COMPARATIVE STRUCTURE OF LOW FERTILITY IN JAPAN AND THE UNITED STATES

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Fertility in Japan and the United States has hovered at or slightly below replacement levels in recent years, suggesting a convergence of fertility patterns. This is shown in Figure 1, which shows conventional total fertility rates (TFRs) for the two countries.

The principal aim of this paper is to show that this apparent convergence conceals striking differences. I also consider the issue of fertility forecasts and their importance (rather small, as it turns out) on future population age structure.

1. Period Parity Progression Ratios for the United States

The period parity progression ratios used here differ from those introduced by Henry (1953) in referring to overall, rather than only to marital, fertility. Fertility in any year is described by a series p(0), p(1), ..., where p(0) indicates the proportion of women born who ever have a first birth, p(1) the proportion of women having a first birth who ever have a second birth, and so on.

Values of p(0) for the United States have been calculated from the "birth probabilities" for five year agegroups given in the cohort fertility tables through 1973 (Heuser 1976, table 9A, pages 355-361) and in the official vital statistics publications through the most recent available year (National Center for Health Statistics: 1980, table 1-2, pages 1-16 to 1-17 for 1973-76; and 1987, table 1-12, pages 15-16 for 1977-83).

Higher order ratios have been estimated indirectly from registered births by order by the method described in Feeney (1985: 131-33). The estimates are good to a within a relative error of one or two percent at worst. The analyses given in Feeney (1986) indicate that these estimates are superior to anything that can be directly computed from available data, such as survey birth history data.

The last parity progression ratio series is an aggregate for progression from seventh and higher order to eighth and higher order births. It is derived by aggregating progression from seventh to eighth birth, eighth to ninth birth, ninth to tenth birth, and so on, the aggregation taking place in the counts of women and births, before the calculation of rates.

Figure 2A shows period parity progression ratios for progression from first to second birth, second to third birth, third to fourth birth, and fourth to fifth birth.

Ratios for higher order progressions have been plotted separately in Figure 2B to avoid cluttering the picture. The data are given in Table 1.

2. Period Parity Progression Ratios for Japan

Figure 3 shows period parity progression ratios for Japan as given in Feeney (1986: table 8, page 20). They have been estimated indirectly in the same way as the United States estimates.

The estimates have been plotted with the same scale as Figures 2A-B for comparability. Only one plot is necessary here because the last series for Japan is an aggregate ratio for progression from fourth or higher order to fifth or higher order birth.

Hineouma, fire-horse year, is regarded in Japan as a most unfortunate year for a female child to be born. This explains the sharp dip in 1966.

3. Japan and the United States Compared

The most striking difference between the parity progression ratio series for Japan and the United States is the large gap between progression from first to second birth and progression from second to third birth in Japan, roughly 85 as compared with 30 percent. The corresponding figures for the United States are 80 and 50 percent.

Also notable are the very low values of the higher order progression ratios in Japan, around 20 percent, as compared with 40 percent for the United States.

4. Comparison of Completed Fertility

Figure 4 shows the completed parity distributions for Japan and the United States implied by the period parity progression ratios for 1980. The Japanese concentration on two child families is extraordinary, with over 50 percent of Japanese women having this number, as compared with only 32 percent of American women.

5. Summary Measure of Period Parity Progression Ratios

The average number of children ever born to women in a birth cohort may be expressed as

$$p(0) + p(0)p(1) + p(0)p(1)p(2) + \ldots$$

where the $p(i)$ are the parity progression ratios for the cohort. Substituting period parity progression ratios in this formula gives a synthetic measure of completed fertility, a total fertility rate based on period parity progression ratios rather than on age-specific birth rates. The relation between the conventional TFR age the period parity progression ratio TFR is analyzed in detail in Feeney and Yu (1987: 85-98).

Figure 5 plots both total fertility rates for the U.S. The period parity progression ratio statistic is less volatile that the conventional TFR, rising less when fertility is rising and falling less when it is falling.

A notable consequence of this difference is that the period parity progression ratio measure indicates fertility substantially closer to replacement levels than the familiar age-specific birth rate measure.

This tendency of the conventional TFR to exaggerate fluctuations is observed in Japan (Feeney 1986: Figure 1) and in China (Feeney and Yu 1987: Figure 4). It is also consistent with the theoretical analysis given in Feeney and Yu (1987: 91-98), which proves the result for the first birth component p(0).

6. Forecasting Fertility Trends

Fertility trends in both Japan and the United States have been reasonably stable since the mid-1970s. This is true whether we look at the individual period parity progression ratio series or at the summary total fertility rate calculated from them.

