is the co-existence of unexploited resources side by side with unemployed and under-employed masses of humanity living below the poverty line. Whilst vast numbers are added to the population every year, the economic resources show little or no expansion. This unrelieved and rel entless population pressure on land not only depresses more and more the standard of living, but makes an escape from it increasingly difficult. If the population and economic trends continue to move in the directions in which they have been moving since 1921, an explosive situation can hardly be avoided in the near future. A situation similar to the present was experienced in Ceylon during the early years of the last century, when a population of one and a half million was reduced to one million by a severe famine and epidemics. The demographic situation of that period is described by Anthony Bertolacci as follows, " The state of the population, at this moment, is . . . far from prosperous ; for it has of late evidently increased so fast (owing, in my opinion, . . . to the introduction of vaccination), that it presses hard upon the means of subsistence ".

" In the northern parts of the island and in the districts of Matura, the population suffered considerably from the immediate effects of famine, and from those evils that are consequent upon it, namely, distempers occasioned by scarcity and unwholesome food. This has been the first very sensible check given to the extraordinary increase of population in Ceylon, brought about by the introduction of inoculation." [1]

During recent years the reduction of the death rate to the unprecedented level of 11 through the control of malaria and other diseases, has created once again the problem of population " pressing hard upon the means of subsistence ". Will the problem be solved as it was in 1812–13, or, can such a catastrophe be avoided ? It is not likely that a solution of the 1812–13 type will be accepted with the same resigned attitude today as it was then. The people of the present generation are more vocal and politically conscious and organised than the people of those days. The possibility exists, as Kingsley Davies puts it in the case of Indian Population, " that strife and turmoil, which at once reduce the existing demographic glut and sweep away old institutions and vested interests, will be the mechanism by which the present vicious circle will be broken ".[2]

The vicious circle mentioned here is the one of population and poverty perpetuating each other. An escape from it is imperative, not only because of the possibility

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[1] *A View of the Agricultural, Commercial and Financial Interests of Ceylon*, 1817, pp. 64 and 72.

[2] " Population and change in backward areas ", *Columbia Journal of International Affairs*, 1950, p. 48.

of the ultimate explosion, but also because of the waste that it involves in terms of human life and suffering and the drag that it exerts on economic and social progress.

## The Remedies

### (1) INFANTICIDE AND ABORTION

The oldest means of population control which were practised in many countries of the world are infanticide and abortion.[1] Infanticide was practised in Ceylon before the British conquest. The comments made to Sir John D'Oyly by a group of Buddhist priests are enlightening.

" The murder of children and exposure of children are said to have been at some period not infrequent, and they were committed chiefly by people of the poorest class, and upon one of the three following grounds :

First, if from more indigence and especially having a numerous offspring, the parents thought themselves incapable of maintaining them.

Second, if any child were supposed to be born under an evil star and hence to threaten misfortune to itself or to the family.

Third, if a child were the fruit of an illicit connection, which the mother was ashamed to own."[2]

Infanticide, because of its monstrous nature, has been banned in all countries. It is perhaps true to say that this custom has become obsolete today in all countries of the world. But not so with abortion. Though abortion is illegal in all countries, yet the frequency of illegal abortion cannot be regarded as insignificant. When under the Nazi rule, the use of contraceptives was banned, the number of illegal abortions in Germany was found to have risen considerably,[3] suggesting that the frequencey of abortion has been reduced by the provision of more efficient birth control methods.

According to Knox, in his time abortion was frequent in Ceylon.[4] No data on illegal abortion is available in present day Ceylon. Dr. Lucius Nicholls mentions that the social stigma attached to illegitimate childbirth is not so great in Ceylon as in Western countries.[5] The comparative segregation of the sexes also reduces the possibility of pre-marital conception. In spite of these facts, in view of Knox's intimate knowledge of Ceylon society and the authenticity of his account in all other matters, his evidence cannot be disregarded. If abortion exists today on any significant scale, then it is necessary that the state and the public should pay some

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[1]  Warren S. Thompson, *Population Problems*, 1953, p. 204 ff.

[2]  Sir John D'Oyly's *Sketch of the Constitution of the Kandyan Kingdom*. Communicated to Graves C. Haughton by Sir Alexander Johnston, 1831, p. 55. Mss. copy : Record Office.

[3]  See Hans Harmsen : Notes on Abortion and Birth Control in Germany. *Population Studies*, Vol. III, No. 4, 1950, pp. 402–405.

[4]  Knox : *Historical Relations &c.*, 1681, p. 146.

[5]  A nutritional survey of the poorer classes in Ceylon, *Ceylon Journal of Science*, Vol. IV, Part I, April, 1936, p. 28.

attention to it and adopt an enlightened policy to help those who, through their ignorance, poverty and economic pressure, become the victim of an unfortunate situation.

The question of abortion was exhaustively examined by a Swedish Commission in 1934.[1] They found most cases of induced abortion occurring among unmarried women. The reason given by the women for wanting abortion was in most cases the fear of future consequences. The difficulties of rearing a fatherless child, the loss of social prestige, and the feared social strictures were strong inducements to inducing abortion. In the case of married women, the commonest cause was economic difficulty.

The Commission concluded that " abortion frequency cannot be reduced by penal laws, but only by giving substantial help in removing or overcoming the social factors which have led to abortion ".[2] Financial aid, advice and encouragement by qualified social workers were suggested by the Commission. They recommended the introduction of more liberal laws relating to induced abortion and suggested the inclusion of social circumstances as grounds for permitting operations.

The strictness of the law with regard to abortion, not only fails to prevent abortion, but acts as a source of profit to the dishonest medical men and village quacks. Often the life of the woman is put into great danger. So long as sex-education to children and adolescents is not given, birth-control facilities are not provided, and the financial and emotional aid to unmarried pregnant women are not made available, the state is not justified in passing a stringent law prohibiting abortion.

As a measure of population control abortion is wasteful. It is true that it is less so than death and infanticide but, with the availability of contraceptives, it has no justification today. Married women often resort to it, either because they are ignorant of contraceptives, because the cost is beyond their means, or, from accidental failure of contraceptive methods. The social outlook of the husband may prevent the use of contraceptives, whilst the means of abortion may be obtained from village quacks without the husband's knowledge. In view of the danger and cost to which women expose themselves by resorting to illegal abortion, there is a strong case for legalising abortion for married women on grounds of economic difficulty, especially if the husband is also willing.[3]

## (2) MAINTENANCE OF A HIGH DEATH RATE

Since the immediate cause of the increase in population pressure is the application of improved public health measures, and the resulting decline in mortality, it has been suggested that such efforts should be abandoned and greater attention should be paid to reducing the birth rate. Public health measures should be introduced only when a decline in fertility is achieved, and only for those groups who achieve it.

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[1] See H. Gill : Recent Developments in Swedish Population Policy. *Population Studies*, Vol. II, No. 1, 1948.
[2] H. Gill, *Ibid.*, p. 32.
[3] See also Reference Nos. 50, 63 and 98.

" The death rate . . . must not be reduced too quickly. Medical health policies must be shaped with great care with better health stemming from more knowledge and co-operation on the part of the people themselves and not from the superimposition of preventive measures. . . . I suggest that public health measures which can save millions of lives should not be practised in China on a nationwide scale until the stage is set for a concurrent reduction of the birth rate." [1]

Such advice as this ranks with the suggestions of the German writers who advocated mass infibulation as a solution to the threat of over-population.[2] It is unlikely that such a policy will receive serious attention, but it is mentioned here because the basic error underlying these suggestions are common and result in other less startling, but nonetheless erroneous, suggestions which are commonly found in demographic works. The basic error lies in treating as mechanical and static the inter-action of the demographic and economic variables. The failure to see this relationship as a dynamic, ever-changing, developing and inter-related complex has led not only these writers but many others into an abstract, unreal, fruitless and erroneous conclusion. The relationship of fertility, mortality, economic progress and social values are not so simple as these writers would have us believe. Fertility, for example, is a function of the historical experience of a community resulting from a complex of economic, social and cultural situations. An attempt to reduce fertility, without changing the economic, social and cultural complex is sure to meet with failure. An attempt to improve the economic condition of the people without improving their health and reducing their death rate cannot but be regarded as foolish. Fertility depends, to some extent at least, as Winfield himself suggests, on mortality. Large numbers of children are a necessity for the survival of the race where the chance of death is high. A reduction in mortality, therefore, is rightly looked upon as a progressive step. The problem of over-population, or rather the population pressure on resources, is created where the exploitation of the resources lags behind such reduction. Such a lag in the expansion of the exploitation of resources may occur due to various institutional and historical factors. A high death rate involves a considerable waste and a heavy burden on the economic resources of the country. A reduction in the death rate clears the way for economic development and the solution of the problem of poverty. It reduces also the necessity of having large numbers of children and thus prepares the way for a smaller family outlook.

### (3) REDUCTION OF THE BIRTH RATE

The suggestion of reducing the birth rate by the use of contraceptives, and by later and fewer marriages, as a solution to population pressure, militates less against the humanitarian sentiment that prevails today. From the demographic point of view however, these remedies suffer from the same defect as the previous one in so far as they are based on an artificial isolation of one factor from a complex of factors which are dynamically related to each other. Techniques of birth control and methods of abortion were not unknown in ancient times, both in the East and the

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[1] Gerald F. Winfield : *China : The Land and the People*, p. 344. See also William Vogt : *Road to Survival*, 1949, pp. 224 ff.

[2] *See* D. V. Glass, (editor), *Introduction to Malthus*, 1953, p. 39 ff.

West.[1] The fact that they were not used extensively shows that the social-economic-cultural complex had not favoured its use till recently. In the West and also in Japan the new socio-economic-cultural complex that developed after the industrial revolution, led to the extensive use of birth control. " In the past history of modern nations a decline in fertility has accompanied or followed industrialisation. It, therefore, seems questionable to assume that such a decline can be made to precede and thus help along the process of economic development."[2] Hankins says, " Experience shows that a population cannot be forced or induced to use contraceptive measures so long as traditional attitudes prevail. It also shows that they will come into almost universal use in spite of much opposition if the surrounding cultural influences are favourable. This experience indicates also that the trend towards the small family system precedes rather than follows widespread propaganda by birth control organisations, though this latter may speed the process. Family limitation is thus a folkway, emerging slowly in answer to widely felt need in a culture traditionally opposed to it, but receiving in due time the blessing of moral and even religious approval."[3] The Committee sent by the Rockefeller Foundation to examine the question of population and public health in the Far East in 1950 states in their report, " The fact that folk methods of contraception of proved effectiveness were matters of common knowledge for centuries before they were generally used is sufficient proof that the critical element in the delayed decline of birth rates were those of motives rather than of means."[4]

Professor Notestein writes, " Human fertility . . . responds scarcely at all in the initial and often superimposed stages of such changes—changes that too often influence only the externals of life and leave the opportunities, hopes, fears, beliefs, customs and social organisations of the masses of the people relatively untouched. These latter are the factors that control fertility and since they are unmodified, fertility remains high . . ."[5]

It is obvious, therefore, that a birth control policy only achieves limited success unless the long over-due economic-social-cultural revolution is carried out in all its aspects and society is modernised at a rapid rate. Even if a birth control policy were otherwise acceptable, the cost involved would be a serious obstacle to its introduction, especially when the need for capital in industrial development is so great and its supply so scarce.

