Secular Increase in Natural Fertility in China

From 1940s to 1980s

by

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Abstract

The purpose of the study is to explore the trend in natural fertility and its components in China over half a century from the 1940s to the 1980s. One of the most important components of fertility, natural fertility and its secular rising trend in modern China, have never been systematically addressed, thus providing the scope for the present study. By fully using recent information on China's population and social development, this thesis documents and analyses the trend of natural fertility in China since the 1940s.

The literature review of natural fertility and its proximate and background determinants comes as the first part after the introduction. An important methodological part of the study comes next. The main data sources are introduced, problems of applying Coale and Trussell's model are discussed and an adjusted version of the model is proposed. Finally, technical problems are also addressed, including such matters as modifying data sources to meet required measurements, assessing the limitations of estimated results, suggesting ways to avoid data truncation and so on.

The major part of the thesis consists in the next four chapters, which involve a thorough demographic analysis of natural fertility levels and trends for the nation as a whole, and of different aspects such as urban-rural differentials, regional variations and educational divergences. The proximate determinants: fecundability and birth intervals, breastfeeding, primary sterility, and age at first marriage are also analyzed at length.

Finally, the importance of socio-economic conditions on natural fertility change is

analysed. The quantitative relationship between natural fertility and these socio-economic conditions was statistically tested and an analytical model was built, which proves to be well able to simulate the identified trends in natural fertility.

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Chapter 1 Introduction

I.1 Underlying reasons for proposing this study

Populations in which no deliberate attempt is made to limit the number of births, such as the now-famous Hutterites, are said to experience 'natural fertility'. This very important and widely used concept was first identified and named by Henry (1961:81-91). Such fertility is essentially a biological phenomenon, and determined by a few factors which have come to be called the proximate determinants or the intermediate variables of fertility. These include fecundability, or the monthly probability of conception, which is itself determined by the length of the fertile period and the frequency and timing of intercourse in relation to ovulation; the nonsusceptible period of pregnancy and postpartum period until both ovulation and sexual relations resume; and the rate of intrauterine mortality. In addition, the probability of primary sterility, the age at menarche, at marriage or the start of sexual union, and secondary sterility, taken together, are the determinants of natural fertility.

However, the level of natural fertility varies between populations mainly according to social customs such as varying average ages at first marriage, differing breastfeeding patterns and coitus frequency, while these factors are also influenced by education, nutrition, health, and so on. This leads to problems in the ability of our demographic techniques to detect this mechanism, and more fundamentally in the availability of proper data, since there are many fewer studies on underlying fertility than on other topics such as general fertility or mortality. Furthermore, much of Henry's work and later research has concentrated on age patterns of fertility and on the proximate determinants, such as birth interval, breastfeeding and age at marriage.

The purpose of this thesis is to explore the trend in natural fertility and its components in China over half a century from the 1940s to the 1980s, a period which interestingly also encompasses the onset of the fertility and mortality transitions. The recent history of demographic changes in China is intensely interesting, firstly because China contains the world's largest population, and secondly because of the unique circumstances under which mortality and fertility change have occurred. While scholars interested in China's demographic past have been concerned with the determinants of levels and trends of fertility, most of their attention has been directed at the family planning programme, the level of mortality, the female status and nuptiality, which are thought to influence the fertility decline. Few of them have mentioned an apparent slight increase in marital fertility, and shortening in birth intervals at low birth orders. No one has ever talked in detail about natural fertility, i.e. differences in trends in the underlying ability to produce. The absence of research on past levels of natural fertility in China is probably in part due to the lack of appropriate data, since most of what we know about fertility change in China over the past four decades comes from the One-Per-Thousand Fertility Survey conducted in 1982 (the 1/1000 Fertility Survey).

One intriguing feature of the results from the survey was that, after controlling for age of first marriage, marital fertility rates in marriage duration 13 to 24 months were higher in China in the 1960s than in the 1950s, and higher again in the 1970s than in the

1960s.[1] The increase from decade to decade in marital fertility rates at early durations of marriage suggests that a substantial rise in the natural fertility of married cohorts occurred in the period 1950-1981. Other evidence, cited later, indicates that the mean length of interval between marriage and first birth was getting shorter. Similar trends are found in other low birth order intervals before the 1970s when there was an absence of effective contraception or abortion early in marriage. Again, similar evidence was found that the level of sterility was higher in older age cohorts among women over 40 years old. All of this evidence suggest a conjecture that natural fertility in China might have risen over time, which gave the original motive to pursue this question.

