

**The Analysis of Birth Statistics in the Light of the Recent International Recovery of the Birth-Rate**



J. Hajnal

*Population Studies*, Vol. 1, No. 2 (Sep., 1947), 137-164.

Stable URL:

<http://links.jstor.org/sici?sici=0032-4728%28194709%291%3A2%3C137%3ATAOBSI%3E2.0.CO%3B2-7>

*Population Studies* is currently published by Population Investigation Committee.

---

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/about/terms.html>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/journals/pic.html>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

---

JSTOR is an independent not-for-profit organization dedicated to creating and preserving a digital archive of scholarly journals. For more information regarding JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

## The Analysis of Birth Statistics in the light of the recent International Recovery of the Birth-Rate

BY J. HAJNAL

The startling recovery of the birth-rate in countries which previously had the lowest fertility in the world has attracted a great deal of attention. In all countries which previously had net reproduction rates below 1, these rates have now been above unity in one or more years since 1943 (with the probable exception of Germany and Austria<sup>1</sup>). The aim of this paper is to deal with certain problems of the technique of analysis arising out of this movement, not to provide a discussion of its significance or an 'explanation'. Indeed, it is argued that speculation as to the cause of this movement should be founded upon an analysis of facts made by somewhat different procedures from those usually adopted.

### 1. *Marriage*

In the field of statistical analysis the rise in fertility rates has mainly resulted in increased attention to the effects of marriage on the birth-rate. In all the countries concerned the number of marriages and marriage rates have increased sharply. Are the rises in the fertility indices solely due to movements in the number of marriages? The simple techniques of relating the number of legitimate births to the population of married women, or to the number of marriages, however, fail to explain more than a part of the recent rise in fertility. The fertility rates of married women have in general risen, and risen very sharply. It has, however, been noticed by several demographers that changes in the numbers of marriages are not fully taken account of by eliminating the effect of the increase in the number of married women on births. Account must be taken also of the distribution of married women by duration of marriage. An increase in the number of marriages results in the years immediately afterwards in an unusually high proportion of recently married women in the population of married women as a whole, and the fertility rates of newly married couples are far higher than those for couples who have been married for some time.

Various techniques have been evolved for dealing with this problem. The German Statistical Office computed a standard population which would arise if a generation of women were subject to the rates of marriage, to the rates of mortality and the rates of dissolution of marriage obtaining in a certain period. This standard population gives the number of women at each age who are unmarried and, further, the number of married women at each age distributed by duration. By applying the fertility rates of unmarried women to the unmarried of the standard population,

<sup>1</sup> The German net reproduction rate must have been over 1 in 1938-40. In several respects, e.g. in the part played by increases in marriages, the recovery of the German birth-rate in 1933-9 may be regarded as similar to the recovery of the birth-rate in recent years in other countries of low fertility, as will be explained below. (Austria, if the birth statistics of 1939 and 1940 are trustworthy, must also have had a net reproduction rate of over 1.)

and the fertility rates of married women at each age and duration of marriage to the married women in the standard population, and adding up the births, we obtain the total number of births which would be born to a generation of women who are subjected through their lives to the rates of marriage and mortality on which the standard population was based, and to the fertility rates of a chosen year. Keeping the standard population constant and applying fertility rates for successive years we obtain reproduction rates which are independent of fluctuations in mortality or marriage. The standard population chosen by the Germans was based on marriage rates (those of 1910-11) considerably higher than those which had obtained in the period just before 1933, when the rise in the German birth-rate began. The result is that for 1933 the reproduction rate based on the standard population is higher than that obtained by the customary method. But as the standardized rate is not affected by the rush of marriages, it rises very slowly. The customary net reproduction rates and the standardized rates described are shown in Table 1.<sup>1</sup> Corresponding calculations for England and Wales and for Australia have been added.<sup>2</sup>

Table 1. (a) *Crude net reproduction rates*, and (b) *nuptial-standardized reproduction rates*

Year	Germany		England and Wales		Australia	
	(a)	(b)	(a)	(b)	(a)	(b)
1933	0.698	0.714	—	—	0.959	0.99
1934	0.861	0.844	—	—	0.941	0.96
1935	0.906	0.890	—	—	0.945	0.96
1936	0.934	0.904	—	—	0.975	0.97
1937	—	0.904	—	—	0.989	0.97
1938	—	0.945	0.805	0.860	0.984	0.96
1939	—	0.982	0.807	0.824	0.995	0.95
1940	—	0.976	0.753	0.752	1.017	0.94
1941	—	—	0.737	0.713	1.068	0.96
1942	—	—	0.846	0.785	1.072	0.94
1943	—	—	0.890	0.835	1.163	1.00
1944	—	—	(0.98)	0.939	—	—

<sup>1</sup> The method of computation of the standardized rates is described in detail, and the standard population given, in 'Neue Beiträge zum Deutschen Bevölkerungsproblem', *Sonderheft zu Wirtschaft und Statistik*, no. 15, pp. 73 sqq. The standard population is based on the marriage rates of 1910-11 and the life table of 1932-4. A series of these rates right up to 1941 may be found in *Statistical Year Book of the League of Nations*, 1942-4, p. 56 (they are given erroneously as net reproduction rates obtained by 'Burgdörfer's Method'). For the ordinary reproduction rates cf. D. V. Glass, *Population Policies and Movements* (Oxford, 1940), p. 305.

<sup>2</sup> The rates for England and Wales were computed, for the Statistics Committee of the Royal Commission on Population, by the Government Actuary's Department, by whose kind permission they are used here. The standard population is based on 1938 nuptiality and 1938-9 mortality. The rates for Australia are from 'Memorandum on some aspects of decline in birth-rate and future of population in Australia', by H. C. Coombs, R. Wilson and S. R. Carver, in *Report of the National Health and Medical Research Council, Eighteenth Session* (Canberra, 1944), p. 19. Precise details of computation are not given. Unlike the rates for Germany and England and Wales, the Australian rates are based, not on a constant life table, but on the mortality of the year to which they relate. As for the standard distribution of women by marital status and duration of marriage, it is possible to infer from the fact that the nuptial-standardized reproduction rates equal the crude reproduction rates for 1929-30 (the rates for these years are not reproduced in Table 1) that the standard population must be either the actual distribution of women by marriage duration in, say, 1929, or a distribution based on marriage rates which produced the 1929 situation, i.e. the rates of the years before 1929.

It is of interest to measure more precisely the proportion of the rise in the crude reproduction rates which is due to changes in the proportion of married women, and in the distribution of married women by marriage duration. For this purpose the trend of reproduction rates standardized for marriage duration may be compared with that of ordinary standardized reproduction rates. The comparison is made in Table 2.

Columns (a) of Table 2 give indices of the gross reproduction rate chosen for comparison with nuptial-standardized rates where mortality is kept constant.<sup>1</sup> Columns (b) of Table 2 give indices of the nuptial-standardized reproduction rates of columns (b) of Table 1. A different calendar year was chosen as base year for different countries, because it was desired to place side by side indices relating to corresponding intervals of time after the date when the steepest increase in marriage rates occurred. The year 1933 has been taken as the base year in Germany. For England and Wales and Australia, the year 1939 has been chosen as the initial year. Marriage rates were rising before that in the latter countries, but the sharp impact of war produced a situation comparable to that of Germany in 1933 and the following years.

A set of slightly different figures relating to Sweden has been added to Table 2. The figures in column (a) give, as in the case of the other countries, indices of the gross reproduction rate (1939 being taken as the base year). The figures in column (b) are based on the ratio of legitimate births occurring in each year to the number of legitimate births that would have occurred if the women of each age and marriage duration had had children at the rates obtaining in 1936-40.<sup>2</sup> This indirect standardization, of course, eliminates the effect of changes in the distribution of women by marital status, by age and marriage duration, as do the nuptial-standardized fertility rates used for the other countries. This Swedish series differs from the figures used for the other countries in that it does not reflect changes in illegitimate fertility rates.

Table 2. *Indices of trend in fertility (a) taking no account of changes in marriage, (b) taking account of the distribution of married women by age and duration*

Year 1 is 1933 for Germany, 1939 for England and Wales, Australia and Sweden.

Year	Germany		England and Wales		Australia		Sweden	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
1	100	100	100	100	100	100	100	100
2	123	117	95	91	102	99	98	96
3	130	125	94	87	107	101	102	98
4	133	127	105	95	107	99	116	111
5	138	127	110	101	116	105	128	119
6	—	—	121	114	—	—	—	—

<sup>1</sup> The Australian nuptial-standardized reproduction rates are based on current mortality, and therefore the trend of the net and not the gross reproduction rate is proper for comparison with them. As it happens over the years covered in Table 2, the indices are exactly the same whether calculated on the gross or the net reproduction rates. (On the other hand, in the case of England and Wales the trend of the net reproduction rate would be very different from that of the gross rate.)

<sup>2</sup> From H. Hyrenius, 'Den äktenskapliga fruktsamheten under senare År', Table 1, published in *Statistiska Undersökningar Kring Befolkningsfrågan Utförda av 1941 års Befolkningsutredning* (Stockholm, 1945).

In England, Australia and Sweden the fertility rates did not rise steeply at the same time as the number of marriages rose, and for that reason the nuptial-standardized reproduction rates did not rise after the rise in marriages. Indeed, in the case of England, the nuptial-standardized reproduction rates were falling in 1940 and 1941. What is common to all the countries in the table is that, because of the large number of newly married couples, the indices in Table 2 are higher for the crude than the marriage-standardized figures. A measure of the disturbance introduced by the changes in marriage may be obtained by expressing the indices in Table 2 for the gross reproduction rate as percentages of the indices in columns (b) of Table 2. It will be seen that in all the countries represented in the table, the crude reproduction rate was higher to the extent of 5-10% than it would have been had the constitution of the female population, as regards women of different age and marital status and duration of marriage, remained what it was in the base year.