The political difficulty of inaugurating a large scale birth control policy should not be minimised. The rapid rise in population has been used as an excuse to

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[1] See Knox : *Historical Relations &c.*, 1681, pp. 145 ff.

Norman E. Himes : *Medical History of Contraception*, 1936. D. V. Glass : *Population Policies and Movements*, 1940, p. 55ff.

[2] Kingsley Davies, *Ibid.*, p. 46.

[3] Frank H. Hankins : " Under-developed Areas with Special Reference to Population Problems". *International Social Science Bulletin*, Autumn 1950, Vol. II, No. 3, p. 315.

[4] Marshall C. Balfour, Rogers F. Evans, Frank W. Notestein and Irene Taeuber : *Public Health and Demography in the Far East*, 1950, p. 10.

[5] Frank W. Notestein : " Summary of Demographic Background of Problems of Undeveloped Areas " ; Millbank Memorial Fund. Papers laid before the Annual Conference, 1947, p. 10.

justify the poverty and backwardness of the population so often by the rulers that it has acquired an atmosphere of mischievous imperialist apology in the minds of the nationalists. The young nationlists found in this excuse an apology for the failure of the rulers to develop the country and a desire to misguide world opinion. His reaction to it was, therefore, violent and unreal in so far as he denied the population increase to be a problem at all. It may not be easy, therefore, to persuade any of the political parties to undertake expenditure on an extensive scale for birth control propaganda, especially when funds are needed so urgently elsewhere.

Moreover, the political backwardness of the population makes them judge the worthiness of a political party, not by its ideology and programme, but by the concrete achievements that it can show to its credit in terms of economic gain. The advantages of birth control are not immediate and concrete. Its advocacy does not therefore make a party popular with the peasants.

### (4) INDUSTRIALISATION

The argument for industrialisation as a solution to the problem of population pressure lies in the fact that the problem is not of excessive population alone, but excessive population in relation to the exploited resources. Since there are unexploited resources [1], we are not entitled to regard the population as excessive until all the available resources have been exploited. The problem, it is often asserted, is the failure to expand economic resources. It is suggested, therefore, that the problem should be tackled at this end rather than the population end.[2]

It is argued further, that industrialisation would lead to a decline in fertility, as it has done in Europe and Japan, and the problem of surplus population would solve itself.

This, however, is a drastic simplification of the problem. Industrialisation is not easy to attain in the conditions in which the under-developed countries are today. The difficulties are great, the efforts needed to overcome them must be strenuous and prolonged, and the moral support required from the entire population must be unstinted. Kingsley Davies mentions some of the difficulties as follows :

" That such agrarian density together with the prospect of rapid growth tends to impede industrialisation there can be little doubt. The following seem to be some of the main ways it tends to do so.

" (1) In general the consequence is to focus economic effort on consumption goods rather than heavy industry, and thus to discount future advantage against present advantage. The swollen masses are so deprived of the immediate necessities that every thing is expended on sheer maintenance of life. As bare necessities are met, the population multiplies so fast that the supply of immediate necessities must be constantly expanded. This makes it hard to accumulate the surplus and invest the energies necessary to develop large scale basic industries, even though in the end these industries would yield a greater volume of consumption goods.

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[1] See Chapter 13, Problems of Industrialisation.

[2] Manilal Nanavati and J. J. Anjaria : The Indian Rural Problem, 1947, p. 358.

Most individuals are so near the subsistence point that they cannot save ; instead they tend to borrow for consumption purposes and thus fall into the vicious circle of personal indebtedness.  Even when they can save they feel so insecure that they prefer a high liquidity of their assets to a modest interest through investment.  In this way the amount of investment capital produced by the population tends to be small.  At the same time the business firm finds the demand for consumption goods so insistent that it sees greater profit in immediately satisfying this demand with inefficient equipment than in making long-run expenditures on new basic equipment. The government feels the same pressure.  Especially if democratic, it finds difficulty in ignoring the pressing wants of the majority of its citizens in order to build heavy industry for the future.  It must use its economic means to feed, clothe and house the population when they are in dire poverty and when there will be many more of them tomorrow than today.  Its labour is like the labour of Sisyphus, except that the stone grows constantly larger  .  .  ."[1]

" (2) The over-numerous farm population is in no condition to furnish the economic surplus with which an industrial system can be built up.

" A high ratio of farm population to agricultural resources means that most of the land is devoted to food crops for sustenance rather than to export crops for an investment surplus."

" (3) In a dense agrarian economy labour is immediately cheaper than machinery. The entrepreneur cuts his costs by selecting labour-using methods in preference to capital-using ones  .  .  .  the measure of industrialisation is precisely the degree to which machinery is substituted for human labour ; to the extent that a dense agrarian economy impedes this substitution, it impedes industrialisation."

" (4) A rapid population growth attributable to an extremely high fertility and a high but somewhat lower death rate, produces an unusual burden of young age dependency."

" (5) Disease, under nourishment, malnutrition, and injury lead to lethargy, absenteeism and inefficiency.  As a consequence the productivity per worker is low, independently of capital equipment."

" (6) Finally, in a heavily peopled agricultural country suffering from the conditions mentioned, the state of public enlightenment is so low and the poverty is so great that political stability is hard to maintain  .  .  .  Under disturbed political conditions, industrial enterprise cannot thrive."[2]

The first two arguments are concerned with the difficulty of saving the capital necessary for industrial development.  The difficulty of obtaining the initial capital has been rather exaggerated.  To understand the process by which capital

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[1] Notestein argues in the same strain saying, " Rapid population growth means that a very large proportion of the social income must be utilized in expanding existing facilities, and therefore, cannot be used either in improving the tools of production with which each worker becomes additionally effective or in improving living conditions."  Millbank Memorial Fund, 1949, p. 93.
[2] *Population of India and Pakistan*, 1951, pp. 218-20.

accumulation may be brought in such a society, let us assume that there is no industrialisation or economic development whatsoever. In such a society an increase of population will mean no addition to the output there being already an excessive supply of labour ; the per capita income will decrease as a result, and the new entrants will squeeze their way into the same volume of income. The level of nutrition will as a result decline and sooner or later deaths will rise. This is the position of Ceylon today. In what way will industrialisation alter this depressing picture ? The first effect will be a removal of the surplus population from the peasant sector. This surplus population, by definition do not contribute anything to the net output ; they are, in fact, a drag on agriculture. The output will not, therefore, decline with the removal of this surplus population.[1] On the contrary the possibility of saving will at once appear. For those who remain, in the village will have fewer mouths to feed and, if they maintain their former standard of living, will have a surplus of income over expenditure. This saving may be invested in agriculture in improving cultivation and thus increasing the income further and making a larger supply of saving available. It will thus become possible for income and saving to spiral upward and produce at every turn an increasing volume of capital.[2]

Those who are moved into industries will now begin to produce an income which they never did before. In the early phases the proportion of labour to capital will necessarily be high. In the third argument, Kingsley Davies describes this as a backward step. Compared to a marginal productivity of zero, which these labourers had when they were dependent on agricultural efforts, this would certainly be an improvement. Thus income would rise, both in the agricultural and the industrial sectors. If the per capita consumption can be kept at the old level by rationing or otherwise, then the increased income thus obtained will provide funds for accumulation. Whether this surplus will be sufficient to provide, on the one hand for the rising population, and on the other for industrialisation, depends on the volume of these two needs relative to the volume of saving available. Immediate control on the volume of population increase may not be possible, and in this sense it may be taken as an independent variable in the situation. The other two variables, namely, the volume of saving and the capital required for industrialisation, are the direct result of industrialisation, and their size can be controlled by determining the scale and tempo of industrialisation and by adopting various other measures such as taxation, rationing, &c. It is clear, therefore, that the scale and tempo of industrialisation are the crucial factors in the situation, and not industrialisation alone.

Lest these arguments appear to be too theoretical, the practical example of industrialisation in Japan in a comparatively short period can be cited.

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[1] Benham argues that there would be a fall in agricultural output if workers were removed from villages. In view of the heavy pressure of population on land, it is difficult to see how this assertion can be regarded as true. See Benham : " The Colombo Plan " — *Economica*, May, 1954, p. 101.

[2] See Ragner Nurkse : *Problems of Capital Formation in Under-developed Countries.* 1952, pp. 36–49.

" The basic reasons why Japan was able to develop with so little foreign  capital assistance, appears to be : first, that she made careful and effective use of such foreign capital as was obtained ; and second, that she made careful, effective and *exhaustive* use of domestic capital potentialities.   The entire process of development depended upon these two measures, and its success promoted and sustained these measures.   In countries where these steps are not taken, the development effort, including the so-called ' stimulus ' of foreign capital injection, tends to dwindle away to nothing."[1]

Kingsley Davies argues that cheap labour is a hindrance to industraialisation. On the contrary, given a fixed amount of capitalisation and productive efficiency, the cheaper the cost of labour, the greater will be the size of capital accumulation In fact private capitalists will use labour instead of machines only because they can enhance their profits thereby, and the higher is the amount of profits, the greater will be the volume of capital accumulation.   Thus, given the technique of production and the labour-capital ratio, the cheaper the labour, higher  is the incentive to investment and industrial development.   Population pressure is thus an incentive rather than a hindrance to industrial development.

Secondly, the larger the population the larger the market is likely to be, other things being equal, e.g., the per capita buying power, the taste of the consumers, prices, &c.   In a country like Ceylon, where large scale production is often discouraged by the smallness of the market, this is of primary importance.

In the first argument, Kingsley Davies mentions that ' the population multiplies so fast that the supply of immediate necessities must be constantly expanded.  This makes it hard to accumulate the surplus and invest the energies necessary to develop large-scale basic industries even though in the end these industries would yield a greater volume of consumption goods '.   This argument would have been valid had the producer goods industries and the consumer goods industries been altogether unrelated.

