

Working Paper

Modelling Ukrainian Fertility Since 1925

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WP-90-25
June 1990



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FOREWORD

Population study cannot proceed without data, and demographers hasten to seize on any pieces of data they can find. They use the kind of ingenuity in reconstructing the demographic record from inadequate materials that we expect from a paleontologist who finds a few bones in a cave and gives us a model of the whole animal. The present work is an example.

For the Ukraine, the demographic record is especially spotty, with gaps due to wars and internal difficulties; so much so that as the material stands, it is not usable directly to deduce the important facts of fertility and mortality.

The authors of this paper ingeniously adapted standard methods to provide a complete and consistent set of estimates year by year. Starting with period data – i.e. by age for each calendar year for which there was a record – they rearranged the series according to cohorts – i.e. following the life course of groups of individuals born at a given time. For each cohort they were able to take the available points spotted through the several ages and fill out the intervening ages, thus obtaining a complete cohort record. This they then reassembled into periods.

Some analysis of the results appears in the paper, but much more can be done to relate the figures to the social and economic history of the Ukraine.

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ABSTRACT

The Ukraine is the second most populous republic in the Soviet Union. With more than 47 million inhabitants, it is one of the most important nations of Europe being only slightly smaller in size to France, Italy, or the United Kingdom, all of which having approximately 57 million inhabitants. Yet very little has been written about the Ukrainian population and its history. Possibly this is due, in part, to the difficulty in obtaining data.

This paper attempts to fill the substantial gaps in the time series of Ukrainian fertility especially in the 1930s and 1940s by converting the period information into cohort data, applying model fertility schedules and reconvertng them into period data. The result is a complete record of Ukrainian fertility since 1925.

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MODELLING UKRAINIAN FERTILITY SINCE 1925

Wolfgang Lutz, Sergei Pirozkov and Sergei Scherbov*

1. INTRODUCTION

Few nations of Europe have experienced such a continued series of crises and cataclysms as the population of the Ukraine over the course of this century. With little time to recover from the deep wounds of World War I and the following civil war of 1918–1921, the forced collectivism of 1931–33 brought about hunger and starvation only to be followed by the years of mass repressions 1934–37 and, subsequently, World War II. After this, periods of hunger came again, and during the 1950s the painful reconstruction of the economy began.

The scars left by these crises on the demography of the Ukraine are twofold. First, they affected the collection of data which has resulted in fragmentary information on Ukrainian population trends. Second, they affected the trends themselves resulting, for instance, in a decline of the total population by two million between 1933 and 1937. In 1926 the Ukraine had a population of 29 million which, due to very high fertility, had increased to 32 million by 1933. This was followed by a decrease to 30.1 million up to 1937 and an increase to 31.6 million by 1941. The census of 1970 gives 47.1 million inhabitants for the Ukraine. The *USSR Demographic Yearbook 1987* (1988) gives a figure of 51.2 million for 1987.

Although these changes in population size and structure were also influenced by mortality and migration, this paper focuses exclusively on the fertility aspect. It attempts to reconstruct the age-specific period and cohort fertility rates for the years of crises where no data is available and to interpret the apparent trends. For this it is useful to first see the observation period (here 1925 to 1987) within a long-term perspective.

2. PRE-TRANSITORY FERTILITY

Around the end of the 19th century the population of the Ukraine had an essentially uncontrolled fertility pattern. According to estimates given by Kuczynski (1969) the total fertility rate around the turn of the century was 7.5, probably

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one of the highest values in all of Europe.* For the period 1891–1900 the registered crude birth rate was on average 49.1 per thousand, in 1901–1913 it had declined to 44.6 and further to 42.9 for the period 1911–1913 (*Demographical Development of the Ukrainian SSR 1959–1970* 1977). These very high fertility rates result from the combination of high marital fertility and very early and nearly universal marriage. This can be seen clearly from the “Princeton Indices” of total fertility (I_f), marital fertility (I_g), and proportions married (I_m) as given in the country report on Russian fertility (Coale et al. 1979) (see Table 1).

Table 1. Indexes of fertility in the Ukraine, 1897 and 1926 (Princeton Indices as given by Coale et al. 1979): I_f – index of total fertility; I_g – index of marital fertility; I_m – marriage index.

| Year | Total | | | Urban | | | Rural | | |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | I_f | I_g | I_m | I_f | I_g | I_m | I_f | I_g | I_m |
| 1897 | 0.55 | 0.75 | 0.72 | 0.40 | 0.64 | 0.59 | 0.58 | 0.77 | 0.74 |
| 1926 | 0.40 | 0.60 | 0.65 | 0.28 | 0.44 | 0.60 | 0.43 | 0.64 | 0.66 |

In 1897 the index of total fertility shows one of the highest values of all European provinces considered in the European Fertility Project (Coale and Watkins 1986). While the index of marital fertility does not lie far from the average of all European provinces around 1900, the unusually high proportion of married women causes the high level of total fertility. Only in parts of the eastern Balkans were similar levels of I_m reached. A view to the urban regions also indicates that the relatively low level of total fertility there is due mainly to the higher proportion of unmarried women in the towns. It seems that, to a measurable extent, family limitation within marriage had not yet started in 1897.

Thirty years later the pattern is quite different. In urban areas the indices show a much lower level of total fertility which is entirely due to declining marital fertility. The proportion married remained about constant between 1897 and 1926 in the Ukrainian towns. In the rural areas, however, both marital fertility and the proportions married declined. However, as most other European provinces also experienced steep fertility declines over that period, the relative position of the Ukraine remains virtually unchanged as one of the highest fertility regions.

Without looking at age-specific fertility rates, it is difficult to say whether the fertility decline during the first quarter of our century was already the beginning of parity specific fertility control or a reaction to the extremely harsh social and

* The analysis of fertility in the Ukraine was first studied by the famous Ukrainian demographer, Korchak-Chepyrkovskiy, who elaborated the methodology of fertility tables construction using the 1926 census data. These were the first fertility tables built in the USSR (Korchak-Chepyrkovskiy 1970). After World War II there was a comprehensive study of fertility by Steshenko (1966) who built the cohort fertility tables for women born in 1921–1964. Modern estimates of fertility are given in *Demographical Development of the Ukrainian SSR 1970–1979* (1987).

economic conditions associated with World War I (1914–18) and the civil war (1918–21). Certainly the much faster decline of I_t in the urban areas compared to the rural ones gives an indication of the voluntary fertility limitation in towns. However, for the total population of the Ukraine, the following analysis shows that the estimated “index of family limitation” m remained at a very low level until at least 1930.

3. AVAILABLE DATA

The statistical analysis in this paper will start with the year 1925 when the first age-specific fertility rates became available. In that year the total fertility rate was as high as 5.4, a level never reached again in the following demographic development.

The time series of age-specific fertility rates given in 5-year age groups since 1925 has been interrupted several times. Empirical data are given in Appendix Table A1. For the years 1931–33, which were characterized by hunger and forced collectivism, no data are available. Due to mass repressions of the population, the same is true for the years 1934–37. Finally, the years of the Great Patriotic War 1941–45 and the year of hunger 1947 remain without appropriate data. Also during the period of the post-war reconstruction of the economy during the 1950s, the collection of fertility rates was omitted for several years.

