

IRISH POPULATION PROSPECTS CONSIDERED FROM THE VIEWPOINT OF REPRODUCTION RATES.

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In a paper¹ which I read before the Society in November, 1935, prognostics were given of the trend of population during the next century on two sets of hypotheses: (1) that the number of births would remain constant, and (2) that the "fecundity rate" would remain constant. Mortality experience as in 1925-27 was assumed to prevail throughout and migration was ignored. The population in the year 2016, according to hypotheses (1) would be 3,304,000, and according to hypotheses (2) the population would be 3,663,000. One of the main objects of the present contribution is to revise and to elaborate these prognostics in the light of the results of the 1936 Census of Population.

It may be stated at once that it is possible to take a more optimistic view of the future of the population than at the time when the previous calculations were made, which was nearly four years before the *Ages and Conjugal Condition* volume of the 1936 Census of Population made its appearance. The statistics in that volume showed that the number of females at the reproductive ages was far lower than could have been anticipated from the official estimate of population for 1935 and, in consequence, that the "fecundity rate" (taken as the ratio of the number of births to the number of females aged 15-44) was considerably greater than had been thought. On the other hand, the Census, in revealing an unsuspected volume of emigration, particularly of females, to the United Kingdom, removed the last shred of plausibility from the assumption that in framing estimates of future population emigration could be left out of account. A revised series of estimates of future population based on the same assumptions as that of (2) of my previous paper is given below, but, as pointed out, its interest is purely theoretical.

Prognostics of population have been made for many countries and have received enormous publicity and, as might have been anticipated, some doubts as to the usefulness of these prognostics had begun to be expressed. Having regard to the manner in which they were sometimes used in the Press this is not surprising. Almost inevitably the most extreme prognostics received the widest publicity and usually were not accompanied by a full statement of the hypotheses on which they were made, or by the warning that the more remote the period to which the figures purport to relate the less reliable the results. In England it was Dr. Enid Charles's misfortune that her extreme pre-

diction that the population of England (assuming a continued decline of fertility) would be only $4\frac{1}{2}$ millions in the year 2035,² received the widest attention, notwithstanding the obvious fact that because the hypotheses on which it was based were the least likely, the "prognostic" itself was merely a very graphic manner of giving a warning as to what would happen if the fertility were allowed to decline. I am sure that Dr. Charles does not consider a decline of the population of England to anything like 5 millions a century hence as within the bounds of possibility. A serious decline in population in advanced countries would be so disastrous that long before it had become a certainty effective methods would have been taken to counteract it. Population can be had at a price, but the price will not be paid until depopulation has become imminent. Short of a major cataclysm which would involve all countries I do not believe that in the next century the population of England will decline by 10 millions.

Estimates of future population are not to be regarded as prophecies, though they may sometimes be taken as warnings. All they purport to show is that, according to reasonably plausible assumptions, usually extrapolations into futurity of relatively constant recent tendencies, the population will show certain trends. In work in other countries it has been customary to give several results based on several different sets of assumptions. Persons wishing to use these figures are accordingly in a position to take their choice and modify the trends as the years go by. The three series of estimates which are given in this paper are submitted with the reservations which are implicit in the foregoing observations. As pointed out in my earlier paper, the estimates for Ireland are more conjectural than those for most other countries, even for less remote periods because of the utterly unpredictable course of emigration.

Estimates of future population render explicit the assumption with regard to population statistics, which is implicit in the use of most current statistics, that the tendencies indicated are applicable *now* and in the near or remote future, though they may actually relate to some time back. Statistics which fluctuated in an arbitrary manner in time would have little practical utility, though they might ultimately have some historical value.

My previous estimates have been criticised because they related to the Twenty-Six Counties. The present series also relate to this area, principally because the exact data required for the Six Counties are not available.

In order to justify the assumptions on which two of the three series of estimates are based, it will be necessary to consider the recent trend in births, deaths and migration.

Births.

The most important fact which Volume V, Part I of the 1936 Census revealed was that, while the total population showed but little change since 1926, the number of children and young persons declined considerably: at ages 0-14 the decline was over 47,000, or 5.5 per cent., and at ages 0-4 the decline was 19,000, or by 6.8 per cent. In the official analysis³ issued with the Census volume the reasons for the decline were closely examined. In particular, it was shown that the decline in the birth-rate from 20.6 in 1925-27 to 19.4 in 1935-37

(equivalent to 5.8 per cent.) was due to a decline in fertility of marriage (standardised for different ages of married women) by 5.1 per cent., and only in a very minor degree to decline in the number of married women and to increase in their average age. It was shown that the whole period from 1871 to 1936 could be divided roughly into two (i) from 1870-2 to 1900-2, during which the birth-rate declined by 20.4 per cent., which decline was due entirely to a decrease in the number of married women at the reproductive ages and to an advance in their average age; (ii) from 1900-2 to 1935-37 the decline in the birth-rate by 11.4 per cent. was due entirely to a very similar decline (10.5 per cent.) in the fertility of marriages.

Another result of great significance was that the decline in the numbers of young children (aged 0-4 years) was relatively greater in rural than in town areas, whether considered in relation to total population, or to females (or married females) at the reproductive ages. If the ratio of children under 5 years to total population be regarded as indicative of the *effective* birth-rate, the Census showed that, whereas in town areas the rate declined by 5 per cent., in rural areas it declined by 9 per cent. The contrasts are more marked in effective fertility of marriages:—in town areas a decline of only 1.6 per cent. contrasts with a decline of 6.6 per cent. in rural areas. The effective birth-rate is much higher in town areas but the fertility of marriages remains 25 per cent. higher in rural areas. In Dublin City and County the effective birth-rate, as defined, fell by 5 per cent. between 1926 and 1936, but the fertility of marriages fell by less than $\frac{1}{2}$ per cent.

The official analysis⁴ shows, in the light of the 1936 Census, the unique position of this country in having the highest number of children aged 0-4 per 1,000 married women at the reproductive ages (123 as compared with Portugal, 103 the next highest on a list of twenty-one countries, on which Belgium is lowest with 58), and proportionately the lowest number of such women (73 per 1,000 population, compared with 93 for Finland, the second on the list, and 145 for U.S.A.). An important fact bearing on the present investigation is that while the ratio of children under 5 years to females aged 15-44 fell by 5.3 per cent. between 1926 and 1936 in the case of Catholics, the corresponding ratio for other religions fell by 14.9 per cent.⁵ The ratio for other religions in 1936 was 0.269, as compared with 0.446 for Catholics and 0.283 for England and Wales. The decline in the ratio in the latter country between 1926 and 1936 (19.6 per cent.) was somewhat greater than for Irish non-Catholics.

While the decline in the birth and fertility rates between 1926 and 1936, following on similar phenomena in the previous intercensal period, has given rise to some concern, it should be pointed out that the percentage decline of 4.9 in the birth-rate between 1926 and 1936 was exceeded by the figures for every country except Germany (with 2.6 per cent.) in a list of no fewer than thirty-two countries, in twelve of which the decline exceeded 20 per cent. and twenty-seven 10 per cent.; in 1936 the birth-rate of this country (19.6) exceeded that of Germany (19.0). From these considerations it is premature to regard this country as on the "slippery slope" of declining fertility, though in making realistic prognostications of population, the possibility of a further decline in fertility cannot be left out of account.

Deaths.

In the third series of prognostics allowance is made for the probability that the increase in the expectation of life, which began early in the present century, will continue. During the most recent intercensal period the expectation of life at birth increased by 0.8 years for males, 1.7 years for females. The latest figures of 58.2 years for males and 59.6 years for females appear to be near the averages for countries for which these figures are available.⁶ The slowing down of the rate of increase compared with the previous intercensal period (1911-26), when the increase for both males and females was 3.8 years, may be due partly to the great increase in urbanisation during the latest period. Any increase in population during the next half century is almost certain to be confined to the non-agricultural population, and accordingly to town-dwellers. There is no essential reason, however, why, in the city dwellings of the future, conditions should be less salubrious than in rural areas.

Emigration.

In the future as in the past it seems likely that the trend in population will depend on the trend in emigration. It will, accordingly, be necessary to consider briefly the trend of emigration in the recent and more remote past with a view to attempting an extrapolation into the future. Annual average net emigration (*i.e.*, emigration less immigration) in the intercensal periods (determined as the sum of the decline in population and the natural increase) is shown in the following table:—⁷

TABLE I.

Net Emigration 1881-1936.

Intercensal Period	ANNUAL AVERAGE			Total per thousand of Average Population
	Males	Females	Persons	
1881-91	29,257	30,476	59,733	16.3
1891-01	20,315	19,327	39,642	11.9
1901-11	11,764	14,390	26,154	8.2
1911-26	13,934	13,068	27,002	8.8
1926-36	7,255	9,420	16,675	5.6

Allowing for abnormal migration during the period 1911-26 on account of the European War and of the political changes, it has been officially estimated that the "normal" net emigration in this period would have been about 7.2 per thousand per annum⁸ so that the sequence of decline since 1881-91 is unbroken. The very considerable female excess in the last intercensal period will be noted. There would probably have been a female excess also in the preceding fifteen years were it not for the exceptional conditions. A possible source of weakness in the future population is the fact that the stream of migration for some years to come will probably continue to be directed towards

Great Britain and in the last intercensal period the excess of females was greater amongst emigrants to Great Britain than to overseas countries: females, as percentage of total emigrants to the respective destinations, were 61 and 53. In this connection it will be recalled that the ratio of females to males in this country is the lowest in Europe and one of the lowest in the world.

The trend in net emigration since the Census is indicated by the following statistics:—

TABLE II.
Passenger Movement by Sea. Number.

Year	Inward	Outward	Balance Outward
1936	481,029	502,568	21,539
1937	523,004	548,940	25,936
1938	534,174	551,729	17,555
1939	456,230	439,808	—16,422*
1940	102,343	94,195	—8,148*

* Balance inward.