In fact, however, the relationship between them is an intimate one, so that  the prosperity and expansion in one is quickly transmitted into the other.   For example, if the demand for consumer goods rises, leading to a rise in the profits in these industries, then the entrepreneurs in these industries will immediately increase their demand for more capital goods, in order to expand their production or to improve their technical equipment and reduce their cost of production and  thereby increase their profit margin.   The producer goods industries will thus share in the prosperity and enjoy higher profits too.   To argue that a rise in population and in demand in the consumer goods sector prevents the growth of the producer goods industries, is to assume that these two sectors are unrelated.   For if we assume them to be unrelated, then it is possible to argue that the rise in profit in the consumer sector would not cause a rise in the profits of the producer sector, so that a proportion

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[1] Edwin P. Ruebens : Foreign Capital in Economic Development : A Case-Study of Japan. *Millbank Memorial Fund Quarterly*.   April, 1950, p. 179.

of the investment funds available would be diverted from the producer goods sector to the consumer goods sector. Kingsley Davies' argument will thus be seen to be based on an unrealistic assumption.

It is possible to think of a situation in which the growth of population would lead to a decline in wage rates and thus induce a technological shift in the labour-capital ratio, causing a substitution of capital by labour in new investment. If this happens, a rise in the demand for consumption goods will not lead to an induced rise in the demand for investment goods. A rise in the demand for consumption goods, however, cannot occur if wage rate is falling, unless the volume of employment rises and more than offsets the fall in income per head. In the latter case, the desired objective of industrialisation would have been secured, whatever might be the labour-capital combination. For what is important in this context is not the labour-capital ratio but a breakaway from the predominance of peasant agriculture with its associated cultural and social values.

A continual increase in population and the consequent depressing effect on wages may produce a " technological regression ", causing a persistent shift towards a lower and lower capital-labour ratio in investment. A breakaway from this vicious spiral can come only through a sudden flood of investment of sufficient extensiveness, which will generate an opposite spiral of rise in employment and in income and thus counteract the population drag on wages.

The extensiveness of industrial projects will, no doubt, depend on the availability of resources. There is no reason, however, to believe that the supply of the resources is unalterably fixed. For example, population growth ensures that at least unskilled labour is available in abundant quantity. Moreover a certain amount of capital accumulation is always available in under-developed countries, partly because of unequal distribution of income and wealth and partly because population increase intensifies that inequality. In countries like Ceylon, where the major part of the consumption goods is imported, the capital supply can be augmented to some extent by economising on imports. With proper organisation and careful selection of projects, a substantial proportion of this initial capital can be mobilised for industrial development and used to obtain a maximum volume of employment consistent with the maximum output-investment ratio. This will introduce a dynamic element of expansion into the system which will be of a self-supporting and self-expanding nature. And sooner or later the expansion in the consumption goods industries will not only create a demand for the products of the investment goods industries, but will also provide the funds necessary to establish such industries.

In India, the development of producer goods industries has lagged behind the consumer goods industries, not because of population increase, but because of the severe foreign competition in this field. In Japan where the government patronage was available to protect the national industries from such foreign competition, the basic industries did not lag behind the consumer goods industries.

Kingsley Davies regards population increase and increase in demand for consumer goods to be synonymous. This, however, is not correct. Population may rise,

fall or remain stationary without having the least effect on the demand for goods. What matters is not the needs of the people, but their ability to buy—the effective demand, as the Keynesians would put it. A rise in population would not automatically lead to a rise in demand if the money available to the people did not increase. The main consideration here is the rate of generation of income. If income can be generated at a rate which is greater than the rate of increase of population, then the question of capital formation ceases to be a problem, provided, of course, the level of consumption remains the same. Here again the *tempo* and the *scale* of industrialisation are what matters and not industrialisation as such.

We have so far assumed the economic development to have no effect on the demographic trend. This assumption, however, is not valid. We have seen in Chapter 11 that an improvement in the economic condition of the people may, under certain circumstances, lead to a rise in fertility and a decline in mortality, and thus cause a more rapid increase in population. The population rise will require much greater national effort to ensure that income rises still faster, than would be necessary had there been no population increase. Population increase may, therefore, introduce great difficulty in the process of industrialisation and may even prevent a rise in the standard of living, or a more rapid rate of development. There are reasons to believe that the small scale of operation of the Colombo Plan has merely succeeded in releasing the brakes on population growth, and the little increase in production achieved has been exhausted in maintaining this increased population.[2]

Increase in fertility, however, is not an inevitable consequence of improvement in the economic condition of the people. It may be possible to give it such a bias that an immediate reduction in fertility follows. In such a case, the difficulty due to rising population need not be a great hindrance to industrialisation.

The crucial issue, therefore, is not industrial expansion, but the scale and tempo of an all round economic and social development. As we have mentioned earlier, the factors involved in the situation constitute an organic complex of dynamic relationships. It is impossible to select any for control to the exclusion of others, or to keep some constant while altering the others. If an extensive development is undertaken at a high tempo, then the multiplier and acceleration effects will generate the necessary support to sustain it and to extend it further. Such a hectic industrial activity will produce a qualitative change in the situation, so that the social customs relating to fertility, marriage, &c., will not be able to escape change.

The reproductive habits, it is true, have shown great stubbornness in the past and have changed but slowly, the old customs persisting for several generations. " If one may judge from the experiences of Western nations it takes at least two generations to effect such a transition from an agricultural to an urban industrial culture as will transform the desire for a large family into a desire for a small family." [2]

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1    *Cf.* Colombo Plan's First Year. *The Economist*, May 10, 1952, p. 355. Also the Second Report of the Colombo Plan Consultative Committee, New Delhi, 1953.

2    Frank H. Hankins, *Ibid*, p. 315.

Again, " The level of fertility is a product of total culture, including its most deeply laid and intimate aspects which are slow to change. Profound changes in fertility will probably await profound changes in the culture and economy."[1]

It does not follow, however, that changes in fertility habits would be necessarily slow in every country and under every condition, just because they have been slow to change in the past. The industrial development in Europe extended over several centuries and developed haltingly against numerous odds, groping its way in the dark. The countries of Asia can draw on the rich experience of these countries and can shorten the period both of economic change and of social transformation. There is no basic reason why " profound cultural and economic changes " must necessarily be slow.

This is not to minimise the difficulties, first of mobilisation of the available resources and the vast multitude of people to achieve the goal, and secondly, of organisation to make the best use of men and materials. As pointed out by Kingsley Davies, the present bourgeois democratic government, composed of persons who have always to consider the electorate, cannot demand great sacrifices from them for their future welfare, but must live from hand to mouth, always distributing such meagre benefits as are immediately available. Obviously, " parliamentary democracy " as it operates today in the Asian countries is not capable of undertaking a fundamental transformation of the economy from an agricultural to an urban-industrial type. Nor can a dictatorship do it, for the carrying out of such a vast programme would be impossible without the willing co-operation of the majority of the population. A highly centralised form of popular government (popular both in the political and literal sense) is necessary, organised in such a way that the continuity of its policy is not destroyed by a change in personnel of the government, and so that it avoids becoming subordinate to the whimsical pressure of public opinion. But such a form of government has yet to evolve.

## Conclusion

### THE ROLE OF POPULATION POLICY

Thus industrialisation, though difficult and requiring gigantic efforts and almost limitless sacrifices, seems nevertheless to be the only way to overcome the growing threat of hunger, destitution and disease in Ceylon, and in other countries of Asia. Population policy, however, can enter into the picture as an auxiliary to industrialisation, for it is evident from the foregoing discussion that the pace and scale of industrialisation is the crucial issue for the success of such a policy. The pace and scale of industrialisation can be increased if the growth rate of the population can somehow be retarded. The saving that would be effected by this could then be added to the capital stock, thus increasing the rate of investment. If population growth is not retarded, then it will be a race between industralisation and population growth, at least in the early stages. It is certain that in the long run

Balfour and others, *Ibid*, p. 113.

industrialisation will lead to a decline in fertility, but in the initial stages the tempo of the process of industrialisation may be retarded by a rapid rise of population. Hence, if population growth can be retarded somewhat, the tempo of industrialisation can be maintained.

The easiest way to give effect to a population policy, therefore, is to draw up the plan of industrialisation in such a way that those forces which lead to a decline in fertility are generted in the process of industrialisation, and a decline in fertility is obtained as a by-product. In the words of Notestein, " The solution of the population problems of the world's undeveloped areas will require that demographic factors be taken into account in all planning for higher living levels, social welfare and health."[1]

Such a policy will have the added advantage that it will not require extra investment of capital on population policy as such. In a situation where every mite of capital has to be economised and put to the maximum use, it is unlikely that a birth control policy as such will receive any attention or would claim any priority, especially when the outcome of that policy is not certain and the opposition of conservative and religious forces is great. It is much easier to persuade the community to choose out of the many alternative ways of industrialisation, those which are likely in addition to generate a decline in fertility. In Chapter 10 we have discussed one such alternative, viz., land reclamation schemes. We saw there that a small peasant settlement is less desirable than large scale farming with the peasants working as wage labourers not only from the point of view of economics but of demography also.

Many other elements in economic development may be found in which the demographic consequence may exercise an important influence in the making of the final choice. Education, commercial recreation, rural banking and female employment are some of the factors which are known to alter the traditional cultural values and thus pave the way for the new urban attitude.

It is necessary to point out that the difficulties both of rapid industrialisation and of reducing fertility have been exaggerated because of the abstract way in which they have been approached. Most of the difficulties that have been mentioned so far, operate today largely because the solution has been more or less prevented by political circumstances. Once an escape from hunger, degradation and poverty is opened to the people, there cannot be any doubt that the exit from the agrarian cultural pattern, and the existence on a bare subsistence plane, will be torrential. Hunger after all is a great solvent and the price of the old cultural pattern that will have to be paid to escape it will not be grudged, except by those who profit by the people's hunger. Already the signs of such effort are discernible. " For a society in which girls of respectable family rarely have roles outside home, the wide support both for their education and their employment in factories is noteworthy. . . A

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[1] Millbank Memorial Fund, 1947, p. 15.

common sentiment was 'Even girls could earn and support us'".[1] Sir Ivor Jennings writes, "a vast change is taking place which may result in an enormous increase in genuine literacy among young men and women in ten years' time. . . . The most impressive change of all is the revolution in the education of girls. Whether this will go beyond the age of puberty has yet to be seen, but the indications from the English schools and the University are that it will. The effect on the general standard of education of the next generation, most of whom can hope to have mothers who can read and write, will be incalculable." [2]

The urge behind education is, of course, economic. For, in the context of present day society in Ceylon, education, especially English education, provides an escape from the common lot of poverty and hunger. Hunger is thus forcing people to change, whenever they get a chance to escape it by doing so. There is no reason to believe, therefore, that the people will cling to the ancient mode of living and cultural values, if a route of escape is opened out to them.