As Figure 1 illustrates, there are only four data points between 1930 and 1960. For these four points as well as for the surrounding periods the full set of age-specific rates is given, which provides a challenge to demographic modelling to attempt the reconstruction of the full time series of fertility rates. The strategy chosen to achieve this reconstruction is as follows:

- first transform the empirical five-year age groups into single year age groups;
- next rearrange the single year of age period fertility rates into cohort form;
- estimate the missing data in the cohort fertility schedules by using the Coale-Trussell fertility model;
- finally rearrange the rates again to get a complete series for age-specific period rates using the Coale-Trussell.

4. TRANSFORMATION TO SINGLE YEAR AGE GROUPS

Two alternative procedures were tested for their usefulness in transforming period fertility rates given in 5-year age groups into single year age groups. The model fertility schedule suggested by Coale and Trussell (1974) was tested against a relational spline graduation. Both methods were applied to the same set of age-specific fertility rates, namely those of France for 1980.

The comparison of the estimated single year of age data to the real data shows that the rational spline graduation results in too high values in the low twenties and in too low values in the upper twenties. The Coale-Trussell model,

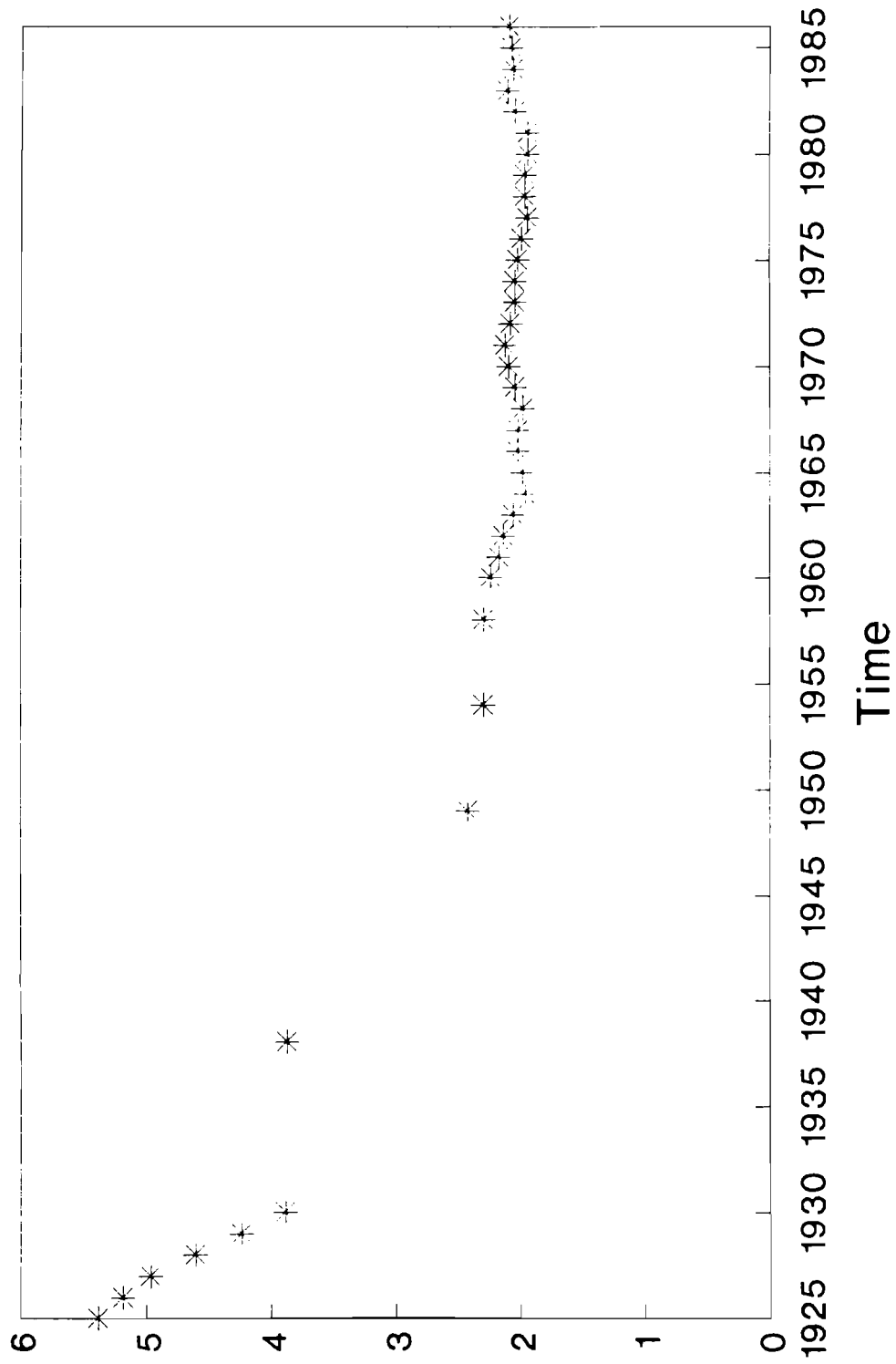


Figure 1. Empirically given total fertility rates in the Ukraine, 1925–1986 (data given in Appendix Table A1).

on the other hand, shows an almost perfect fit. Consequently we chose the Coale-Trussell function for transforming the Ukrainian data for all available years into single year age groups.

Another advantage of using the Coale-Trussell model is that all parameters have some interpretation and as a side product, we get the index of family limitation. Table 2 lists the parameters resulting from a combination of the Coale-Trussell marriage and marital fertility models, namely a (giving the age of the beginning of marriage), k (giving the speed of marriage), and m (the "index of family limitation" that gives the degree of deviation from natural fertility) for the years for which empirical age-specific fertility rates are given.

While the nuptiality parameters a and k show no clear trend but some complementary oscillation (when a is high and k is low) the "index of family limitation" shows a clear and distinct trend: the index remains at a very low level indicating almost natural fertility conditions up to 1930. Hence the decline in TFR observed during 1925 does not seem to be related to the introduction of parity specific fertility control. In 1938, however, after a seven year gap of information, the index is up to almost 0.6, and 10 years later in 1949 it reaches 0.9. This indicates clear deviations from the pattern of natural fertility. Although the level of total fertility declined only slightly over the 1950s and has remained constant around a level of 2.0 since the early 1960s, the "index of family limitation" continued to increase rapidly, particularly between 1970 and 1980. This indicates that the age pattern of fertility has become more "modern" (i.e. younger and further away from natural fertility) during the 1970s although the average level of fertility remained virtually unchanged.

5. ESTIMATION OF COHORT FERTILITY PATTERNS

After rearranging the single year of age period fertility rates into birth cohorts, the Coale-Trussell model is used again to estimate the missing points in the curve. In all cases the parameters were estimated using a non-linear least-squares algorithm (Scherbov and Golubkov 1986).*

Figure 2 depicts the available empirical data and the estimated fertility schedules for selected cohorts. As we can see this procedure yields very plausible results even for the cohorts where large sections of the curve are missing. There is no indication that the assumption made for the estimation, namely that cohorts do not deviate much from the model schedule, is violated to a significant extent. All the available empirical points fit nicely to the estimated schedules.