Table 3. *Index of effect of changes in marriage on gross reproduction rate*

Year	Germany	England and Wales	Australia	Sweden
1	100	100	100	100
2	104	104	103	102
3	104	108	106	104
4	105	110	108	105
5	108	109	110	108
6	—	106	—	—

The figures given in Table 3 do not, except in the case of Germany, extend to the years when the rise in fertility rates was most striking. Yet even by 1944 in England and Wales and 1943 in Sweden, considerable increases had occurred in reproduction rates standardized for age and duration of marriage, even relative to the 1939 level (14% in the former case and 19% in the latter. The level of 1944 in England and Wales when measured against 1941 represented an increase of 31%). If account is taken of the further increases in fertility which have occurred since the period covered by the figures given above, it is clear that even fertility indices designed completely to exclude the effects of marriage will show very considerable rises.<sup>1</sup> Marriages and births for other low-fertility countries of the

<sup>1</sup> The crude birth-rates in England and Wales, Australia and Sweden in the past few years changed as follows (see *Monthly Bulletin of Statistics*, Statistical Office of the United Nations, March 1947, for Australia and Sweden; for England and Wales, the official *Quarterly Return of Births, Deaths and Marriages*, No. 392):

Year	England and Wales	Australia	Sweden
1942	15.6	19.1	17.7
1943	16.2	20.6	19.3
1944	17.5	21.0	20.3
1945	16.1	21.8	20.2
1946	19.1	21.1*	20.3†

\* First 6 months.

† First 9 months.

Western World have, as is well known, moved in a similar way in the past few years to those in the countries described. Even without elaborate calculations it may be regarded as certain that so long as we confine ourselves to excluding the effects of fluctuations in marriages, even the most refined analysis will show considerable increases (of 20% or more) in many of the low-fertility countries of Europe, America and Oceania in recent years.

## 2. *The relation of the level of fertility rates in successive years*

Is the elimination of the complications due to marriage which were described above all that demographic analysis can do? Is the next stage to resort to 'sociological' explanations, such as that the increased fertility rates are due to 'full employment', 'family allowances', etc.? If demographic analysis can reveal no regularity underlying irregular fluctuations in fertility rates<sup>1</sup> as large as those which have recently occurred, it would provide very little basis for a reasoned discussion of population trends. For all such discussion assumes that a reasonably orderly and smooth development of fertility rates may be expected.

This difficulty is often met by assuming that fertility fluctuates irregularly round some underlying 'trend'. It is natural to relate rises in the birth-rate to the low level of the birth-rate in past years, and to suppose that after a period when people have been having few children, they will have children more rapidly. How this comes about is not usually discussed. Nor is it clear what is the justification for drawing some curve through the fluctuations and assuming that this curve represents the 'trend' which will persist in the future. The following discussion attempts to show that year-to-year fluctuations in fertility are indeed likely to conceal a relatively smooth development. It aims to show that, by analysing the fertility statistics of any given year in relation to those of past years, it is possible to appraise more correctly the significance of changes in fertility rates.

There is a curious discrepancy between the customary analysis of marriage statistics and that of birth statistics. In marriage analysis it is necessary to take account of the marriage trends of previous years if only because a person who has been married cannot marry again until his marriage is dissolved and, therefore, the reduction in the marriageable population consequent on a period of high marriage rates will result in a reduction in the number of marriages. (Sometimes account is also taken of temporary fluctuations of the marriage rates of the marriageable population by regarding a marriage boom—such as that following an economic recovery—as being, in part at any rate, due to marriages postponed during the slump. The number of postponed marriages is occasionally calculated.) All current methods of fertility analysis, on the other hand, rely entirely on the births occurring

<sup>1</sup> In §§ 2-5, but not in § 6, 'fertility rates' means, unless otherwise stated, legitimate births to women of given age and duration of marriage related to the number of women of that age and marriage duration, i.e. rates entirely unaffected by changes in the distribution of the population by marriage duration or age.

in a given year (or in the period analysed if other than a year) and take no account whatever of the number of children that have already been born to the persons concerned.<sup>1</sup>

The assumption that the births of one year are entirely unaffected by the births of a previous period is not strictly true, even from a purely physiological point of view. The proportion of married women who, at any one time, are not really 'at risk' of conceiving because they are already pregnant or have recently had a child and are precluded from conceiving by the subsequent lactation and amenorrhoea, is quite large. If this proportion varied, the number of births would vary, even if the rates at which births were occurring to the women properly reckoned as 'at risk' remained constant. If, *per impossibile*, all the married women in a population had births in one year, it is clear that for purely physiological reasons the number of births in the next year would be very low. To take a more realistic example, if owing to the separation of husbands and wives enforced by war, the fertility of married women has been low for a period, it would be expected, for purely physiological reasons, that after the end of the war married couples would have children at a higher rate than usual. For, at the end of a war, an unusually small proportion is precluded from conceiving by being already pregnant or having recently had a pregnancy.

This consideration is reinforced in modern times by the fact that the stream of births is far less regulated by purely physiological factors than was formerly the case. In modern times, a large proportion of married couples take steps to prevent themselves from having more than a certain, and by past standards, very limited, number of children. It is clear that our judgement as to whether a given couple is likely to have a child this year depends very much on the number of children they already have. This surely applies to the whole body of married people in the population at any one time. The practice of family limitation thus means that the number of children is likely to be influenced by the size of family which married women of child-bearing age have already produced.

This commonplace conclusion acquires great importance for the present discussion because the widespread practice of family limitation makes it likely that the distribution of the existing families by size will vary irregularly from year to year.<sup>2</sup> Family limitation is not resorted to only when a decision has been taken that the size of family already achieved is large enough and no more children are desired.

<sup>1</sup> The assumption required to justify this treatment of fertility statistics is sometimes explicitly stated. Thus R. R. Kuczynski writes ('The Analysis of Vital Statistics. I. Marriage Statistics', *Economica*, May 1938, p. 138): 'It may seem surprising at first sight that, while the trend in the number of births indicates rather correctly the trend of fertility, the trend of nuptiality may differ so considerably from the trend in the number of marriages. The explanation for this difference is that while the number of births in one period does *not at all* affect the number of births in the next period, the number of marriages in one period may affect most essentially the number of marriages in the next' (italics mine).

<sup>2</sup> This point is independent of variations in the number of marriages. What is meant is that if marriages of equal duration are compared at successive periods (say by taking a census each year and asking how many children have been born to marriages of each duration), it will be found that the distribution of their families by size varies irregularly. For example, it would be found that the proportion of marriages childless after 3 years of marriage went up and down irregularly.

Sample investigations<sup>1</sup> show that family limitation (by birth control or other means) is frequently resorted to immediately after marriage, or at any rate before the desired size of family is reached. First births occur, on average, longest after marriage in those sections of the population who have the lowest fertility.<sup>2</sup> In modern times, therefore, many married couples try to plan not only the total number of births they will have, but also the precise spacing of their births.

Under such circumstances a change in the rate at which people are having children in a given year can no longer be taken as an indication of a change in the number of children they will bear altogether in the course of their reproductive lives. For example, people may decide to vary the rate at which they are having children, while the ultimate size of their families remains the same. Thus under the stimulus of an economic depression some may put off having another child for the time being. Then when conditions improve, the fertility rates may rise above the level at which they were before the fall due to the depression, as married couples are 'making up' for having relatively few children in previous years.<sup>3</sup> In other words, the significance of a given rate of child-bearing cannot be gauged without taking into account how many children the people concerned have had in previous years.

This conclusion would, in itself, suffice to reveal a very serious deficiency in current methods of demographic analysis. But this is not all. The picture of the modern practice of family limitation given above suggests that the analysis of the rate of child-bearing of a given year—even an analysis in relation to the existing family size of the population—is not in fact the most important task of demography. The argument outlined implies that the reason why fluctuations in fertility

<sup>1</sup> E.g. in Britain, C. Scott Russell, in a study of women attending ante-natal, post-natal and gynaecological clinics at Oxford during recent years, found that 120 out of 197 women, i.e. 63%, had used some method of birth control before their first pregnancy (see 'Human Fertility', *The Lancet*, 2 March 1946). In America, P. K. Whelpton and Clyde V. Kiser, found that among Protestant couples in Indianapolis married in 1927-9, 89.2% had attempted to practise family limitation at some period of their married life, but 64.0% began already before their first pregnancy (see 'Social and psychological factors affecting fertility. Part VI', *The Milbank Memorial Fund Quarterly*, January 1947, Table 1). Raymond Pearl, in his study of questionnaires relating to women in maternity homes in a number of cities in eastern United States found that of 7499 women having their first child, only 2837, or 37.8%, were 'contraceptors' (Raymond Pearl, *The Natural History of Population*, London, 1939, p. 331). It has, however, been plausibly suggested (Scott Russell, *op. cit.*) that Pearl's figures are a good deal too low. In any case, even if his figures are correct, the proportion of couples who plan the timing of their first child is quite large enough for the present argument. Among women attending birth control clinics it is found (e.g. R. K. Stix and F. W. Notestein, *Controlled Fertility*, Baltimore, 1940, p. 25) that a high percentage had, in the period before attending the clinic, attempted to postpone their first pregnancy. But it may be supposed that women who afterwards attended the clinic would be more likely to practise family limitation early on in marriage than the population at large.

<sup>2</sup> Cf. e.g. W. A. B. Hopkin and J. Hajnal, 'Analysis of the births in England and Wales, 1939, by father's occupation', *Population Studies*, vol. 1, no. 2, 1947, Table 8.