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[1] Bryce Ryan : The Ceylonese Village and the New Value System. *Rural Sociology*, March, 1952, Vol. 17, No. 1, p. 24.
[2] The General Report on the Census. *University of Ceylon Review*, Vol. III, No. 4, October, 1950, p. 218.

# PROBLEMS OF INDUSTRIALISATION

## Necessity for Industrial Development

THE necessity for industrial development lies in the fact that it will enable the people to maintain and advance their standard of living ; and, secondly, if carefully designed, it will bring about a social transformation and change in the cultural outlook. This will lead to a decline in fertility, and a demographic balance of an advanced type with fewer deaths and births may be achieved. The threat of the population increasing faster than economic progress will thus disappear and a rapid rise in the standard of living may ensue.

Any economic development plan which does not take into consideration the effect that such developments will produce on the population trend, will stand in danger of defeating itself.

## The Colombo Plan and the Plan Proposed by the International Bank of Reconstruction and Development

The Colombo Plan and the International Bank Plan suffer from this defect to a serious extent, for both of them attach primary importance to an expansion of the present type of agrarian economy, and put industries into a position of insignificance. Their allocation of funds, and a close scrutiny of the proposed projects, show that the plans are not designed to bring about the type of social and industrial revolution that we have emphasised here, but are meant to resuscitate the existing economic structure. The projects are planned so that least change is produced in the existing economic system. Three basic assumptions seem to lie at the foundation of these plans, namely that (1) agriculture must dominate the scene ; (2) the supremacy of the plantation economy must remain intact ; and (3) the peasant economy must remain unaltered. The Colombo Plan accepts these assumptions tacitly ; the International Bank Plan admits them emphatically with the only difference that the latter would not mind if the peasants were displaced by the big planters.'[1]

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[1] " Export agriculture (i.e. plantations N. S.) must certainly continue as the mainstay of Ceylon's economy . . . ." The Economic Development of Ceylon, p. 2. Discussiong the colonisation scheme, the International Bank Mission stated : We believe that while retaining peasant settlement as the main line of advance, it would be very useful to make a trial issue of leases of suitable length to individuals prepared to take up larger areas, and also to corporations, whether limited liability companies or co-operative societies, prepared to lease over large blocks of land ". *ibid*, p. 309.

The percentage allocation of the investment funds among the major classes of items in the two plans are given below :

TABLE 1—PERCENTAGE DISTRIBUTION OF DEVELOPMENT FUNDS

| Class | Colombo Plan 1953–54 | International Bank Plan |
|---|---|---|
| Agriculture including multi-purpose schemes and other allied activities | 34·7 | 28·8 |
| Transport | 31·1 | 26·9 |
| Social capital (Education, Health, &c.) | 21·5 | 25·0 |
| Power | 6·8 | 13·1 |
| Industry | 4·0 | 4·7 |

*Sources :* Compiled from the Colombo Plan : the Second Annual Report of the Consultative Committee, New Delhi, October, 1953. His Majesty's Stationery Office, Cmd. 9016, p. 36 ; and, The Economic Development of Ceylon, Report of the International Bank Mission, p. 112–113.

These percentages show the relative importance that the planners give to the different aspects of economic development. In this respect the plans differ little from each other.

Now, compare these percentages with the existing economic structure. The percentage occupational distribution and the proportion of the contribution made by the different sectors of an economy to the national output may be taken as reasonably indicative of the nature of an economy.

TABLE 2—DISTRIBUTION OF THE GAINFULLY OCCUPIED—1946 CENSUS

| Occupation | Per cent |
|---|---|
| Agriculture | 51·3 |
| Forestry and fishing | 1·6 |
| Industry and mining | 11·0 |
| Trade and transport and banking, &c. | 21·1 |
| Professions, public and domestic services | 15·0 |

*Source :* 1946 Census Report.

The class 'industry and mining' consists mostly of cottage industry workers, and workers engaged in processing plantation products. They are, therefore more agricultural than industrial in their social and cultural outlook.

The percentage distribution of gross national output, as estimated by the Director of the Census and Statistics Department, is given below :

TABLE 3—PERCENTAGE DISTRIBUTION OF GROSS NATIONAL OUTPUT BY SOURCE, 1949

| Source | Per cent |
|---|---|
| Agriculture | 55·0 |
| Industry, fisheries, construction, &c. | 17·2 |
| Trade and transport (other than in domestic agricultural product) | 11·3 |
| Others | 16·5 |
| | 100·00 |

*Source :* Statistical Abstract, 1949.

Here again industrial output mostly consists of the output of cottage and processing industries.

Thus it is evident that agriculture is today the dominating sector in the national economy of Ceylon. The Colombo Plan and the International Bank Plan proposed by far the largest proportion of the investment in this dominating sector. If successful, these plans will reduce the other sectors of Ceylon's economy to insignificance. Ceylon will become much more of an agricultural country than she is at present.

One of the objectives of the Colombo Plan was to bring about " increased economic stability by reducing the country's precarious dependence upon factors outside its control. This was sought to be achieved through a diversification of the economy including increased food production, and by other forms of activity calculated to give employment." [1] If real diversification was the objective, then the financial provision of the plan certainly did not show it. Increasing the variety of agricultural crops can hardly be called a diversification, for the main purpose of diversification is to reduce the inelasticity of supply from which all agricultural countries suffer. Diversification of agricultural crop does not remedy this situation, because all agricultural prices are more or less linked together in their movement.

The belief that industrialisation was bad for Eastern countries and therefore they should concentrate rather on agricultural development, was common among the English economists. For example, J. M. Keynes wrote in 1911 " in India  .  .  .

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[1] The Colombo Plan : The First Annual Report of the Consultative Committee, Karachi, 1952. Cmd., 8529, p. 12.

a considerable part of the educated class seem to desire, with patriotic fervour, the industrialisation of their country with the greatest possible development of manufactures.  In my opinion such a change is not, in the future which one can foresee, either desirable or likely.  It is an unfortunate consequence of the English connection, that industrialisation should present itself to Indians as the royal road to prosperity and to a dignified position among nations  . . .  if regard be had to climatic conditions and to the aptitudes and habits of her people, it seems hard to believe that India will not obtain more wealth by obtaining from the West, in exchange for her raw products, most of those commodities which she now obtains in this manner, than by diverting her capital and her peasants from the fields of the country to Bombay, in order to make them herself . . . is there not good reason to believe that  . . .  her future prosperity is to be sought almost entirely in the application of more skill and knowledge and specially of more capital, in the methods of agriculture.  There are obvious difficulties in the employment to this way of large amounts of foreign capital, but every diversion of indigenous capital from agriculture, where her relative advantage is great, to industries to mention one of the many difficulties, the relative position of coal, iron and the sea place her at a disadvantage, will be to the detriment  of her economic prosperity. The raising of the level of comfort amongst the vast mass of the population must be brought about by the application to the *land* of the brains and the capital of new India." [1]

Since Keynes wrote this passage India has made considerable progress in industrial development.  It is rather difficult today to convince anyone of the disadvantages and the difficulties of developing industries in Eastern countries.  Imperialist illusions, however, die hard and many of the ' experts' in Britain still find it difficult to subscribe wholeheartedly to the rapid development of industries in these countries. They are willing, perhaps, to allow some industries to grow as a concession to the nationalist sentiment, but fully fledged industrialisation of these countries are still anathema to them.  For example, Guy Wint writes : " in the framing of the Colombo Plan a balance has to be kept between agriculture and industry.  A case could, it is true, be made out for concentrating on agricultural improvement.  The back-wardness of agriculture was the chief cause of poverty : if the agricultural income could rise, the farmer would demand industrial products, and thus in the long run industrialisation would be stimulated.

" But the architects of the Plan realised the weight of other considerations.  For decades the cry had gone up from the nationalistic parties of the East that the West wanted to keep the Asian peoples as hewers of wood and drawers of water.  Industrialisation had become a symbol of national adulthood and self-respect. Any oriental government which failed to produce schemes of industrialisation would lose caste with its people. The economic experts therefore looked with a sympathetic eye to all the industrial plans laid before them." [2]  The ' sympathetic eye of the experts ' resulted in the balance of 35 per cent of investment in  agriculture and 4 per cent in industry.

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[1] Review of *The Economic Transition in India* by Sir Theodore Morison in *Economic Journal*, Vol. XXI, 1911, pp. 426 , 428.

[2] *What is the Colombo Plan.*  London, 1952, p. 24.

The writers of the Second Report of the Colombo Plan Consultative Committee state, " The 1950 programmes laid emphasis on three main fields of development: agriculture, power and communications . . . the programmes have undergone since 1950 extensive revision in detail to meet changing economic conditions ; but the general structure still remains . . ." [1]

Again, " Clearly the pressing need is to produce more food, both by opening up new land and by increasing the yield from land already under cultivation. New land can be opened up where conditions permit, by irrigation, reclamation, or flood control. Yields can be increased by the use of fertilisers, by replacing present varieties of crop or animals by improved varieties and better control of pests . . .

" Improved means of communication and increased supplies of power were basic forms of investment . . . Better roads or railways enable the growers of agricultural produce to send their produce to more distant markets, where it is more needed and commands a higher price, and in general promote the expansion of production and trade in all fields." [2]

It is clear that the primary objective of the Colombo Plan is to develop agriculture. Power and communication are given importance because they are necessary for agricultural improvement.

It is often assumed that, since these countries are agricultural, further development must be concentrated on agriculture and this will, by stages, lead to a development of industries. [3] This assumption is not always correct. Agricultural development will not necessarily lead to industrialisation. " Agricultural improvements are not necessarily ' on the road ' toward industrialisation where they establish a new equilibrium based on relatively unskilled labour and where continuing high birth rate simply yields more people rather than increased product per capita." [4] Agricultural improvement may thus lead to a rise in either population, imports from foreign countries, or both. The agricultural development of Ceylon in the last hundred years has resulted in increases in both population and imports of consumption goods, and not in industries. With the existing institutions and cultural outlook, agricultural developments cannot be expected to have any other consequence. The type of agricultural development proposed in the two plans will produce the problem of relative over-population at every turn. Not only so, the possibility of escape in the future from this vicious circle will become increasingly difficult with every development of agriculture, since the population load will become heavier and heavier.

It is true that in England the industrial revolution was preceded by the agricultural revolution. This, however, does not mean that it will necessarily be so in Asia. The agricultural revolution in England helped the industrial revolution in two ways ;

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[1] The Colombo Plan : The Second Annual Report of the Consultative Committee. New Delhi, October, 1953, Cmd., 9016, p. 88-89.

[2] The Colombo Plan, Second Annual Report, p. 89.

[3] Cf. Benham, The Colombo Plan ; Economica, May, 1954, p. 100.