The procedure used for reconstructing the missing information also yields estimates for the future fertility of cohorts which are not yet at the end of their reproductive career, i.e. the birth cohort of 1950. To take advantage of this possibility the estimation procedure was applied up to the birth cohort of 1971, which

*In the cases of larger proportions of the curve missing, a procedure of sequential estimation was used in which parameter estimates for the surrounding cohorts were used as *a priori* information on the new parameters and the inverse of their covariation matrix was used as the matrix of weights.

Table 2. Parameters of the Coale-Trussell marriage and marital fertility models (a indicating the age at which marriage starts, k the speed of marriage, and m the "index of family limitations") applied to period data in the years for which empirical data is given for the Ukrainian SSR.

| | a | k | m | TFR |
|------|-------|------|------|------|
| 1925 | 16.45 | 0.37 | 0.27 | 5.38 |
| 1926 | 16.97 | 0.27 | 0.21 | 5.19 |
| 1927 | 16.40 | 0.34 | 0.27 | 4.96 |
| 1928 | 16.49 | 0.32 | 0.29 | 4.61 |
| 1929 | 16.70 | 0.27 | 0.24 | 4.24 |
| 1930 | 17.59 | 0.13 | 0.20 | 3.88 |
| 1938 | 16.52 | 0.37 | 0.59 | 3.87 |
| 1949 | 16.21 | 0.46 | 0.91 | 2.42 |
| 1954 | 16.30 | 0.45 | 1.08 | 2.30 |
| 1958 | 15.86 | 0.44 | 1.23 | 2.30 |
| 1960 | 15.10 | 0.51 | 1.31 | 2.24 |
| 1961 | 15.12 | 0.53 | 1.41 | 2.17 |
| 1962 | 15.46 | 0.50 | 1.45 | 2.14 |
| 1963 | 16.32 | 0.37 | 1.38 | 2.06 |
| 1964 | 16.66 | 0.31 | 1.30 | 1.96 |
| 1965 | 17.13 | 0.24 | 1.22 | 1.99 |
| 1966 | 17.11 | 0.22 | 1.20 | 2.02 |
| 1967 | 17.58 | 0.15 | 1.19 | 2.02 |
| 1968 | 17.27 | 0.18 | 1.24 | 1.98 |
| 1969 | 17.90 | 0.11 | 1.32 | 2.04 |
| 1970 | 18.02 | 0.10 | 1.34 | 2.09 |
| 1971 | 18.00 | 0.10 | 1.39 | 2.12 |
| 1972 | 17.10 | 0.20 | 1.45 | 2.08 |
| 1973 | 16.73 | 0.24 | 1.52 | 2.04 |
| 1974 | 16.59 | 0.25 | 1.60 | 2.04 |
| 1975 | 16.71 | 0.23 | 1.61 | 2.02 |
| 1976 | 16.25 | 0.28 | 1.68 | 1.99 |
| 1977 | 16.26 | 0.27 | 1.68 | 1.94 |
| 1978 | 16.90 | 0.18 | 1.75 | 1.96 |
| 1979 | 17.36 | 0.13 | 1.80 | 1.96 |
| 1980 | 16.72 | 0.19 | 1.84 | 1.94 |
| 1981 | 17.05 | 0.16 | 1.79 | 1.94 |
| 1982 | 16.55 | 0.22 | 1.83 | 2.04 |
| 1983 | 16.28 | 0.26 | 1.86 | 2.10 |
| 1984 | 16.02 | 0.28 | 1.89 | 2.05 |
| 1985 | 16.10 | 0.27 | 1.84 | 2.07 |
| 1986 | 16.10 | 0.27 | 1.82 | 2.09 |

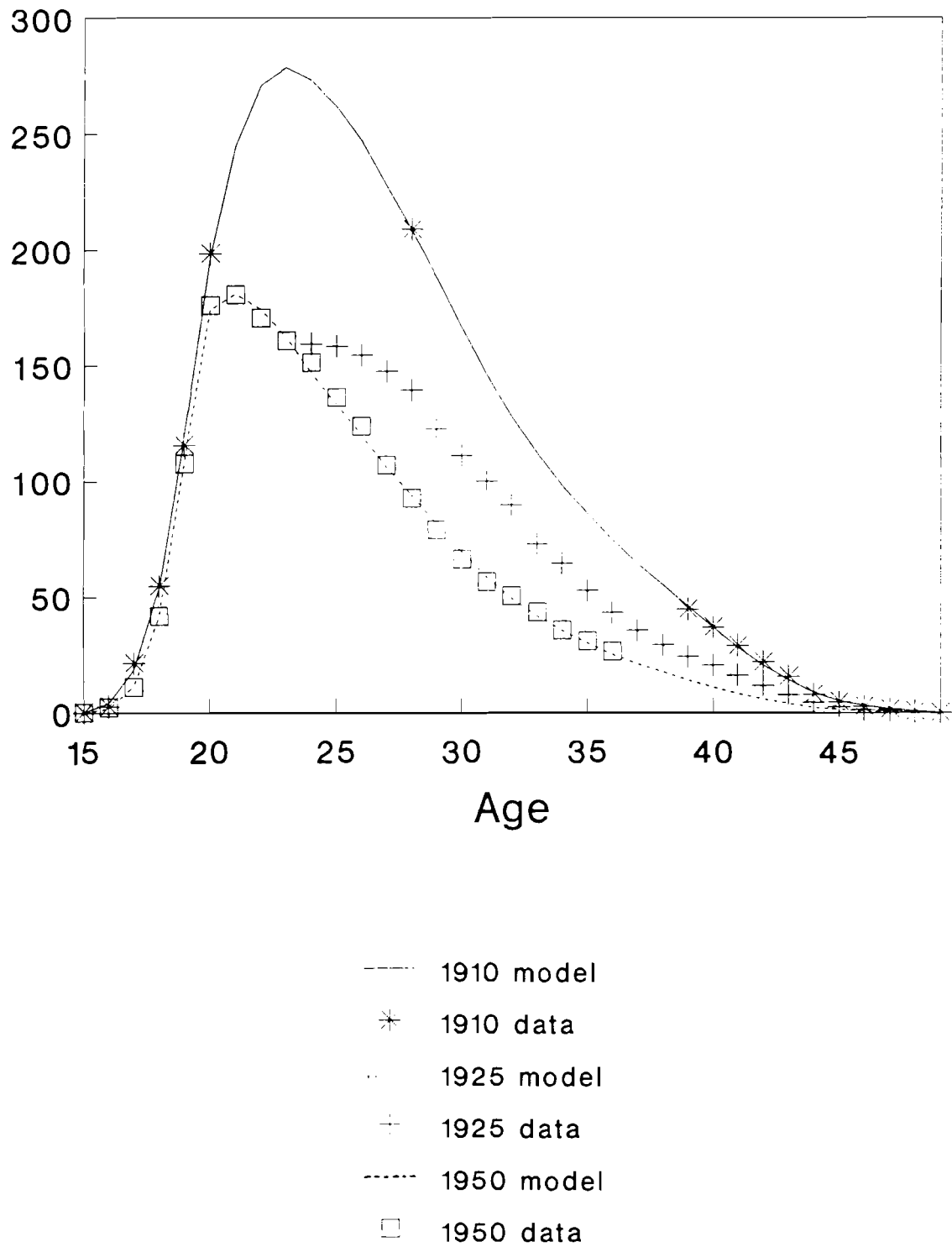


Figure 2. Empirical and fitted age-specific fertility rates for selected cohorts: 1910, 1925, 1950 birth cohorts.

in consequence allowed us to give period fertility estimates up to the year 2000. Naturally these estimates are very conservative in the sense that the sequential estimation procedure used for the cohorts with only few data points at younger ages tends to result in very stable fertility patterns. However, the observed increase in fertility rates of younger women over the last 10 years results in a moderate but visible increase in estimated completed cohort fertility for the youngest cohorts (see Figure 3 and Appendix Table A2).