The best fertility forecast is that these levels will remain constant in future years. We have no reason to expect a sharp departure from this level for the next five or ten, and longer range forecasts are too speculative to bother with more elaborate assumptions.

Period parity progression ratios give slightly higher levels of fertility that age-specific birth rates. In 1980, for example, the values for the U.S. where 2.02 and 1.84 children per woman, respectively. The corresponding figures for Japan were 1.83 and 1.75.

While these are certainly not large differences, current concern over low fertility levels makes them more than negligible.

I have shown elsewhere in detail how to carry out population projections using period parity progression ratios (Feeney 1985). The calculations are tedious, however, and while useful in certain analytical applications, they are hardly necessary for forecasting.

For forecasting one may simply adjust current age-specific birth rates upwards to the level of the period parity progression ratio total fertility rate and carry out a standard component projection.

7. Forecasting Population Age Structure

The age distribution of a population at any future time is determined by past levels of fertility and mortality. In forecasting future age structure, however, we naturally begin with the current age structure, which embodies the effects of past levels of fertility and mortality.

In practice, then, the age distribution of a population at any future time has three determinants: the current age distribution, future fertility, and future mortality.

In the very long run, future fertility and mortality dominate, for the effect of the initial age distribution, as the weak ergodic theorem tells us, disappears.

In the short to medium run, however, the most important determinant of future age distribution is the current age distribution. This is especially true in developed countries, where mortality is low and age distributions old. Mortality has essentially no effect before very old age. Fertility has only modest effects because young people constitute a relatively small portion of total population.

8. Example of Aging in Japan

Consider the example of aging in Japan, which is discussed in detail in Feeney (1988). Take as a measure of aging the ratio of the number of persons aged 65 and over to the number aged 20-64.

This ratio was 10 in 1950 and had declined to 6 in 1985. Over the next 40 years it will decline to about 2.3. Virtually all of this decline will be the result not of future fertility and mortality, but of the current age distribution.

Radically different fertility assumptions raise or lower the ratio by a mere 0.2 (Feeney 1988: table 2). The effect of sharply different mortality assumptions is roughly twice as large (Feeney 1988: table 7), but this is still
modest in relation to the effect of the current age distribution.

An elementary but not insignificant consequence is that the future aging of the Japanese population is very predictable. We can make better or worse forecasts of future fertility and mortality, but the current age distribution is known. It does not have to be forecast.

9. Forecasting and Bureaucracy

Simple procedures generally provide as good or better forecasts as more complicated procedures. Given the choice between a simpler and a more complicated forecasting procedure, however, bureaucracy will invariably choose the more complicated procedure, provided only that it does not give obviously and grossly inferior results.

There are two simple but compelling reasons for this choice. First, the forecasting method adopted will be scrutinized and subject to criticism by various outside authorities. The simpler method will be an easy mark for criticism, both because it is easily understood, and because it will be easy to suggest elaborations that might conceivably improve it. A complex method will be harder to understand, requiring more effort on the part of potential critics. The producers will understand it better than anyone else, and so be in the best possible position to deflect criticism.

The second reason for choosing a more complex over a simpler forecasting technique has to do with the outcome of the forecast. If the forecast is unsuccessful, as so many are, the may be an inquiry of sorts. Should it turn out that a simple method was used, criticism is likely to be intense. Surely a more sophisticated approach would have yielded a better result, or at least a higher probability of a better result? The producer is at risk of appearing lazy, ignorant, incompetent. A very complex forecasting procedure allows at least the defense that "we did the best we could, no effort was spared to obtain the best possible forecast."

REFERENCES

Feeney, Griffith. 1985. Parity progression projection. In International Population Conference, Florence 1985, Vol. 4, pages 125-136.

--. 1986. Period parity progression ratio measures of fertility in Japan. NUPRI Research Paper Series No. 35. Nihon University Population Research Institute, Tokyo, Japan. Copies available on request to NUPRI, 3-2, Misaki-cho 1-chome, Chiyoda-ku, Tokyo 101.

--. 1988. The aging of the Japanese population: 1950-2025. Typescript, East-West Population Institute, Honolulu, Hawaii USA.

-- and Jingyuan Yu. 1987. Period parity progression measures of fertility in China. Population Studies 41(1): 77-102.

Henry, Louis. 1980. Fertility of Marriage: A New Method of Measurement. Population Studies Translation Series No. 3, United Nations, New York. Original French version published 1953.