I.2 Data from demographic surveys

The demographic information employed in this study comes mainly from three sample surveys (introduced in Chapter 3 in detail): the 1/1000 Fertility Survey in 1982, the In-Depth Fertility Sample Survey in 1985, and the One-Percent Population Sample Survey in 1987. The 1/1000 Fertility Survey in 1982 covers 28 provinces in China (except Tibet), in which 311,000 women 15-67 years of age were interviewed and provided detailed fertility histories. The survey results have permitted the reconstruction of Chinese demographic history since the early 1940s, such as measures of fertility and nuptiality, as well as information to estimate fecundability, birth intervals, and primary sterility. The In-Depth Fertility Survey provides much important extra information, such as unique information on marriage patterns and breastfeeding by different social strata, supplementary information on birth intervals and so on. The One-Percent Population Sample Survey is used here to provide information on the mid-1980s, because the 1/1000

[1] China State Family Planning Commission 1987: ***1986 Family Planning Statistical Yearbook***, Beijing

Fertility Survey only reached 1982. Thus the demographic data, such as age specific marital fertility in 1985, are vital information to estimate natural fertility for 1980s.

I.3 Summary of contributions and findings from the study

I.3.1 Methodological development

The most widely used model of human natural fertility is that developed by Coale and Trussell. As defined by them(1971, 1974, 1978), the model can be regarded as having two conveniently interpretable parameters. M indicates the underlying level of fertility and m indicates the deviation of the rate from the standard pattern and hence the degree of fertility control. In the model, the control schedule, v, is defined as zero for age group 20-24, in other words, the fertility of age group 20-24 is assumed by the model to be natural. However, in some cases, such as in the 1970s and 1980s in China, in some other developing societies after World War Two, and many developed societies in this century or even earlier, the existence of birth control among young age groups including age group 20-24 seems likely. This raises a fundamental issue with regard to the model's assumption that marital fertility at age 20-24 is a natural pattern when the model is applied to detect changes in natural fertility in China.

In this study, an adjusted version of the model is developed, which tries to overcome the problem. For purpose of comparison, both natural fertility levels (M) estimated from the original and adjusted version respectively, are presented. The result positively suggests that the adjusted version is a more sensitive and better way to interpret changes in natural fertility in China. The statistical approach, again, presents a significant correlation coefficient between estimated mean fecundability level and M from the adjusted version, but a much less significant coefficient against M from the original version. By perceiving the limitation of the original version and providing a sensible way to tackle the problem, the methodological development here, therefore, not only benefits this Chinese case, but also potentially, contributes to other studies applying Coale and Trussell's model and facing similar problems.

I.4.2 Demographic findings

A comprehensive study of the reproductive histories of couples married between the 1940s and the 1980s in the three surveys strongly suggests that natural fertility increased significantly over time in China as a whole, though the results for the 1940s are estimated from an indirect approach and thus less robust than those from later periods. The results of our efforts to discover which components of natural fertility were responsible for the increase, although not conclusive, are clearest with respect to an increase in fecundability, and probably to a decrease in length of breastfeeding and birth intervals, and in primary sterility; less clear was evidence concerning a rise in age at first marriage. The attempt to discover which background determinants of the natural fertility were accountable for the increase, was most successful with respect to improvement in food consumption, education achieved by young mothers, and medical service. Changes in other socio-economic aspects proved not to be statistically significant.

In terms of urban and rural differentials, regional and educational variations, the conclusions are consistent that natural fertility increased in both urban and rural areas, in almost all sub-regions (including provinces, autonomous regions, municipality cities) and at all education levels of the population. One exception is the university educated population: the possibility remains that they might undertake more intensive spacing behaviour during the early years of first marriage, thus even the adjusted model is unable to discover their real natural fertility level. A further plausible finding is that those in better socio-economic positions had comparatively higher levels of natural fertility, such as those living in urban areas, or in the east coast regions, and those who were educated comparatively longer. These groups also tended to have higher levels of fecundability, undertake shorter durations of breastfeeding, have shorter birth intervals and later ages of first marriage. However, an unexpected finding is that these privileged groups had larger proportions of childless women, and possible reasons for this are discussed.