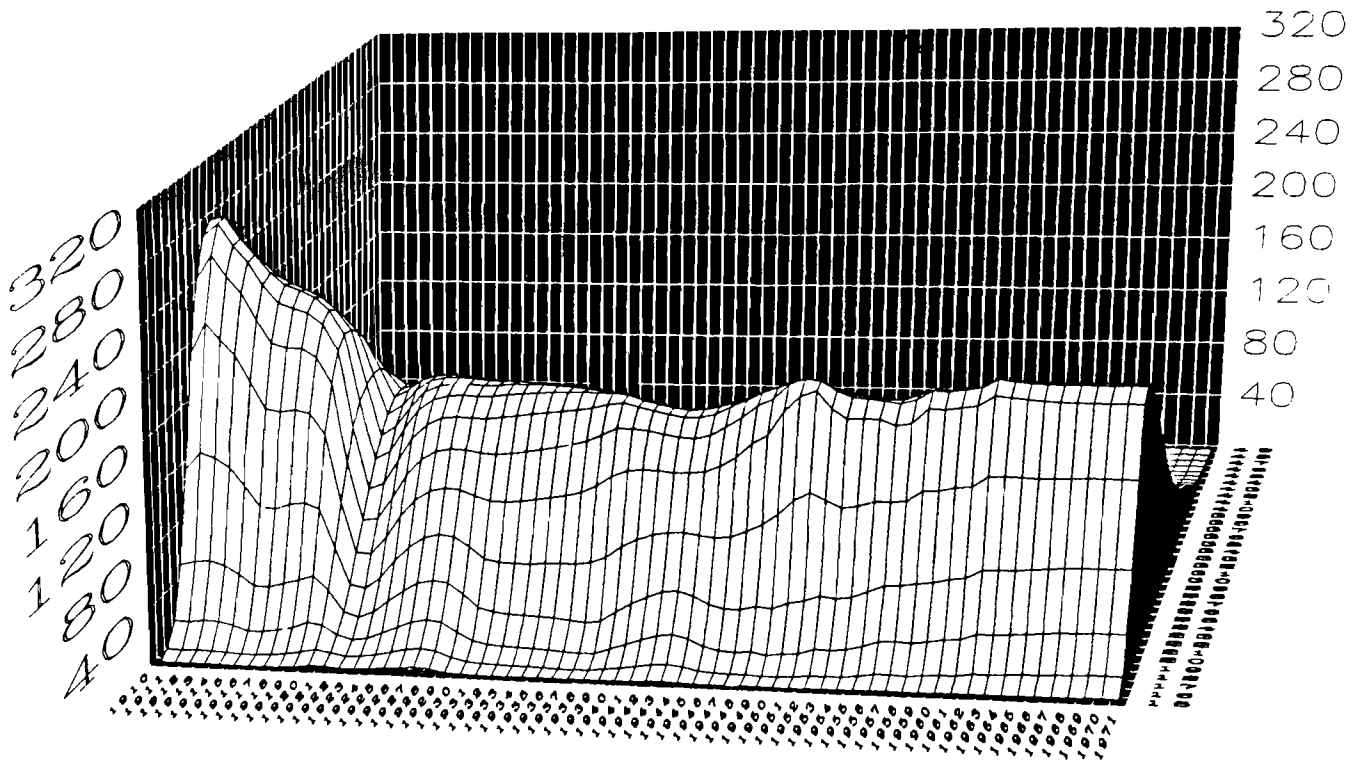


Figure 3. Estimated cohort age-specific fertility rates, 1910–1971.

Figure 3 gives a three-dimensional view of the estimated cohort fertility rates for single year of age and all cohorts born 1910 to 1971. The first apparent feature in the figure is the fast fertility decline from cohorts born around 1910 to those born in the early 1920s. In particular, the birth cohorts of 1921 and 1922 with a completed cohort fertility of only 2.0 seem to have suffered most intensely from the cataclysms of Ukrainian history. After a slight recovery of the cohorts born up to 1930, the completed cohort fertility remains relatively stable at a level slightly below 2.0 (see Appendix Table A2).

The other major feature visible in Figure 3 is the change in the age pattern of fertility. Looking at the modal age of fertility which is given by the ridge of the 3-D mountain one can see that the modal age at birth has become significantly

younger over time. A closer look actually shows four distinct phases. The first cohorts (born 1910–1918) experienced a fast decline in the level but little change in the modal age at birth. The cohorts born 1920 to 1924 experienced a rather significant increase in the ages at birth probably associated with the postponement of births due to crises. For the cohorts 1925 to 1952, however, the modal age steadily declines to the age of 21. After that the age pattern remains virtually unchanged despite minor changes in the level of fertility.

6. BACK TO PERIOD FERTILITY RATES

The estimated single year of age cohort fertility rates can be easily re-transformed into the period mode of temporal aggregation. Figure 4 plots the estimated period fertility rates for the complete period 1925 to 2000. The data are given in Appendix Table A3. The figure shows a steady decline of fertility above age 30 over the whole period. This is parallel to the trends in most other European populations caused by the increasing practice of parity specific fertility control.

The age group 20–24 shows the most irregular trend. It seems to be very sensitive to the exogenous influences of Ukrainian history: some decline during the years of forced collectivism in the early 1930s followed by a recovery. Next, a very steep decline during World War II reached an all time low in the fertility of women aged 20–25 in 1925. This may be considered in part as a timing effect when births were postponed due to adverse conditions or the absence of men. One indication for this is that the mean age of childbearing jumped from 27.5 for the cohort born in 1920 to 29.9 for the cohort born in 1922. However, the above analysis of cohorts also indicates that those cohorts born 1921 to 1923 ended up with a very low level of completed fertility at age 45. This hints at a very distorted marriage market and the lack of a rapid consolidation after the war. Actually, period fertility in the next age group 25–29 did not recover at all after World War II, and shows a continued slow decline until around 1980.

It is remarkable to note that the Ukraine did not experience anything similar to a post-war baby boom. Instead, already in 1964, fertility fell to subreplacement level. As mentioned above with the “index of family limitation”, over the recent decade the fertility pattern has become younger, although the average level of fertility has not changed.

The estimates made above for cohorts that have not yet completed their reproductive career may also be transformed into period rates which are given here up to the year 2000. These estimates lead us to expect a slight increase in total fertility to 2.12 in the early 1990s followed by a return to the current level by the year 2000. This, of course, assumes that cohorts continue to follow the pattern of fertility described by the model up to a certain specified age. The data for cohorts are given in Appendix Table A2, and data for periods in Appendix Tables A3 and A4.

