PERIOD PARITY PROGRESSION MEASURES OF FERTILITY FOR CHINHA AND ITS PROVINCES: ESTIMATES FROM THE 1990 CENSUS

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This paper presents parity progression measures of fertility for China by place of residence and for urban and rural areas of each province estimated by the method of birth history reconstruction applied to the new 1/100 household sample of the 1990 census records.

We are particularly interested to see whether declines at different parities are consistent with the effects of the later-longer—fewer policy initiated at the beginning of the Fourth Five Year Plan period 1971-75 and the one-child family policy initiated in 1979.

Previous work has shown large declines in fertility in China as a whole and in place of residence categories, but there have been no reports on parity progression measures by province and urban rural residence. Given the size and diversity of the country, it is arguably essential to move well below the national level if we are to understand the extraordinary changes in fertility that have occurred over the past two decades.

CHINA'S MACROREGIONS

G. William Skinner has argued persuasively that, for agrarian China, at any rate, the appropriate units for spatial analysis of population (and many other) phenomena are not provincial level units, but macroregions, functionally differentiated economic and social regions (Skinner 1964/65, 1977). The relationship between macroregions and provinces is indicated in Map 1. There are only ten macroregions, covering roughly the area of China less Xinjiang, Xizang (Tibet), most of Qinghai, and a few small portions of Yunnan and Gansu. Macroregional and provincial boundaries crosscut each other in ways that make it impossible to aggregate provinces into macroregions.

While the study of fertility levels and trends within and between macroregions will surely teach us more than analysis at the provincial level, levels and trends within provinces are by no means without interest. Since the evidence is strong that much of China's fertility decline has been policy induced, and since policies are mediated through the administrative structure, it would not be surprising to find some provincial differentiation. Analyses by province will also hold interest for those involved in birth planning work.

It will be desirable in the future to study the relationship between macroregional and provincial patterns of fertility change, for this is likely to illuminate the interplay of policy and broader socioeconomic influences on fertility change. To do so, however, it is necessary to disaggregate administrative data down the county level and then re-aggregate to form adequate approximations to macroregions. Study of the internal structure of macroregions would benefit from even more detailed disaggregation, though much progress may be made

with county level data.

Our concern here is to make a modest beginning by looking at patterns of fertility change by province, noting what appear to be macroregional patterns as they appear. We intended initially to look at provincial fertility disaggregated by type of residence, but examination of results for selected provinces from the one-per-thousand advance tabulation sample of the 1990 census indicated clearly that neither the size nor the design of the sample would suffice for this purpose. We have therefore restricted our attention to fertility patterns for China as a whole by residence type and overall fertility within each province.

THE 1/100 SAMPLE

The statistics given in this draft report are based on a preliminary version of the new 1/100 household sample of the 1990 population census records, which has superseded the 1/100 and 1/1000 advance tabulation samples used in earlier work. See Appendix 1 for details of the new 1/100 sample.

BIRTH HISTORY RECONSTRUCTION

We begin by applying the birth history reconstruction method developed by Norman Y. Luther (Luther and Cho 1988; for a previous application to China see Luther, Feeney and Zhang 1990) to the one-per—thousand advance tabulation sample of the 1990 census records, obtaining reconstructed birth histories for every woman aged 15—64.

Birth history reconstruction requires as input (1) life tables by sex representing the level and trend of mortality in the years prior to the census and (2) cohort fertility schedules for women aged 15-64 at the time of the census. These inputs should be specific for subpopulations that differ substantially from the total population.

We used life tables for each province from the 1982 and 1990 censuses together with intercensal life tables for 1964—82 and 1953—64 and the 1930 life tables of (Barclay, et. al., 1976). The 1982 provincial life tables were computed directly from reports of deaths in households during 1981 in the 1982 census. The 1990 life tables utilized data on deaths in households during the first half of 1990 from the 1990 census with a correction for under reporting of deaths by a variant of the Brass growth balance method applied to the middle ages and younger and lower ages adjusted according to the pattern of the 1982 life tables. We considered generating estimates of provincial life tables for urban and rural areas, but calculations based on the mortality differences given in Men (1993) indicated negligible differences in survival probabilities.