Heuser, Robert L. 1976. Fertility Tables for Birth Cohorts by Color: United States, 1917-73. National Center for Health Statistics, Rockville, Maryland. DHEW Publication No. (HRA) 76-1152.

National Center for Health Statistics. 1980. Vital Statistics of the United States: 1976. Volume I - Natality. U.S. Department of Health and Human Services, Public Health Services, Hyattsville, Maryland.

--. 1987. Vital Statistics of the United States: 1983. Volume I - Natality. U.S. Department of Health and Human Services, Public Health Services, Hyattsville, Maryland.

Table 1. Period Parity Progression Ratios for the United States: 1941-1984 (x1000)

Year	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7+\8+
1984	802	789	488	386	382	419	439	456
1983	806	787	490	391	390	423	439	442
1982	806	798	501	402	399	427	443	439
1981	810	797	502	408	402	426	444	432
1980	800	801	507	416	409	425	436	432
1979	791	796	505	418	402	410	411	431
1978	796	779	494	412	388	384	393	380
1977	791	778	495	411	382	375	380	375
1976	797	755	474	394	361	350	355	358
1975	808	746	468	386	347	336	342	347
1974	812	742	471	384	340	329	333	340
1973	830	730	483	397	358	345	349	353
1972	857	745	520	435	392	376	376	377
1971	878	784	590	498	444	422	416	419
1970	875	809	625	523	462	435	427	430
1969	883	807	618	508	447	426	422	430
1968	873	808	606	491	429	421	427	444
1967	886	823	622	502	448	443	456	477
1966	887	838	640	520	472	475	490	521
1965	900	864	680	564	519	524	542	571
1964	896	892	720	604	561	574	596	620
1963	904	904	732	620	587	598	623	643
1962	914	911	741	634	601	623	649	668
1961	919	919	750	647	618	645	673	686
1960	923	922	746	645	619	650	682	689
1959	926	923	740	643	622	659	689	694
1958	932	923	733	640	625	662	695	689
1957	927	924	733	645	639	679	709	698
1956	922	917	717	641	642	684	714	691
1955	922	907	702	638	648	689	707	682
1954	917	899	693	641	655	692	709	680
1953	917	887	677	637	654	683	699	669
1952	914	872	670	638	653	678	690	670
1951	898	851	653	624	636	670	688	669
1950	909	828	637	605	621	657	682	663
1949	918	832	634	603	620	657	680	667
1948	942	845	639	600	617	647	670	647
1947	898	857	650	616	634	661	677	655
1946	810	818	637	631	654	679	695	663
1945	819	734	618	637	667	692	705	673
1944	854	757	653	669	683	705	705	667
1943	867	797	669	675	685	698	695	657
1942	817	775	638	647	658	669	673	634
1941	779	745	628	639	651	670	666	635

Note: See text for explanation.