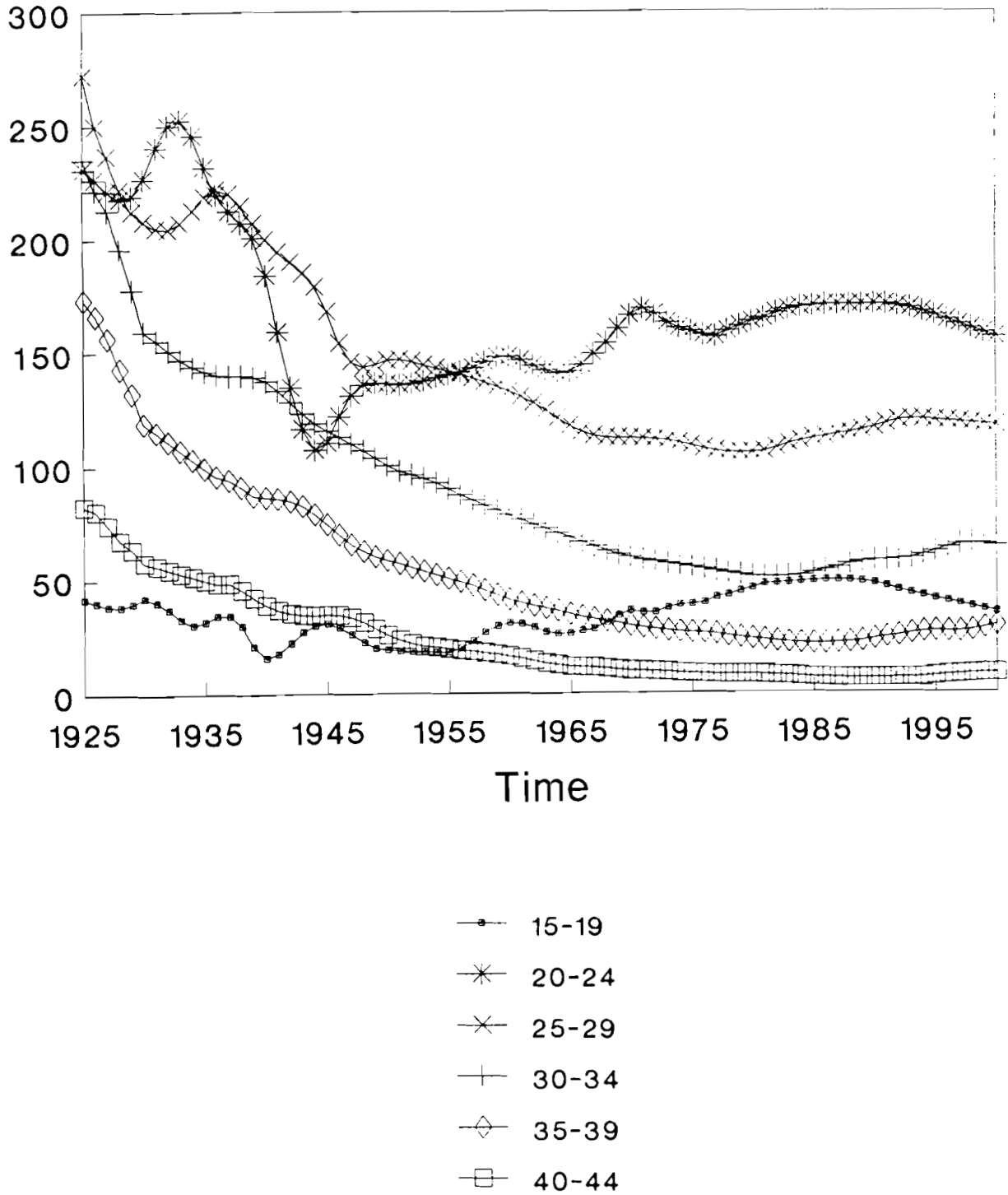


Figure 4. Reconstructed and estimated age-specific period fertility rates, 1925-2000 (data given in Appendix Table A3).

7. SUMMARY AND CONCLUSION

For the first time, this paper gives a full account of all empirical information on Ukrainian fertility trends since 1925. To fill the wide gaps of information between 1930 and 1960, a period for which only 4 data points are given, a model fertility schedule for cohorts is used to reconstruct the missing years. The result is a full series of annual age-specific fertility rates since 1925 with some extrapolations (stemming from the assumed completion of cohort behavior) to the year 2000.

At the beginning of the century, the Ukraine had one of the highest fertility levels in Europe due to universal marriage and high marital fertility. Up to 1925 when a TFR of 5.38 was registered, proportions married declined significantly and marital fertility started to decline, although this was not associated with an increase in the "index of family limitation" until 1930. Over the following years of severe crises during the 1930s and 1940s, the reconstructed data show a continued sharp decrease in TFRs which was now associated with an increase in family limitation practice. Whether this was a "cultural innovation" as shown for other countries or directly induced by the adverse living conditions cannot be answered directly. However, the fact that earlier crises only depressed fertility and did not bring about parity specific fertility control, and that the "index of family limitation" increased rather steadily and did not follow the fluctuations in TFR suggests that there must have been some cultural dissemination process. However, it may well be that the crises contributed in speeding up the onset of family limitation.

With a TFR of 2.07, the Ukraine presently has the lowest fertility level of all Soviet Republics. Fertility has been rather stable at this level for the past 25 years and the fertility projections given above do not indicate a change for the rest of this century. Whether Perestroika and associated changes in living conditions will induce a further fertility decline to Western European levels remains pure speculation at this point.

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APPENDIX

Table A1. Empirically given period age-specific and total fertility rates: Ukraine SSR, 1925-1986.