[4] Wilbert E. Moore : Industrialisation and Labour, Cornwall University Press, N. York, 1951, p. 302.

first, the enclosure movement uprooted the peasantry from the soil and drove them from the fields to the factory. Secondly, commercialisation of agriculture helped the accumulation of capital which found its way into industries. The type of agricultural development that the authors of the plans have in mind will merely result in resettling the depressed peasant in a new plot of land, and improving his output by altering the technique of cultivation. Such a development is likely to reduce the labour supply for industries rather than to increase it.

" The Mexican field investigation provided a crude confirmation of the hypothesis that factory workers are most readily recruited from nonagricultural occupation, but also indicated the disadvantaged persons in agriculture will make the move while persons benefiting from agricultural innovation are not thereby ' closer ' to the industrial form of production and thus more amenable to further changes. In this respect at least a ' stage ' theory of industrial development appears less appropriate than the older notion of ' revolution '." [1] As to capital accumulation, in the absence of a change in the cultural outlook, the enhanced income will merely result in addition to the mouths to be fed.

The possibility exists, as Guy Wint pointed out, that the enhanced income will find its way into the pockets of the money lenders and merchants, who may, under favourable circumstances, invest the fruits of their exploitation into industries. The depressed condition of the peasantry, however, will limit the market for industrial goods considerably, and the temptation to reinvest the profits in their own trade, instead of in unknown and uncertain enterprises, will be great.

It must be remembered, moreover, that the agricultural revolution in England was considerably strengthened, and the process of development of agriculture quickened, by the investment that came from the commercial and the industrial sectors. The process, in fact, was a double track one, in which both industrial and agricultural development sustained and accelerated each other.

It is often argued that, in the face of the growing threat of a rapid rise in population, greatest emphasis should be placed on food production,[2] and, since funds are limited, industrial development must be given lower priority. Yet, can the food problem ever be solved by an approach such as that of the Colombo and the International Bank Plans ? Will not the growing population recreate it on an ever increasing scale ? " Because underdeveloped countries are mainly agricultural, it is too often assumed that the urgent necessity is to improve methods of agricultural production first, before there can be any general advance. But many of the benefits which might be achieved by reform of the agrarian structure may be nullified if there is not simultaneous development in other sections of the economy." [3]

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[1] Wilbert E. Moore, *ibid*, p. 304.

[2] " It should be emphasised again that industrialisation is only a small part of the needs of South and South-East Asia. However far it may be developed, industry will always remain a secondary factor compared with agriculture, and the vast majority of the crops grown will have to remain the food by which the area must live." D. G. Bridson : *Progress in Asia : The Colombo Plan in Action.* Her Majesty's Stationery Office, 1953, p. 8.

[3] *Land Reform ; Defects in Agrarian Structure as Obstacles to Economic Development.* United Nations, N. York, 1951, p. 87.

The supporters of these plans may argue that the expenditure allotted to education, transport and communication will lead to the necessary change in the cultural outlook, so that the fertility trend will gradually decline. The past experience with regard to fertility belies such expectation. The fertility trend showed a slight decline during the first four decades of this century due to a decline in marriages, resulting from the spread of education and the difficulty of accumulating the dowry. During the war years, however, the economic deterrent was removed and, despite the rapid spread of education and the rise in the age of first marriages, the fertility trend showed a rapid rise. This post-war rise in fertility is to be attributed to the rise in the marriage frequency in all middle age groups. It is unlikely that the age at first marriage will rise above the high point already reached, even if education becomes widespread. On the other hand, if economic conditions improve, the marriage frequency is likely to remain high. This throws doubt on whether, in the absence of an economic stimulus education alone will be a sufficiently strong lever of social change. In fact, English education has so far produced little change in the cultural outlook, even of the intelligentsia. The great demand for English education has arisen today because of the possibility of economic advancement that it offers and not because any cultural change is desired. The type of cultural outlook that favours small families is associated with industrial urbanism ; and it is unlikely that an agriculture-based society will ever give up its familial attachments which prevent the rise of a small family system.

Having decided that Ceylon must remain an agricultural country, the authors of the plans consistently placed the development of power in as obscure a corner as industries. For example, in the Colombo Plan, it gets only 7 per cent and in the International Bank Plan 13 per cent of the total investment. The potential hydro-electric power in Ceylon is estimated to be between 400,000 and 550,000 K.W. The amount at present developed is only 35,000 K.W. The possibilities in this respect are vast indeed.

A countrywide electrification can easily be made the harbinger of industrial and social revolution as much as steam power was in England. Given a cheap supply of electric power, mechanisation of agriculture, development of small scale industries in rural areas and large scale industries in towns, and an efficient means of transport system can easily be developed.

In the previous chapter we have emphasised the need for a high tempo and extensive scale of industrial development. The Second Report of the Colombo Plan Consultative Committee admits the need for a high tempo.[1] It is difficult to understand, however, how a plan which relegates industries and power development to such obscurity, can ever achieve the tempo that is necessary to bring about a radical economic and social change. Agricultural activities must necessarily be slow. The slow tempo of life in the East is only a reflection of the agricultural basis of the civilisation. So long as agriculture remains at the foundation of Eastern society it is futile to expect any activity to develop at a high tempo.

[1] Ibid, p. 89.

Both the plans suffer from the defect that the interdependence of the different sectors of the economy is generally ignored and each sector has been viewed in isolation from others. A static, unrelated and incoherent development plan cannot hope to break through the innumerable vicious circles which cumulatively reinforce each other in their strangulating effect. Wilbert E. Moore's warning is most appropriate in this connection : "Among official and private bodies concerned with economic and technical assistance to 'undeveloped' areas, there is no lack of awareness of the many facets of the problem. The programme takes cognisance of fields of possible assistance from agriculture to water supply, from capital accumulation to life expectancy. With this there can be no quarrel, granted the desirability of economic modernisation. There is, however, some danger that the scarcity of resources will lead to haphazard selection of points for emphasis, because of a short run and overly pragmatic view that every little bit helps . . . Seemingly desirable changes may have unanticipated negative consequences if not accompanied by other changes to which they are functionally related."[1]

Not only are the variables involved in the situation functionally related, they are related in a dynamic way, so that whatever change is introduced in any one of them produces a 'chain-reaction' and is transmitted in all directions. If the original stimulus is of sufficient intensity, its consequence may spread far and wide and release much latent energy to continue, sustain and strengthen many other changes. If not, the inertia of the situation may succeed in smothering it. This dynamic relationship between the social, economic and demographic variables has been termed by Professor Gunnar Myrdal the principle of *cumulative causation*.[1] Thus we may briefly summarise our criticisms of the Colombo Plan and the International Bank Plan as follows : The emphasis given on peasant agriculture in these plans will, by a process of cumulative causation, reproduce the present trends in ever-widening circles.

It is clear, therefore, that these plans cannot be regarded as instruments designed to bring about a rapid economic, social and demographic change. They have been designed primarily to prevent an immediate explosion. The method that they have suggested, however, will make a much bigger explosion at a future date almost inevitable.

### An Alternative Approach

A more effective approach to the problem of economic development and social change would have been to give much greater emphasis to electrification, industrialisation and education.

The power of a modern industrial system in dissolving the agricultural social values cannot be exaggerated. "The modern industrial system has a rather

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[1] *Ibid*, p. 312.
[2] Gunnar Myrdal, *Chronicles of the World Health Organisation*, Vol. 6, Nos. 78, August, 1952, p. 205.

overwhelming record of penetration into and even conversion of those (i.e. non-industrial) societies. It carries with its train, and in direct proportion to its success many unifying cultural characteristics that cut across former differences." [1]

Rapid industrialisation, however, is not easy to accomplish. It calls for a tremendous effort on a national scale and heroic sacrifices from all. It is possible that the easier Colombo Plan and the International Bank Plan are finding favour with the authorities because of the little effort and sacrifice required for their implementation.

The problems involved in industrialisation are generally classified under four heads, viz., problems related to the supply of money, materials, men and markets.[2] Let us consider these problems beginning from the last.

**Problem of Market**

A common fallacy with regard to market is that it depends on the size of the country or the size of the population. This obviously is not true ; the size of the market depends primarily on the income of the population.

If a programme of rapid industrialisation is started, then the income generated thereby will create sufficient effective demand to prevent any glut of goods in the market. It may even generate a demand for consumers goods which may far exceed their supply. In such a situation the problem will be one of restricting the market and some form of rationing and control of distribution will be necessary.

Restriction on consumption is also necessary for another purpose. The programme of rapid industrialisation will require the diversion of a large proportion of the national income towards investment. Restriction of consumption will help in this diversion.

Drastic reduction will have to be made in imports of consumer goods, so that foreign currency may be conserved to buy investment goods and to secure the services of foreign technicians.

Here again, whether the volume of the market will expand or not will depend on the volume of investment undertaken. If the volume of investment is small, the income generated will be insufficient to influence and change the market situation. For example, if a small shoe factory is started, and nothing else, then the income generated by wage payments, &c., will not necessarily lead to a rise in the demand for shoes, for the majority of the consumers not being employees of the shoe factory, will not have any increase in their income and, therefore, will have no increased means to buy shoes. If, on the other hand, a large number of factories are opened, so that most of the people now earn more in these factories, then their demand for shoes and other consumer goods will increase. Thus, these increased

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[1] Wilbert E. Moore, *Ibid*, p. 311.
[2] Vera Anstey : *Economic Development of India*, 1936, p. 227.

demands will feed on each other, causing a further rise in demand.   A chain-reaction will be started and, by a process of cumulative causation, further expansion in industry and a general economic development will be made easier.

## Problems of Material

(a) *Raw-materials: :* Very little is known of the mineral potential of Ceylon.   No thorough geological survey has yet been made.   The little information that the rudimentary geological department has compiled shows that a number of minerals such as graphite, gems, ilmenite, thoriamite, monazite, mica and iron  ore are available on a scale to permit commercial exploitation.   Only the first two are exploited today, and these not fully.

The potentiality of forest is altogether unknown.   Many agricultural raw materials, such as cotton, sugarcane and fruits, can be grown if sufficient attention is paid to them.   Improvement in hides and skins is also possible.

In any event an internal supply of raw materials cannot be considered an essential to industrialisation, at least in times of peace.   Industrialisation is possible by using imported raw materials, as has been pointed out by the International Bank Mission.[1]

(b) *Power-Resources :* Ceylon has no coal or petroleum, but her hydro-electric potentiality is very high.   The supply of power should not therefore be a cause of anxiety.   The presence of thoriamite may give her some advantage over other countries in the future, if the atomic age ever comes.