The cohort fertility schedules required for birth history reconstruction have in previous applications [cite] been generated using Luther’s (1982) truncated Pearson Type III model for age-

specific birth rates fitted to five year births rates every fifth year prior to the census or survey by the approximate numerical formulas given in that source. An earlier application [cite, the 1982 SSB conference paper] encountered difficulties in this fitting procedure arising from the late ages at marriage in China during the 1980s, for the numerical formulas break down if age at marriage rises beyond a certain point.

We suspected that the problem was due to inadequate fit of the model, which had been tested primarily against data for five year age groups, at the younger ages by single year of age. A detailed examination of the fit of the model to single year schedules of age-specific birth rates was made, using rates estimated by application of the conventional own children method to the 1/100 sample data. Fitting was accomplished by numerical minimization of the sum of squared differences between observed and fitted values. Estimates of the model parameters s and m by single year of age were produced for the total, urban, and rural areas of China as a whole and for each province. These single year values were then average into the following five year groups to serve as input to the birth history reconstruction.

Though the resulting s and m values give good results, the examination of the model fit indicated the desirability of developing a new model giving better fits to the left tail of the distribution of age-specific birth rates, and perhaps, in some cases, to using actual data in place of models. The latter option is feasible, of course, only with very large data sets and quite accurate age reporting.

The recent paper by Feeney and Wang (1993) provides a detailed description of the calculation of various period parity progression measures of fertility, to which the reader is referred for definitions of the statistics presented below.

PROCEDURES

It will be useful to note here some of the details of the processing that generated the estimates.

(1) Vicki Ho ran conventional own children match plus tabulation routines for shi, zhen, and xian of each province on Sun work station using the complete 1/100 sample. Except as noted below, the following work was done on a 386 PC.

(2) Li Xiru produced life tables by sex from q_x values (0,1,5,10,...,80) for 1981 and 1990 for every province and for the total population. Interpolation to single years of age was accomplished using the MORTPAK-LITE routine UNABR for unabridged life tables.

(3) Yuan Jianhua wrote FORTRAN program to produce single year age-specific birth rates from the tabulations and life tables produced in the preceding two steps. This was necessary because the OWNCH3 routine does not produce single year output. This resulted in single year age-

specific birth rates for the 15 years prior to the census for total, urban, and rural areas for the national level and for each province. We would like to have produced rates for the 20 years prior to the census, but the tabulations were available only for the 15 years prior to the census.

(4) Yuan Jianhua wrote a FORTRAN program, taking these single year age-specific birth rates as input, to estimate s and m values for Luther's truncated Pearson Type II model by numerically minimizing the sum of squared deviations of model from observed single year ASBR5. This resulted in values of s and m for each single year of age 15—64 for total, urban and rural residence for the nation and for each province. Values were averaged for the following five year age groups: <=16, 17—18, 19—22, 23—27, 28—32, 33—37, 38—42, 43—47, 48—52, 53—57, 58—62, >=63. These files are in the YJHSM directory.

(5) Li Xiru wrote a FORTRAN program to produce life table input files for Judy Tom's birth history reconstruction program. These files are in the LXRLIFET directory.

(6) Judy Tom used the s and m values and life tables produced in the preceding two steps to run birth history reconstruction on the IBM mainframe. Reconstruction was carried out separately for urban and rural areas within each province using the parameter values for the appropriate area and province. A single run for the total population took about 20 minutes. [check this value]

(7) Gayle Yamashita produced basic parity progression data tables from the reconstructed birth histories for total, urban, and rural areas of the nation and each province.