<sup>3</sup> It is of interest to note that if once fluctuations in the rate of child-bearing have been introduced, physiological factors alone will operate to keep them going. A population in which the rate of child-bearing has been depressed will contain a smaller proportion of women than formerly who are debarred from conceiving by being pregnant or having recently been pregnant. This alone, other things being equal, will raise fertility rates in the next period. As a result a larger proportion of women will now be debarred from conceiving than in the previous period. This again will tend to lower fertility rates and so on.



rates over a period 'cancel out', why the fertility rates of a given year can only be appraised in relation to past fertility, is that family size itself remains fairly stable. People 'make up' for children postponed, say, in an economic depression, and thereby bring their total number of children nearer to that achieved by their predecessors.

It is clear that, from the point of view of the ultimate prospects of population growth, what is of importance is the size of completed family which married couples ultimately have. This is admitted implicitly by the usual popular explanation of the gross reproduction rate as giving the number of children born to a woman during her child-bearing period. If births are high in one year only because of delayed child-bearing, this fact is of interest in the analysis of temporary fluctuations, but it is of importance in assessing the ultimate prospect of population growth only if the total number of children with which married couples will complete their reproductive lives is increased at the same time.

Now the total number of children which people have in the course of their lives, and changes in this number between people married in successive periods, cannot be deduced from any analysis of fertility data relating to single years or periods of years. For the fertility rates of any period, however defined, are always affected by the previous fertility history of the couples concerned, as has been shown above. Whether the marriages contracted in, say, 1925-9 did or did not have more children altogether than those contracted in 1930-4 cannot be decided simply by analysing the fertility rates of any period. The total birth 'achievement' of different generations of marriages must be analysed directly.

It is desirable to show how the view developed above on the relation between temporary fluctuations in fertility and the size of family ultimately achieved works out in practice. Some figures are, therefore, discussed in § 3 below relating to the striking rise in German fertility rates between 1933 and 1939. These figures are intended to show two points:

(1) The total number of children born to successive generations of marriages throughout their existence was changing very slowly in a period of widely fluctuating fertility rates.

(2) The stream of births in successive years after 1933 shows temporary influences due to the making up of postponed births.

### 3. *The example of German fertility after 1933*

What did the striking rise of fertility rates in Germany after 1933 mean in terms of the considerations set out in § 2? Did the more recent marriages really have more children, and how many more, in the whole of their existence than their predecessors had had? It is, of course, only possible to be sure that the fertility of a group of marriages is complete when the wives concerned have reached the upper age limit of child-bearing. But to analyse the fertility of successive generations of marriages in which the wife has reached, say, 45 is a procedure whose usefulness is very limited. For the marriages in which the wife has reached 45 had most of their children a long time before. An examination of their fertility therefore throws

little light on the fertility of those marriages which produced the majority of births in recent years.

It is, nevertheless, possible to apply the ideas of § 2 to examine recent developments in fertility, such as the rise in the German birth-rate after 1933. The number of children born to the marriages which were principally responsible for the births of 1933-40, i.e. of marriages which were of recent duration in those years, may be compared with the number of children which had been born to marriages contracted at earlier periods when those had lasted for the same number of years.

Table 4 below gives the average number of children which had been born to marriages still in existence<sup>1</sup> in the middle of 1933, 1935, 1936 and 1939. The figures for 1933 and 1939 are derived from the censuses taken in those years, at which a statement was required in respect of all marriages of the number of children ever born. The figures for 1935 and 1936 are estimates. Each figure in the table relates to marriages contracted in one calendar year. The marriage duration stated at the side of the table is the difference between the year stated at the top and the year in which the marriages in question took place. The line of figures for marriage duration '5', for example, thus means that marriages contracted in 1928 and still existing in June 1933, had had altogether an average of 1.24 children, the marriages contracted in 1930 and existing in 1935 had had 1.25 children, marriages contracted in 1931 had had 1.30 children on average by 1936 and marriages of 1934, 1.30 children by 1939. Each of these groups of marriages had existed about 5 years on average at the date to which the numbers of children noted relate.

Table 4.\* *Number of children ever born to marriages of various duration. Germany, 1933-1939*

Duration of marriage (years)	Average no. of children per marriage				Indices (1933 = 100)		
	1933	1935	1936	1939	1935	1936	1939
1	0.47	(0.32)	(0.32)	0.44	(68)	(68)	94
2	0.72	(0.60)	(0.60)	0.73	(83)	(83)	101
3	0.90	0.97	0.82	0.96	108	91	107
4	1.08	1.13	1.16	1.14	105	107	106
5	1.24	1.25	1.30	1.30	101	105	105
6	1.40	1.39	1.40	1.49	99	100	106
7	1.55	1.50	1.52	1.63	97	98	105
8	1.65	1.63	1.63	1.72	99	99	104
9	1.74	1.76	1.74	1.77	101	100	102
10	1.79	1.83	1.87	1.83	102	104	102
11	1.90	1.91	1.93	1.91	101	102	100
12	2.06	1.92	1.99	1.99	93	97	97
13	2.17	2.03	2.00	2.08	94	92	96
14	2.33	2.17	2.10	2.12	93	90	91
15	2.29	2.26	2.23	2.15	99	97	94
16	2.40	2.41	2.31	2.13	100	96	89
17	2.51	2.35	2.47	2.20	94	98	88
18	2.53	2.45	2.40	2.32	97	95	92
19	2.70	2.56	2.49	2.38	95	92	88

\* See special note on this table at end, p. 162.

<sup>1</sup> I.e. undissolved by the death of either partner, by divorce or by annulment.

The most striking feature of Table 4 is the stability of the figures in each row as the eye moves from left to right.<sup>1</sup> In a period when fertility rates—even when they are measured in a way which completely removes the effect of the marriage boom—were rising very steeply, the number of children which marriages of the same duration produced remained very much the same from year to year. The nuptial-standardized reproduction rates given in Table 1 increased by 37% between 1933 and 1939. On the other hand, only the marriages contracted in one single year had had as many as 7% more children by 1939 than marriages of corresponding duration in 1933.

If Table 4 is examined more closely, the following features may be noted. The first few durations<sup>2</sup> of marriage excepted, the indices on the right-hand side of the table decrease in each column with increasing duration of marriage. The higher the duration the lower was the average of births achieved in 1935, 1936 or 1939 relative to that for marriages of the same duration in 1933. At durations under '12' the figures for 1935 and 1936 are at much the same level as those for 1933, and in 1939 marriages of durations under '12' show more children than the corresponding marriages in 1933—the excess being relatively greatest at short durations and falling off with increasing duration. On the other hand, at marriage durations of '12' or more, the figures for 1935 and 1936 are lower than those for marriages of over 14 years' duration; they do not rise at all, even above the 1936 level.

All these phenomena are completely in accord with the suggestion which these figures are intended to illustrate—namely, that the number of children per marriage remained relatively stable in Germany after 1933, the violent increase in fertility rates being due to the 'making up' of births postponed before 1933. The fact that at some low durations the number of children born to marriages by 1939 was larger does not prove that there was an increase in family size from 1933 to 1939. It is precisely because the marriages existing in 1933 had had at that date 'abnormally' few children, i.e. had postponed their births, that fertility rates rose in the later years. It would be expected that the deficit of births postponed would be the greatest (proportionately to their average number of children) in marriages of short duration, for the marriages of longer duration were most fertile before the time when births were being postponed, i.e. in the years just before 1933. Accordingly, it is at short durations that the 1939 figures in Table 4 exceed the 1933 figures in the greatest proportion.

On the other hand, the marriages of very long duration (say over 12) produced

<sup>1</sup> The table should not be read downwards, i.e. the birth achievement at any one date of marriages of varying duration should not be compared. The table relates only to the marriages still in existence. The fertility of marriages dissolved is lower than the average fertility of all marriages, mainly because the incidence of mortality is heaviest on the marriages of older persons. The surviving marriages are therefore selected for fertility. This does not affect the comparability of the figures in any one row of Table 4. For it may be assumed that the process of selection due to the influence of mortality has had roughly the same effect on the marriages of, say, 1923 during the 10 years of their existence before 1933 as on the marriages of 1929 before the year 1939.

<sup>2</sup> The figures for the very short durations are for various reasons less reliable than the rest, and some of those for 1935 and 1936 (the figures bracketed) not comparable with the others. See note on Table 4 at end.

almost all of their children before 1939, and the fall in their number of children between 1933 and 1939 really reflects the fall in family size which was proceeding before 1933.

The stability revealed by Table 4 in the number of children born to successive generations of marriages seems to be almost too complete to be believed. How, then, it is natural to ask, was it possible for fertility rates to rise so sharply? For example, by 1935 fertility rates were about 25% above the level of 1933. Yet hardly a generation of marriages had by 1935 or 1936 had more children than marriages of corresponding duration in 1933. How is this possible?

The problem may be approached by considering a hypothetical case. Imagine a population in which no marriages are dissolved and fertility rates are constant. Suppose that in the same calendar year in which they are contracted, marriages produce on the average  $f_0$  children; in the year after the marriage they have  $f_1$  children and so on, producing  $f_n$  children in the  $n$ th year. Then the total number of children born to a group of marriages which have completed the first year after the marriages would be  $f_0 + f_1$ ; and, generally, if the total number of children born to marriages which have completed their  $n$ th year be written  $T_n$ :

$$T_n = \sum_{j=0}^n f_j.$$

Now suppose that in a certain year, perhaps on account of an economic depression, fertility rates are lower, say  $f_0^a, f_1^a, \dots, f_n^a$  (where  $f_n^a < f_n$ ).