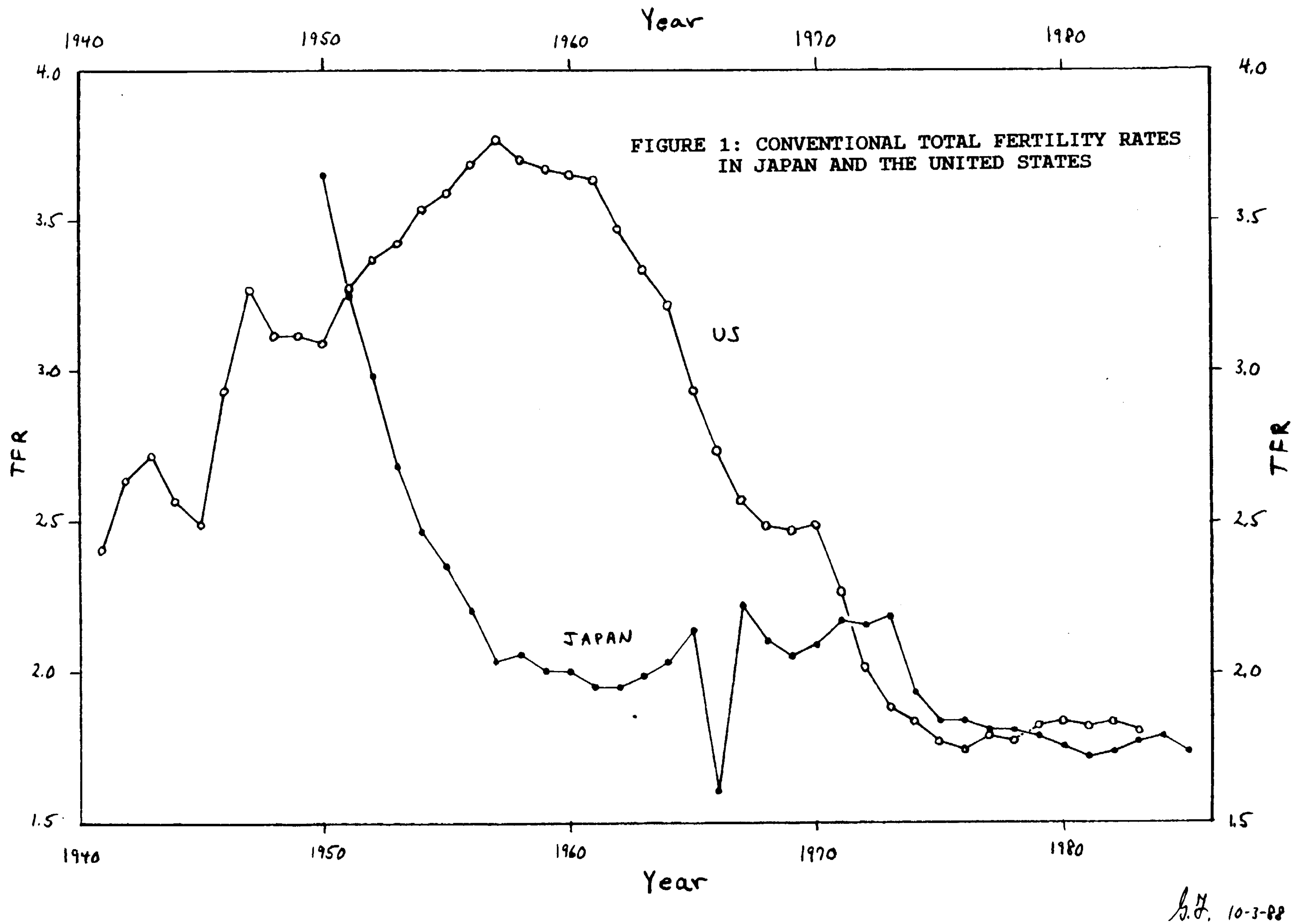
FIGURE 1: CONVENTIONAL TOTAL FERTILITY RATES
IN JAPAN AND THE UNITED STATES
Year
1940
1950
1960
1970
1980
4.0
3.5
3.0
2.5
2.0
1.5
TFR
US
JAPAN
G.J. 10-3-88