The conventional view is that in the West only pre-transition fertility satisfies the definition of natural fertility. As a consequence, it is not surprising that analysis of high fertility in developing societies is often conducted in the natural fertility framework. Thus a study of natural fertility in China, which has the largest population in the world, and particularly its interaction with the demographic transition and industrialization can contribute not only to our knowledge of the demographic past in China, but also to our understanding of demographic processes occurring in other parts of the world today, especially in Third World countries.

I.4 Organisation of the thesis

Natural fertility is one of the most important components of fertility. However, the secular changes in natural fertility in modern China has never been systematically addressed, thus providing the scope for the present study. By fully using recent information on China's population and social development, this thesis documents and analyses approximately five decades of trends of natural fertility in China after the 1940s.

The literature review of the natural fertility and its proximate and background determinants comes as a first part after this introduction. Three methods, Coale and Trussell's model and Page's model for natural fertility, and Bongaarts' model for fecundability are presented and discussed. The determinants of natural fertility such as: fecundity and fecundability, marriage pattern, breastfeeding, nutritional status, income level and education are also presented and examined. Finally, a review of studies on natural fertility and its determinants is provided.

A basic methodological part of the study comes next and is then employed in the later sections. In Chapter 3, the three fertility sample surveys, as main data sources, are introduced in great detail. Then problems of applying Coale and Trussell's model are discussed and an adjusted version of the model is illustrated and proposed. Finally, the technical problems are also addressed. These include matters such as modifying data sources to meet required specifications, revealing the limitations of estimated results, suggesting ways to avoid time truncation and so on.

The major substantive part of the thesis is comprised by Chapters 4 to 7, which involve a thorough demographic analysis of levels and trends of natural fertility for the nation as a whole, and for its different dimensions such as urban-rural differentials, regional variations and educational divergences. This is accompanied by a brief introduction of socio-economic background and presentation of general fertility and marital fertility as preliminary contexts for each dimension. The proximate determinants: fecundability and birth intervals, breastfeeding, primary sterility, and age at first marriage are also consistently analysed in each dimension.

Finally, we come to the effect of socio-economic conditions on changes in natural fertility. On the one hand, this involves a search for possible explanations of rising natural fertility by examining the dynamic changes of some socio-economic aspects. On the other hand, the quantitative relationship between the natural fertility and these socio-economic conditions has been statistically tested. In addition, a robust mathematical model has been built to simulate dynamic changes of the natural fertility over time.

Chapter 2 Methodological and Conceptual Review

I.1 Fecundity and natural fertility

Fecundity is defined as the physiological capability of a man, woman or couple to produce a live birth. It is contrasted with fertility which is the actual reproductive performance of an individual, a group or a society.

Although widely invoked as a factor in determining fertility differentials, fecundity is still imperfectly understood in quantitative terms. Analysis of the fertility of populations not deliberately using birth control shows large variations in the level of fertility, although such populations do exhibit common age-specific patterns of childbearing. In terms of population as opposed to individuals, it is probably possible to assess fecundity only with reference to various behavioural factors, the proximate determinants, which are closely linked to reproductive physiology. The various components of fecundity, such as fecundability, foetal mortality, and breastfeeding, can also be investigated.

Natural fertility is defined as marital fertility, whereby couples do not alter their reproductive behaviour according to the number of children already born. In practice, this can be taken to mean the fertility of populations whose members do not use contraception or induced abortion. The concept of natural fertility has subsequently been widely influential both in demographic analysis and in the development of mathematical models of the process of reproduction. The term 'natural' is an unfortunate adjective since it seems to imply that a unique level of fertility is natural to humanity (and possibly universal in the past). In reality natural fertility populations have wide variations in the level of fertility. For example, Leridon (1977:107-109) found total fertility rate variations between 3.7 and 9.5 in a group of 23 populations with natural fertility. Even allowing for the impact on these values of different marriage patterns, some populations had fertility close to double that of others. The differences arose from differences in the various proximate determinants, above all from variations in the post-partum non-susceptible period owing to different patterns of breastfeeding. This, along with such factors as sexual taboos, physiological sterility and foetal mortality, produces the great variation in levels. Natural fertility is not a given level, rather a reproductive strategy: births may be spaced at long or short intervals, but couples do not make extra efforts to reduce fertility after reaching any particular family size or parity. The term 'parity-independent' fertility is thus sometimes employed.