Then at the end of this year, those who were married in the previous year will have had  $f_0 + f_1^a$  children, those who married two years before will have had  $f_0 + f_1 + f_2^a$  and, in general, the number of births achieved at the end of the slump year by a group of marriages which have just completed their  $n$ th year after marriage will be

$$T_n^a = T_{n-1} + f_n^a = \sum_{j=0}^{n-1} f_j + f_n^a. \quad (1)$$

Now assume that in the next year (which we may call the year  $b$ ) fertility rates are such that, at the end of the year, marriages of each duration will have the number of children which marriages of the same duration had at the end of the previous year, i.e. marriages which at the end of year ( $a$ ) had completed their  $(n-1)$ th year after marriage and had  $T_{n-1}^a$  children will by the end of year ( $b$ ) have had  $T_n^a$  children. The fertility rates of year ( $b$ ) may therefore be written as follows:

$$f_n^b = T_n^a - T_{n-1}^a = \sum_{j=0}^{n-1} f_j + f_n^a - \left[ \sum_{j=0}^{n-2} f_j + f_{n-1}^a \right] = f_{n-1} + f_n^a - f_{n-1}^a. \quad (2)$$

Now since, by the assumptions of this example,  $f_{n-1}^a < f_{n-1}$ , it follows that  $f_n^b > f_n^a$ .

Thus to maintain even the decreased child-bearing achievement of the end of the slump year (year  $a$ ), fertility rates in year ( $b$ ) ( $f_j^b$ ) must rise over the level of that year ( $f_j^a$ ). They must rise because the child-bearing achievement at the end of the slump year is higher than would be the number of children born to generations of marriages which had been subjected throughout their existence to the decreased fertility rates of year ( $a$ ). The marriages in existence at the end of year ( $a$ ) ex-

perienced through all their married life, apart from one year, the higher normal fertility rates. It will thus be seen why it was possible for German fertility rates to rise steeply after 1933 while the number of children born to successive generations of marriages remained at the 1933 level.

It may be shown, indeed, that on the assumptions stated not only must fertility rates in year (*b*) be higher than they were in year (*a*), but they are likely to be even above the original 'normal' level. The amount by which  $f_n^b$  exceeds  $f_n^a$  is  $(f_{n-1} - f_{n-1}^a)$ , i.e. the number of births postponed at the previous marriage duration. Now fertility rates decrease with increasing marriage duration and, therefore,  $f_{n-1} - f_{n-1}^a$  is likely to be larger than  $f_n - f_n^a$ . Thus  $f_n^b = f_n^a + (f_{n-1} - f_{n-1}^a)$  is likely to be larger than  $f_n^a + f_n - f_n^a = f_n$ .

It would thus be expected that a sudden fall in fertility which does not correspond fully to a fall in family size, but is due to the 'postponement' of births, would result in considerable subsequent increase in fertility even if no full 'making up' occurs. Moreover, the relation of the fertility rates of different durations to one another may be expected to be altered under such conditions because of the effect shown above, of the births postponed at low durations on the fertility rates of high durations.

A simple arithmetical example will show that fertility rates will indeed be considerably disturbed by this process. Suppose that in the hypothetical population considered above, fertility rates decline, say, owing to a slump, in such a manner that in the first year they are at each duration at 90% of the normal level and in the second year 80% of the normal level. If we denote by  $f'_n$  the fertility rates at duration *n* in the second slump year, then the 'normal' pre-slump fertility rate is  $1.250f'_n$  and the fertility rate of the first slump year  $1.125f'_n$ . For marriages completing the *n*th year after the year of marriage at the end of the second slump year, the average number of children may be written (similarly to equation (1) above)

$$T'_n = 1.250 \sum_{j=0}^{n-2} f'_j + 1.125f'_{n-1} + f'_n.$$

If in the third year fertility rates are such as to maintain this number of children for marriages of each duration, the fertility rate at duration *n* will be (analogously to equation (2) above)

$$\begin{aligned} T'_n - T'_{n-1} &= 1.250 \sum_{j=0}^{n-2} f'_j + 1.125f'_{n-1} + f'_n - \left[ 1.250 \sum_{j=0}^{n-3} f'_j + 1.125f'_{n-2} + f'_{n-1} \right] \\ &= f'_n + 0.125f'_{n-2} + 0.125f'_{n-1}. \end{aligned}$$

How we may expect the pattern of fertility rates in the year after the 'slump' to differ from the 'slump' year may be seen by applying this formula to a set of actual fertility rates. The result is shown in Table 5. The second column of Table 5 shows the fertility rates ( $f'_n$ ) per 1000 married women under 45 recorded in Germany in 1933. The third column of the table shows the modification of these rates by the addition of  $0.125f'_{n-2}$  and  $0.125f'_{n-1}$ . The fourth column of the table gives the rates resulting from this modification as a percentage of the original rates.

Table 5. *Hypothetical changes in fertility rates*

(1)	(2)	(3)	(4)
Duration of marriage ( <i>n</i> )	$f'_n$	$f'_n + 0.125 f'_{n-1} + 0.125 f'_{n-2}$	Column (3) as percentage of column (2)
0	146	146	100
1	319	337	106
2	212	270	127
3	168	234	139
4	142	190	133
5	121	160	132
6	105	138	131
7	92	120	130
8	79	104	131
9	68	89	131
10	57	75	133

Table 5 shows that under the assumptions made the fertility rates would rise considerably and their pattern change substantially, even while the number of children per marriage remained constant at the 'slump' level. Fertility rates at some durations would rise far more than those at other durations. If such changes occur in reality, it can surely hardly be doubted that movements in fertility rates cannot be properly understood except by relating them to the number of children achieved by those who are experiencing the fertility rates in question.

That such changes do in fact occur may be seen from Table 6, which shows indices of the fertility rates of Germany in the period 1933-9 by duration of marriage.

Table 6. *Indices of fertility rates by duration of marriage in Germany, 1933-1939\**  
(1933 = 100)

Duration† of marriage	1934	1935	1936	1937	1938	1939
0	(110.1)	(113.0)	(116.0)	(108.3)	(108.9)	(95.2)
1	108.1	103.4	105.3	107.0	108.7	108.6
2	111.5	114.8	111.6	112.3	118.1	120.2
3	131.7	125.7	122.1	118.5	125.0	130.6
4	126.8	131.7	130.4	126.6	129.0	135.2
5	128.7	135.7	136.4	134.8	139.2	140.1
6	128.3	135.4	135.7	137.2	144.3	148.5
7	128.2	135.6	137.0	137.1	147.4	154.6
8	130.5	138.1	139.0	138.4	149.7	160.8
9	129.2	141.0	142.4	141.1	150.6	161.0
10	137.0	148.4	154.0	150.9	162.2	172.6

\* The rates are from the 1935, 1936, 1937 and 1938 issues of the *Statistisches Jahrbuch für das Deutsche Reich*, pp. 42, 43, 45 and 49 respectively and from *Wirtschaft und Statistik*, February 1942, p. 32.

† The duration of marriage is to be understood in the same sense as in Table 4. The rates relate to marriages contracted in different calendar years, and the marriage duration stated at the side of the table is the difference between the year stated at the top and the year in which the marriages in question took place. The rates for duration '0' (i.e. rates relating to children born within the calendar year in which the marriage took place) cannot be trusted. These rates are obviously greatly affected by differences in the distribution of marriages between different parts of the year. In some years (e.g. 1939, owing to the outbreak of war) marriages were concentrated abnormally in one or other season.

The run of the figures in Table 6 relating to 1934 and 1935 bears some resemblance to the last column of Table 5. The reason is that, as shown above in Table 4, the fertility rates of 1934 and 1935 roughly sufficed to maintain the number of children at the level reached in 1933 for marriages of each duration. In later years, 'making up' of postponed births proceeded sufficiently to raise the number of children above the level achieved in 1933 at many durations of marriage. The very steep rises in fertility rates shown in Table 6 for marriages of higher duration are easily explained as a result of the making up of 'postponed' births. Since fertility declines with increasing duration of marriage, a relatively small proportion of the births normally taking place in the third year of marriage will, if postponed to the sixth year, raise the normal fertility rate of the year very considerably.<sup>1</sup>

The results of this section may be summarized by saying that a comparison of the stability of the figures in Table 4 with the violent changes revealed by Table 6 bears out to the full the two following propositions so far as Germany in this period is concerned:<sup>2</sup>

(1) The number of children born to marriages throughout their existence was changing very slowly in a period of widely fluctuating fertility rates.

(2) The movements of fertility rates show the effect of the making up of 'postponed' births.

It follows that long-term prospects of population growth should be discussed in terms of the size of family, which remains stable, and not in terms of fertility rates, whose level this year is no reasonable guide whatever to their level next year. The movements of fertility rates are intelligible only in terms of the size of family already achieved of the marriages to which they relate.

#### 4. *The future of demographic analysis*

It has been shown that wide variations in fertility rates may occur while the total number of children born to marriages throughout their existence is changing smoothly and slowly. Does this fact really make it necessary, as has been suggested, to abandon the present modes of analysis based solely on the fertility rates of successive years?

<sup>1</sup> That the fertility rates relating to marriages of long duration rose more than those for marriages of short duration has often been regarded as an indication that marriages contracted before the rise of the Nazis to power were more affected by the recovery of 1933-9 than the later marriages which were mainly assisted by several of Hitler's pro-natalist measures. This suggests, it has been argued, that Nazi propaganda and policy was not in fact the cause of the rise in fertility. This line of argument is quite usual, and illustrates the mistaken conclusions into which one is led by studying fertility rates without relation to the size of family achieved by those to whom the rates relate. That the rates of those who *had* postponed births to make up rose more than the fertility rates of those who had not, simply shows that total family size changes fairly slowly. In other countries also, in the past decade, the fertility rates of marriages of long duration have fallen less or risen more than those relating to marriages of short duration. See P. H. Karmel, 'Fertility and marriages—Australia, 1933-42', in *Economic Record*, June 1944, p. 78; Jean Bourgeois, 'La Situation Démographique', *Population*, no. 1, 1946, p. 132. This is one of the reasons which make it seem likely that in other countries similar developments to those in Germany have taken place—if on a smaller scale.