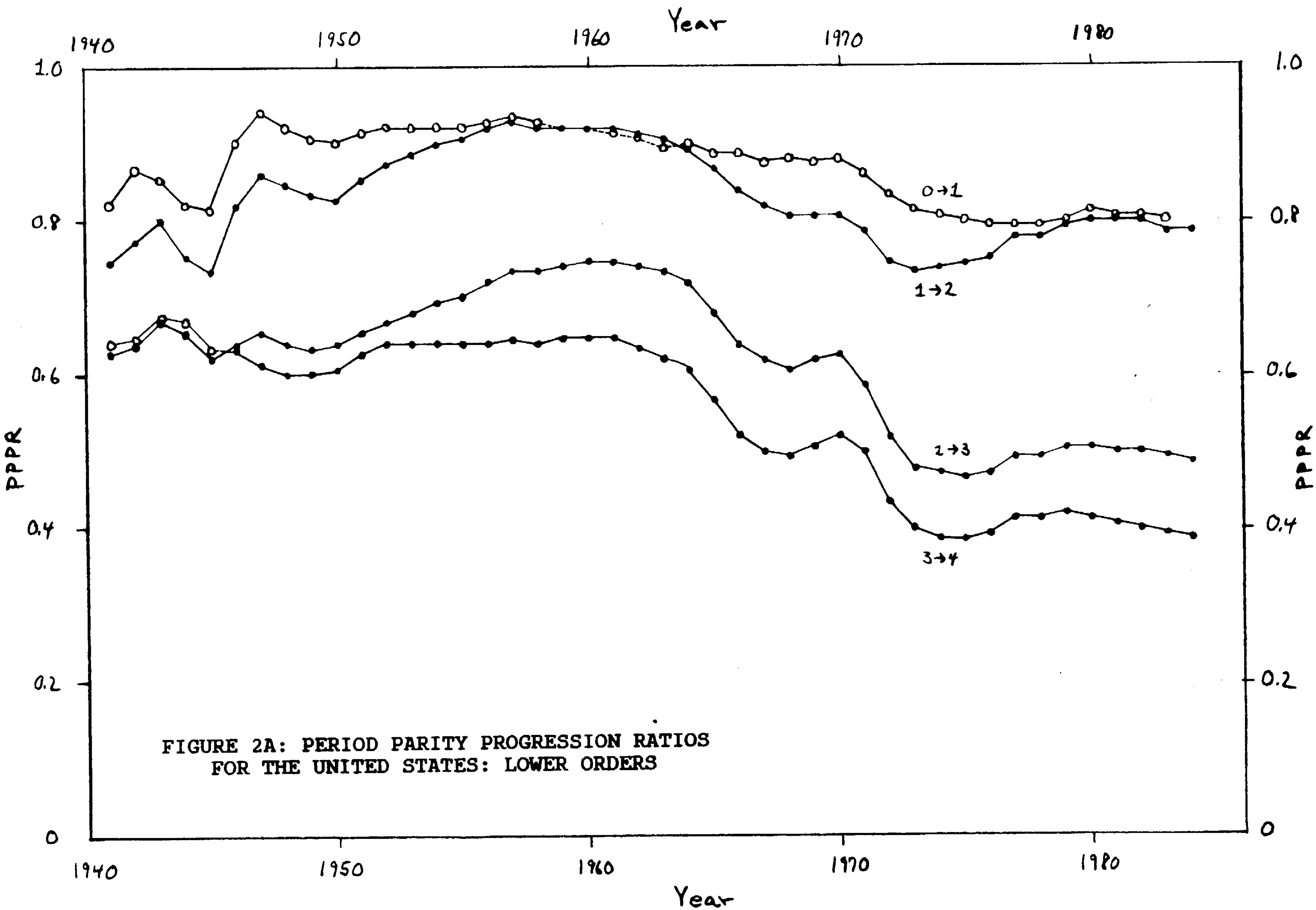

FIGURE 2A: PERIOD PARITY PROGRESSION RATIOS
FOR THE UNITED STATES: LOWER ORDERS

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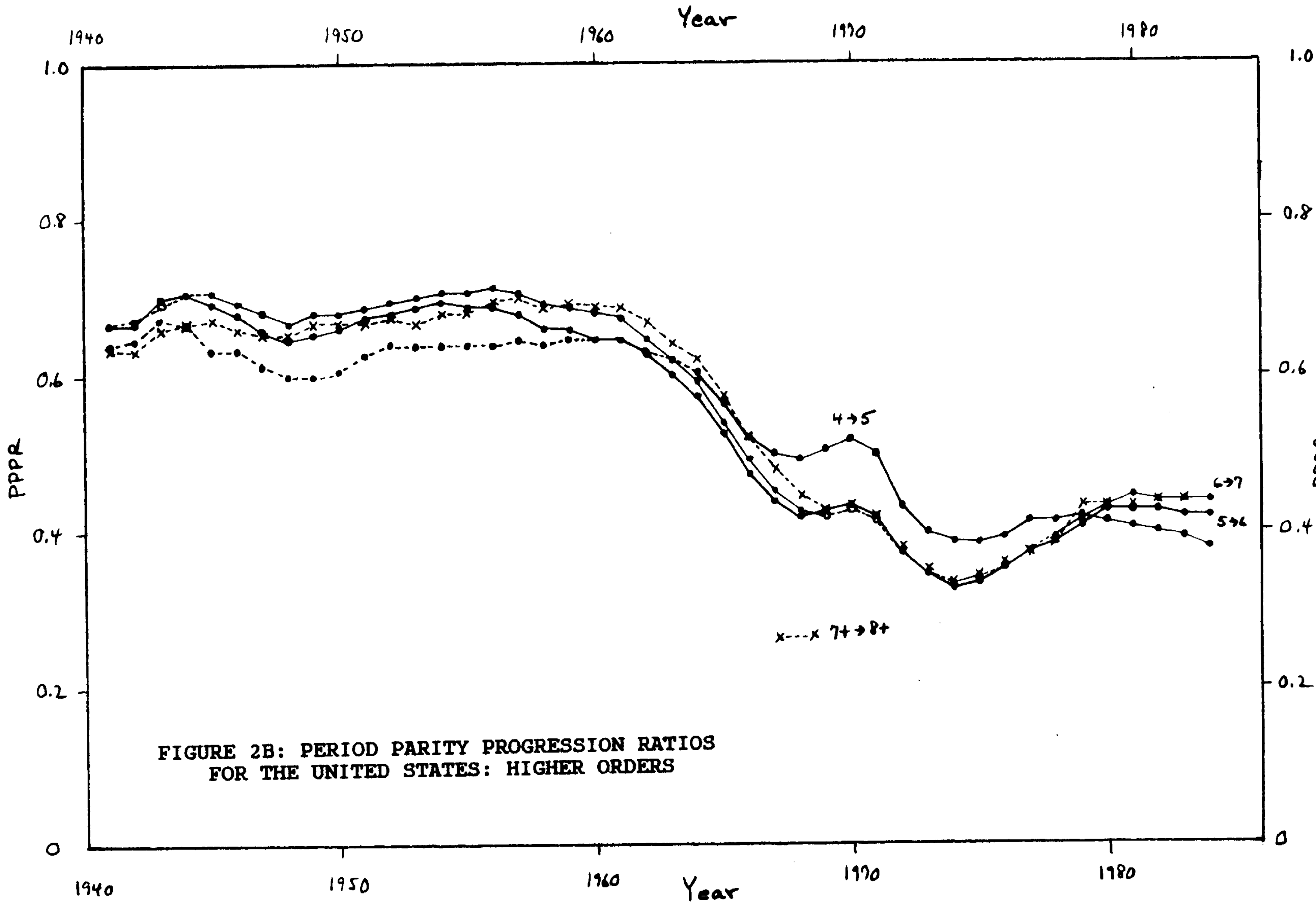