Although the overall level of fertility is a poor indicator of fertility regime, a number of other measures show consistency between natural fertility populations. That is, populations exhibiting natural fertility have different levels of age specific marital fertility rates, but show a common pattern when the rates are indexed to the rate for women aged 20-24.

I.2 Coale and Trussell's model

This model was originally proposed by Coale (1971:193-214) to describe and compare fertility schedules. In this study I shall employ it to investigate natural fertility.

The main reasons for choosing this model as a basic measurement in this study are not only that it gives both underlying level of natural fertility and birth control, but also the lack of a better alternative measure when only limited historical data are available. It is hoped that adoption in the case of investigating Chinese natural fertility will be insightful. In any event, given the limited availability of historical data and the lack of a superior alternative method for the investigation, the model is virtually the only way that historical demographers can measure both natural fertility and the extent of birth control in the past.

Coale suggested that a standard pattern of natural fertility could be modified by incorporating a vector indicating the effect that birth control usually had in altering the age pattern. He also noted that the deviations from the natural pattern were similar in all the populations he had investigated. Three years later, Coale and Trussell (1974:185-258) produced a more detailed specification of the model of marital fertility. They defined it in the following equation:

$$r(a) = n(a) \cdot M \cdot exp[m \cdot v(a)]$$

where a stands for age, r(a) is the observed marital fertility schedule, n(a) is the empirically derived standard natural fertility, and m is the average magnitude of the divergence for the observed schedule. Since n(a) approximates the age pattern of fertility for populations without fertility control, the vector expressing the pattern of divergence from it, v(a), can be taken as representing a characteristic way in which control increases with age in contracepting populations; m can then be taken as the average intensity of birth control in a given population. The values of n(a) and v(a) are shown in Table 2.1.

Table 2.1 Coale and Trussell's model: The values of n(a) and v(a)

Parameters	20-24	25-29	30-34	35-39	40-44
n(a)	0.460	0.431	0.395	0.322	0.167
v(a)	0.000	-0.279	-0.667	-1.042	-1.414

Technically, the parameters M and m are derived from this equation by a method suggested by Coale and Trussell (1978:203-205). By taking the natural logarithms of both sides of the equation, the result becomes:

$$Ln(r(a)/n(a)) = Ln M + m \cdot v(a)$$

By letting $Ln(r(a)/n(a)) = y$, $Ln M = c$, and $v(a) = x$, LnM and m can be estimated by ordinary least squares in which all points have equal weight. This type of model falls in the class of generalized linear models described by Nelder and Wedderburn (1972:370-384), representing the special case where: (1) the error or stochastic structure is Poisson, (2) the link between the expectation of the dependent variable and the linear predictor is the logarithmic function, and (3) the linear predictor contains a known part or offset. An important implication of this fact is that maximum likelihood estimates of the parameters of the model are available, together with estimated standard errors and a likelihood ratio goodness of fit *Chi*-square statistic. Furthermore, all calculations may be performed by using statistical packages such as GLIM, SPSS, or SAS.

Though the technique to solve the equation has been developed, theoretical problems remain. Although Coale did not define M exactly as the population's underlying level of natural fertility, he and Trussell (1974:188) gave M practical meaning in this way: "The factor M is a scale factor expressing the ratio r(a)/n(a) at some arbitrarily chosen age.

... we are concerned only with the age pattern of fertility schedules." However, as the model was defined in the above equation, the parameters were set in such a way that if there is no birth control, m is zero and the right-hand term *exp*(m·v(a)) becomes one. This means that the population has natural fertility at a level defined by the M parameter. In other words, if a fertility schedule is interpreted by M alone rather than both M and m, then it can be taken as a natural fertility schedule. Obviously, the model has an underlying assumption: that the fertility experienced by age group 20-24 is a natural level(v(20-24) = 0). Indeed, M, the scale factor expressing the ratio r(a)/n(a) at age 20-24, is widely interpreted as indicating the underlying level of marital fertility without any effect of birth control.

Until quite recently, most attempts to identify and to parameterize fertility patterns were based primarily on finding the mathematical function that best fits the observed range of overall age-specific fertility. This approach has produced some extremely useful functions: polynomials approximating cross-sectional fertility schedules underlie many of the methods that are frequently used for estimating fertility and mortality levels from defective or indirect data. Despite their great utility, however, models based simply on finding the function that best fits the data are not very satisfying, unless, the function's parameters can be identified with the biological or social processes that govern fertility. There have been several conscious efforts to tease out patterns that can be explicitly linked with underlying processes or components. In some instances this effort has concentrated first on identifying a well-fitting function, and only then on attempting to find an interpretation for its parameters.