| Time | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | TFR |
|------|-------|--------|--------|--------|--------|-------|-------|------|
| 1925 | 37.25 | 247.91 | 295.49 | 204.08 | 182.69 | 84.52 | 25.01 | 5.38 |
| 1926 | 36.70 | 253.90 | 264.00 | 217.90 | 163.70 | 80.40 | 20.70 | 5.19 |
| 1927 | 40.00 | 237.94 | 265.93 | 190.36 | 165.16 | 74.17 | 19.34 | 4.96 |
| 1928 | 38.36 | 225.72 | 245.64 | 176.72 | 151.98 | 65.96 | 17.48 | 4.61 |
| 1929 | 37.67 | 210.56 | 220.39 | 159.50 | 140.09 | 62.10 | 17.55 | 4.24 |
| 1930 | 40.22 | 202.58 | 192.34 | 141.19 | 123.54 | 56.98 | 19.96 | 3.88 |
| 1938 | 29.00 | 206.80 | 216.40 | 160.90 | 103.30 | 46.90 | 10.70 | 3.87 |
| 1949 | 18.50 | 135.70 | 145.90 | 97.30 | 56.10 | 25.80 | 4.80 | 2.42 |
| 1954 | 19.20 | 140.20 | 138.90 | 94.20 | 48.10 | 16.00 | 2.60 | 2.30 |
| 1958 | 28.10 | 150.90 | 137.40 | 85.10 | 44.60 | 11.50 | 1.60 | 2.30 |
| 1960 | 35.00 | 148.30 | 131.50 | 81.60 | 39.50 | 10.60 | 1.10 | 2.24 |
| 1961 | 32.70 | 145.70 | 130.40 | 78.10 | 36.40 | 10.80 | 0.80 | 2.17 |
| 1962 | 29.70 | 145.70 | 129.90 | 75.10 | 35.10 | 10.80 | 0.80 | 2.14 |
| 1963 | 25.90 | 146.50 | 122.80 | 72.10 | 33.20 | 10.20 | 0.80 | 2.06 |
| 1964 | 24.30 | 141.10 | 114.50 | 70.20 | 31.80 | 9.70 | 0.80 | 1.96 |
| 1965 | 25.10 | 145.40 | 111.90 | 72.80 | 31.70 | 9.30 | 0.90 | 1.99 |
| 1966 | 27.80 | 148.10 | 111.90 | 75.50 | 31.30 | 8.80 | 0.90 | 2.02 |
| 1967 | 29.90 | 151.40 | 108.50 | 75.00 | 29.50 | 8.30 | 0.80 | 2.02 |
| 1968 | 31.40 | 148.60 | 107.10 | 71.40 | 28.60 | 7.80 | 0.80 | 1.98 |
| 1969 | 33.10 | 160.10 | 110.10 | 68.30 | 29.20 | 7.20 | 0.70 | 2.04 |
| 1970 | 35.10 | 164.90 | 112.60 | 67.70 | 30.90 | 6.80 | 0.60 | 2.09 |
| 1971 | 36.10 | 169.60 | 114.80 | 65.30 | 31.60 | 6.60 | 0.50 | 2.12 |
| 1972 | 36.50 | 163.90 | 115.20 | 63.20 | 31.10 | 6.30 | 0.40 | 2.08 |
| 1973 | 37.40 | 160.60 | 113.90 | 61.10 | 29.10 | 6.20 | 0.40 | 2.04 |
| 1974 | 38.80 | 162.80 | 114.10 | 59.60 | 26.80 | 6.30 | 0.40 | 2.04 |
| 1975 | 40.30 | 162.40 | 111.20 | 58.70 | 25.00 | 6.60 | 0.40 | 2.02 |
| 1976 | 41.50 | 158.90 | 110.10 | 57.50 | 22.70 | 6.60 | 0.40 | 1.99 |
| 1977 | 42.70 | 155.70 | 106.10 | 56.80 | 20.80 | 6.20 | 0.30 | 1.94 |
| 1978 | 45.90 | 163.30 | 104.20 | 54.10 | 19.30 | 5.30 | 0.30 | 1.96 |
| 1979 | 47.83 | 166.11 | 102.38 | 52.63 | 18.10 | 4.60 | 0.33 | 1.96 |
| 1980 | 48.28 | 163.01 | 102.23 | 50.85 | 18.22 | 4.20 | 0.34 | 1.94 |
| 1981 | 47.77 | 162.73 | 101.66 | 51.58 | 19.19 | 3.87 | 0.34 | 1.94 |
| 1982 | 49.09 | 170.84 | 109.22 | 54.60 | 20.26 | 3.67 | 0.30 | 2.04 |
| 1983 | 50.54 | 175.21 | 113.54 | 56.23 | 20.72 | 3.59 | 0.25 | 2.10 |
| 1984 | 51.10 | 170.70 | 111.20 | 54.00 | 20.20 | 3.50 | 0.20 | 2.05 |
| 1985 | 51.16 | 170.74 | 111.56 | 55.52 | 20.73 | 3.80 | 0.19 | 2.07 |
| 1986 | 51.30 | 171.26 | 112.59 | 56.08 | 21.47 | 4.31 | 0.18 | 2.09 |

Table A2. Reconstructed age-specific total fertility rates for birth cohorts born 1910–1971: Ukraine and Ukrainskaia SSR.

| Time | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
|------|------|------|------|------|------|------|------|
| 1910 | 0.20 | 1.46 | 2.59 | 3.24 | 3.56 | 3.67 | 3.68 |
| 1911 | 0.21 | 1.52 | 2.61 | 3.23 | 3.54 | 3.65 | 3.66 |
| 1912 | 0.21 | 1.44 | 2.48 | 3.08 | 3.38 | 3.48 | 3.49 |
| 1913 | 0.20 | 1.38 | 2.38 | 2.96 | 3.25 | 3.35 | 3.36 |