The substantial balance inward in the last two years, due, of course, to the war, will be noted, as will the decline in the volume of passenger movement in 1940 to one-fifth of the annual volume in peace-time.

In addition to the figures shown above for 1936 to 1938 there must be taken into account net emigration over the Northern border which in the intercensal period was found to average about 3,500 per annum,⁹ which figure was confirmed by direct investigation in 1938; so that, in the years 1936 to 1938 inclusive, annual net emigration averaged about 25,000, equivalent to a rate of 8.5 per 1,000 population. From the statistics of birthplaces published in Volume III of the Census it has been estimated that net immigration (i.e., the excess of the movement inward in the numbers of persons born outside the Twenty-six Counties over the movement outward of such persons) averaged about 1,500 per annum, so that gross emigration may have been about 26,500 per annum in the years before the war.

It will accordingly be conceded that in making realistic estimates of the future trend of the population allowance must be made for emigration and, from the trend of emigration in the last half-century, the assumption is made that the rate will decline in three decades to two-fifths of the 1926-36 rate and remain thereafter at that level. Having regard to the trend in the last column of Table I and more particularly to the volume of migration to Great Britain just before the war, this assumption must be regarded as optimistic.

In making the calculations, regard was had to the ages of emigrants which could be deduced approximately from the age distributions of the population in the years 1926-1936:—¹⁰

TABLE III.

Net Emigration, Ten Years 1926-1936.

Ages in 1926	ACTUAL NUMBERS (in thousands)		PERCENTAGE	
	Males	Females	Males	Females
5-9	4	6	5½	6½
10-14	11	20	15	21
15-19	27	31	37	33
20-24	24	20	33	21
25-28	4	6	5½	6½
30-34	3	6	4	6½
35-39	0	6	0	6½
Other ages	0	-1*	0	-1*
All ages	73	94	100	100

* Net immigration.

The interesting difference in the age distribution of male and female emigrants will be noted: there were proportionately more female emigrants in the younger and older age groups shown. It will be borne in mind that in all age groups the numbers relate to net emigration, so that the zero for males at age group 35-39 simply means that emigration and immigration at the intercensal period in this age group were approximately equal.

Gross and Net Reproduction Rates.

The concept of reproduction rate was introduced into statistical analysis by Richard Boeckh and considerably developed by R. R. Kuczynski and his pupils in the London School of Economics. While its devotees have perhaps been a little overclamant about its merits as compared with the birth-rate, crude or standardised, there is no doubt that as a single figure it gives more information about the condition of the population than the birth-rate. The latter will, and should, continue to be used in conjunction with the reproduction rate, because it has been available for a great number of years for many countries, while the number of countries for which *exact* reproduction rates are calculable are few. The situation as between the reproduction rate and the birth-rate is not unlike that between the Life Table death-rate and the crude death-rate, in that the older measure has received rather too severe a drubbing from the advocates of the new. Simple statistics have the great merit that they are used by many who, lacking the technical equipment to understand them, are distrustful of modern elaborations. Even amongst technicians one notices a reaction against elaboration and one must feel a certain sympathy with the question asked some years ago in a discussion in another statistical society: "When you have standardised and corrected (index numbers) for seasonality and for secular trend, what have you left?" The solution of the difficulty is, of course, to give both old and new.

The Net Reproduction Rate represents the number of female children who will be born to each female child born now, assuming

the indefinite continuance of present-day mortality of females up to the end of their reproductive period, and of present-day fertility. The Gross Reproduction Rate is a similar concept but it ignores mortality; i.e., it assumes that each female born now will survive to the end of her reproductive period; naturally the gross must be greater than the net reproductive rate.

Since the number of male births bears an almost constant relationship to the number of female births it may be anticipated from the definition of net reproduction rate that a population in which this rate is exactly unity and continues to be unity will ultimately become stable and, furthermore, that the distribution of the population will ultimately be that of the Life Table population. This result follows from mathematical considerations and it is usually proved by assuming that the mortality and fertility functions involved are continuous in the mathematical sense. Since in practice the reproduction rates and future populations are calculated from discrete (i.e., non-continuous) statistics I have thought it well to give as an appendix to this paper a proof of the theorem using discrete statistics only, and it is shown that, ignoring migration and assuming constancy of fertility mortality rates, the future population will be given in the year t by the formula

$$P_t = P_0 \cdot \alpha^t,$$

where α is the single positive root of a simple equation. It is shown that as the net reproduction rate is greater than, equal to, or less than unity, the value of α is less than, equal to, or greater than, unity respectively, and, in consequence, the population constantly increases, remains fixed, or decreases. The proportionate age distribution in such a population will become stable, the number at age x being $L_x \alpha^{-x}$, where L_x is the familiar Life Table function representing the number in a fixed population aged x .

The only other general comment on the net reproduction rate which seems necessary is that the rate takes no account of mortality of males or of females after the end of the reproductive period. It is, accordingly, theoretically possible for a population with a rate exceeding unity to decline for some years if the present population contains an excessive number of elderly people with a high mortality rate or a population (like that of Great Britain at present) to increase for several years although its net reproduction rate is substantially less than unity. Ultimately, however, the population, in the conditions stated, must assume the trend indicated by the foregoing formula.

In Ireland, at present, births are not classified according to age of mother and it has been necessary to have recourse to indirect methods for the purpose of estimating the reproduction rates. It is to be hoped that this statistical deficiency will soon be remedied as it was recently in Great Britain as a consequence of the Population Act. Since the net reproduction rate is so extremely important a figure I may be pardoned for going into some dull detail in regard to the method used to compute it, more particularly because the estimate for the years 1935-37 which I have adopted is somewhat, though not seriously, in excess of a figure published in the 1939-40 Year Book of the League of Nations* which apparently emanated from the London School of Economics. It was necessary to take account of the fact that in Ireland females marry late, that an abnormal number do not marry at all, and that the illegitimate birth-rate was very small. Full

* The figures there given for the gross and net rates were, respectively, 1.386 and 1.162 as compared with the estimates 1.479 and 1.217 adopted in this paper

statistics of births by age of mother are available for a few countries and, on examination, it seemed that for the purpose of computing an Irish net reproduction rate the statistics for Bulgaria were the most suitable. Like Ireland this is largely a rural community in which births are almost uncontrolled and in which the illegitimate birth-rate is low. The method of calculation will be most conveniently exhibited in tabular form :

TABLE IV.
Method of Estimation of Reproduction Rates.

Ages (1)	Average Annual Births per Married Woman (Bulgaria 1921-26) (2)	Ditto \times 1.223341, taken as Irish Ratio 1935-37 (3)	Estimated Annual Average Births per Female (Ireland 1935-37) (4)	Life Table Ratio of Females Living when Females Born=1 per Annum (5)	Product (4) \times (5) (6)
15-19	0.3122	0.3819	.003590	4.42883	.01590
20-24	0.3795	0.4643	.062727	4.35195	.27298
25-29	0.3100	0.3792	.134540	4.25328	.57224
30-34	0.2313	0.2830	.154348	4.14588	.63991
35-39	0.1757	0.2149	.138052	4.03212	.55664
40-44	0.0933	0.1141	.076960	3.90739	.30071
45-49	0.0437	0.0535	.034952	3.75944	.13140
			TOTAL A = .605169		TOTAL B = 2.48978

Col. (3) . Multiplier 1.223341 = Ratio of annual average births (57,623) in three years 1935-37 to expected number (47,103) found by multiplying rates in column (2) by numbers of married women

Col (4) : Col (3) \times Ratio married to total women

Proportion female to total births 1935-37 = .48868

Estimated Gross Reproduction Rate = Total A \times .48868 \times 5 = 1.479.

Estimated Net Reproduction Rate = Total B \times .48868 = 1.217

The gross and net rates found for the Twenty-six Counties in 1935-37 were thus 1.479 and 1.217 respectively. It may be well to point out that, using that data for all the other countries for which these statistics were available,¹¹ the gross and net reproduction rates for this country would be as indicated in the following table:—

TABLE V.
Estimated Gross and Net Reproduction Rates for Ireland in 1935-37. Results of Using Fertility Data for Seven Different Countries.

Using Fertility Data for—	Estimated Reproduction Rates for Ireland, 1935-37	
	Gross	Net
Bulgaria	1.479	1.217
Hungary	1.432	1.189
Czechoslovakia	1.427	1.185
Finland	1.460	1.204
Denmark	1.426	1.185
France	1.422	1.184
Norway	1.455	1.201

Notwithstanding the fact that the Bulgarian data yield the highest estimates the latter seem on the whole to be the most acceptable because the "expected" number of births using the Bulgarian figures comes closest to the "actual" number of births in Ireland and though, as will be seen from the notes to Table IV., the latter figure is far in excess of the former. Actually the magnitude of the estimates bears a fairly close relation to the fertility rates in the respective countries.

When exact data are available it is customary to use single years of age in computing reproduction rates, not quinquennial groups as in Table IV. Kuczynski has shown that this makes but little difference in the results.¹² It may be added that the fertility for each group shown in columns (3) and (4) might be found to be substantially at variance with actual figures if these were available; it is unlikely, however, that the reproduction rates could be considerably in error.

It will be clear from Table IV that in the computation of the reproduction rates it was not considered necessary to distinguish between legitimate and illegitimate births since the latter constituted only 3.3 per cent. of total births in 1935-37. If, notionally, illegitimate births were attributed exclusively to females at ages 15-19, 20-24 and 25-29 in the ratio 1:2:1 then for 1935-37 the gross reproduction rate would be reduced from 1.479 to 1.470 and the net rate from 1.217 to 1.211.