Since in this model voluntary control has been defined in the narrower sense of parity dependent behaviour, voluntary efforts to extend birth intervals which are not dependent on the number of children already born can complicate interpretation of both M and m, i.e. the level of natural fertility and extent of birth control. This is because the model assumes that control can be equated with stopping behaviour. While it is certain that stopping behaviour must become widespread in any population if very low fertility is to be attained, Wilson, Oeppen and Pardoe (1988:4-20) suggest it is wrong to preclude the existence of conscious spacing behaviour purely because our statistical techniques are unable to detect it. So they suggest a more profitable way to interpret the model's parameters as follows: m indicates the extent of stopping behaviour, which could be brought about either by deliberate attempts to limit the number of births or indirectly through the effect of non-volitional factors. Similarly, M indicates the extent of birth spacing, achieved either through deliberate interventions such as contraception or through less obviously volitional practices such as breastfeeding. It is certain that this interpretation with its greater caution marks an improvement on the original one which is quite crude. Obviously, young cohorts like those aged 20-24 practise contraception more for spacing purposes than for stopping, while among old cohorts stopping purposes are more likely. However, it appears that at least two questions remain.

First, when stopping is mixed with spacing behaviour in young age groups such as 20-24, it is hardly valid to conclude that M exactly indicates the extent of birth spacing. For example, in the situation of the 1970s and 1980s in China when the mean age at first marriage was about 21, and family planning campaigns, the 'Later-Longer-Less'[1] and the 'One Child', were launched, stopping behaviour occurred among young cohorts including age group 20-24.

[1] Later: to have children later; Longer: to space birth intervals; Less: to have fewer children.

Second, when the M value represents only spacing behaviour, the model can only be used for the purpose of estimating birth control rather than for the underlying fertility level. Anyway, this interpretation seems unlikely to be a proper way to explain changes both in natural fertility and contraceptive practice for extreme cases, such as China in the 1980s.

I.3 Page's model

Another similar model to describe marital fertility and birth control was proposed by Page (1977:85-106), which follows on the earlier work of Henry, Coale, and Coale and Trussell. The common theme of these models is the assumption that lacking deliberate birth control marital fertility follows a typical age-pattern of natural fertility. In her study of levels and trends of fertility in Sweden, Page considered a general model of marital fertility and the duration of first marriage, where the marital fertility rate $f(a,d,t)$ at age a and duration of first marriage d for a given period t was given by:

$$f(a,d,t) = T(t) \cdot A(a,t) \cdot D(d,t) \qquad (1)$$

where T(t) is a period effect on the overall level of fertility, A(a,t) is a time-varying age-pattern of fertility and D(d,t) is a time-varying duration-pattern of fertility. To estimate these functions she used a robust procedure based on trimmed means developed by Tukey (1977:46-47).

The fit of the model to the long series of Swedish data was excellent. Moreover, she found that the age pattern A(a,t) was fairly constant over time and resembled the average of Henry's schedules of natural fertility. Furthermore, the duration pattern D(d,t) for each period was a monotonic function of duration which, except for some of the earlier cross-sections, could be approximated reasonably well by an exponential function. For a fixed period, these simplifications led to the model:

$$f(a,d) = \Theta \cdot n(a) \cdot exp\{\beta \cdot d\} \qquad (2)$$

where $f(a,d)$ is the marital fertility rate at age a and duration of first marriage d, Θ is a parameter representing the level of natural fertility, n(a) is the age pattern of natural fertility and β is a parameter representing the extent to which marital fertility at a given period departs from natural fertility as a function of increasing duration of first marriage.

If we divide both sides of (2) by n(a) and take logarithms, we obtain an alternative formulation of the model as:

$$Ln[f(a,d)/n(a)] = \alpha + \beta \cdot d \qquad (3)$$

where we have written α for $Ln(\Theta)$. The logarithm of the ratio of marital fertility at a given age and duration to natural fertility at that age is, therefore, a simple linear function of time elapsed since first marriage.