<sup>2</sup> The discussion is intended only to establish these two propositions—it is not, in any sense, an assessment of the demographic development of Germany after 1933, nor is the example illustrated in Table 5 a 'model' of the German experience.

It is convenient to begin by defining two terms in the light of the discussion of previous sections. By family size I shall denote the average number of children born to couples over the whole of their fertile period.<sup>1</sup> By 'postponement' of child-bearing I mean a fall in fertility rates balanced by a subsequent rise so that the size of the family remains relatively constant (an 'anticipation' being a rise followed by a fall).

Thus the requirement that fluctuations in fertility rates should be regarded as 'postponed' or 'anticipated' births does not involve any knowledge of people's intentions to have children. It is not even necessary to suppose that at the time the 'postponement' takes place, i.e. when fertility rates fall, people have the idea clearly in their minds that they will later have the children they are 'postponing'.<sup>2</sup>

It is perhaps desirable to discuss a few other misunderstandings which may arise in regard to the view of family-building habits implied in the argument of this paper. To establish that changes in fertility rates are not necessarily an indication of changes in family size it is not necessary to have any very extravagant idea as to the extent to which the number of children is planned and foreseen. It is not necessary to assume that all married couples begin their married life with a fixed idea (afterwards invariable) as to the number of children they want, that they are all completely successful in having this number of children, no less and no more, and in 'postponing' and 'anticipating' child-bearing exactly when they wish. To take the last point first, it is only necessary to suppose that a substantial proportion of couples attempt to exercise control over the time at which they have children with such success that they can substantially reduce the rate at which, as a group, they have children in a given period. A moderate degree of control attempted by, say, half the couples in a population would fully explain the fluctuations which are in fact found in fertility rates.

Nor is it necessary to assume that married couples never in the course of their lives modify their plans as to the number of children they intend to have. For example, in an economic depression there are no doubt some who put off having another child—which they might have had soon in favourable circumstances—so long that they never in fact have it at all. There will no doubt be some who will

<sup>1</sup> Usually the question 'Is the rise in the birth-rate due to a change in family size?' means 'Is it due to increased marriage or to a rise in legitimate fertility rates?' A rise in legitimate fertility rates clearly does not necessarily indicate an increase in family size on the definition given above.

<sup>2</sup> The difference between 'postponement' or 'anticipation' (1) in a statistical sense—i.e. the correspondence of a fall and rise in rates—and (2) in a psychological sense—i.e. decisions on the part of individuals that some particular event which they are intending to bring about shall take place later or earlier than originally intended—may be seen in the case of marriages. For example, a marriage boom followed the outbreak of war in 1939 in Great Britain. The additional marriages which occurred then, over and above those which would have taken place at 'normal' marriage rates, may, from the statistical point of view, be treated as in large part anticipated marriages, i.e. in discussing the future it may be supposed that the generations experiencing the high marriage rates will later experience correspondingly lower marriage rates, so that they will end with roughly the same proportion still unmarried as in the case of previous generations. This supposition implies only that, even apart from the war, the persons who married at the beginning of the war would in general have married at some time. It does not imply that they would have married the same partners, i.e. that the marriage boom was due to the contraction of intended marriages earlier than originally planned. It is the latter meaning which is frequently attached to the phrase 'anticipated' marriages.



decide never to have any more. The argument for analysing fertility movements in terms of family size lies solely in the experience that changes in family size are far less irregular than fluctuations in fertility rates.

We may now return to the question whether in future fertility rates are likely to be so affected by postponement and anticipation of births as to continue to render them unsuitable to be the sole instruments of demographic analysis. Will the direct analysis of family size remain imperatively necessary if fertility changes are to be correctly appraised?

It might be supposed that the conditions in which the traditional methods of fertility analysis have become inadequate are temporary, and that in a few years' time the ordinary fertility rates will no longer be influenced by the shifting of children from one period of people's married life to another. It is, however, unlikely that the demographic analysis of low fertility countries will again be possible solely on the basis of annual fertility rates.

A fundamental circumstance which affects the significance of annual fertility rates is the proportion of planned births. This is clearly unlikely to decrease. The effect of planning has in recent years been such, in most of the low fertility countries, as to necessitate the analysis of fertility in terms of children per marriage. The sensitivity of fertility rates during the recent war to the general state of public confidence has been noted in several countries.<sup>1</sup> Births were 'postponed' in the years when the prospects of the war seemed gloomy and 'made up' in subsequent years, so that fertility rates rose very steeply to a level substantially above the 'normal'. Thus, in England and Wales legitimate fertility rates specific by age and duration fell on the whole by about 15% between 1939 and 1941, they then rose by 25% between 1941 and 1944. These extremely violent fluctuations cannot be explained by changes in the degree of wartime separation between husbands and wives. In the period of rising fertility rates a far larger number of men were on service overseas than when the children born in 1940 and 1941 were conceived.

It seems likely also that fertility rates are becoming more and more sensitive to economic fluctuations. We know that the fertility rates are more closely correlated with economic fluctuations in those sections of the population where fertility is low than in high fertility groups, and more closely correlated in this century than in the last.<sup>2</sup> The 'postponement' or 'anticipation' of child-bearing in response to economic fluctuations seems to be having an increasing effect on fertility rates as fertility comes more and more under voluntary control.

Moreover, even if there are periods in which the smooth orderly development of fertility rates is undisturbed by wars or other shocks, fertility rates cannot be relied upon as instruments of demographic analysis. Even on this assumption, the existence of disturbances, such as economic depressions, at intervals renders it impossible to deduce the true trend of family size from fertility rates. Thus in the early 1920's fertility rates in western Europe were 'abnormally' high because they

<sup>1</sup> Including neutral countries, e.g. Sweden (H. Hyrenius in *Statistiska Undersökningar Kring Befolkningsfrågan Utfordra av 1941 års Befolkningsutredning* (Stockholm, 1945), p. 199).

<sup>2</sup> Cf. H. Hyrenius, loc. cit., p. 192; Dudley Kirk, 'The relation of employment levels to births in Germany', *Milbank Memorial Fund Quarterly*, April 1942, p. 134; D. S. Thomas, *Social Aspects of the Business Cycle* (London, 1925), p. 127.

had been 'abnormally' low in 1915-17. On the other hand, in the early 1930's fertility rates were 'abnormally' low because births were being postponed owing to the depression. For this reason the rate of decline of fertility rates from, say, 1923 to 1935 was greater than was the rate of decline in the size of family.<sup>1</sup> Yet many population projections have been computed in the last dozen years on the assumption that fertility 'will continue to decline in accordance with present trends'. 'Present trends' were obtained by passing a curve through the fertility rates of the 1920's and 1930's and extrapolating. In this procedure lies one of the reasons why many projections gave so very startling a decline in the future number of births—a forecast which has turned out to be entirely at variance with the facts.

Further, even if no shocks like wars or depressions were ever to occur again, people may still vary the rate at which they have children without changing the size of family. For example, married couples may come to let a longer period, on the average, elapse after marriage before having their first child, or they may decide to space their children at wider intervals. There is no doubt that changes in both these directions have to some extent accompanied the spread of family limitation. The effect of such changes on fertility rates may be seen by considering a hypothetical population in which successive cohorts<sup>2</sup> of marriages all end their married life having had the same average size of family. Suppose that those marrying after a certain date decide to space out the same total number of children as in the past over a longer period. The fertility rates of these later cohorts would then be lower in their early years of marriage, but higher at higher durations, than those of their predecessors. Now consider a demographer analysing this movement, say in terms of the gross reproduction rate. When the cohorts in question were in their early years of marriage, he would notice a 'decline in fertility'. After a time, when the fertility rates of the higher marriage durations were having effect, he would diagnose that the 'trend of fertility had changed', and 'fertility was now rising again'. If such an increase in the average spacing of families has been going on in the last 20 years, it would help to explain a part of the movement of the customary fertility indices.

It must be concluded, therefore, that demographic analysis in future must study changes in the number of children born over the whole of their married lives to successive cohorts of marriages and relate yearly fertility rates to the number already born to the marriages in question.<sup>3</sup>

<sup>1</sup> The course of events in this period was particularly likely to be falsely interpreted by demographers because the fertility indices normally employed not only failed to eliminate the distortions referred to above, but also failed to take account of the effects of marriage. The population of married women in the early 1920's in many of the countries of low fertility contained an abnormally high proportion of recently married women. As the distribution of married women by duration of marriage became far less 'favourable' to fertility in the later 1920's and early 1930's, the customary fertility indices tended to fall, quite apart from changes in fertility rates.

<sup>2</sup> The word 'cohort' is here used to denote a group of marriages taking place in a given period, say a year.

<sup>3</sup> Analysis of the total number of children born throughout their lives to successive generations of men or women (i.e. to groups of men or women *born* in successive years) would serve substantially the same purposes as the analysis of the total number of children born to couples *married* in successive periods, and would similarly reveal the smooth changes underlying sharp fluctuations in fertility rates. Only analysis in terms of marriages has been considered in this paper because the material is more conveniently available.

### 5. *Explaining the recent rise in the birth-rate*

It may be asked how the analysis of birth changes in terms of family size affects attempts to 'explain' these changes in sociological terms.