Accordingly, while a measure of imprecision must attach to the estimates of the Irish reproduction rates, it is quite clear that under existing conditions of fertility and mortality the Irish population is reproducing itself with a substantial margin of safety. It may be stated that *five* females born to-day will, in due course, give birth to *six* females. While a further decline in fertility is not beyond the bounds of possibility it is evident that the danger of a decline in population during the next 25 years or so must come primarily from emigration.

The Irish net reproduction rate is compared with that of a number of other countries in the following table:—¹³

TABLE VI.

Net Reproduction Rate (about 1935)	Country
1.4—1.6	Russia (?), Japan (2 countries).
1.2—1.4	Bulgaria, Éire, Portugal, Ukraine, Canada, Chile, Union of South Africa (7 countries).
1.0—1.2	Holland, Iceland, Italy, Luthuania, Poland, Spain (6 countries)
0.8—1.0	Czechoslovakia, Denmark, Finland, France, Germany, Hungary, Latvia, Luxembourg, Northern Ireland, Scotland, U.S.A., Australia (12 countries)
Under 0.8	New Zealand, Austria, Belgium, England, Estonia, Norway, Sweden, Switzerland (8 countries).

In the list of 35 countries, Ireland ranks about fourth. Between 1925-27 and 1935-37 the Irish rate declined from 1.249 to 1.217 or by 2.8 per cent.

Gross Reproduction Rates: Trend and Regional Distribution.

In the next table the gross reproduction rate, which must be regarded as the most efficient measure of fertility, is compared with two more familiar functions about each Census year since 1871.

TABLE VII.

Years	Gross Reproduction Rate	ANNUAL AVERAGE	
		Birthrate	Births per 1,000 Females aged 15-44
1870-2	2.089	27.5	128.7
1880-2	1.884	24.0	109.4
1890-2	1.733	21.7	98.6
1900-2	1.612	21.9	95.4
1910-2	1.658	22.7	104.3
1925-7	1.560	20.6	97.5
1935-7	1.479	19.4	93.3

A remarkable feature of this table is that the gross reproduction rates form a more regular sequence of figures than the other two. Thus the series of intercensal declines in the reproduction rate between 1871 and 1901 are seen to be 0.20, 0.15, 0.12 as contrasted with 3.5, 2.3, + 0.2 (increase) in the birth-rate and 19.3, 10.8 and 3.2 in the figures in the last column. Having regard to the fact that the period between 1911 and 1926 is of 15 years and between 1926 and 1936 is of 10 years the figures indicate that fertility declined at an accelerated rate in the last intercensal period. Over the whole period, 1871 to 1936, fertility declined by 29.2 per cent. compared with 29.5 per cent. for the crude birth-rate and 27.5 per cent. in births per 1,000 females at the reproductive ages. In the last intercensal period the respective percentage declines were 5.2, 5.8 and 4.3, so that over the long and short periods the much-abused birth-rate comes out of the test very well as an indicator of the trend in fertility. It will be recalled that up to 1901 the decline in fertility was due entirely to a decline in the number of marriages and to an increase in the age at marriage; since 1911 the decline has been due definitely to a decline in the fertility of marriages. The out-of-trend increase in all three series in 1911 is curious, and it is strictly in accordance with the abnormal behaviour of all Irish demographic statistics that in the present century the Census year in which the birth-rate was highest should be the year in which the proportions of married females at the reproductive ages were lowest.

Regional estimates of gross reproduction rates in 1926 and 1936 are compared in Table VIII.

TABLE VIII.

Regional Gross Reproduction Rates, 1926 and 1936.

Area	1925-7	1935-7	Percentage Decline
Dubhn City and County	1.476	1.412	4.3
Rest of Leinster	1.543	1.525	1.2
Munster	1.525	1.464	4.0
Connacht	1.726	1.603	7.1
Ulster (3 Counties)	1.601	1.478	7.7
Saorstát Éireann	1.560	1.479	5.2
<i>Town Areas</i>	1.479	1.444	2.4
<i>Rural Areas</i>	1.600	1.500	6.3

Decline in fertility has been substantially greater in Connacht and in the three Ulster counties than in the rest of the country and the decline in town areas (i.e., towns with population of over 1,500 at the respective censuses) was less than in rural areas. It is entirely unexpected to find that the decline in Dublin City and County is due primarily to the decrease in the percentage of married females in the age group 15-44 and only in a slight degree to a decline in fertility of marriages.¹⁵

Future Population.

The three series of estimates are given in Table IX. Particular attention is directed to the assumptions underlying the respective computations which are described in detail in Appendix 2 and, for the reasons discussed at the beginning of the paper, none of the prognostics should be divorced from a statement of the underlying assumptions. The difference in the three series show how profoundly the assumptions affect the calculations.

For two of these estimates it has been assumed that fertility rates and mortality rates at each age will be the same as in 1935-37. For the first estimate ("Estimate A") it has been assumed that, in addition, both immigration and emigration will be nil. For the second estimate ("Estimate B") it has been assumed that the rate of net emigration (emigration less immigration) at each age will be about four-fifths in 1936-46, about three-fifths in 1946-56, and about two-fifths after 1956, of the rate in the ten years 1926-36.

For the third estimate ("Estimate C") the same assumptions as to migration were made as for Estimate B. In addition, however, it was assumed that the trends in fertility and mortality during the last intercensal period will continue for the next 30 years, after which they will remain constant.

In making all three series of estimates quinquennial age groups were used. Single year age distributions would have given more accurate results, but the use of the five-yearly groups reduced the volume of computation by four-fifths. To assess the effect, an estimate of the number of males in 1946 (ignoring migration and using the 1935-37 Life Table) was made using the single-year age distribution for 1936. This gave an estimate for males aged 10

TABLE IX.

Estimates of Future Population on Different Assumptions.

AGE GROUP	YEAR										
	1936*	1946	1956	1966	1976	1986	1996	2006	2016	2026	2036
	Estimate A Fertility and Mortality as in 1935-37, migration nil										
	MALES										
0-14	416	417	460	494	514	544	583	618	653	695	738
15-44	661	734	778	797	839	899	953	1,007	1,070	1,137	1,206
45-64	302	300	322	382	423	418	433	472	501	526	559
65-	141	154	149	151	162	194	207	207	219	236	250
TOTAL MALES	1,520	1,605	1,709	1,824	1,938	2,055	2,176	2,304	2,443	2,594	2,753
	FEMALES										
0-14	404	405	447	481	501	530	568	602	636	676	719
15-44	618	687	738	770	811	870	922	974	1,036	1,101	1,167
45-64	281	290	307	353	401	405	421	459	488	511	544
65-	146	152	150	156	164	192	212	215	227	246	260
TOTAL FEMALES	1,448	1,534	1,642	1,760	1,877	1,997	2,123	2,250	2,387	2,534	2,690
Persons, Estimate A	2,968	3,139	3,351	3,584	3,815	4,052	4,299	4,554	4,830	5,128	5,443
	Estimate B Fertility and Mortality as in 1935-37; migration declining to two-fifths of rate in 1926-36 by 1956, constant after										
	MALES										
0-14	416	399	402	409	417	426	435	444	453	463	472
15-44	661	673	677	682	688	701	714	729	744	759	775
45-64	302	298	310	333	347	348	350	356	362	370	378
65-	141	154	149	149	156	166	172	172	174	177	180
TOTAL MALES	1,520	1,524	1,538	1,573	1,608	1,641	1,671	1,701	1,733	1,769	1,805
	FEMALES										
0-14	504	387	391	398	406	415	424	432	441	450	460
15-44	618	617	623	638	648	662	676	690	704	718	733
45-64	281	284	287	296	312	319	324	331	338	345	352
65-	146	152	149	152	153	159	165	169	172	176	179
TOTAL FEMALES	1,448	1,440	1,450	1,484	1,519	1,555	1,589	1,622	1,655	1,689	1,724
Persons, Estimate B	2,968	2,964	2,988	3,057	3,127	3,196	3,260	3,323	3,388	3,458	3,529
	Estimate C Fertility and Mortality declining until 1966, constant after, migration declining to two-fifths of rate in 1926-36 by 1956, constant after										
	MALES										
0-14	416	394	385	379	377	379	373	377	376	376	375
15-44	661	675	683	686	682	680	676	671	671	669	668
45-64	302	298	312	338	359	365	364	364	360	356	357
65-	141	154	149	150	157	169	178	180	180	181	178
TOTAL MALES	1,520	1,521	1,529	1,553	1,575	1,593	1,596	1,592	1,587	1,582	1,578
	FEMALES										
0-14	404	382	375	370	368	369	369	367	367	366	366
15-44	618	619	630	645	648	646	643	643	642	641	639
45-64	281	286	293	310	336	350	354	354	351	350	361
65-	146	152	150	155	159	170	182	188	191	191	190
TOTAL FEMALES	1,448	1,439	1,448	1,480	1,510	1,535	1,548	1,552	1,551	1,548	1,546
Persons, Estimate C	2,968	2,960	2,977	3,033	3,085	3,128	3,144	3,144	3,138	3,130	3,124

* Actual.

years or over of 1,320,300 as compared with the 1,319,500 deduced from the quinquennial grouping, an "error" of only .06 per cent. Up to age 80 years, the errors never exceed 0.3 per cent. in any quinquennial group and at ages over 80 the percentage errors are large but the actual errors are insignificant.

According to Estimate A, the population will increase regularly from its present 3 millions to about 5½ millions a hundred years hence. It must not, however, be assumed that if, through the action of the Government of this country or otherwise, emigration ceased entirely, the population would take the course indicated by Estimate A. In the first place, it does not follow that the fertility rate would remain constant in such circumstances. If potential emigrants were forced to remain in this country a large proportion might not marry. Furthermore, there are grounds for believing that emigration in many cases makes possible the marriage of those who remain behind. It seems not unlikely that if, at the present time, an embargo were placed on emigration, the number of births might not increase to any great extent; in other words, the *birth-rate* might decline, and a relatively small decline in the birth-rate would give quite a different picture of the trend in population to that presented by Estimate A above.