Firewood, though a wasteful source of fuel, may be used in the early stages of industrialisation, when the supply of hydro-electric power may not be adequate, and when the replanting of the forests with more valuable trees will make a supply of firewood available.

## Problem of Capital

In the previous chapter we have considered the general problem of capital supply. Here we will discuss in more concrete terms the position with regard to this important factor.

According to the estimate of the International Bank Mission, Ceylon can without much difficulty raise a fund of Rs. 550 million for economic development per year from public and private investments together.[2]   By a drastic reduction of consumer goods imports and by heavier taxation, this amount can be raised still further.

The International Bank Mission, however, failed to include the hidden rural source of capital formation that we discussed earlier, namely, the saving that would ensue from removing the rural surplus population.   According to our estimate the number of surplus rural families in 1946 was 615,000.   The average annual income per family was, according to a sample survey, Rs. 1,116 in 1950.[3]   Assuming that

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[1] *Economic Development of Ceylon*, 1953, p. 524-525.

[2] *The Economic Development of Ceylon*, 1953, pp. 88–105.

[3] *Preliminary Report on the Economic Survey of Rural Ceylon*, 1950.

these figures are unchanged today and that the income and expenditure of the peasant families are equal, the annual saving that will result if the entire surplus population is removed from agriculture, is Rs. 686 million. It is not likely that the whole of this surplus rural population could be absorbed into industry at the same time. The immobility of rural population and the inadequacy of industrial openings would prevent such large scale movement. Secondly, a rise in births among the families who remain in agriculture, will partly offset this movement. Thirdly, the peasant to whom the saving will, in the first instance, occur, may use it in either of the following ways : (a) Firstly, the peasant may increase his demand for consumer goods, the price of which may rise and the saving may vanish in financing the price increase. (b) Secondly, given the necessary encouragement and opportunity, he may put his surplus savings into a saving bank. In this case the saving will be available for industrial development. The peasant will be helped to take this step, if a mass psychology is created by an intensive propaganda based on patriotic appeal. (c) Thirdly, he may spend it in improving the method of farming. For example, he may invest it in buying a better plough. In this case he will add to the effective demand for the products of those industries which produce them ; their turnover will, therefore, increase resulting in a greater efficiency and economy of their capital. In this case, therefore, the peasant will be making an indirect contribution to the industrial development of the country. (d) Fourthly, the danger is present under the prevailing psychology, that the peasant will dig a hole in his floor and hide his savings in idle hoards, or buy jewellery and gold and keep the hoard on his wife's person. At present there are good reasons for them to do so. The risk of crop failure is great and a surplus from the land cannot be expected every season. Traditionally the peasant distrusts the banks and other similar institutions. Once he is convinced of the future security of his savings, it is likely that he will realise the gain that he may obtain by keeping his money in the bank rather than in idle hoards.

Propaganda, persuasion and education will thus occupy a key role in ensuring success to any effort at social change.

Even if we assume that only half of this saving of Rs. 686 million becomes available for industrialisation, it will augment the supply obtained from the present sources by 62.4 per cent.

Mobilisation of capital thus resolves itself into two problems : First, the mobilisation of normal savings through banks and life insurance companies, and the control of consumption by rationing, taxation and control of imports. Secondly, the mobilisation of rural savings and rural surplus population. A new facet to the functional relationship between capital formation, mobility of labour and industrialisation is thus revealed.

## Problems of Mobility of Labour

A more difficult problem is that of obtaining labour. It is, perhaps, easier to obtain skilled labour for higher paid jobs. Social barriers to such jobs are few. The high

salary or wage, and the prestige value attached, are additional attractions, so that the supply of cadres can be assured for these jobs by arranging suitable training facilities.

The more difficult problem is that of obtaining labour for semi-skilled and unskilled industrial employment. The agricultural and familial type of social organistaion of today offers great resistance to factory work. The security that the family offers to its members in rural areas, prevent them from leaving its fold and migrating to towns. The emotional attachments and loyalties militate against movement. The possibility of economic advancement may be ignored so long as the prevailing customary needs are more or less adequately satisfied. Ignorance of the prospects and fear of the unknown cities, deter the rural population from moving to the towns.

In addition to geographical mobility of this type, the mobility from occupation to occupation may be hindered by the presence of caste prejudice. Occupations which are regarded as below the caste dignity are often avoided, even if they are economically advantageous.[1]

Wilbert E. Moore in a field survey in Mexico investigated the question of labour supply for the purpose of industrialisation. His findings, which we have already had occasion to quote a number of times, are instructive and illuminating in this respect. He says, " Among the common barriers . . . . the following are of special importance : ignorance of alternatives and of the skills for their adoption ; the security system, both emotional and economic, provided by the social structure ol non-industrial societies ; the status system of non-industrial society which generally depends largely upon inherited position, regards the performance of duties according to traditional expectations, and minimises impersonal, functionally specific types of economic relations and division of labour ; the " freedom " and socially recognised skill of the independent producer in primitive and peasant societies."[1]

It would be wrong, however, to assume that these difficulties are absolute and insurmountable. Firstly, it is often possible to develop industries in such a way that the labour supply may be obtained from the neighbouring villages. The development of hydro-electric power and transport facilities makes possible this kind of decentralised industrialisation. The familial barrier to labour supply may be overcome in this way. Often it may be possible to organise the division of labour within the production unit more or less on a caste line. For example, the success of the Bata Shoe Company in India is based on this system. The work of cleaning the raw hides and doing the first stages in tanning, are performed by labourers belonging to a caste whose traditional caste work was not very much different. This work is regarded as ' low ' by all other castes. But once the leather is tanned and is put onto the conveyor belt, the high caste labourers do not object to attend to it and perform the appropriate operations.

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[1] See *Jackson Committee Report on Imm ration*, 1938, and also *The Economic Development of Ceylon*, pp. 522–523.

[2] *Ibid*, p. 302.

Often the operations involved are so novel that their classification in terms of traditional caste dignity becomes difficult. The economic motive in such cases may become the deciding issue.

It must be remembered that the economic foundation on which these cultural values and traditional behaviour are based are fast crumbling. The old social structure is already in a process of disintegration. The resistance that it can offer to the new way can, therefore, only be temporary. " Any society has some degree of resistance to change, whether the source of the change be internal or external. That resistance arises from the nature of society itself. As a complex organisation of interrelated human activities, orientated to certain goals and fulfilling certain functions necessary to its own survival, a society provides more or less adequate answers to the common problems of human existence. To the degree that a particular society approximates the model of perfect integration, the established and normally sanctioned patterns . . . . are internally consistent and self-perpetuating. It follows that an innovation in the organisation of production and the means of gaining a livelihood will initially encounter resistance approximately proportional to the integrations of the established structure." [1]

A society that fails in the primary task of providing work and food for the people cannot be regarded as possessing a high degree of integration. The pressure that poverty exerts on the population is a powerful factor in favour of overcoming the resistance of the old social values. " The comparative survey of labour incentives testifies to the importance of coercion and poverty as the effective circumstances for the initial transition from non-industrial to industrial employment." [2]

Again, " it is among the landless, the hungry, the politically powerless, the socially disaffected that the first industrial recruits are mostly to be found." [3]

**Conclusion**

Electrification, industrialisation and education are the three levers of social change which should be given the highest priority in any scheme of national development. Agricultural development will follow as a by product of these three. For example- irrigation will necessarily be developed when hydro-electricity is installed. Supply of fertiliser, improved and mechanical means of cultivation, &c., will be the result of industrial progress. Education and propaganda will help in their introduction in the rural areas. The removal of surplus population from the rural areas will not only help industrial labour supply, but will create the basic situation where agricultural improvement may be made possible.

If, in addition, the demographic and institutional factors are given due consideration in drawing up the plan for industrialisation, then the success will be quicker and the sacrifice less.

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[1] Wilbert E. Moore, *Ibid*, p. 14.
[2] Wilbert E. Moore, *Ibid*, p. 304.
[3] Wilbert E. Moore, *Ibid*, p. 307.

# CHAPTER 14

## EPILOGUE *

THE opening years of the second half of the twentieth century saw the completion of the first phase of the rapid demographic changes which began during the Second World War and the post-war years. The most spectacular of these changes was the decline in mortality.

### Post-War Trend in Mortality

The crude death rate based on uncorrected figures during the period 1944–1955 is set out below :

TABLE 1—CRUDE DEATH RATE, 1944–55

| Year | Crude Death Rate | Index |
|------|------------------|-------|
| 1944 | 21·2 | 100·0 |
| 1945 | 21·9 | 103·3 |
| 1946 | 20·2 | 95·3 |
| 1947 | 14·3 | 67·4 |
| 1948 | 13·2 | 62·3 |
| 1949 | 12·6 | 59·4 |
| 1950 | 12·6 | 59·4 |
| 1951 | 12·9 | 60·8 |
| 1952 | 12·0 | 56·6 |
| 1953 | 10·9 | 51·4 |
| 1954 | 10·4 | 49·1 |
| 1955 | 11·0 | 51·9 |

The revolution in mortality began in 1946 and recorded a remarkable decline in the death rate almost every year. The highest decline ever recorded was that of 1946–1947 when the death rate fell by as much as 29·2 per cent in a single year.

By 1953 this decline exhausted itself and came gradually to a halt. The progress achieved during the course of these few years was tremendous. The present rate of 11·0 compares well with that of England and Wales which was 11·9 in 1953. The average expectation of life at birth, calculated by the Registrar-General shows a rise of 14 years, from 42·8 years in 1946 to 56·8 years in 1955. The average expectation of life at birth in England and Wales at present is about 70 years. The

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* The data used in this chapter are compiled from the Registrar-General's Reports without any correction. It is necessary, therefore, to keep in mind their limitation discussed earlier.

expectation of life at birth gives a more correct measure of mortality because it is free from the distortion produced on the crude death rate by the age and sex composition of the population.   The high figure of 70 years for England and Wales shows that Ceylon has yet a long way to go to reach the British standard of health and mortality.

Infant mortality rates based on registered deaths and births, show a similar steep decline during 1946–50, a gradual decline till 1953 and flattening out of the trend since then.

TABLE 2—INFANT MORTALITY RATES, 1944–1955

| Year | Infant Mortality Rates | Index |
|---|---|---|
| 1944 | 135 | 100·0 |
| 1945 | 140 | 103·7 |
| 1946 | 141 | 104·4 |
| 1947 | 101 | 74·8 |
| 1948 | 92 | 68·1 |
| 1949 | 87 | 64·4 |
| 1950 | 82 | 60·7 |
| 1951 | 82 | 60·7 |
| 1952 | 78 | 57·8 |
| 1953 | 71 | 52·6 |
| 1954 | 72 | 53·3 |
| 1955 | 71 | 52·6 |

The maternal mortality rate shows a steep decline during 1946–50.   Since 1950 the rate of decline has been considerably slowed down and is tending towards an asymptotic level.