FIGURE 2B: PERIOD PARITY PROGRESSION RATIOS
FOR THE UNITED STATES: HIGHER ORDERS

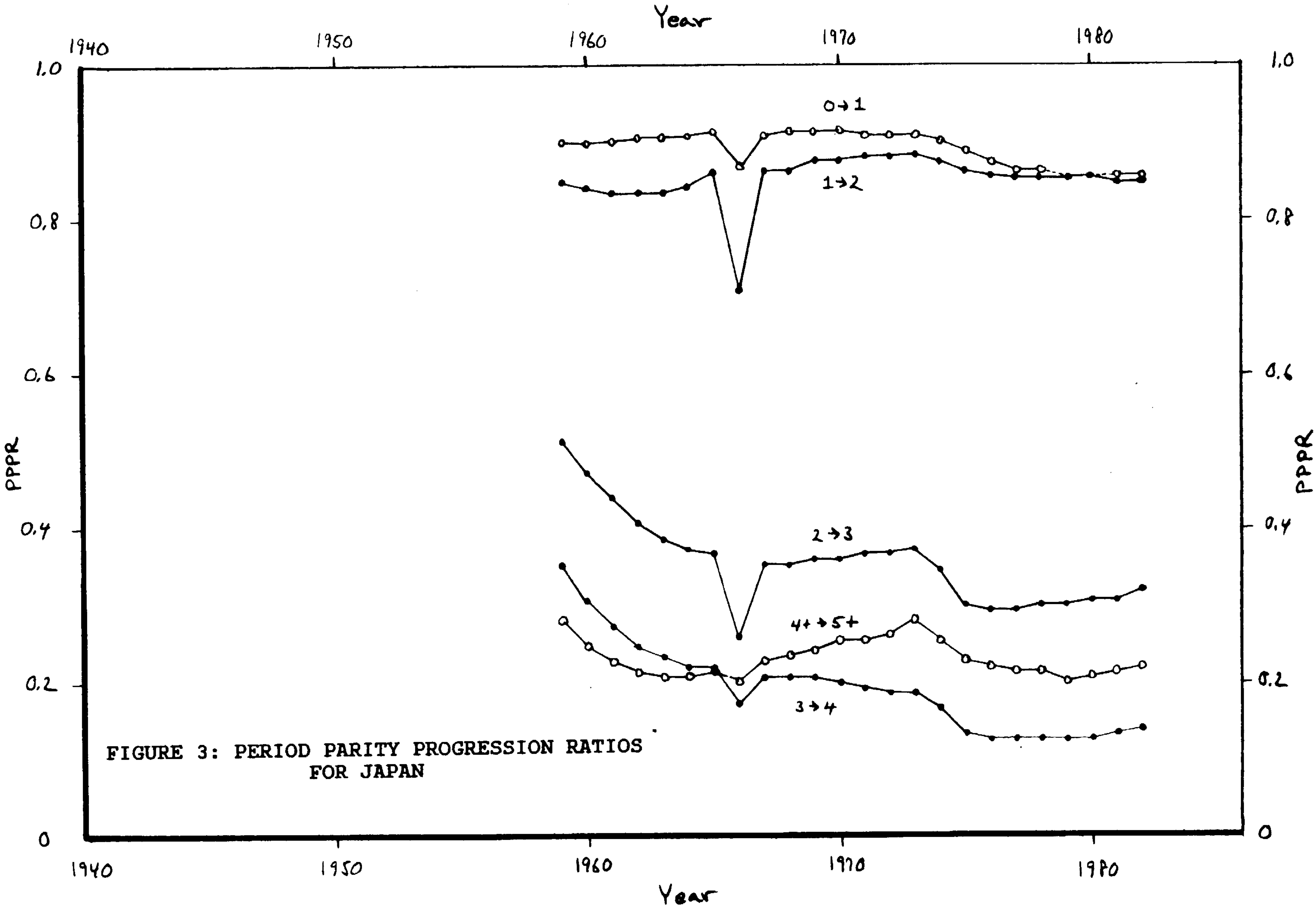