According to Estimate B the population would show a small decline between 1936 and 1946, increase slightly during the next decade and increase regularly thereafter, reaching 3½ millions in the year 2036. With the assumptions underlying the computation of Estimate C the population would as in the case of Estimate B first show a small decrease and then increase very gradually to reach 3,144,000 in the year 1996. The estimate, to the nearest 1,000, would be the same in 2006, but thereafter there would be a small regular decline, to a figure of 3,124,000 in the year 2036. To assess the plausibility of Estimate C it may be useful to state that in the year 1996 when the assumed decline of fertility (and mortality) come to an end the birth-rate would be 17.6 as compared with 19.4 in 1935-37, a decline of 9.3 per cent. in the 30 years. Considering that in the 35 years prior to 1936 the birth-rate fell by 11.4 per cent., (see Table VII) and that the figure of 17.6 per cent. would give this country a position only a little below the median amongst 32 countries in 1936, such a decline cannot be regarded as at all unlikely, unless definite steps be taken to counteract it. Since the assumption with regard to the trend of emigration must be considered optimistic, particularly in the light of the immediate pre-war movement, this investigation shows that this country will have a stern struggle ahead if the population is to be maintained at even its present level. As might be expected from the assumption of constant fertility, birth-rates implicit in Estimates A and B do not change much: in the year 2036 the figures would be respectively 20.2 and 19.7 per 1000 population.

Table X indicates a marked degree of regularity in the "intercensal" changes in population for all three series of estimates.

TABLE X.

Inter-decadal Percentage Increases in Population (Decreases —).

Estimate	1936- 46	1946- 56	1956- 66	1966- 76	1976- 86	1986- 96	1996- 06	2006- 16	2016- 26	2026- 36
A ...	5.7	6.8	6.9	6.5	6.2	6.1	5.9	6.0	6.2	6.1
B ...	-0.1	0.8	2.3	2.3	2.2	2.0	1.9	2.0	2.1	2.0
C ...	-0.3	0.6	1.9	1.7	1.4	0.5	0	-0.2	-0.3	-0.2

Throughout the whole period the percentage changes for Estimate A vary very little: from 1966-76 on they are practically constant for a reason which will presently be discussed. The Estimate B percentages (at about 2 per cent.) from 1986-96 on and Estimate C percentages from 2006-16 on show very little change. Theory indicates that percentages very similar to these would be found if the calculations were continued beyond 2036.

Percentage age distributions for each series at 1936 and in three selected years in the future are shown in Table XI.

TABLE XI.

Percentage Distribution in Age Groups, and Sex Ratio.

Age Group	Census 1936	Estimate A			Estimate B			Estimate C		
		1946	1986	2036	1946	1986	2036	1946	1986	1936
0—14 ...	27.6	26.2	26.5	26.8	26.5	26.3	26.4	26.2	23.9	23.7
15—44 ...	43.1	45.3	43.7	43.6	43.6	42.6	42.7	43.8	42.4	41.8
45—64 ...	19.6	18.8	20.3	20.3	19.6	20.9	20.7	19.7	22.9	22.7
65— ...	9.7	9.7	9.5	9.3	10.3	10.2	10.2	10.3	10.8	11.8
TOTAL	100	100	100	100	100	100	100	100	100	100
Females per 1,000 males	953	956	972	977	945	948	955	946	964	980

Perhaps the most surprising feature of this table is that so little variation is shown in the percentage distribution notwithstanding the wide variations in the actual figures in the ultimate year. If the final column of percentages for Estimate A, as referring to a population with a "healthy" natural increase and with no migration, be regarded as "normal", then the present-day Irish population age distribution is much more "normal" in this sense than might have been anticipated. As might be expected the ultimate proportion of children for Estimate C is lower than at present by about 14 per cent.

None of the estimates indicate in any year an excess of females in the population. In fact, nothing seems more certain from this inquiry than that the male excess, which is such an abnormal feature of the Irish population, will persist.

Theoretical Aspect.

While the trend indicated by Estimate A is not likely to be realised, the series of figures is of great theoretical interest on account of its affinity with the net reproduction rate discussed above. If we define the *length of a generation* as the average age of mothers at birth of children then it is a simple matter to calculate from the data in Table IV that the average length of a generation (according to mortality conditions of females to age 50 and estimated fertility as in the years 1935-37) was 33.3 years, easily memorised as just one-third of a century! Because Irish women marry late (when they marry at all) the length of a generation is greater than in other countries.

Now A. J. Lotka¹⁶ has shown that in a closed population the annual rate of natural increase r is related approximately to the net reproduction rate R and to the length of a generation T by the formula

$$1+r=R^{\frac{1}{T}}$$

In such a population the rate of natural increase would equal the rate of increase of population. The decennial increase in population is accordingly given by

$$1+\rho=(1+r)^{10}=R^{\frac{10}{T}}$$

which gives $\rho=0.061$, practically identical with the average rate of increase shown by the Estimate A from 1976 on, as was to be expected.

From Appendix 1 it will be seen that when the rate of natural increase is computed by the method used in this paper the population will tend to increase or decrease in a geometrical progression, i.e., the n th decade after "zero year" the population will tend to assume the form $P_n=P_0a^n$ and it was shown that a was given approximately as the single positive root of the equation

$$\cdot 1056 + \cdot 3979a + \cdot 4989a^2 + \cdot 2104a^3 + \cdot 0039a^4 = a^5$$

By trial this root is found to be approximately $a = 1.0612$ so that again the decennial rate of increase is found to be approximately 6.1 per cent. It will be observed that the sum of the coefficients on the left hand side is 1.217, the net reproduction rate.

The net reproduction rate depends on the proportion of females who survive through their reproductive period and on the specific fertility at each age of mother. "Survivorship" in Ireland normally depends on emigration as well as on mortality, so that it has seemed desirable to compute net reproduction rates taking account of net emigration in addition to mortality of females. The results are given in Table XII.

TABLE XII.

Net Reproduction Rates on Different Assumptions with regard to the Course of Female Births, Deaths and Emigration.

[Explanatory Note: b , d and e represent birth-rate, death-rate and net emigration differentials, on 1926-36 trend basis. For example, $b=d=e=0$ is the case where fertility and mortality are as in 1935-37 and net emigration is nil; $b=1$, $d=\frac{1}{2}$, $e=\frac{1}{2}$ means that the fertility rate has declined by the same amount, and deaths at the reproductive ages by half the amount, of the decline in the decade 1926-36, while net emigration is half the rate in 1926-36. (See formulæ (8) of Appendix 1.)]

Births and Deaths					NET EMIGRATION		
					$e=0$	$e=\frac{1}{2}$	$e=1$
$b=0$,	$d=0$	...	...	...	1.217	1.034	.867
$b=0$,	$d=1$	...	...	...	1.251	1.064	.894
$b=0$,	$d=2$	...	...	...	1.286	1.095	.920
$b=1$,	$d=0$	...	...	...	1.156	.983	.826
$b=1$,	$d=1$	...	...	...	1.188	1.011	.850
$b=1$,	$d=2$	...	...	...	1.221	1.040	.874
$b=2$,	$d=0$	...	...	...	1.095	.932	.784
$b=2$,	$d=1$	...	...	...	1.126	.958	.807
$b=2$,	$d=2$	...	...	...	1.158	.986	.830

This table does not contemplate the possibility of (i) an *increase* in death rates or fertility rates or (ii) net *immigration*. Formula (8) of Appendix 1, which were used in the computation of this table can be adapted to any set of assumptions with regard to these factors. It will be recalled that a net reproduction rate consistently less than unity means an ultimate regular decline in population, and vice versa; in fact, from Lotka's formula (above) the decadal percentage change is given very approximately by 30 ($R-1$).

The most important deduction which can be made from the foregoing table is that depopulation must be regarded as extremely probable if emigration of females continues at the same rate as in the last intercensal decade. It will be seen, in fact, that in the last column ($e=1$) none of the rates exceed unity.

The Young—

Certain fairly definite indications of the number of children in the near future can, of course, be derived from the Registrar-General's statistics of births, in conjunction with the Census statistics. The following table prognosticates changes in the number of children aged 0-14 in the 15 years 1936-1951 in each county. Attention is directed to the assumptions underlying the computation which, it will be noted, are different from those for the estimates in Table IX. Since the prognostic for each county was derived from the formula

$$\frac{15 \times \text{No. of children aged 0-14, 1936}}{\text{Births in years 1922-1936}} \times \frac{\text{Annual average}}{\text{No. of births, 1935-1937}},$$

account is implicitly taken of the small but interesting migration of children. Did you know that 2,031 (or 5.3 per cent.) of the children under 12 years residing in County Galway were born outside that county and, of these, 507 were born outside Ireland, children, no doubt, of emigrants?

TABLE XIII.

Prognosticated change (+increase—decrease) in numbers of children aged 0-14 years, 1936-1951, assuming that births in each county in each year will equal the average in 1935-1937 and that mortality will continue as in 1922-1936.

County (including County Borough)	Number	Per-centage	County (including County Borough)	Number	Per-centage
Roscommon	-3,400	-16.7	Clare	-1,300	-5.5
Kerry	-5,300	-13.7	Carlow	- 500	-5.3
Longford	-1,200	-11.4	Offaly	- 700	-4.9
Leitrim	-1,500	-11.2	Limerick	-1,900	-4.7
Mayo	-4,800	-10.6	Wexford	-1,100	-4.4
Donegal	-3,900	-10.2	Tipperary	-1,600	-4.1
Kilkenny	-1,700	- 9.0	Wicklow	- 500	-3.0
Sligo	-1,500	- 8.8	Waterford	- 500	-2.3
Cavan	-1,700	- 8.3	Meath	- 300	-1.8
Westmeath	-1,100	- 7.3	Louth	- 100	-0.7
Monaghan	-1,200	- 7.2	Galway	+ 700	+1.4
Laoghus	- 800	- 6.1	Kildare	+ 700	+4.0
Cork	-5,500	- 5.9	Dublin	+15,100	+9.0
			TOTAL	-25,600	-3.2

This table, in which, it will be observed, the counties have been arranged in decreasing order of percentage decline in child population, raises a very important question. However optimistic the view which may be taken of the number of children in the whole country 10 years hence, a decline in the first 10 or 11 counties in the table seems practically a certainty.