Model(2) follows the tradition of Coale and Trussell's model. The fundamental difference between Page's and Coale and Trussell's model hinges on the assumptions concerning departure from natural fertility; whereas Coale and Trussell assumed that fertility control depends on age, Page assumed that it depends on duration of marriage.

Age and duration are, of course, closely interrelated; and one would expect the two models to be very similar.

The age-pattern of fertility implied by Page's model is in the form

$$f(a) = n(a) \cdot exp\{\alpha + \beta \cdot d_0(a)\} \qquad (4)$$

where $d_0(a)$ is an age-dependent value of duration such that multiplication by ß and exponentiation gives the average degree of control at age a. This value will, in general, depend on the unknown parameter ß.

A similar analysis shows that the duration-pattern of fertility implied by Page's model is of the form

$$f(d) = \bar{n}(d) \cdot exp\{\alpha + \beta \cdot d\} \qquad (5)$$

where $\bar{n}(d)$ is the average natural fertility of women at duration d. Note that this function does not depend on unknown parameters: it is fully determined by the distribution of women by age and duration.

Later, Rodriguez and Cleland (1988:241-257) suggested a method to derive the parameters a and d, which fits a simplified version of Page's model, as given in Equation (2), to empirical data consisting of counts of births and exposure time for a fixed period. They assumed that the birth counts P(a,d) were independent *Poisson* random variables with mean (and variance) equal to the product of exposure time T(a,d) and a theoretical marital fertility rate f(a,d):

$$E[P(a,d)] = T(a,d) \cdot f(a,d) \qquad (6)$$

From Equation (6) taking the logarithm of the expected number of births at a given age and duration they obtained:

$$Ln E[P(a,d)] = Ln T(a,d) + Ln\{n(a)\} + \alpha + \beta \cdot d$$

from which the parameters α and β, the level of natural fertility and the degree of control of marital fertility can be estimated.

To my knowledge, Page's model has not been extensively applied, presumably because it requires more information than Coale and Trussell's model; namely marital fertility rates classified by both age and duration of first marriage, which are not available from traditional registration systems, nor from the data archive in this study. Secondly, Chinese fertility followed more or less a parity-dependent rather than a duration-dependent pattern after the birth control campaigns. In any event, Page's model is not applicable to this study mainly due to lack of the data such as marital fertility rates by age and duration of first marriage.

I.4 Fecundability, Bongaarts' model and its modification

The concept of fecundability was introduced by Gini (1924:889-892) in 1924, and is defined as the probability of a married woman conceiving during a month without any deliberate attempt to limit procreation. Fecundability varies both among women of a given age and for a particular woman, by age. The variation is related to four variables: separation, which affects coital frequency; age, which represents biological changes and, perhaps decline in coital frequency, lactation practices and the duration of amenorrhoea. Fecundability and marital fertility are linked in the following way: frequency of unprotected coitus - fecundability - exposure interval - birth interval - marital fertility rate. In the past, at least five different methods for estimating the mean value of fecundability in a population have been explored:

1, Calculating fecundability from coital frequency and duration of the viability of sperm and ovum.[2]

2, Observing the proportion of women conceiving during a one-month period of exposure to risk of conception.[3]

3, Fitting models to the distribution of waiting times to conception.[4]

4, Fitting models to birth interval distributions.[5]

5, Fitting models to the distribution of parities attained within a certain period of time by a group of women.[6]

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[2]D.V. Glass and E. Grebenik 1954: ***The Trend and Pattern of Fertility in Great Britain: A Report on the Family Census of 1946, Papers of Royal Commission on Population,*** Vol. 6, London, H.M.Stationery Office.

[3]J.C. Barrett 1969: A Monte Carlo Simulation of Human Reproduction, ***Genus 25,*** pp.1-22. And 1971: Fecundability and Coitus Frequency, ***Population Studies 23***, pp.309-313.

[4]L. Henry 1964: Mortalite Intra-Uterine et Fécondabilité, ***Population 19***, pp.899-940. M.C. Sheps and J.A. Menken 1973: ***Mathematical Models of Conception and Birth***, Chicago, University of Chicago Press, pp.82-83.

[5]S. D'Souza 1973: Interlive Birth Intervals of Non-Contraceptive Populations: A Data Analytic Study, ***Social Action 23***, pp.404-425.

[6]W. Brass 1958: The Distribution of Births in Human Population, ***Population Studies 12***, pp.51-72.