In the first place, on the view that it is family size which matters, the phenomenon which is to be explained becomes something entirely different. We may refer again to the example of the German rise in fertility after 1933. On the usual view what has to be explained is a rise in fertility of over 30%. The problem of 'explaining' this change in view of the previous decline in fertility proved baffling. A large literature arose. On the one hand, German writers proclaimed that the rise in fertility was a sign of a glorious 'national rebirth'; on the other hand, there were some anxious attempts to show that in reality nothing remarkable occurred at all. But, in fact, the whole problem was wrongly put. The usual way of looking at the matter implies that the fertility rates of 1933 in some way represent the family building habits of the German people in that year, while the fertility rates of 1939 are an index of their family building habits in the latter year. Hence arises the need to explain a vast change in the attitudes and behaviour of the German people.

If, on the other hand, family size is regarded as the important factor, no such significance can be attached to the fertility rates of particular years. Take, for example, the assumption that, apart from some change from the conditions of 1933 (and the discussion really revolves round the question whether that change was the national rebirth, reduced unemployment, etc.), German fertility rates would have remained at the 1933 level. The mere fact that, in the year 1933, fertility rates were at that level, gives no warrant whatever for such an assumption. For the marriages existing in 1933 had had far more children than they would have had, if they had throughout their existence experienced the low fertility rates of 1933. To assume that those low fertility rates would continue to be maintained unless social conditions changed is to assume a considerable further fall in family size. Such an assumption may in fact be reasonable, but it clearly requires to be argued. The same must be said of the assumption that, in the conditions of 1939, the fertility rates of 1939 would be maintained. This assumption implies that, in the conditions of 1939, family size would increase considerably above the size of family actually recorded in 1939.

As was shown in § 3, the fertility history of Germany after 1933 looks very different in terms of family size. It appears that family size remained fairly constant. This, of course, does not dispose of the question: What caused family size to remain constant? It does not prove that the Nazi regime had no demographic success. To answer this question it would be necessary as a first step to study the development of family size after 1933 in relation to its trend previous to that date. For example, one might investigate how suddenly the declining trend was interrupted. Again the trend of family size in Germany should be compared with that in other countries of similar demographic status. It is only after an answer, however rough, has been given to these and similar questions that it is possible to isolate how much change in the declining trend of family size is peculiar to Nazi

Germany, and only when this has been done is it profitable to speculate on whether the change is or is not due to pro-natalist propaganda or family allowances.

If the rise in the birth-rate is considered in the first place in terms of family size, there now arises a separate question, the problem of precisely why did the 'postponement' and 'making up' of postponed births take place at precisely the dates at which they did take place. In tackling this question it is also necessary to take account of family size. For if a given change in fertility rates is regarded in the light of the number of children already attained, its magnitude may be differently appreciated. For example, at first sight the increase in fertility rates from 1933 to 1934 seems very much greater than the increase between 1938 and 1939. But, in fact, the former increase is measured against a level of fertility rates far below that required to maintain existing family size, while the latter rise occurred when fertility rates were at a relatively high level. The first essential, therefore, for a proper understanding of movements in births, such as the recent international increase, is the careful analysis<sup>1</sup> of the two elements—changes in size of family and changes in fertility rates resulting from the postponement of births. If this is done, it will certainly appear that the whole of the recent changes appear smooth and regular when regarded in terms of family size and far less startling than the changes in fertility rates. It will also certainly appear that family size has stopped falling in several countries, and some increase may be found.

The next task will be to place the recent changes in their context. For various reasons given in § 4 above it seems probable that the demographic history of the period between the two wars has not been correctly understood because of deficiencies in the statistical techniques customarily employed. We do not know, for example, at what rate the fall in family size was proceeding just before the war. Was the development in recent years simply a smooth continuation of the pre-war trend? It is quite possible that the sudden upward turn in the fertility indices usually employed was caused entirely by sudden changes in the number of marriages and postponement or anticipation of births.

When these questions can be answered, it will be possible to judge with greater confidence whether what has happened is a temporary development due to the war. When we know precisely what changes have to be explained it will be opportune to discuss what, in sociological terms, were the causes.

<sup>1</sup> A proper discussion of the statistical procedures suitable for this task lies outside the scope of the present paper. It should be mentioned, however, that censuses at which details of the number of children are obtained are not an essential prerequisite for this type of analysis. The German censuses (and estimates based on them) were used in § 4 as they were conveniently available. But where the date of marriage has been recorded at birth registration for a sufficiently long period and the births tabulated by a sufficiently detailed classification of marriage duration, it is possible to attribute the births occurring in different periods to the cohorts of marriages who produce them; and thus changes in family size can be successfully analysed by means of registration statistics alone.

### 6. *A critique of gross and net reproduction rates*

The questions considered in the previous sections are directly relevant to the meaning and value of gross and net reproduction rates, now the most widely used indices of fertility. These rates are generally regarded as the 'best measures of fertility and reproduction', both by demographers and by the lay public. Great importance is now attached—even by many laymen—to the question: Is the net reproduction rate below 1, and by how much?

The significance of a net reproduction rate derives from the fact that in the absence of migration a population permanently subject to the fertility and mortality rates on which the reproduction rate is based, will, in the long run, decrease (or increase) at the rate indicated by the reproduction rate.<sup>1</sup> To pay attention to a reproduction rate is, therefore, to contemplate the consequences of the maintenance, in the long run, of the fertility and mortality rates on which the reproduction rate is based. Is it, in fact, reasonable to attach significance to what would happen if the specific rates on which reproduction rates are based were to be maintained in the long run? Or is it possible to foresee that age-specific fertility and mortality rates will not be maintained because they are influenced by factors which must be temporary?

One important qualification to the use of reproduction rates was pointed out in a previous article.<sup>2</sup> It was shown that in the countries of 'Western civilization' the ratio of men to women at the important child-bearing ages was often abnormal, i.e. it could not be maintained in the long run in the absence of war or migration. But if the sex structure of the population changes, the proportions married must change among men or women, or both. Unless it is supposed that all required adjustments are made entirely in the proportion of men who marry, it follows that in the absence of war or migration the proportions married among women will change. It was shown that the abnormalities of sex structure have had a very great influence on reproduction rates. In fact the net reproductivity of most European countries has been considerably underestimated by the customary net reproduction rates.

These considerations show that reproduction rates reflect a situation which is only temporary, because the proportions married are likely to change. But in view of the earlier section of this paper it may be seen that, even apart from changes in the proportions married, reproduction rates for European countries in recent years reflect a situation which is temporary.

In the first place, as shown in § 1, the population of married women has been abnormally heavily weighted with recently married women as a result of changes in marriage rates.

Secondly, the fertility rates of individual years have been heavily influenced by the past fertility history of the population of reproductive age (§§ 2-4). Both

<sup>1</sup> The remarks made in this section also apply, of course, to the 'true rate of natural increase'.

<sup>2</sup> 'Some aspects of recent trends in marriage in England and Wales', § 5, 'Paternal reproduction rates', *Population Studies*, no. 1, 1947. See also P. Vincent, 'De la mesure du taux intrinsèque d'accroissement dans les populations monogames', *Population*, no. 4, 1946, pp. 699 sqq.

these factors mean that the fertility rates will change although the habits of the population in regard to marriage and family size remain what they were.

The combined effect of these temporary 'disturbances' on the age-specific fertility rates on which reproduction rates are based may be shown by using statistics of birth order. Each specific fertility rate may be separated into the component contributed by illegitimate births, and components due to first, second, third, etc., legitimate births. By adding up the births of each order we obtain the number of legitimate births of that order which would occur to 1000 women passing through their child-bearing period, if they were subjected throughout to the fertility rates of the year in question and no mortality was occurring. The results of such a calculation for the fertility rates of Scotland for the period 1938-44 are shown in Table 7. The total fertility rate (the sum of age-specific fertility rates based on all births, legitimate and illegitimate, male and female), and the ordinary gross reproduction are also given.

Table 7.\* *Number of legitimate live births that would be born to 1000 women passing through child-bearing age according to the fertility rates of Scotland in 1938-1944*

Year	First births	Second births	Third births	Fourth and higher order	Total legitimate births	Total fertility rate	Gross reproduction rate
1938	710	483	306	572	2072	2202	1.072
1939	711	483	293	549	2037	2164	1.050
1940	753	466	284	508	2017	2136	1.042
1941	789	451	278	516	2033	2175	1.057
1942	815	483	279	487	2065	2222	1.084
1943	846	554	307	497	2204	2383	1.163
1944	811	605	331	506	2254	2444	1.180

\* For 1938 the data are to be found in the *Annual Report of the Registrar-General for Scotland* for 1938 (pp. lxix sqq.); for 1939-43, the data are in the *Annual Report* for 1943 (pp. lxxxiii sqq.); and for 1944 in the *Annual Report* for 1944 (pp. lxxxix sqq.). The age-specific fertility rates are given in Table F (2) for each year. (The rates for 1938, based on the births registered from July to December only, have to be multiplied by the ratio of the births in the whole year to births in July-December.) Legitimate and illegitimate births by age of mother are in Table F (2), and legitimate births by number of previous children and age of mother in Table F (4). An interesting series of figures for Australia, similar to those in Table 7, may be found in Enid Charles, 'The changing structure of the family in Australia', *Political Arithmetic*, ed. L. Hogben (London, 1938), p. 230.

The figures show the effect of the marriage boom at the beginning of the war, the 'postponement' of child-bearing in the early years of the war and the subsequent 'making up'.