(8) Griffith Feeney wrote APL programs to create APL files for each file and compute period parity progression ratios and total fertility rates for each subpopulation. These programs are in the PPPRAPL directory. CREATEAPLFILE takes the name of an ASCII file as an explicit right argument and creates an APL file with 18 components, each component containing the basic data table for the corresponding parity. PUTPPPRTABLE takes the coded province plus resident designation (e.g., AHICNTY) as an explicit right argument and produces an ASCII file containing a table of period parity progression ratios and corresponding TFR5, with year labels at left.

The basic data table consists of an initial column of numbers of entries for the given progression (births of women for birth to first, first births for first to second, and so on) followed by the matrix showing, for each of these groups, the numbers having a first or higher order birth in the given and each subsequent year. Basic data tables were produced for birth of woman to first birth, first to second birth, through 17th to 18th birth for each subpopulation, the limit imposed by the one digit codes for children ever born by sex on the census questionnaire. In tabulating basic data tables, only women for whom initial and terminal event is reported are included. [double

check details of this with Gayle]

The 18 basic data tables for each subpopulation were written to an ASCII file in which the name of the province and the residence area were coded according to the following scheme. TOTL=total, URBN=urban, CNTY=rural.

1. AHI - Anhui
2. BJG - Beijing
3. FJN - Fujian
4. GDG - Guangdorig
5. GSU - Gansu
6. GXI - Guangxi
7. GZU - Guizhou
8. HeB - Hebei
9. HeN - Henan
10. HLJ - Heilongjiang
11. HNN - Hainan
12. HuB - Hubei
13. HuN - Hunan
14. JLN - Jilin
15. JSU - Jiangsu
16. JXI - Jiangxi
17. LNG - Liaoning
18. NMG - Neimonggu
19. NXA - Ningxia
20. QHI - Qinghai
21. SCN - Sichuan
22. SDG - Shandong
23. SHI — Shanghai
24. SX1 — Shanxi
25. SX3 — Shaanxi
26. TJN - Tianjin
27. XJG - Xinjiang
28. XZG - Xizhang
29. YNN - Yunnan
30. ZJG - Zhejiang

These codes were generated as follows. Three syllable names were coded by the initial letters of each syllable. Two syllable names coded by initial letters of each syllable, with conflicts resolved by inserting second letter of the first syllable, except for SX1 and SX3, in which the number designates tone. Each file was given an extension .DAT. The first file name is thus AHICNTY.DAT, which gives basic data tables for counties in Anhui. These files are in the PPPRDATA directory in zipped format, in which they occupy 1-2 percent of the space the unzipped files require.

The structure of these files is as follows. Tables occur in order, birth of woman to first through 17th to 18th birth. Each table consists of 92 lines, a leading blank line followed by 91 data lines

for the years 1900 through 1990 inclusive. Each line consists of 364 data characters plus 2 delimiter characters. In numeric format, each line consists of a number of women entering the given parity during the given year followed by 51 numbers giving the numbers in subsets of women who exited the parity during the given and subsequent years.

THE NATIONAL LEVEL

China Total. Parity progression measures of fertility in China as a whole calculated from reconstructed birth histories are given in Feeney, Luther, Meng and Sun (1992). Here we present statistics not only for the~ total population, but for the population residing in cities, towns, counties, and cities and towns combined, termed 'urban.' The residence classification is based on the second of the two State Statistical Bureau definitions, which represents a relatively restrictive definition of city residents.

Progression to fifth and higher order births for China as a whole was nearly constant at just over 80% during the first three years of the series, 1967-69. Fertility decline appears to have set in following 1969 and to have accelerated gradually though 1976, reaching 44% in this year. There is a clear discontinuity in 1976, with a rapid and accelerating decline through this year and a slow and decelerating decline in subsequent years. Progression to fifth and higher order births is nearly level at about 32% from 1981 forward.

Progression from third to fourth birth is approximately level at just under 90% during the first five years of the series, 1967- 71. Fertility decline begins following 1971 and proceeds almost linearly through 1981, reaching 40% in this year. On close examination, however, we see a clear break in the rate of decline following 1978 and a pronounced dip in 1981. Subsequent years see minor fluctuations superimposed on a slow downtrend, reaching 34% in 1990.