If, taking an optimistic view, no appreciable change will be recorded in the total child population, the position will then be that a decline in almost every other county would be numerically compensated by an equal increase in Dublin. Would this be a satisfactory state of affairs? This tendency will be deplored by persons who believe, or instinctively feel, that each different part of the country makes its individual contribution to the mental and physical characteristics of the race. For example, the substitution of the rather nondescript attributes of a metropolis for the positive attributes of the people of Kerry will be regretted by many people.

The figures hold a rather gloomy prospect for the teaching profession particularly in rural areas, while current ideas about "averages" prevail. If, however, you consider that this country, like every other country, is under-educated, you will be wise to ignore the figures completely and agitate for an increase of, say, 50 per cent. in the number of teachers, and, say, 100 per cent. in the teachers of teachers, during the next 10 years.

These views have nothing to do with statistics and you are quite at liberty to treat them with the contempt which, perhaps, they deserve.

—and the Old.

Using the 1935-37 Life Table and the single-year age distribution of the population as returned at the 1936 Census the following estimates have been made for the number of persons aged 70 years of age:—

TABLE XIV.

Estimated Population aged 70 years of age and over.

Year	Males	Females	Total Persons
1936*... ..	80,859	92,824	173,683
1937	84,300	94,600	178,900
1938	87,900	96,600	184,500
1939	89,000	96,300	185,300
1940	90,500	96,500	187,000
1941	94,200	98,700	192,900
1942	95,700	99,400	195,100
1943	96,200	99,000	195,200
⋮	⋮	⋮	⋮
1946	98,700	100,000	199,000

* Actual Census figures.

It may be well to state in support of the method of estimation used that an estimate based on the 1926 Census statistics of the 1936 population, of persons over 70 years of age was identical to the nearest 1,000 with the figures which the 1936 Census revealed, though the estimate for females was 2,000 more and for males 2,000 less than the actual figures.

The considerable increase to be expected during the 10 years 1936-1946 will be noted. In 1936, 78 per cent. of persons over 70 in the State were in receipt of old age pensions. Taxpayers may derive some solace from the reflection that from 1946 to 1956 the number of old age pensioners will decline by 2,200!

Economics and Ethics of Emigration.

In my previous paper I wrote that "It may be taken as axiomatic that no Saorstát Government will allow emigration to assume dimensions which will lead to a permanent lowering of the present population," and in this paper I have shown that the proximate source of danger of a decline in population lies in emigration and not, as in other countries, in a too low net reproduction rate.

Latterly there has been a growing tendency to condemn all emigration and to take the view that a stated number of emigrants represent each year a (sometimes) stated capital loss to the State. I cannot agree with this contention. To me, the question "what is the value of an emigrant?" has no meaning. From the ethical standpoint his or her value is infinite and the economic value may range from minus anything to plus anything. The fact that the emigrant has cost so much to rear and educate (say £1,000, though this is probably a large exaggeration) does not justify the statement that the loss to the country was £20 millions in a year in which emigration was 20,000. I think that it can be refuted by the economic argument that the price of an article has no necessary relation to its cost of production: a human being cannot have a "supply price" or a "demand price".

The argument has, however, been put more subtly in somewhat the following form: if the parents and the State had not spent the £1,000 on the support and education of the emigrant the money would have been saved and become available for investment. But would it? If the money would otherwise have been spent on consumption of goods and services, does not a human being, even if reared for export, normally render a great measure of satisfaction to his parents than the cost of his upbringing otherwise expended?

Adherents of the economic loss by emigration theory have maintained that the case is analogous to that of farmers exporting their cattle for nothing. This argument, it seems to me, completely breaks down on the fact that the producers expect to receive a price for their cattle which will compensate them for the cost of production. In the case of their children they are normally actuated only by considerations of their children's happiness. Would they be happier at home than abroad? It is not even necessary to postulate that the emigrant should send home the by no means substantial remittances for this contention to succeed. The parents feel amply repaid for the cost of the upbringing of the emigrant in the thought that in emigrating their child has "bettered himself".

I am well aware that the parents or the emigrant himself or herself should not necessarily be allowed to have the final word in the matter. The State must also "have its say". One can easily envisage a situation in which emigrants should not be permitted to leave the country even in peace-time. Persons whose services are essential to the State should not be allowed to leave. The position during the past half century seems to have been that, while many

people emigrated who might have done better for themselves and their country had they stayed at home, the great majority would in the *existing economic condition of the country* (the italicised words are essential) have reduced their own and the general average standard of living had they not emigrated. It seems to me that, viewed solely as an economic problem, the test of the permissibility of emigration is simply this: "If the people remained, what would be the effect on the general average standard of living including that of the potential emigrants themselves?"

The net reproduction rate of this country is high and, in consequence, a considerable volume of emigration is not inconsistent with a moderate increase in population. With the improvement in transport and communication and in the standard of living, which, we must hope, will resume its upward course when the present nightmare period is at an end, emigration in the future need not result in the irrevocable sundering of the ties of family and friendship as in the past. The links with our fellow-countrymen overseas can more easily be maintained. The period of greatest glory in the country's history was that in which her missionaries and teachers found their way to the limits of the known world. Surely we feel almost as heightened a sense of pride of race in the achievements of the Irish abroad as at home. Ireland is a small country but the Irish race is one of the world's life streams. Irishmen have the right of membership of the State and of the Race.

My principal objection to emigration which does not result in further depopulation of this mother country is that so many of our emigrants find themselves unfavourably circumstanced abroad. This might be obviated by instituting a Department or sub-Department of State specially charged with the regulation of emigration and the care of emigrants, which in certain cases might involve repatriation and action through the diplomatic and consular representatives in the country of immigration. It is a prime essential that future emigrants should go forth better trained for the battle of life.

I agree, however, that the correct attitude towards this vital problem of emigration is extremely difficult to determine. It is the perfect example of a controversial matter of great social and economic importance in which the controversialists may all be perfectly correct if one accepted their respective sets of axioms. Important considerations (ethical and other) are not infrequently left out of account, or at least do not receive sufficient weight, because they are not economically assessable or statistically measurable. In such cases it would be well for the State to determine the ethical and other non-economic axioms and perhaps enshrine them once and for all in the Constitution, beyond the reach of controversy.

The Industrial Pattern.

How people will be employed in the years to come would be a more interesting thing to know than how many people there will be, but is even less predictable; and in this domain we are liable to drift into "wishful thinking". I shall conclude, however, by drawing your attention to a few figures which seem to me to be

significant in this connection. In this discussion the actual or potential effects of the war have been ignored.

The most important figures are, of course, the recently issued Census of Population statistics which may be summarised as follows:—

TABLE XV.

Persons at work, 1926 and 1936.

Industrial group	Persons engaged		Percentage change
	1926	1936	
	Thousands		
Agriculture	646.5	609.2	— 5.8
Other production	164.1	205.6	+25.3
Other employment	409.7	420.6	+ 2.7
TOTAL AT WORK...	1,220.3	1,235.4	+ 1.2

A moderate increase in the population in say, the next quarter-century must result primarily, if not exclusively, from an increase in the population of town dwellers or, at least, in the population not dependant on agriculture. Certainly before the war, and probably even at the present time, there was under-employment in agriculture, taken as a whole. The fact that in 1938-39 the estimated net income per person actively engaged in agriculture (after payment of all expenses, including rent, land annuities, rates, etc.) was only £64 per annum is in itself sufficient proof. This figure may be regarded as confirmed by Mr. M. Murphy's surveys.⁴⁷ A very considerable increase in the volume of agricultural output will be possible without any increase in the agricultural population. On the whole, a further small decline in the agricultural population seems likely.

One of the outstanding results of the 1936 Census was the increase of 81,000 (or 16.1 per cent.) recorded in the population of Dublin City and County, which increase was, of course, associated with the great increase in industrialisation during the last intercensal period. The indications are that the population of the metropolis is still increasing though at a slightly reduced rate. In fact, between 1926 and 1936 the increase in the population *aged 21 and over* averaged 1.6 per cent. per annum, whereas between mid-1936 and mid-1940 the number of registered Dáil Electors increased by 1.4 per cent. per annum; from the same source it would appear that the total adult population of the country declined slightly in the four years so that the decline in the *rural* population is still going on. Between 1936 and 1939, the most complete annual indicator of the volume of employment of the employee class, namely, the Net Contribution Income of the National Health Insurance Fund, showed an increase of only 1.5 per cent. per annum, compared with 3.1 per cent. per annum in the five years previous. In the three years before the war industrial development might be said to be "marking time", after the great upsurge of the years previous.

The recent trend has, however, one particularly significant feature. Between 1936 and 1939, while the aggregate volume of production of "transportable" industrial goods increased by 4.2 per cent., the volume of production of producers' equipment and materials for capital goods increased by 18.5 per cent. The other two main groups, namely consumers' permanent equipment (consumers' capital) and goods currently consumed or materials therefor, increased by 7.8 per cent. and 2.4 per cent. respectively. This increase in the volume of producers' equipment though it is still only a small proportion of the whole (about 11 per cent. by net output in 1939) is most interesting as indicating that we were advancing into the secondary stage of industrial development.