| 1914 | 0.18 | 1.28 | 2.25 | 2.81 | 3.10 | 3.19 | 3.20 |
| 1915 | 0.15 | 1.19 | 2.15 | 2.70 | 2.98 | 3.07 | 3.08 |
| 1916 | 0.15 | 1.17 | 2.11 | 2.65 | 2.92 | 3.01 | 3.02 |
| 1917 | 0.16 | 1.17 | 2.08 | 2.60 | 2.87 | 2.95 | 2.96 |
| 1918 | 0.16 | 1.14 | 2.02 | 2.52 | 2.78 | 2.86 | 2.87 |
| 1919 | 0.17 | 1.07 | 1.90 | 2.39 | 2.64 | 2.72 | 2.73 |
| 1920 | 0.13 | 0.78 | 1.54 | 2.01 | 2.25 | 2.33 | 2.34 |
| 1921 | 0.08 | 0.54 | 1.22 | 1.69 | 1.92 | 1.98 | 1.99 |
| 1922 | 0.07 | 0.54 | 1.24 | 1.70 | 1.92 | 1.98 | 1.99 |
| 1923 | 0.09 | 0.63 | 1.35 | 1.80 | 2.01 | 2.07 | 2.07 |
| 1924 | 0.11 | 0.73 | 1.46 | 1.89 | 2.09 | 2.15 | 2.16 |
| 1925 | 0.14 | 0.80 | 1.53 | 1.95 | 2.14 | 2.20 | 2.21 |
| 1926 | 0.16 | 0.84 | 1.56 | 1.97 | 2.16 | 2.22 | 2.22 |
| 1927 | 0.17 | 0.86 | 1.57 | 1.97 | 2.15 | 2.21 | 2.21 |
| 1928 | 0.16 | 0.85 | 1.55 | 1.95 | 2.12 | 2.17 | 2.18 |
| 1929 | 0.13 | 0.82 | 1.51 | 1.90 | 2.06 | 2.11 | 2.12 |
| 1930 | 0.11 | 0.79 | 1.48 | 1.85 | 2.02 | 2.06 | 2.07 |
| 1931 | 0.10 | 0.78 | 1.46 | 1.83 | 1.99 | 2.04 | 2.04 |
| 1932 | 0.10 | 0.79 | 1.46 | 1.81 | 1.97 | 2.01 | 2.02 |
| 1933 | 0.09 | 0.79 | 1.45 | 1.80 | 1.95 | 1.99 | 1.99 |
| 1934 | 0.09 | 0.79 | 1.45 | 1.78 | 1.93 | 1.97 | 1.97 |
| 1935 | 0.09 | 0.80 | 1.44 | 1.76 | 1.90 | 1.94 | 1.95 |
| 1936 | 0.09 | 0.80 | 1.43 | 1.74 | 1.88 | 1.92 | 1.92 |
| 1937 | 0.09 | 0.81 | 1.42 | 1.72 | 1.86 | 1.90 | 1.90 |
| 1938 | 0.10 | 0.82 | 1.41 | 1.71 | 1.85 | 1.89 | 1.89 |
| 1939 | 0.12 | 0.84 | 1.41 | 1.71 | 1.84 | 1.88 | 1.88 |
| 1940 | 0.13 | 0.85 | 1.41 | 1.70 | 1.83 | 1.87 | 1.87 |
| 1941 | 0.15 | 0.85 | 1.41 | 1.69 | 1.82 | 1.86 | 1.86 |
| 1942 | 0.16 | 0.86 | 1.41 | 1.69 | 1.81 | 1.85 | 1.85 |
| 1943 | 0.16 | 0.86 | 1.42 | 1.69 | 1.81 | 1.84 | 1.85 |
| 1944 | 0.15 | 0.86 | 1.42 | 1.69 | 1.80 | 1.84 | 1.84 |
| 1945 | 0.14 | 0.87 | 1.42 | 1.69 | 1.80 | 1.83 | 1.84 |
| 1946 | 0.13 | 0.88 | 1.43 | 1.70 | 1.81 | 1.84 | 1.84 |
| 1947 | 0.13 | 0.91 | 1.46 | 1.72 | 1.83 | 1.86 | 1.87 |
| 1948 | 0.14 | 0.94 | 1.49 | 1.74 | 1.85 | 1.88 | 1.88 |
| 1949 | 0.15 | 0.98 | 1.51 | 1.77 | 1.87 | 1.90 | 1.91 |
| 1950 | 0.16 | 1.00 | 1.53 | 1.79 | 1.89 | 1.92 | 1.93 |
| 1951 | 0.17 | 1.00 | 1.53 | 1.79 | 1.90 | 1.93 | 1.93 |
| 1952 | 0.18 | 0.98 | 1.51 | 1.76 | 1.88 | 1.91 | 1.91 |
| 1953 | 0.17 | 0.96 | 1.49 | 1.75 | 1.86 | 1.89 | 1.89 |
| 1954 | 0.17 | 0.96 | 1.49 | 1.75 | 1.87 | 1.91 | 1.91 |
| 1955 | 0.18 | 0.97 | 1.50 | 1.78 | 1.91 | 1.95 | 1.95 |
| 1956 | 0.19 | 0.98 | 1.52 | 1.80 | 1.93 | 1.97 | 1.98 |
| 1957 | 0.20 | 0.99 | 1.55 | 1.83 | 1.96 | 2.00 | 2.00 |
| 1958 | 0.20 | 1.03 | 1.59 | 1.88 | 2.02 | 2.06 | 2.07 |
| 1959 | 0.21 | 1.03 | 1.59 | 1.88 | 2.02 | 2.06 | 2.06 |
| 1960 | 0.21 | 1.04 | 1.60 | 1.89 | 2.03 | 2.07 | 2.07 |
| 1961 | 0.22 | 1.05 | 1.61 | 1.90 | 2.03 | 2.07 | 2.07 |
| 1962 | 0.24 | 1.10 | 1.67 | 1.95 | 2.08 | 2.12 | 2.12 |
| 1963 | 0.24 | 1.09 | 1.68 | 1.99 | 2.14 | 2.19 | 2.19 |
| 1964 | 0.24 | 1.09 | 1.69 | 2.02 | 2.18 | 2.23 | 2.23 |
| 1965 | 0.24 | 1.09 | 1.69 | 2.02 | 2.19 | 2.24 | 2.25 |
| 1966 | 0.24 | 1.09 | 1.69 | 2.02 | 2.18 | 2.24 | 2.24 |
| 1967 | 0.24 | 1.10 | 1.69 | 2.02 | 2.17 | 2.22 | 2.23 |
| 1968 | 0.24 | 1.10 | 1.69 | 2.01 | 2.16 | 2.21 | 2.22 |
| 1969 | 0.25 | 1.10 | 1.69 | 2.01 | 2.16 | 2.21 | 2.21 |
| 1970 | 0.25 | 1.10 | 1.69 | 2.01 | 2.16 | 2.21 | 2.21 |
| 1971 | 0.25 | 1.10 | 1.69 | 2.01 | 2.16 | 2.21 | 2.21 |