Progression from second to third birth increases slightly during the first three years of the series and declines slightly over the following four years,, with a median level of 94%, The onset of decline is not as clear here. The nearly straight line pattern of 1974-78 suggests that the decline be taken as beginning following 1974, with rather clear discontinuities occurring in following years. On the other hand, the values for 1973 through 1984 may be well fit by a straight line. Initially, at least, we shall eschew finer discriminations and focus on the larger picture, which shows progression from second to third birth decreasing from 91 percent in 1973 to 46 percent in 1984, a decline of 45 percent in 11 years for a rate of just over 4 percent per year. This level is nearly unchanged over the next four years, but there is a pronounced decline from 1988 to 1990.

Progression from first to second birth declines very slightly from the early l970s through 1980, reaching 94 percent in the latter year. A irregular but sharp decline follows, bring the level to 66 percent

in 1984, a rate of decline of 7 percentage points per year. Progression to second birth rises sharply between 1985 and 1987 and then falls nearly equally sharply through 1990. It is notable that the value in 1990 is 65 percent, the same as the previous low reached in 1985. :Despite the one-child family policy and its patently clear impact on fertility behavior, Chinese families in 1990 were progressing to second birth at rates which would give a substantial majority of them at least two children.

Cities (Shi). The trend of the various period parity progression ratios is considerably sharper in cities than it is in the country as a whole. Progression to fifth and higher order births is declining rapidly from the beginning of the series in 1967. It falls from 75 percent in 1967 to 24 percent in 1977, a decline of just over five percentage points per year. Subsequent values vary around a median level of about 20 percent without no long term trend up or down.

Progression from third to fourth birth is in decline from the beginning of the series in 1969. A nearly linear through 1977 brings the ratios from 80 to 31 percent in eight years, a rate of just of six percentage points per year. Subsequent values vary around a median level of about 25 percent with no long term trend up or down.

Progression from second to third birth begins to decline following 1970. A nearly linear decline through 1978 brings the ratios from 95 to 52 percent in eight years, a rate of 5.4 percent per year. A slightly decelerating rate of decline during 1976-78 is followed by a sharp decline from 1978 through 1981, bringing the ratio down to 25 percent in the later year. Subsequent values vary around a median level of about 30 percent with no long term trend up or down.

Progression from first to second birth is nearly constant at 96 percent through 1973, after which it begins to decline slowly, reaching 81 percent in 1980. Following 1980 there is an extremely sharp drop, bringing the level to 27 percent in 1985, a decline of 54 percent in five years for a rate of nearly 11 percentage points per year. This is followed by a rise to 38 percent in 1987 and a fall back to 29 percent in 1989 and 1990, similar to the pattern for the county as a whole.

The response of progression from first to second birth to the one-child family policy is very clear. While the decline before 1980 is relatively small, it is very pronounced and raises the question of whether this decline also was due to antinatalist policy or to other causes.

Higher order progressions begin to decline abruptly following 1969 and 1970. The abruptness suggests a response to policy rather than to more slowly changing socioeconomic conditions, but the timing of the decline is somewhat earlier than one would expect. It is notable that all the higher order parity progression ratios reach a level of between 20 and 30 percent by 1981.

Towns *(Zhen).* The general pattern for towns is very similar to that of cities. Higher order progressions decline later in towns than it cities, so that towns show higher levels during the period of decline. By the early 1980s, however, the higher order progressions in towns are at essentially the same level as the higher order progressions in cities. The pattern of decline in progression from first to second birth is nearly identical, but the level reached in towns is some 10 percent higher than the level reached in cities.

These results show the fertility of towns to be much closer to that of cities than to that of counties, an observation not surprising in and of itself, but in sharp conflict with the results of the two-per-thousand fertility survey of 1988 (Feeney and Wang 1993 *passim*), which shows the fertility of towns much closer to the fertility counties than to that of cities. While it is easy to see how different definitions of residence type could lead to discrepancies between the two sources, this particular pattern has thus far defied explanation.