TABLE 3—MATERNAL MORTALITY RATES, 1944–1955

| Year | Maternal Mortality Rate | Index |
|---|---|---|
| 1944 | 13·7 | 100·0 |
| 1945 | 16·5 | 120·4 |
| 1946 | 15·5 | 113·1 |
| 1947 | 10·6 | 77·4 |
| 1948 | 8·3 | 60·6 |
| 1949 | 6·5 | 47·4 |
| 1950 | 5·6 | 40·9 |
| 1951 | 5·8 | 42·3 |
| 1952 | 5·8 | 42·3 |
| 1953 | 4·9 | 35·8 |
| 1954 | 4·6 | 33·6 |
| 1955 | 4·1 | 29·9 |

The progress in maternal death rates has been much higher during these years than the general death rate and the infant mortality rate as is brought out clearly in Diagram 8. In Chapter 6 we pointed out the relatively smaller decline in the death rates of females compared to that of males till 1947. In view of the rapid progress achieved in reducing maternal mortality, it is pertinent to ask whether this situation has now been remedied.

DIAGRAM 8 : CRUDE DEATH RATE, INFANT MORTALITY RATE AND
MATERNAL MORTALITY RATE, 1944–1955
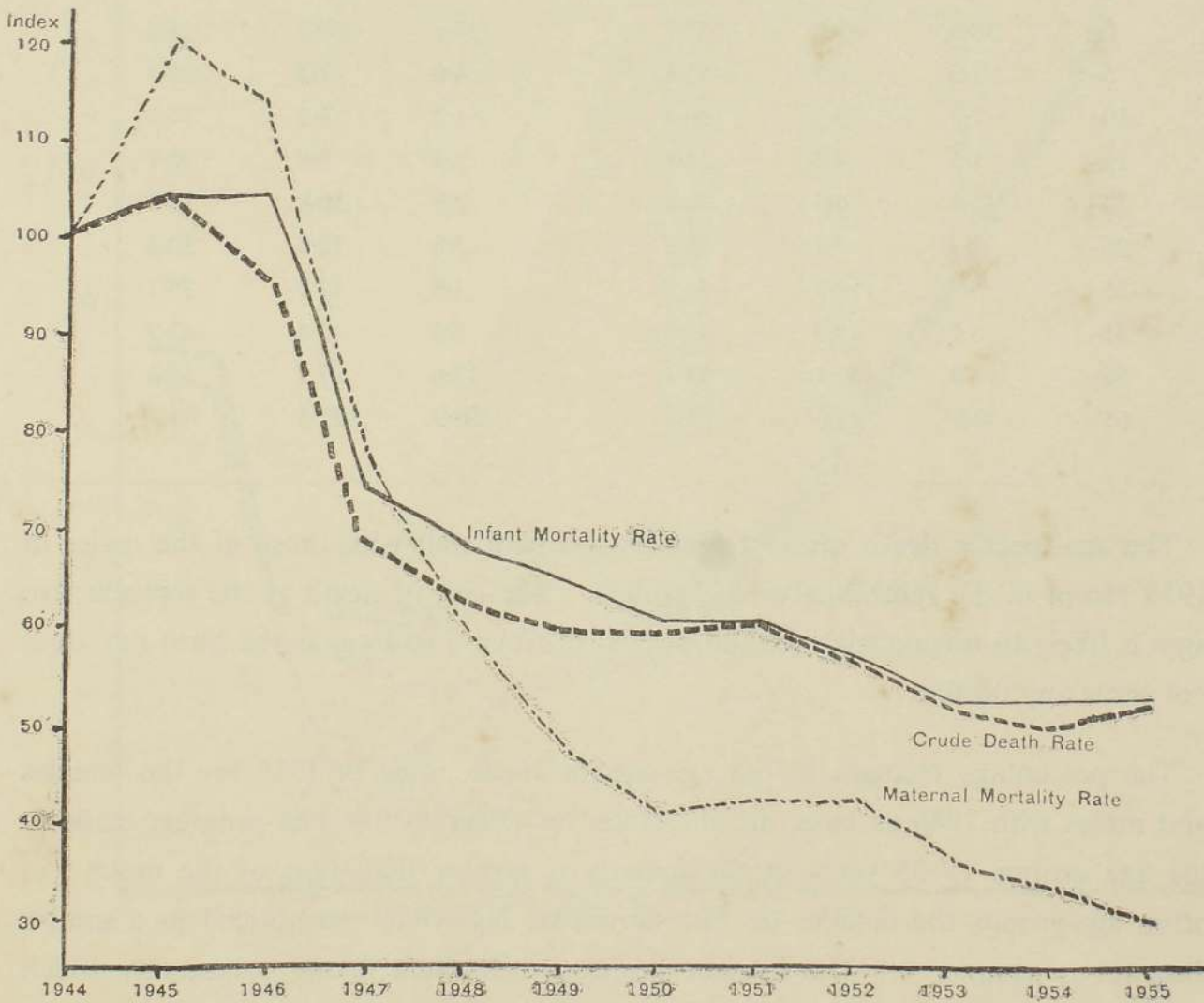
The age-specific death rates of males and females are set out in Table 4 for the years 1946 and 1955.

### TABLE 4—AGE-SPECIFIC DEATH RATES, 1946 AND 1955

| | Male Death Rates | | | Female Death Rates | | |
| --- | --- | --- | --- | --- | --- | --- |
| Age | 1955 | 1946 | Percentage of 1955 over 1946 | 1955 | 1946 | Percentage of 1955 over 1946 |
| 0– | 38·0 | 67·0 | 56·7 | 37·1 | 68·0 | 54·6 |
| 5– | 3·6 | 6·5 | 55·4 | 4·0 | 7·5 | 53·3 |
| 10– | 1·2 | 3·3 | 36·4 | 1·2 | 3·5 | 34·3 |
| 15– | 1·5 | 4·4 | 34·1 | 1·2 | 5·8 | 20·7 |
| 20– | 2·0 | 6·5 | 30·8 | 2·9 | 10·8 | 26·8 |
| 25– | 2·4 | 7·7 | 31·2 | 3·8 | 12·5 | 30·4 |
| 35– | 3·7 | 11·3 | 32·7 | 4·6 | 12·9 | 35·7 |
| 45– | 8·1 | 18·5 | 43·8 | 6·6 | 15·4 | 42·9 |
| 55– | 18·0 | 31·1 | 58·1 | 15·6 | 27·7 | 56·3 |
| 65+ | 78·9 | 96·0 | 82·2 | 86·9 | 102·3 | 84·9 |

The age-specific death rates of females compare well with those of the males in 1955 except in the reproductive age groups. The risk of death at the reproductive ages is likely to remain high for the women of Ceylon so long as the birth rate does not show any decline.

The percentage changes in the age-specific death rates in 1955 for the females and males with 1946 as base, are illustrated in Diagram 9. The progress made in the age groups 15–35 years of the females is greater than that of the males : in other age-groups the females do not show that lag which we noticed in a similar diagram in chapter 6. The inferior position of women in the community which resulted in a relatively higher death rate for the females of Ceylon till the middle of this century is being rapidly remedied. Fall in the female death rate has been more rapid during recent years than in the male death rate, and the difference between the two has almost vanished. If this decline in the female death rate is maintained for some time, the abnormal sex-composition of the population of Ceylon will soon

DIAGRAM 9 : AGE-SPECIFIC DEATH RATES : PERCENTAGE CHANGE IN 1955
AS COMPARED TO 1946
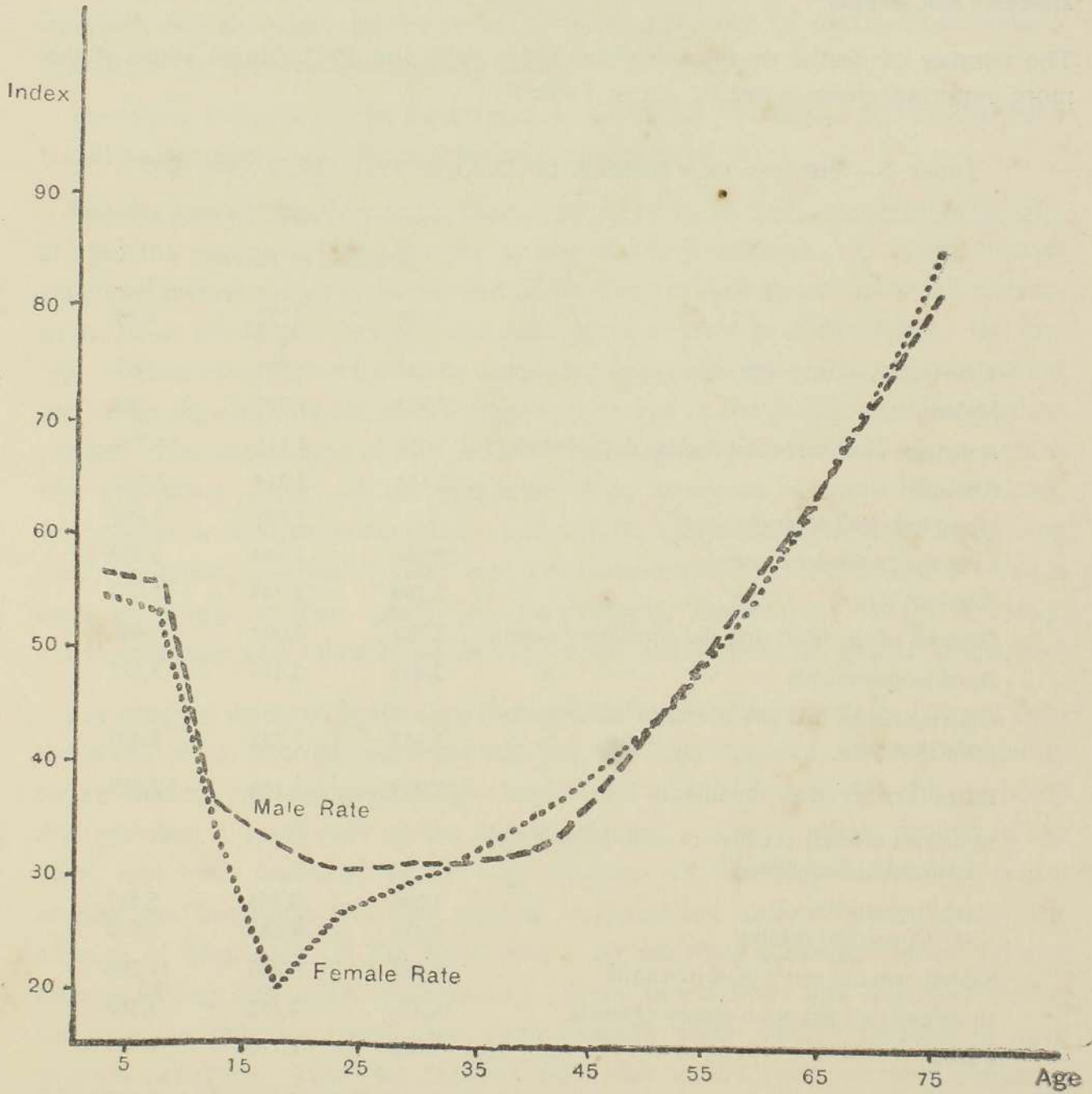
be remedied and the proportion of women in the population will rise.  Such a rise in the proportion of female population is likely to have far reaching effects on the political, economic and social affairs of the country.