In the period 1939-41 the figures for first births were rising slowly while those for higher births fell. The figures for first births were kept high by the large number of recently married couples resulting from the marriage boom at the beginning of the war. After 1941 the figures begin to rise steeply. The number of first births reached its peak in 1943 and then declined slightly in 1944. Births of higher-order rose later but continued to increase between 1943 and 1944. This is what was to be expected. An increase in the number of marriages affects first births first, then second births and so on. The effect of the 'making up' of postponed births is

similarly slower on the births of higher order.<sup>1</sup> The gross reproduction rate was thus, in its composition by birth order, representing a shifting situation. In these circumstances, can a reproduction rate, as a whole, be considered a reliable index of long-term trends?

It is interesting to note that the figures for first births in 1941-4 are clearly temporary in the sense that the permanent maintenance of such high age-specific first birth-rates is inconceivable. The proportion of all women aged 45-54 who had married once or more (i.e. married, widowed and divorced women) was 78.2% in Scotland in 1939.<sup>2</sup> According to the age-specific fertility rates of 1941-4, a larger proportion of a generation of women would have a first<sup>3</sup> legitimate child than would get married.<sup>4</sup>

<sup>1</sup> A precisely similar development, as can be seen in the crude totals of births by order, took place in Germany after 1933 and in several other countries which have participated in the recent rise in the birth-rate (e.g. Switzerland and the U.S.A.). First births always 'lead the way' and are then followed by births of higher order. In Germany, for example, the rise in first births ended in 1935, as it did in Scotland in 1943. Changes in the distribution of births by order are usually considered from an entirely inadequate point of view. It is often believed that when the first births only increase, this shows that there is no 'real increase in fertility'. Even demographers sometimes think that if only first births increase, the movement must be due entirely to a changing number of marriages. This method of distinguishing the influence of marriage is entirely false. It is not true either (1) that if higher-order births increase as well as first births, the increase in births can no longer be explained by increases in the number of marriages, or (2) that if first births only increase, the whole movement is due to changes in the number of marriages. The first proposition may be seen to be false by considering what would happen if the number of marriages increased but family size remained the same. The additional marriages would after a time have second and third births without any increase in family size. The second proposition is shown to be false by considering a case where the number of marriages remained constant, but the number of first births increased. In such a case a smaller proportion of marriages would remain childless and the average number of children per marriage would increase. A reduction in childlessness is in fact a possible mode of increase in family size which has great importance in the countries where families are small. The study of figures of birth parity is of importance in connexion with several of the questions discussed in this paper. For example, one method of analysing fluctuations in fertility in the light of the number of children already born to the couples concerned, is to relate the number of  $n$ th births in a given year and at a given marriage duration to the number of couples who have had, by the beginning of that year and that duration,  $n-1$  children.

<sup>2</sup> See *National Register, Statistics of Population*, Table II. No more recent figures are available for Scotland. In England and Wales the proportion of women married once or more in the age group 45-54 was still practically the same in 1945. See 'Some aspects of recent trends in marriage in England and Wales', *Population Studies*, no. 1, 1947.

<sup>3</sup> The figures for first births in Table 7 are based on first births in the sense of births to mothers who have not had a previous child (live or stillborn) by the *present* husband. It is thus possible for a woman who has married more than once to have more than one first child in this sense in the course of her life. The effect on the figures is, however, slight (cf. *The Registrar-General's Statistical Review for England and Wales*, 1938, Tables, Part II Civil, p. 126). The statement made in the text above could only be affected in the case of 1941. In any case, the inclusion of stillbirths; and possibly children legitimated by the marriage, in the number of previous children acts in the other direction, and some first live-born children have been recorded as second or later children.

<sup>4</sup> Cases in which the first birth components of the age-specific fertility rates of a given year could not be maintained in the long run are quite frequent. This was true, for example, of England and Wales in 1941-4. In the U.S.A. (where all births, legitimate and illegitimate, are classified by parity), the first birth-rates of 1942 would have meant that 100 women passing through child-bearing age had 109 first births! (See an interesting article by P. K. Whelpton; *Amer. J. Publ. Hlth*, April 1945.) For rates 'impossible' in this sense in Australia, see E. Charles, *op. cit.* pp. 233 and 235. Such 'impossible' rates must in recent years have occurred once or more in almost every one of the countries which have participated in the striking rises in the birth-rate, since very sudden increases in the number of first births have occurred.

To show further how the distribution between the births of different order implied by the fertility rates of successive years reflects temporary variations and not underlying changes in family size, the following procedure may be adopted. If we subtract the number of first births yielded by the fertility of any year, as given in Table 7, from 1000, we obtain the number of women who, if subjected to the fertility rates of that year throughout their lives, would reach the end of their child-bearing period without having borne a legitimate child. Subtracting the number of second births from the number of first births we obtain the number of women who, according to the fertility rates of that year, would reach the end of their child-bearing period having had one child and one only. Similarly, the number of those having had two children only or three children may be obtained. Table 8 shows the result of this calculation.

Table 8. *Distribution of a thousand women according to the number of legitimate children they will have by the end of their child-bearing period according to fertility rates of Scotland, 1938-1944*

Year	No child	One child	Two children	Three or more children	Total
1938	290	227	177	306	1000
1939	289	228	190	293	1000
1940	247	287	182	284	1000
1941	211	338	173	278	1000
1942	185	331	205	279	1000
1943	154	292	247	307	1000
1944	189	206	274	331	1000

It will be seen that the distribution of families by size implied by the fertility rates of successive years is highly unstable. For example, if the rates of 1942 remained permanently in operation 33% of women would end their reproductive lives having had one child and one only. According to the rates of 1944, the corresponding figure would be 21%. It seems difficult to suppose that any importance, as an indication of long-term trends, attaches to the total of the rates which were composed in this shifting manner of births of different orders.

The essence of all these considerations against the use of reproduction rates is that the rates embody a situation which is necessarily temporary. To look upon the long-term prospects of population growth following from the maintenance of the situation of a given year in terms of rates which are certain not to remain as they are is clearly an unreasonable proceeding. To use reproduction rates as precise indications of population growth is wrong in exactly the same sense as the use of crude birth- and death-rates which reflect the effects of an age distribution which is certain to change.

The effect of temporary influences on the reproduction rates is, moreover, by no means negligible. The reproduction rates of the past two decades, which have



been the subject of so much notoriety, must often have misstated replacement prospects to the extent of 10% or more.<sup>1</sup>

In view of the importance currently attached to reproduction rates it is worth emphasizing especially that a very false impression is given by the common practice of showing a series of reproduction rates for successive years. The reproduction rate is a most unsuitable instrument for obtaining a view of the significance of year to year fluctuations. The gross reproduction rate shows the same variations as the total of births, except that the effect of changes in the size of the female population and its age structure are eliminated. Now usually the age structure of the population changes but slowly from year to year. The advantage of using the gross reproduction rate as compared with the number of births for tracing year by year movements is, therefore, usually negligible. The gross reproduction rate does not enable one to distinguish between the effects of changes in marriage rates, 'postponed births', etc.

The year to year fluctuations in the *net* reproduction rate also reflect the effects of variations in mortality. Thus the low net reproduction rate of one year might reflect some epidemic. This reproduction rate<sup>2</sup> would indicate how far a population

<sup>1</sup> To demonstrate this in detail, for several countries, would involve a very lengthy memorandum. The essential points may once more be roughly illustrated in relation to Germany. The net reproduction rate of Germany in 1933 (see Table 1 above) was 0.698. At that period in Germany (as in other north-west European countries) the ratio of men to women was such that the paternal reproduction rate was about 20% above the maternal (Table 18 of my paper, quoted above, on 'Aspects of recent trends in marriage in England and Wales'). The proportion married among women was therefore likely to change as the sex structure became normalized, in such a way as to raise the reproduction rate considerably. Secondly, even among men proportions married were abnormally low owing to marriages postponed in the depression. Thirdly, legitimate fertility rates were in 1933 far below the average level which would be maintained in the long run if family size remained at the 1933 level (as shown in § 3). Legitimate fertility rates were already in 1934 on the average more than 20% above the 1933 level. Family size remained constant even in subsequent years when fertility rose further. The full extent of this rise was due to the 'making up' of postponed births. But there can be no doubt that, taking account of the unbalance of the sexes stated above and the abnormal depression of fertility rates, the 'replacement' fraction (to use an intentionally vague phrase), resulting from the permanent maintenance of the marriage and family building habits of the German people in 1933, should have been over 0.9 and not under 0.7. Similar, if less extreme, corrections apply to the net reproduction rates of other low-fertility countries in the 1930's.