Counties (Xian). Because county residents comprise the large majority of the total population, the county trends are of necessity close to the trends for the total population. It is notable, in particular, that the one-child family policy had a very clear, though also a much more limited impact in counties, with progression to second birth never falling below 80 percent.

PROVINCIAL LEVEL UNITS

Because differences between cities and towns at the national level were modest, cities and towns were grouped and designated ‘urban’ for the generation of province level estimates. County residence may be referred to as ‘rural’ this context.

Because birth planning regulations in cities and towns are broadly similar across China, we begin by analyzing the fertility trends in urban areas of each province. Total fertility rates turned down sharply in urban areas of nearly every province with the initiation of the one-child family program in 1979 and 1980, mainly because of a sharp drop in proportions of women progressing to first birth. In some provinces this decline began earlier, sometimes toward the beginning of the l970s, but it invariably accelerated with the one child family program.

TFR5 for 1990 showed modest variability. Beijing and Shanghai are at one child per woman, the western provinces of Xizang and Xinjiang at just over two children per woman. Dongbei, the Lower Yangzi provinces of Jiangsu and Zhejiang, and Sichuan showed levels just above one child per woman, Yunnan and Qinghai 1.5 children per woman. The remaining provinces show levels of 1.3 or 1.4 children per woman with the sole exception of Guangdong, which at 1.6 children per woman is a clear outlier.

Rural fertility in the various provincial level units is rather more structured. For the Lower Yangzi provinces of Zhejiang and Jiangsu up though Shandong, Hebei, and on through Dongbei, rates are very low, 1.6 children per woman for Zhejiang and Liaoning through 2.2 children per woman in Hebei. The western provinces of Xizang, Xinjiang, and Qinghai form the upper end of the distribution, with levels of three children per woman or more. The remaining provinces form a broad, north-south belt with levels clustered remarkably closely around 2.6 children per woman. The exceptions are Sichuan, which at 1.7 children per woman groups with the low fertility group, Guizhou, high with 3.2 children per woman, and Jiangxi and Guangdong, at 2.8 and 2.9 children per woman, respectively.

For those subpopulations in which progression to second birth and total fertility fell sharply following the one child family program two patterns are observed. For many provinces, as for the national level, a low is reached in 1984 or 1985, followed by a rise to a high in 1987 or 1988, followed by a decline through 1990. The pattern is illustrated in extreme form in rural Liaoning. Other provinces, mostly those with lessor declines in progression to second birth, show no trace of this pattern.

This pattern of rise and fall during the late 1980s is notable because although policy innovations have been reported for 1990 and later years, no specific policy initiatives can be invoked to explain the reversal of the rise of fertility following the *kaixiao-kou* initiative of 1984 and 1985. Yet it is clear from the data that the trend of rising fertility during the mid-l980s was halted decisively in 1987 or 1988, well before the 1990 census.

CONCLUSION

Several conclusions stand out from this brief analysis of provincial level fertility trends in China. Most obvious is the impact of the one-child family program on fertility, specifically on the level of period parity progression ratios for progression from first to second birth. In the provinces of greatest impact, the magnitude and timing of the decline leave no doubt that it was a direct result of government policy, though this is not inconsistent with an important restraining role for broader socioeconomic trends.

The impact of the later-longer-fewer policy is less clear. Certainly fertility in the form of period parity progression ratios for progression to third and higher order births was declining nearly everywhere during the later-longer-fewer period, and in many provinces the sharp discontinuity in the initiation of the decline and/or the speed of the decline strongly suggest the operation of government policy. On the other hand, there is clear evidence of fertility decline among higher birth orders before the later-longer-fewer period. This might indicate an impact of earlier antinatalist policies, a question we have not addressed, but it might equally indicate the beginning of fertility decline cause by broad

socioeconomic forces. In the latter case, some portion of the decline during the later-longer-fewer period should be attributed to non-policy factors.

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