FIGURE 3: PERIOD PARITY PROGRESSION RATIOS FOR JAPAN

G.T.
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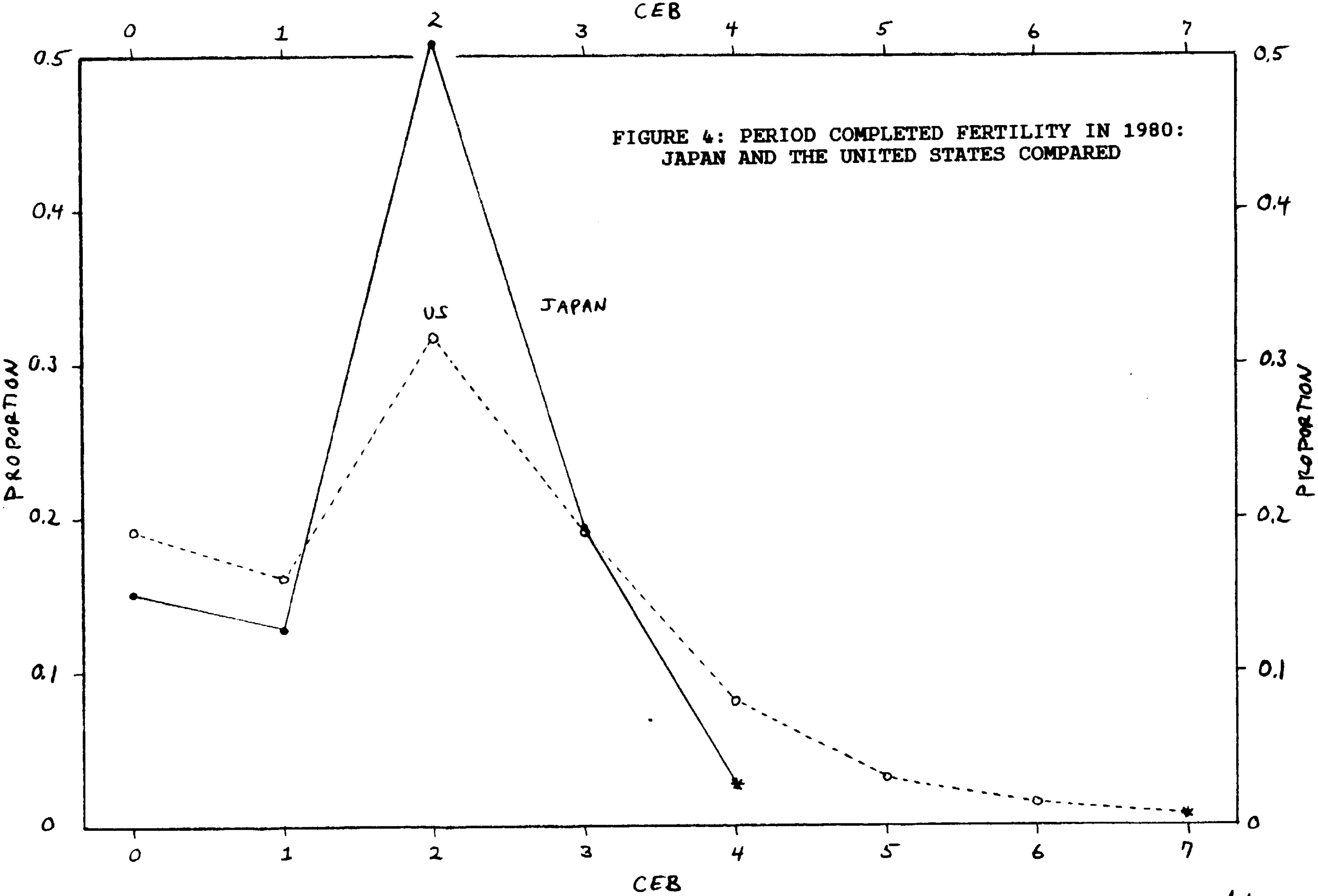