It is a truism that the greatest hope for the future, not only for agriculture but for the non-agricultural economy as well, lies in the intensive development of agriculture. It has often been observed that the great industrial drive which began in 1932 coincided with a period of unprecedented agricultural depression; the extent to which potential agricultural purchasing power was immobilised during this period has not, however, commonly been realised. In 1934-35 when the gross agricultural income was estimated at £39 millions the amount of *cash* available to farmers and members of their families for household expenditure (*i.e.*, after allowing for all expenses of their industry) was only about £10½ millions. The corresponding figure for 1936-37 had increased to about £17 millions, but this was only a small fraction of the value at retail of the consumption of Irish industrial products (including foodstuffs) and imports valued in the same year at about £120 millions. It will be recalled that the agricultural population is about half the total population. Even now, when the agricultural price index number is about 150, compared with 83 in 1934-35 and 96 in 1936-37, the agricultural market for Irish industrial products is too small and restricted.

The present crisis has brought home to everyone the paramount importance of agriculture in this country's economy, not only because it supplies the home population with its primary necessity, food, but also because it is by means of agricultural exports that we acquire by exchange the bulk of our essential imports. One need not subscribe to any of the current "multiplier" theories (which seem, generally, to be oversimplified and lacking in practicality) to realise that any increase in exports, whether by an increase in volume or improvement in the "terms of trade", or both, will, as a result of the consequential increase in imports, normally result in a considerably greater increase in the national income. The national income may almost be regarded as a superstructure built on the basis of essential imports both of finished goods and of materials.

The farming community stands to gain by any increase in the non-agricultural population which is not the result of causes which tend to increase costs of production for export, for any substantial increment in agricultural income must, in the first instance, come from exports, which should not, accordingly, be hampered in any way. In 1938-39 purchases (at farmers' prices) per person of the non-agricultural population averaged about £11, per person in non-agricultural occupations £22, and per non-agricultural family £45. The future of industry proper seems to be bound up with that of agriculture. Increased agricultural incomes will increase the market for home industrial

products and in thereby increasing the scale of home industry will put it in a condition to enter the competitive export market.

Summary.

The significance of gross and net reproduction rates is discussed from the theoretical and practical viewpoints. It is estimated that in 1935-37 the gross and net reproduction rates for this country were 1.479 and 1.217, respectively. The latter figure is one of the highest in the world. Gross reproduction rates are computed for each Census year back to 1871, and the rates for different areas of the country in 1935-37 are compared. Many net reproduction rates are computed taking emigration into account and making different hypothesis with regard to fertility and mortality.

One of the principal objects of this paper is to revise and elaborate, using 1936 Census data, the prognostics of population made in 1935. Three series of prognostics are made :—(A) if mortality and fertility rates as in 1935-37 are presumed to continue indefinitely and migration is ignored, the population would increase regularly by about 6 per cent. per decade to 5½ millions in the year 2036—this population is not, however, likely to be attained on present-day indications; (B) if the rate of net emigration is presumed to decline to two-fifths of the 1926-36 rate by the year 1956 and thereafter remain constant at this figure, the population would increase to about 3½ millions in the year 2036; (C) with the same assumption with regard to net emigration as for series (B) but with the further assumptions that for three decades the mortality and fertility rates would continue to decline at the same rate as in 1926-36, the population would increase to about 3½ millions in the year 2036. Prognostics are made of the numbers of children in each county and of aged persons in the near future.

As a preliminary to the introduction of the new series of prognostics the trends in births, deaths and emigration are considered in some detail.

The vexed question of the loss by emigration is considered briefly, and the paper concludes with some observations on the industrial pattern of the future, taking into account the recent industrial trend.

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- ¹ *Journal*, Volume XIV (1935-36), page 17.
- ² See, for example *Political Arithmetick*, edited by Lancelot Hogben, F.R.S., page 82.
- ³ *Analysis of Volume V—Part I; Census of Population, 1936* (mimeographed), page 15 seq
- ⁴ *Ibid*, page 19
- ⁵ *Analysis of Volume III, Census of Population, 1936* (mimeographed), page 6.
- ⁶ Ref (3), page 32.
- ⁷ *Analysis of Volume I, Census of Population, 1936* (mimeographed), page 18.
- ⁸ *Ibid*, page 19.
- ⁹ *Preliminary Report of the Census of Population, 1936*, page 19.
- ¹⁰ Ref (3), page 36.
- ¹¹ Charles Schmeller, *Congrès International de la Population*, Volume I, page 211.
- ¹² Pierre Depoid, *Congrès International de la Population*, Volume I, page 138.
- ¹³ Ref. (2), page 67. I have transferred Eire from the third to the second group.
- ¹⁴ Ref (3), page 22.
- ¹⁵ Ref. (3), page 19.
- ¹⁶ *Journal of the American Statistical Association*, September, 1925, pp. 305-339.
- ¹⁷ *Journal*, 92nd Session (1938-39), page 112, 93rd Session (1939-40), page 91.

APPENDIX I

SOME ASPECTS OF THE NET REPRODUCTION RATE FOR DISCONTINUOUS DATA.

Novelty is not claimed for the properties discussed in this Appendix. The object is the establishment by elementary methods of certain well-known theorems with regard to the relations between the Net Reproduction Rate and the trend in the resulting population, assuming that the Net Reproduction Rate is calculated using grouped data (i.e. as in this paper).

Let the number of female births in the equal periods of time (e.g., quarters, years, decades) be x_1, x_2, \dots, x_k .

If the probability of surviving to m periods be L_m and if the number of female births in a period per female aged m periods be b_m , then female births in periods $k+1, k+2$, etc., are as follows:—

$$\left. \begin{aligned} x_{k+1} &= a_1 x_k + a_2 x_{k-1} + \dots + a_k x_1 \\ x_{k+2} &= a_1 x_{k+1} + a_2 x_k + \dots + a_k x_2 \\ x_n &= a_1 x_{n-1} + a_2 x_{n-2} + \dots + a_k x_{n-k} \end{aligned} \right\} \dots (1)$$

where $L_m b_m = a_m$ and $\sum_{m=1}^k a_m = R$, the Net Reproduction Rate. The a_m

are either positive or zero. The problem is to study this iteration.

CASE (i) $R = \sum a_i = 1$

In this case it can be shown that as n tends towards infinity x tends towards a limit X . Suppose that the iteration (1) is such that the variable on the left-hand side always appears on the right-hand side of the equation following, as will be the case when, in particular, none of the a_i is zero.

From the Theorem of the Mean, since $\sum a_i = 1$, x_{k+1} must lie within the range x_1, x_2, \dots, x_k ; x_{k+2} must lie in the range x_2, x_3, \dots, x_{k+1} and hence in the range x_1, x_2, \dots, x_k . The range must constantly diminish in the conditions stated as n increases, because if at a certain stage the limits of range are x_l and x_L in the sequence $x_{N-1}, x_{N-2}, \dots, x_{N-k}$ then at a later stage in the iteration both the x_l and x_L will disappear leaving a range narrower at both ends. After a certain stage it is obvious that the range will be less than an arbitrary positive quantity ϵ :—

Hence $|x_n - X| < \epsilon$ for all values of n equal to or greater than a certain value N .

The limiting value is easily found by summation of (1) from $n = k+1$ to n , when, since $\sum a_i = 1$,

$$x_n + (1-a_1)x_{n-1} + (1-a_1-a_2)x_{n-2} + \dots + (1-a_1-a_2-\dots-a_{k-1})x_{n-k+1} = x_k + (1-a_1)x_{k-1} + (1-a_2-a_2)x_{k-2} + \dots + (1-a_1-a_2-\dots-a_{k-1})x_1 \dots (2)$$

In the limit, set all the x on the left side equal to X . Then the limiting value X is given by

$$X = \frac{x_k + (1-a_1)x_{k-1} + \dots + (1-a_1-a_2-\dots-a_{k-1})x_1}{ka_k + (k-1)a_{k-1} + \dots + a_1} \dots (3)$$

Professor C. H. Rowe has kindly pointed out to me that the necessary and sufficient conditions that the iteration should have more than one limiting value is that (i) the k should be a composite number, say $k=k'p$ and (ii) all the a 's should be zero except $a_k, a_{k-p}, a_{k-2p}, \dots, a_p$, in which case there will be p independent limits, one for each of the sub-iterations into which the original iteration will split up. For the present purpose it will suffice to assume that there is only one limit.

CASE (ii) : $R=\Sigma a_i \neq 1$

In this case in (1) set

$$x_n = a^n y_n \quad (n=1, 2, \dots) \quad \dots (4)$$

and let α be a root of the equation

$$f(\alpha) = a_k + \alpha a_{k-1} + \dots + \alpha^{k-1} a_1, \quad -\alpha^k = 0 \quad \dots (5)$$

so that we are in the conditions of Case (i) and y_n tends towards a limit Y given by

$$Y = \frac{y_k + \left(1 - \frac{a_1}{\alpha}\right) y_{k-1} + \dots + \left(1 - \frac{a_1}{\alpha} - \frac{a_2}{\alpha^2} - \dots - \frac{a_{k-1}}{\alpha^{k-1}}\right) y_1}{\frac{ka_k}{\alpha^k} + (k-1) \frac{a_{k-1}}{\alpha^{k-1}} + \dots + \frac{a_1}{\alpha}} \quad \dots (6)$$

where α is a root of (5).

Let $R = \Sigma a_i > 1$. It may be shown that there is only one positive root of equation (5) and that this is greater than unity. Let $\alpha = \frac{1}{\beta}$. Then the

equation becomes

$$\phi(\beta) = a_k \beta^k + a_{k-1} \beta^{k-1} + \dots + a_1 \beta - 1 = 0$$

Then $\phi(\beta)$ is always positive since none of the a is negative. Since, in addition, $\phi(\beta)$ changes sign between $\beta = +\infty$ and $\beta = 0$, there is only one positive root of $\psi(\beta) = 0$, and it is evident that this root is less than unity; for $\phi'(\beta)$ is clearly positive for $\beta \geq 1$. Hence the single positive root of $f(\alpha) = 0$ must be greater than unity.