<sup>2</sup> Some purists even insist that the net reproduction rate for England and Wales in 1940 should be calculated on the death-rates of that year (all deaths being included in the calculation of the death-rates). This net reproduction rate then shows how a population constantly exposed to aerial bombardment, as England was in 1940, would be replacing itself! In this connexion reference may be made to the calculations of the effective reproduction rate, made by the Registrar-General of England and Wales since 1944 and published regularly in the *Quarterly Returns of Births, Deaths and Marriages*. These rates are, like ordinary reproduction rates, based on the age-specific fertility rates of the year, but, unlike ordinary reproduction rates, they are based, not on actual mortality, but on a set of hypothetical death-rates which it is thought the generation of girl babies born in the year may be expected to experience in the course of their lives up to the end of their reproductive period. These death-rates are obtained by extrapolation of the past death-rates of each age group. For 1938-41, the 'effective' and the ordinary 'net' reproduction rates were as follows:

Year	'Effective'	'Net'	Year	'Effective'	'Net'
1938	0.810	0.805	1940	0.772	0.757
1939	0.808	0.807	1941	0.761	0.737

The 'effective' reproduction rates have been very severely criticized (e.g. by R. R. Kuczynski, in 'Demography; science and administration', *Eugen. Rev.* April 1945) on the ground that they are

in which such an epidemic was raging continuously would, in the long run, be replacing itself. Clearly a temporary increase (or decrease) in death-rates should not alter one's view of the long-term prospects of population growth. In view of all this, it is very difficult to see what conclusions, if any, can be drawn from the fact that the net reproduction rate has, for example, increased from one year to the next by 3 points in the third place of decimals (the accuracy to which it is usually calculated). Any statistician, may, of course, wish to explore the long-run consequences of supposing that the age-specific fertility and mortality rates of a given year continue in operation (even though he knows this assumption cannot be fulfilled), and calculate the appropriate net reproduction rate for this purpose. But the general public should not be left with the impression that any significance whatever attaches to the mere fact that the net reproduction rate in one year was 0.809 as against 0.801 in the previous year. It may, of course, appear as a result of analysis of an entirely different kind that changes in the habits of the population from one year to the next alter the prospects of population growth in the direction in which, and to the extent to which, the net reproduction rate happens to have changed. But this conclusion will not be strengthened in the least by calculating the net reproduction rate. For, as has been shown, the change in the net reproduction rate may have been caused by circumstances which have nothing to do with long-run prospects.

But, it might be asked, though the net reproduction rate of any given year may not be an indication of the long-term prospects of population growth, an average net reproduction rate over several years is surely significant? For example, is it not reasonable to be anxious, from the point of view of population policy, if the net reproduction rate remains below unity for a series of years? Now it is true that the temporary effects on the reproduction rate of variations in marriage frequency, or of the shifting of births from one year to another while ultimate family size remains unchanged, are likely to be of short duration. Nevertheless, this 'defence' of the net reproduction rate must be rejected, for two reasons.

In the first place, it is quite impossible to know from a study of reproduction rates, over which years one should average them; nor is there any reason to suppose that the effect of the temporary disturbances over a period will be eliminated by taking an arithmetic average. For example, the excessive representation of recently married women in the population in one year will undoubtedly result after a period in an excessive weighting of marriages of long duration. But the average reproduction rate is speculative, because future mortality is uncertain, and that they tend to overstate reproduction because they disregard fluctuations in mortality. These criticisms are largely justified; but as the figures above show, the difference between the 'effective' and the 'net' rates was very small in the pre-war years. From the point of view of judging the prospects of population no importance can be attached to these differences in the third place of decimals. On the other hand, the extrapolated mortality rates, on which the effective reproduction rate is based, must, of course, change smoothly from year to year. The effective reproduction rate does not reflect the abnormal mortality of 1940 and 1941, and is thus well above the net reproduction rate in these years. One limitation to the use of series of net reproduction rates is thus removed by the effective reproduction rate. The effective reproduction rate is, of course, still subject to those limitations of the net reproduction rate which are due to its being based on age-specific female fertility rates—in other words, the most serious limitations.

duction rate over the whole period could not, on that account, be relied upon to give any definite measure of the degree of replacement which would result, in the long run, from a maintenance of the marriage and family building habits of the population in that period.

Secondly, the effects of a disturbed balance of the sexes are not necessarily temporary. As I have pointed out elsewhere,<sup>1</sup> the continued existence of migration may permanently maintain an excess (or deficit) of women in relation to men, and the age-specific fertility rates of women recorded in such a population would give no exact indication of the extent to which the population would be replacing itself in the absence of migration.

Finally, it may be asked, can any index be substituted for the reproduction rates in the light of these criticisms? It is, of course, possible to extend the technique of calculating a replacement index by utilizing rates other than age-specific fertility and mortality rates. For example, Table 1 gives replacement indices for a population continuing to experience perpetually a given set of marriage rates and a set of fertility rates specific by duration of marriage. Even more refined rates could easily be devised.

It is, however, clear that no more complicated calculation will take the place of the net reproduction rate, which, according to the view now common, is *the* index of the prospects of population growth. For, if the argument of this paper is sound, it follows that the question 'To what extent is the population replacing itself according to the rates of *this* year?' is a futile question. In however refined a way we analyse the fertility rates of a given year they will still reflect temporary fluctuations.<sup>2</sup> Reproduction indices based on the rates of single years must always to some extent reflect a situation which can be known to be temporary.

The only way to form a proper judgement of the long-term prospects of population growth is to analyse carefully the trend of marriage and the total number of children per marriage. There can be no mechanical formula which can be applied year in, year out.

#### APPENDIX

##### *Notes on the computation of Table 4*

The figures relate to existing marriages (i.e. not dissolved by death of either partner, by divorce or annulment). All live or stillborn children of the couple (including any born before the marriage) are supposed to be covered by the figures, but not children of previous marriages.

The census figures for 1933 and 1939 are taken from *Wirtschaft und Statistik*, May 1942, p. 171. The 1939 figures have been adjusted to allow for the fact that the census of 1939 was taken on 16 June, while that of 1933 had been taken on 17 May. As the couples were tabulated by year of marriage, this means that the 1939

<sup>1</sup> *Population Studies*, April 1947, loc. cit.

<sup>2</sup> This also applies to marriage rates which are always affected by such phenomena as the trade cycle.

enumeration shows the position when marriages had on average lasted one month less than the marriages with which they were compared for 1933, e.g. the marriages of 1938 had lasted one month less, on average, by census date in 1939 than the marriages of 1931, with which they are compared, had lasted by census date in 1933. The figures given for 1939 in Table 4 are therefore based on the children enumerated plus  $\frac{30}{365}$  of the births occurring in 1939 to the appropriate group of marriages. These statements assume that marriages occurring in different years may be regarded as distributed throughout the year in roughly the same way. This assumption is necessary in general to justify the procedure by which marriages of different years are regarded as having lasted for the same time at the same date after the calendar year of their occurrence. As in some years—1933 for example—the marriages were very abnormally distributed throughout the year, the average duration of the various groups of marriages compared in any one line of Table 4 is not always exactly the same. This cannot, however, affect that comparability in respect of average numbers of children except at very early durations of marriage, when the rate of child-bearing is high and thus the average number of children varies appreciably with small variations in the duration of marriage.

The figures for 1935 and 1936 were obtained as follows. The issues of the *Statistisches Jahrbuch für das Deutsche Reich* for 1936, 1937 and 1938 give (on pp. 44, 48 and 50, respectively) the distribution by number of children ever born of the marriages existing on 31 December 1934, 1935 and 1936 respectively. From these tables, the average<sup>1</sup> numbers of children born up to the dates stated to the marriages of successive years were computed. An estimate of the position as at the middle of 1935 was obtained for, say, the marriages contracted in 1930, by taking the mean of the number of children they had had by 31 December 1934 and the number they had had by 31 December 1935.

As has been said above, the figures for 1933 and 1939 relate to the position as at 16 June and not 30 June. In making the estimates for 1935 and 1936 a simple mean of the position at the beginning and end of the year was used without further adjustment, because, since the fertility of marriages decreases with increasing marriage duration, the mean number of children must be reached slightly before the middle of the year. This source of error can, however, only affect the comparability of the figures for 1935 and 1936 with those of 1933 and 1939 very slightly and at short durations.

Some of the figures for short durations given for 1935 and 1936 are not strictly comparable with the other figures in the table and have been bracketed. They are figures relating to groups of marriages contracted after 1933, i.e. groups of marriages some or all of which had not been contracted at the time of the census of 1933. In the case of these groups of marriages the number of children is only known for those couples who registered one or more births and, therefore, stated

<sup>1</sup> The average number of children for marriages with 'six or more children' was taken at each duration as the average number of children in marriages with six or more children in 1939. In the 1939 data used the distribution of marriages by number of children is given in detail up to 'ten or more children' (the average number of children in families with ten or more was taken as eleven at all durations of marriage).

the number of their children at registration. There are, however, some children legitimated at marriage who are not included in the figures because they were not attributed to the group of marriages concerned as a result of any act of registration subsequent to their parent's marriage. The bracketed figures are therefore lower than they would be if all the children of each group of couples were counted as in the rest of the table.

It may be thought that the figures in successive columns of Table 4 are not comparable because of changes in the distribution by age of the wife of the groups of marriages compared. There are quite considerable differences in age structure between some of the groups of marriages compared in the rows of the table. These differences were due in part to changes in the age structure of the female population in general (married and unmarried) and to changes in the age at marriage. (The former changes were mainly connected with the passing of the survivors of the girls born in 1915-18, when the number of births was very low, through the most important child-bearing ages.) From the point of view adopted in this paper, it is doubtful to what extent the consequences of changing age distribution should be eliminated from comparisons such as those made in Table 4. In so far as fertility is subject to voluntary control, younger marriages, for example, will not necessarily result in more children. The subject is a complicated one, but, in any case, for the present purpose it is sufficient to show that changes in the age distribution could not affect the conclusions drawn here. If the figures for 1933 are standardized for the distribution of marriages by the wife's age found at the 1939 census, the average number of children for marriages of different duration is as follows:

Duration of marriage	1	2	3	4	5	6	7	8	9
Av. no. of children	0.44	0.69	0.89	1.07	1.25	1.41	1.57	1.67	1.77
Duration of marriage	10	11	12	13	14	15	16	17	
Av. no. of children	1.80	1.93	2.10	2.22	2.39	2.33	2.42	2.49	

By comparison with the figures for 1933 in Table 4 it may be seen that the difference made by standardizing for age is slight and nowhere affects the statements made in the text. (The data for standardizing the figures for 1935 and 1936 are not available.<sup>1</sup>)

<sup>1</sup> The standardized figures for 1933 are derived from data given in *Wirtschaft und Statistik*, May 1942, p. 174.