## Diseases and Deaths

The number of deaths during the years 1946, 1952 and 1955 due to some of the more important diseases are set out in Table 5.


TABLE 5—DISEASES AND NUMBER OF DEATHS, 1946, 1952 AND 1955

| Disease | Number of Deaths | | |
|---|---|---|---|
| | 1946 | 1952 | 1955 |
| Tuberculosis of the respiratory system | 3,627 | 2,808 | 1,667 |
| Malaria | 12,587 | 1,049 | 268 |
| Ankylostomiasis and other diseases of the helminth | 5,038 | 4,811 | 4,794 |
| Anaemias | 2,664 | 2,318 | 2,452 |
| Hemiplegia and other paralysis | — | 2,275 | 2,678 |
| Convulsions (under 5 years) | 12,896 | 7,764 | 6,829 |
| Rheumatic fever | 2,299 | 1,343 | 1,074 |
| Diseases of the heart and the circulatory system | 3,380 | 4,062 | 5,448 |
| Broncho-pneumonia | 2,453 | 3,117 | 3,527 |
| Gastro-enteritis and colitis, except diarrhoea in the new-born | 5,452 | 3,322 | 5,420 |
| Rathe (Erythematous condition) | 7,089 | 3,110 | 2,719 |
| Ill-defined diseases peculiar to early infancy and immaturity unqualified : | | | |
| (a) Immaturity | 5,090 | 5,265 | 5,517 |
| (b) Congenital debility | 6,488 | 4,688 | 3,942 |
| Senility without mention of psychosis | 8,386 | 9,483 | 11,299 |
| Ill-defined and unknown causes—Pyrexia | 10,456 | 3,472 | 3,563 |
| Cancer | 829 | 1,175 | 1,555 |


In estimating the progress achieved in the control of any disease, we must remember that : (a) the population has been rising during all these years ; (b) some improvement in the reporting machinery and also in diagnosis might have been effected, and (c) temporary factors affect the annual deaths.  Hence increase in the number of deaths due to a disease does not necessarily imply increasing prevalence of and mortality due to the disease.  The rise in the number of deaths may well be due to

the rise in population, and/or better reporting. In the case of a fall in the number of deaths, specially where the decline is large and persistent, we may surmise with greater certainty that some progress has been achieved in controlling the incidence of the disease.

Table 5 shows that the greatest single achievement of the health services of Ceylon of which she can justifiably be proud of is the reduction of deaths from malaria from 12,587 to 268 in the course of ten years.

The rising trend in deaths from tuberculosis, noted in Chapter 6, has also been halted and a reduction in the number of deaths achieved.

The diseases of the older age groups, such as heart diseases, cancer, senility &c., are gaining in importance with the ageing of the population. In other diseases progress has been rather slow. It should be noted that the more important diseases from which the largest number of deaths occur today are of two types : the first type of diseases are those which are associated with older age groups, and, therefore, are rather the consequence of the progress achieved in the health conditions of the people. The second type of diseases are mostly those connected with, (a) malnutrition and lower vitality of the population (e.g. mandame, anaemia, tuberculosis, convulsions in children, pneumonia) ; and, (b) the habits of the population regarding food, sanitation, personal hygiene &c., and the availability of public health services such as sewage system, system of water-supply, disposal of refuse &c. (e.g. ankylostomiasis and other helminthic diseases, gastro-enteritis, colitis, dysentery.)

The progress achieved in the conditions of health of the people so far has not been the result of an internal social growth, but has been imposed on the community by an efficient external organisation maintained at a high cost (Rs. 10 per head) and spending a good part of the national income. The dramatic decline in the death rate bears testimony to the high efficiency of this organisation, but, it also reveals the limitation that an external organisation suffers from, namely the absence of deep roots in the community. By adopting measures which did not require willing and active participation of the population, this organisation has succeeded in reducing death rates from diseases which readily respond to such external measures. This also explains why after a few years of rapid progress, the death rate is at present approaching an asymptotic limit.

The next phase of the progress in health conditions of the people would require co-operation of the masses, and, secondly, large investment of funds for water-supply, sewage and drainage, housing and other schemes. These would require economic development and rise in national income on the one hand, and, education of the people and reorientation of their habits and system of values, on the other.

In other words, the next phase of progress in public health in Ceylon must await a social transformation which may take place rapidly and at a high tempo if accompanied by a social revolution (*cf.* the campaigns against flies and rats in China during recent years), or, it may be gradual and slow if it is brought about by a process of spreading education from generation to generation accompanied by a slow rate of economic growth. The rapid increase in population, however, creates an urgency in the situation and justifies a high tempo as discussed in the last chapter.

## Marriages and Births

Ceylon seems to be entering a stable phase not only in mortality but also in marriages and births. The war and the post-war years saw a marriage boom followed by a baby boom both of which seem to have come to an end by 1955 as shown in Diagram 10.

### TABLE 6—MARRIAGE RATES AND CRUDE BIRTH RATES

| Year | Marriage Rates | Crude Birth Rates |
|------|----------------|-------------------|
| 1940 | 5·3 | 35·7 |
| 1941 | 5·7 | 36·4 |
| 1942 | 7·6 | 36·6 |
| 1943 | 7·7 | 40·4 |
| 1944 | 7·1 | 36·9 |
| 1945 | 6·5 | 36·6 |
| 1946 | 6·2 | 38·2 |
| 1947 | 5·9 | 39·3 |
| 1948 | 6·1 | 40·5 |
| 1949 | 6·0 | 39·8 |
| 1950 | 6·5 | 40·4 |
| 1951 | 6·7 | 40·5 |
| 1952 | 6·4 | 39·5 |
| 1953 | 6·1 | 39·4 |
| 1954 | 5·9 | 36·2 |
| 1955 | 5·9 | 37·9 |

Table 6 and Diagram 10 show that the peaks and troughs of the birth rate generally follow those of the marriage rate with a time lag. Too close resemblance between these two variables cannot be expected because marriages enter into the computation of marriage rates only once, when it is registered, while their influence on the birth rate continues over a long period, and, secondly, newly married couples constitute only a small proportion of the total married population. Some significance should

DIAGRAM 10 : MARRIAGE RATE AND BIRTH RATE, 1940–1955
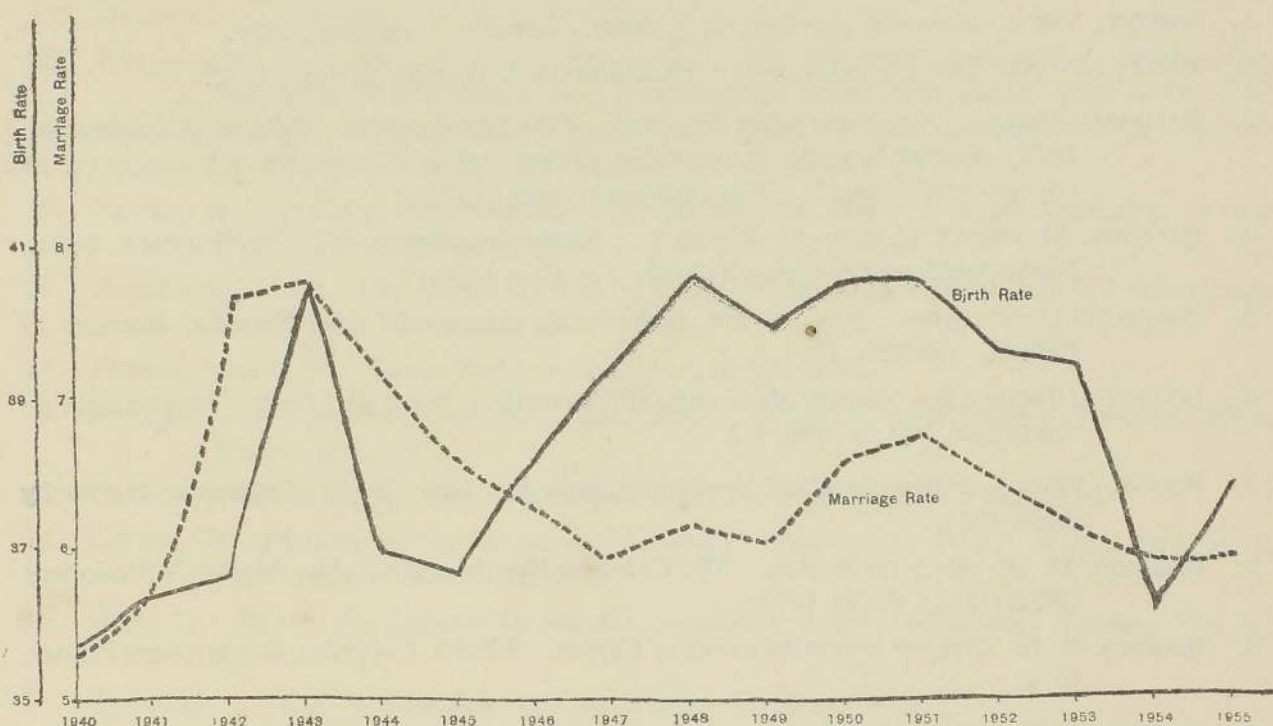


be attached, therefore, to the correlation that we found to exist between marriage rate and birth rate. Marriages, specially age at first marriages, seems to be the only factor that has so far exerted some influence on fertility of Ceylon population. So long as the community does not adopt family planning on a significant scale, raising the minimum age of marriage may appear to be the only feasible measure for controlling population growth.

Marriage habits, however, change rather slowly and evasion of marriage laws may be widespread, if they seriously come into conflict with the existing social customs.

Efforts to solve the population problem by such isolated and minor social reforms are not likely to produce the desired result because of the way the variables involved in the situation are enmeshed into the social structure. A movement aimed at complete social transformation with industrialisation as its spearhead stands a better chance of success.

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# SUBJECT INDEX

# AUTHOR INDEX