FIGURE 4: PERIOD COMPLETED FERTILITY IN 1980: JAPAN AND THE UNITED STATES COMPARED

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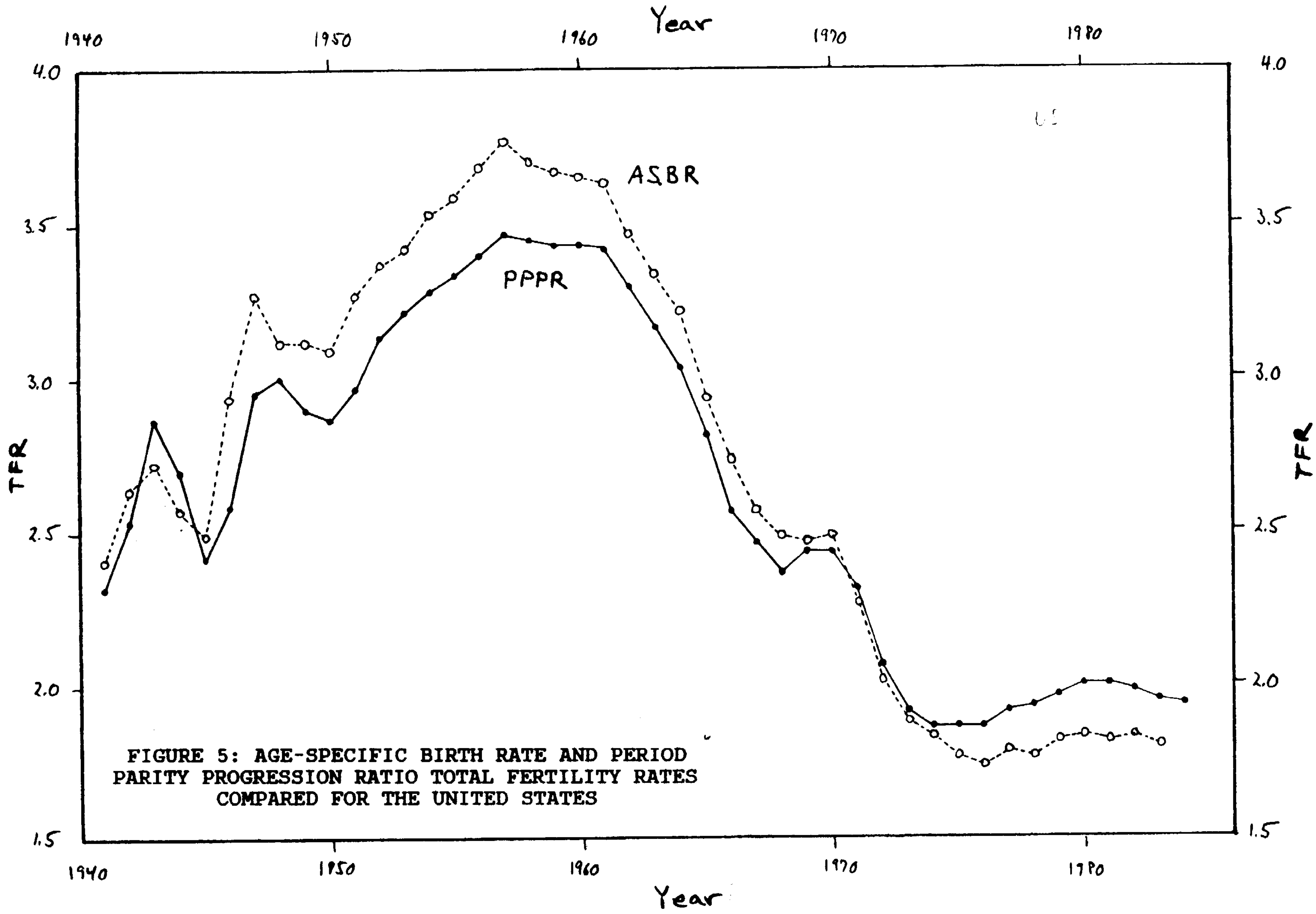

FIGURE 5: AGE-SPECIFIC BIRTH RATE AND PERIOD PARITY PROGRESSION RATIO TOTAL FERTILITY RATES COMPARED FOR THE UNITED STATES