Table A3. Reconstructed period age-specific and total fertility rates: Ukrainskaia SSR, 1925-1986.

| Time | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | TFR |
|------|-------|--------|--------|--------|--------|-------|-------|------|
| 1925 | 41.86 | 231.08 | 272.30 | 235.56 | 173.56 | 82.30 | 11.48 | 5.24 |
| 1926 | 40.18 | 226.58 | 249.78 | 221.78 | 166.32 | 80.30 | 11.36 | 4.98 |
| 1927 | 38.68 | 221.40 | 236.80 | 212.96 | 156.52 | 74.12 | 10.32 | 4.75 |
| 1928 | 38.32 | 218.12 | 221.98 | 195.94 | 143.24 | 67.50 | 9.36 | 4.47 |
| 1929 | 39.78 | 219.28 | 212.30 | 177.88 | 132.28 | 63.36 | 8.92 | 4.27 |
| 1930 | 42.10 | 226.64 | 207.96 | 159.28 | 118.76 | 57.60 | 8.18 | 4.10 |
| 1931 | 40.14 | 240.52 | 204.92 | 155.53 | 114.84 | 56.08 | 7.88 | 4.10 |
| 1932 | 37.00 | 250.32 | 204.50 | 150.91 | 110.93 | 54.56 | 7.59 | 4.08 |
| 1933 | 32.86 | 252.62 | 207.32 | 147.16 | 107.01 | 53.03 | 7.29 | 4.04 |
| 1934 | 30.40 | 245.78 | 212.76 | 144.06 | 103.10 | 51.51 | 6.99 | 3.97 |
| 1935 | 31.98 | 232.06 | 219.14 | 141.94 | 99.18 | 49.99 | 6.69 | 3.90 |
| 1936 | 34.44 | 220.02 | 222.34 | 140.62 | 95.74 | 48.47 | 6.40 | 3.84 |
| 1937 | 34.48 | 212.72 | 220.32 | 140.18 | 94.13 | 48.47 | 6.40 | 3.78 |
| 1938 | 29.90 | 207.58 | 214.76 | 140.16 | 90.96 | 45.42 | 5.80 | 3.67 |
| 1939 | 20.76 | 201.02 | 207.18 | 139.56 | 87.02 | 42.13 | 5.59 | 3.52 |
| 1940 | 15.68 | 184.24 | 199.98 | 137.60 | 86.36 | 38.82 | 5.39 | 3.34 |
| 1941 | 17.50 | 159.42 | 194.56 | 133.52 | 85.78 | 36.73 | 5.18 | 3.16 |
| 1942 | 22.24 | 134.88 | 190.04 | 128.30 | 84.68 | 35.41 | 4.98 | 3.00 |
| 1943 | 27.20 | 116.46 | 185.26 | 123.26 | 82.48 | 34.73 | 4.77 | 2.87 |
| 1944 | 30.12 | 107.38 | 179.18 | 118.90 | 78.96 | 34.52 | 4.56 | 2.77 |
| 1945 | 30.66 | 110.30 | 168.14 | 115.64 | 74.46 | 34.54 | 4.36 | 2.69 |
| 1946 | 28.98 | 121.80 | 154.20 | 112.78 | 69.70 | 34.32 | 4.21 | 2.63 |
| 1947 | 25.94 | 131.10 | 146.04 | 109.88 | 65.50 | 33.30 | 4.14 | 2.58 |
| 1948 | 22.34 | 135.86 | 143.68 | 106.72 | 62.40 | 31.22 | 4.12 | 2.53 |
| 1949 | 19.82 | 136.78 | 144.74 | 103.52 | 60.22 | 28.52 | 4.18 | 2.49 |
| 1950 | 19.04 | 136.12 | 146.60 | 100.28 | 58.60 | 25.72 | 4.22 | 2.45 |
| 1951 | 18.74 | 135.78 | 147.16 | 97.78 | 56.98 | 23.46 | 4.14 | 2.42 |
| 1952 | 18.54 | 136.34 | 146.12 | 96.14 | 55.32 | 21.86 | 3.88 | 2.39 |
| 1953 | 18.36 | 137.52 | 144.56 | 94.48 | 53.60 | 20.84 | 3.44 | 2.36 |
| 1954 | 18.02 | 138.92 | 143.06 | 92.40 | 51.94 | 20.20 | 2.96 | 2.34 |
| 1955 | 18.06 | 140.12 | 141.76 | 89.98 | 50.40 | 19.62 | 2.56 | 2.31 |
| 1956 | 19.54 | 141.40 | 140.30 | 87.24 | 49.08 | 18.98 | 2.36 | 2.29 |
| 1957 | 22.90 | 143.16 | 138.70 | 84.76 | 47.40 | 18.34 | 2.22 | 2.29 |
| 1958 | 26.80 | 145.76 | 136.84 | 82.56 | 45.40 | 17.76 | 2.16 | 2.29 |
| 1959 | 29.64 | 147.94 | 134.82 | 80.48 | 43.22 | 17.18 | 2.08 | 2.28 |
| 1960 | 31.02 | 148.16 | 132.74 | 78.32 | 41.20 | 16.48 | 2.02 | 2.25 |
| 1961 | 30.58 | 146.64 | 130.44 | 76.24 | 39.66 | 15.40 | 1.94 | 2.20 |
| 1962 | 28.84 | 144.16 | 127.68 | 74.26 | 38.46 | 14.20 | 1.86 | 2.15 |
| 1963 | 26.84 | 141.92 | 124.40 | 72.30 | 37.22 | 13.14 | 1.82 | 2.09 |
| 1964 | 25.84 | 140.68 | 120.80 | 70.38 | 35.94 | 12.34 | 1.74 | 2.04 |
| 1965 | 26.08 | 141.40 | 117.56 | 68.46 | 34.72 | 11.80 | 1.62 | 2.01 |
| 1966 | 27.20 | 144.28 | 114.86 | 66.40 | 33.60 | 11.52 | 1.38 | 2.00 |
| 1967 | 28.24 | 149.10 | 113.04 | 64.38 | 32.58 | 11.18 | 1.22 | 2.00 |
| 1968 | 30.96 | 154.00 | 112.16 | 62.42 | 31.60 | 10.76 | 1.10 | 2.02 |
| 1969 | 34.06 | 160.24 | 111.98 | 60.78 | 30.68 | 10.34 | 1.10 | 2.05 |
| 1970 | 35.94 | 166.00 | 111.90 | 59.54 | 29.66 | 10.00 | 1.06 | 2.07 |
| 1971 | 35.06 | 169.10 | 111.76 | 58.58 | 28.68 | 9.70 | 1.04 | 2.07 |
| 1972 | 35.16 | 166.80 | 111.36 | 57.78 | 27.86 | 9.42 | 1.00 | 2.05 |
| 1973 | 37.12 | 162.92 | 110.92 | 56.96 | 27.28 | 9.14 | 0.94 | 2.03 |
| 1974 | 38.64 | 160.56 | 109.96 | 56.16 | 26.86 | 8.86 | 0.90 | 2.01 |
| 1975 | 38.76 | 159.06 | 108.76 | 55.22 | 26.54 | 8.52 | 0.90 | 1.99 |
| 1976 | 39.54 | 157.38 | 107.36 | 54.24 | 26.22 | 8.26 | 0.88 | 1.97 |
| 1977 | 41.78 | 156.64 | 106.20 | 53.34 | 25.76 | 8.06 | 0.86 | 1.96 |
| 1978 | 42.86 | 159.00 | 105.52 | 52.56 | 25.06 | 8.06 | 0.84 | 1.97 |
| 1979 | 44.28 | 161.16 | 105.10 | 51.84 | 24.32 | 8.06 | 0.78 | 1.98 |
| 1980 | 45.84 | 163.26 | 105.12 | 51.20 | 23.62 | 8.00 | 0.76 | 1.99 |
| 1981 | 47.56 | 164.76 | 105.82 | 50.82 | 22.98 | 7.92 | 0.74 | 2.00 |
| 1982 | 47.88 | 167.00 | 107.30 | 50.64 | 22.50 | 7.68 | 0.74 | 2.02 |
| 1983 | 48.14 | 168.60 | 109.06 | 50.88 | 21.98 | 7.36 | 0.76 | 2.03 |
| 1984 | 48.50 | 169.58 | 110.38 | 51.38 | 21.70 | 7.00 | 0.78 | 2.05 |
| 1985 | 48.82 | 170.02 | 111.50 | 52.38 | 21.46 | 6.76 | 0.78 | 2.06 |
| 1986 | 49.04 | 170.40 | 112.20 | 53.54 | 21.48 | 6.56 | 0.74 | 2.07 |

Table A4. Projected period age-specific and total fertility rates: Ukrainskaia SSR, 1987-2000.

| Time | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | TFR |
|------|-------|--------|--------|-------|-------|-------|-------|------|
| 1987 | 49.08 | 170.40 | 113.32 | 54.80 | 21.60 | 6.40 | 0.72 | 2.08 |
| 1988 | 48.96 | 170.52 | 114.08 | 56.30 | 21.92 | 6.20 | 0.68 | 2.09 |
| 1989 | 48.60 | 170.60 | 115.12 | 57.32 | 22.50 | 6.10 | 0.62 | 2.10 |
| 1990 | 47.78 | 170.64 | 116.40 | 57.78 | 23.40 | 6.10 | 0.62 | 2.11 |
| 1991 | 46.38 | 170.64 | 117.92 | 57.90 | 24.30 | 6.20 | 0.60 | 2.12 |
| 1992 | 44.88 | 170.08 | 119.34 | 58.14 | 24.98 | 6.32 | 0.58 | 2.12 |
| 1993 | 43.52 | 169.00 | 119.86 | 58.82 | 25.94 | 6.46 | 0.54 | 2.12 |
| 1994 | 42.22 | 167.52 | 119.74 | 60.10 | 26.60 | 6.74 | 0.54 | 2.12 |
| 1995 | 40.98 | 165.78 | 119.40 | 61.70 | 26.76 | 7.20 | 0.54 | 2.11 |
| 1996 | 39.70 | 163.86 | 119.08 | 63.34 | 26.64 | 7.58 | 0.58 | 2.10 |
| 1997 | 38.54 | 161.90 | 118.66 | 64.80 | 26.56 | 7.78 | 0.58 | 2.09 |
| 1998 | 37.40 | 160.02 | 118.22 | 65.08 | 27.06 | 8.16 | 0.60 | 2.08 |
| 1999 | 36.22 | 158.14 | 117.74 | 64.70 | 28.12 | 8.38 | 0.64 | 2.07 |
| 2000 | 35.12 | 156.28 | 117.14 | 64.12 | 29.38 | 8.36 | 0.70 | 2.06 |