Similarly it may be shown that if $R = \Sigma a_i < 1$ the single positive root α of $f(\alpha) = 0$ must be less than unity.

When the Net Reproduction Rate is unity the age distribution is that of the Life Table, and at age x the number is proportional to L_x , in the usual notation. In general, the age distribution is proportional to $L_x \alpha^{-x}$ where, as before, α is the single positive root of (5).

Application to Net Reproduction Rate calculated from Grouped Data.

Let the age groups be 15—19, 20—24, . . . , 45—49 and let the fertility rates per female per annum in the seven respective age groups be f_1, f_2, \dots, f_7 . In a Life Table population recruited by one female birth per annum let the number at ages 15—19, 20—24, . . . 45—49 be respectively L'_1, L'_2, \dots, L'_7 . Then if the number of female births

per annum in the n th decade be b_n , it can be shown that the most appropriate iteration formula for b is

$$b_n = \frac{c_1}{2} b_{n-1} + \frac{c_1+c_2+c_3}{2} \cdot b_{n-2} + \frac{c_2+c_3+c_4+c_5}{2} \cdot b_{n-3} + \frac{c_4+c_5+c_6+c_7}{2} \cdot b_{n-4} + \frac{c_5+c_7}{2} \cdot b_{n-5} \dots (7)$$

with $c_i = f_i L'_i$ and the Net Reproduction Rate $R = \sum c_i$. The iteration formula can accordingly be written

$$b_n = a_1 b_{n-1} + a_2 b_{n-2} + \dots + a_5 b_{n-5}$$

and $R = \sum_{i=1}^7 c_i = \sum_{j=1}^5 a_j$.

The estimated c_i for Ireland in 1935-'37 are given in column (6) of Table IV.

There is no theoretical difficulty about taking account of emigration of females, which affects the net emigration rate in exactly the same manner as mortality, in the computation of Net Reproduction Rates and trend of population. The values of the coefficients and of the net reproduction rate are as follows:—

$$\left. \begin{aligned} C_1 &= 00777 - 00039b + 00011d - 00037e + 00002be \\ C_2 &= 13340 - 00667b + 00252d - 01928e - 00013bd + 00097be - 00022de \\ C_3 &= 27964 - 01398b + 00634d - 07687e - 00032bd + 00385be + 00004d^2 - 00119de + 00302e^2 \\ C_4 &= 31271 - 01563b + 00835d - 09788e - 00042bd + 00489be + 00009d^2 - 00189de + 00762e^2 \\ C_5 &= 27202 - 01360b + 00839d - 10232e - 00042bd + 00511be + 00010d^2 - 00238de + 01046e^2 \\ C_6 &= 14695 - 00735b + 00537d - 05444e - 00027bd + 00272be + 00007d^2 - 00156de + 00621e^2 \\ C_7 &= 06421 - 00321b + 00265d - 02952e - 00013bd + 00148be + 00004d^2 - 00098de + 00449e^2 \\ \text{Total} &= \text{Net Reproduction Rate} = \\ & 1.21671 - 00083b + .03373d - .38068e - .00169bd + .01904be + .00034d^2 - .00822de + .03180e^2 \end{aligned} \right\} (8)$$

Fertility and mortality of females in 1935-'37 are assumed to have changed by respectively b and d times the changes in the decade 1926-'36—for this purpose fertility has been taken as declining by an even 5 per cent. in the decade—and emigration of females at each age is assumed to be e times the rate in 1935-'37, so that $b=d=e=0$ gives the case where mortality and fertility are as in 1935-'37 and emigration is nil; i.e., the case in which the estimated net production rate is 1.217. In these formulæ unimportant terms of degree higher than 2 have been ignored. The figures in Table XII were computed from the above formula for the Net Reproduction Rate.

APPENDIX 2

METHOD OF CALCULATION OF THREE SERIES OF PROGNOSTICS OF POPULATION, 1946-2036.

ESTIMATE A :

Fertility rates :

1. The annual average number of births per married woman in Bulgaria, in the years 1921-'26, by quinquennial age-groups for ages 15-49 were multiplied by the numbers of married women in these age-groups in Ireland, as returned at the 1936 Census of Population.

2. The sum of the products, viz. 47,103, represents the number of legitimate births per annum in this country in 1936 if the Bulgarian experience obtained here.

3. Average annual live births in Ireland in 1935-'37 were 57,623. The Bulgarian rates were accordingly adjusted by increasing them in the ratio $\frac{57,623}{47,103} = 1.223341$, illegitimacy being ignored.

3. The resulting rates per married woman were reduced to rates per woman by multiplying them by the ratio of married women to total women in each quinquennial age-group.

Population, 10 years and over.

5. The number of males and females in each quinquennial age-group above 10 years was estimated by applying the appropriate Life Table ratio $\frac{T_{x+1} - T_{x+15}}{T_x - T_{x+5}}$ to the age-group ten years younger at the preceding Census.

Children aged 0-9 years.

6. The number of children aged 0-9 years at successive Censuses was assumed to be born to the average number of women in the different quinquennial age-groups (ages 15-49) during the intercensal period. The average numbers of women in each quinquennial group were multiplied by the appropriate fertility rates as calculated above, and the sum of the products represents annual average births in the intercensal period.

7. The average annual number of male live-births was 51.132 per cent. and of female live-births 48.868 per cent. of total live-births in the years 1935-'37. The average annual number of births obtained above was divided in these proportions to give average annual male and female live-births in the intercensal period.

8. The resulting figures for males and females were multiplied by the appropriate Life Table Ratios $(T_0 - T_5)/10^5$ to give the estimated number of males and females aged 0-4, and by the appropriate Life Table Ratios $(T_5 - T_{10})/10^5$, to give the estimated number of males and females aged 5-9 years, at the later Census date.

ESTIMATE B.

9. The method adopted for this estimate was the same as for Estimate A, except in the calculation of the population, aged 15-49 years at the later Census.

10. New survival ratios were calculated for quinquennial age-groups between the ages 5-39 at the earlier Census, account being taken of intercensal emigration. Actual survival ratios were calculated for these age-groups, based on the numbers returned at the 1926 Census, and the numbers returned in the age-groups 10 years older at the 1936 Census. The numbers in age-groups 30 years and over were first smoothed to correct for overstatements at ages ending in the digits 5 and 0.

11. The differences between the average of the Life Table ratios for 1926 and 1936 and the actual ratios represent net emigration rates for the period 1926-'36. For 1946, four-fifths of these rates was deducted from the Life Table Ratios for 1936; for 1956; three-fifths and for 1966 and subsequent Census years, two-fifths.

ESTIMATE C.

Fertility rates.

12. It was assumed that the fertility rates calculated for the previous two estimates would decline by the following percentages per decade up to 1966 :—

Ages	Percentage Decline	Ages	Percentage Decline
15-19 ...	0	35-39	5
20-24 ...	2	40-44	8
25-29 ...	5	45-49	8
30-34	5		

It has been observed that in other countries in which fertility has declined the fall has usually been greater at the later reproductive ages. Effect has been given to this fact in the foregoing assumptions which were designed to give an average decadal decline of 5 per cent which was recorded between 1926 and 1936.

The rates for 1976 and subsequent Census years were supposed the same as in 1966.

Mortality.

13. It was assumed that mortality would decline, i.e., that the quinquennial survival ratios would increase in each intercensal decade up to 1966, by the amount of the increase in the ratios between 1926 and 1936. The Life Table functions T_0-T_5 and T_5-T_{10} for both males and females were assumed to increase each decade up to the year 1966 as the functions for females increased between 1926 and 1936, which increased more than for males. The ratios for males were adjusted up to age-group 35-39 years at earlier Census, and those for females up to age-group 50-54 years at earlier Census.

14. As in Estimate B, net emigration rates were deducted from the resulting ratios.

15. The means of the ratios for successive Census years were applied to the numbers in the different age-groups in the earlier Census year to estimate the numbers in the groups 10 years older in the later.

Children aged 0-9.

16. The number of births in each Census year was calculated from the estimated number of females in quinquennial age-groups from 15-49 years, using the revised fertility rates (paragraph 12).

17. The average annual numbers of births in the first five years (B_1) and in the last 5 years (B_2) of each intercensal decade were calculated by the formulae.

$$\begin{aligned} B_1 &= B_x - \frac{1}{4} (B_x - B_{x+10}) \\ B_2 &= B_x - \frac{3}{4} (B_x - B_{x+10}) \end{aligned}$$

where B_x represents the number of births in the earlier Census year.

18. The revised survival ratios $(T_5 - T_{10})/10^5$ for males and females for the *earlier* Census year were multiplied by $B_1 \times .51132$ and by $B_1 \times .48868$ respectively to estimate the numbers of males and females aged 5-9 years at the later date.

19. The revised survival ratios $(T_0 - T_5)/10^5$, for males and females, for the *later* Census year, were multiplied by $B_{2x} \times .51132$ and $B_2 \times .48868$ to estimate the numbers of males and females aged 0-4 years at the later date.

DISCUSSION ON DR. R. C. GEARY'S PAPER.

PROFESSOR GEORGE O'BRIEN proposed the vote of thanks to Dr. Geary. The paper they had just heard, he said, would by itself justify the existence of the Society. Forecasts of population trends were an invaluable contribution to the planners of a country's economy. They could help in ensuring the avoidance of both under-investment and over-investment. Unlike some countries, excellent statistics have for a long period been available in Ireland, and he was surprised when reading a recent study on the economic problems of a falling population to find no reference to this country where ample statistics were available to substantiate *a priori* reasoning. As the paper pointed out, Irish planners would have to accept the data of the situation—that from the assumptions outlined the Irish population was likely to decline. It is agreed that there are many difficulties associated with prognostics, but to err in demography is to err in distinguished company. Many trends in population are self-reversing. Then again, the government may intervene to stem the decline of the population. There has been much discussion of late about the price that has to be paid to raise the birth rate. Family allowances, for instance, have not stopped the decline in birth-rate. Of themselves they have proved insufficient, and it is difficult to know what price would be adequate. It is clear that the anxiety of the times we live in induces many parents to refrain from having children.

Professor O'Brien said he wished especially to congratulate Dr. Geary for Table XII, much of which he thought was an entirely new departure.

In this country such methods of raising the national dividend as introducing an internal loan had only academic importance. The dividend could be increased only if exports were increased. There must be greater efficiency of production. He agreed with Dr. Geary's remarks about the teaching profession. Even though population may decline here, the quality of education should increase. It may well be that with a falling

population, quality is all important especially in view of the competition in export markets after the war.

In dealing with the friendly controversy between himself and Dr. Geary in connection with the loss to the country occasioned by emigration, Professor O'Brien emphasised that there were reservations on both sides. But whatever the cost of emigration might be, there was no doubt that a more efficient education programme would increase that cost. He wondered whether this was wise. If it was not, what should be done about it? In choosing people for emigration should the population be graded? By means of such a method the most useful people could be kept at home and the others sent abroad. If emigration is to be regarded as normal for the country a differential education might be advisable. Perhaps the commission envisaged by Dr. Geary could control this matter.

LIEUT.-COL. K. E. EDGEWORTH, in seconding the vote of thanks, said that the paper raised several questions any one of which would provide material for a whole evening's discussion.

He could not accept Dr. Geary's view that emigration could be prevented by legislation; no democratic government could prevent people from emigrating if they wished to go, and if there were foreign countries willing to receive them. Emigration could only be arrested by the development of an economic system which would give full employment in conjunction with a reasonable standard of living, and this in turn was only possible by an expansion of industry and by ensuring that individual industries were operated efficiently.

The development of industrial efficiency involves research in order to secure technical efficiency, and in particular to ensure that existing knowledge is correctly applied to local conditions, the efficient operation of small scale industries being of special importance.

Col. Edgeworth concluded by disagreeing with Dr. Geary's disparaging remarks about the theory of the multiplier. Unemployment has cumulative effects, and it is only too probable that the correctness of the theory will be exemplified in this country in the near future. The theory of the multiplier must not, however, be confused with the doctrine that a policy of public works provides a satisfactory cure for unemployment: that is quite a different story.

GENERAL MULCAHY, speaking to the paper, said that Dr. Geary reminded him of a hermit emerging from austere seclusion and displaying his observations with a clarity of vision that was a joy. The suggestion that the decline in population in Galway was due to non-economic causes was only too true. The joy of life was passing in the West. The people see with shame that they are poor—a fact they had not hitherto appreciated. Economic conditions take effect when people are conscious of it. The joy of life may deflect eyes from it for a while.

What Dr. Geary said about agriculture reminded him of Dr. O'Brien's article on the late Mr. Patrick Hogan in *Studies* in 1935. Recalling the four aims of agricultural policy postulated by Dr. O'Brien, the speaker said that in the long run agricultural production was best served by maximizing the farmer's income. Thus the whole of Ireland's economic future lies in intensive agriculture. It was true that the need for increased food production occasioned by the war has temporarily obscured the necessity for maximizing the farmer's income. But this involves no permanent harm.

If town dwellers increase in number, increased industrial production must be achieved. At the moment this presents difficulties. It should be remembered, however, that this country was at present experiencing conditions that would not take place in other countries till the post-war years. Such experience, though unpleasant, would be valuable.

The basic data of Dr. Geary and Professor O'Brien were making certain things clear; they presented the theoretical background to the manner in which the country's resources should be organized. Referring to emigration General Mulcahy said that after the war the difficulty would be to get free emigration into other countries.

MR. HONOHAN pointed out that it was not quite correct to speak of Estimate A as being based on the same assumptions as that of (2) of Dr. Geary's previous paper, having regard to the fact that the mortality was different and that a new method was adopted in dealing with fertility. Notwithstanding these differences, however, which probably do not affect the position seriously, and having regard incidentally to the fact that in both cases the assumption regarding fertility had at least the common feature of "constancy" in some form, it was somewhat disconcerting to find that the new estimate for the year 2016 was 4,830,000 as against 3,663,000 on the previous occasion. The possibility of a divergence of this magnitude arising in estimates which differ in time of presentation by only 6 years suggested that a preferable alternative would be to prepare maximum and minimum figures, thus allowing a wide field for various intermediate assumptions which must necessarily contain a large personal element.

With regard to the use of Bulgarian statistics of births by age of mother, he remarked that it was by no means unusual to find one country borrowing suitable statistics of another for its own purposes. In this connection, it was of interest to note from the White Paper published in connection with the 1925 Contributory Pensions Act in Great Britain that recourse had to be made in the preparation of certain of the estimates of cost to New Zealand statistics of the numbers and ages of children at death of father and to the experience of the Patriotic (Russian War) Fund, 1854-1900 for remarriage rates of widows.

MR. J. C. M. EASON said that he did not comprehend the first part of the paper in the manner he would have wished. The economics and ethics of emigration, however interested him very much. He doubted whether the State is justified in interfering in such matters, and whether such interference when it does take place serves any purpose. To begin with, it overlooked the psychological side of the problem. If the State forbids emigration, the individuals affected by the prohibition will be disgruntled and keeping them at home will have lost its purpose. Furthermore, he did not like the suggestion that essential people should be forced to remain at home and the others left to emigrate if they thought fit. Anyone can be considered essential or inessential as the case may be; it is only a matter of opinion, who is to be the judge? Indeed the world could do very well without certain people who are regarded as essential.

MR. BLYTHE said that many of Dr. Geary's estimates seemed to be on the optimistic side. The lesson, however, was that unless a social change took place, the country was faced with a decline in population. The introduction of less laborious methods of agriculture will mean less people on the land even though prosperity may increase. Such a rapid

fall in population on the land made an increase in industrial production more necessary. But unfortunately there are many industries whose output depends on number of population, not on standard of prosperity. Could better co-ordination in industry be achieved? Many Irish industries have to compete with imports offered in a senseless variety of shades and patterns.

Mr. Blythe continued by remarking that he regarded emigration as economic hæmorrhage. Certainly, some of it was unavoidable at present; but there was much that was not necessary even in our circumstances. Denationalization was a cause of many of our troubles. Many people were still blindly prejudiced against Irish goods and preferred British ones which were no better. It should be remembered that a way of living of our own would have a great economic value.

DR. KANE said that Dr. Geary has assumed that mortality rates would decline in a certain fashion. On the other hand, the latest Public Health figures published in Great Britain showed that the mortality rate was becoming a straight line.

COLONEL EOGHAN O'BRIEN said that the remark on p. 94: "A possible source of weakness in the future population is the fact that the stream of emigration will probably continue to be directed to Great Britain," is perhaps the most significant in the whole paper. The numbers of the future population are more likely to depend on the relative standards of living and of liberty of person and speech in Éire and neighbouring lands than on any other factor such as fertility or birth or death rates.

It does seem very doubtful whether a further progress towards self-sufficiency is in the least likely to raise the standard of living in Éire: the ultimate sources of the national wealth are (1) the products of our soil and (2) the value added by our skill and industry to these or to raw materials imported and re-exported.

If these increase and the population decreases the standard of living will rise, the tendency to emigration will decrease till a balance is attained.

The author raises the question of the loss to the country by emigration: emigration can be taken as evidence of either economic or political pressure but it is only a loss if productive work could have been found for the emigrants.

In spite of the author's able analysis of available statistics it seems permissible to doubt on general grounds that any such increase in the population as he foreshadows will take place: a substantial reduction is more likely.

The Chairman, MR. BRENNAN, Vice-President of the Society, putting the vote of thanks to the House, said that the most significant element in Dr. Geary's calculations was perhaps the fact that the chief influence towards any important change in population during the next thirty or forty years would be emigration. Comparison of estimates (B) and (C) showed that different assumptions about the factors of fertility and mortality had little effect over that period. It followed that the figure of our population forty years hence would be conditioned largely by economic forces working through the factor of emigration. The outlook was only partly dependent on matters within our own control, and international factors and especially the course of events in Britain and the United States, must exert an appreciable influence on the flow of emigration.

On page 95 Dr. Geary gives the figures for movement out of Ireland during some recent years. It was interesting to compare these with the figures for unemployment in the United Kingdom during the same period, especially noticeable being the correspondence between rising unemployment in Britain in 1938 and a decline at the same time in our balance of outward migration.

On page 14, Dr. Geary says : " Nothing seems more certain from this inquiry than that the male excess, which is such an abnormal feature of the Irish population, will persist." Is this linked up with the estimate of emigration ?

Mr. Brennan continued by saying that it seemed to him that terminological questions entered into the controversy between Dr. Geary and Professor O'Brien on the point whether emigrants represented a loss of the country's capital. Investment represented only a small part of the National Income. Potential capital is always being lost by consumption, and a moderate reduction in consumption would increase capital. But the maintenance of a growing child, though taken as part of the consumption of the community, is not to be regarded as part of the capital gone wrong. The matter, however, assumes a different aspect when Professor O'Brien treats of State funds providing for the education of the child till he emigrates. This is a situation which becomes aggravated according as more of the National Income comes under State control. Loss of potential capital by one's own consumption differs from equal loss by a forced contribution to the consumption of others, more especially if the consumer in the latter case eventually becomes an emigrant.

DR. GEARY briefly replied to the discussion.