In recent years straightforward and easily applicable estimation procedures have been developed. The method used in the present study is based on the work of Bongaarts (1975:645-660). He proposed two methods for estimating of fecundability and tested them on data drawn from five historical family reconstitution studies. He showed that the two methods produced almost identical results in the five cases he analysed. One method involved the calculation of a simple statistic, namely the proportion of first births which occurred during the ninth, tenth and eleventh completed months after marriage, excluding those women who conceived their first child before marriage. By assuming a fixed coefficient of variation of fecundability, this proportion can be converted into a value of mean fecundability. Bongaarts assumed a *Beta*-distribution in total fecundability, and defined total fecundability as recognizable fecundability divided by 0.65, since he assumed a risk of 0.35 of spontaneous abortion within the first month.

Later, Knodel and Wilson (1981:53-84) found that at most values this was acceptable, but at high values of mean fecundability, to define the variation of fecundability in terms of total fecundability had drawbacks. They suggested that this was because at high values of recognizable fecundability (above 0.33) total fecundability exceeded 0.5. Given this value and a plausible figure for the coefficient of variation of fecundability, the two parameters of the *Beta*-distribution, a and b, both go below unity. So they found that this produced a shallow U-shaped distribution with high proportions of women with either very high or very low fecundability. They suggested that the effect of this was to make mean waiting times to conception stop decrease with higher fecundability and increase instead. To circumvent this undesired effect, they defined the variance of fecundability in terms of recognizable fecundability. With this modification, new expected proportions of first births in completed months nine, ten and eleven were generated and used to estimate fecundability. They are presented in Table 2.2 and applied in later chapters.

Table 2.2 Predicted value for the proportion of first births occurring in completed months nine to eleven after marriage by mean fecundability (FB) given by the adjusted model

FB	Proportion	FB	Proportion
0.03	0.0553	0.20	0.3700
0.04	0.0799	0.21	0.3834
0.05	0.1035	0.22	0.3964
0.06	0.1262	0.23	0.4089
0.07	0.1480	0.24	0.4210
0.08	0.1690	0.25	0.4328
0.09	0.1892	0.26	0.4441
0.10	0.2087	0.27	0.4551
0.11	0.2275	0.28	0.4656
0.12	0.2455	0.29	0.4759
0.13	0.2630	0.30	0.4857
0.14	0.2798	0.31	0.4952
0.15	0.2961	0.32	0.5044
0.16	0.3119	0.33	0.5132
0.17	0.3271	0.34	0.5218
0.18	0.3419	0.35	0.5300
0.19	0.3562		

In interpreting the results of this method, it is important to realize that the values of mean fecundability obtained are actually estimates of fecundability immediately following marriage. If fecundability declines with the duration of marriage, as is often assumed, then the level of fecundability in the population at large could be substantially below that estimated here. Moreover, fecundability as assessed by this method is taken to be recognizable fecundability, i.e. the probability of conception occurring and the foetus surviving beyond the cycle of conception.

I.5 The proximate determinants and background determinants

The analysis of fertility in terms of its proximate determinants, or intermediate fertility variables, as they are sometimes called, because they logically come between fertility and its "ultimate determinants", as suggested by Freedman (1987:773-795), is one of the most fruitful developments of recent demographic analysis. As Freedman suggested, the proximate variables stood between fertility and all other preceding variables. They immediately determined fertility, and all other variables acted through combinations of them. Quantifying the effects of the proximate determinants on fertility is one of the most important achievements in fertility research.[7] The great improvement over earlier conceptual frameworks is that this one allows the demographers to move closer to the behavioural realities of the population being studied. As their name indicates, proximate determinants have a direct effect on fertility; background factors, such as cultural or socio-economic variables, can only influence fertility by altering one or more of the proximate determinants. Over the last four decades demographers have increasingly given attention to the interactions between biological factors such as the periods of anovulation, post-partum infecundability, fecundability, lactation, and natural sterility, the important proximate determinants of natural fertility.[8]

The process of human reproduction is far from simple and early mathematical or conceptual models of it reflected this complexity. Apart from fecundability, another major

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[7] Cf. See Wilson C. 1986: The Proximate Determinants of Marital Fertility in England 1600-1799, in Bonfield, et al. (eds.) ***The World We Have Gained***, Blackwell, Oxford, pp.203-230.

[8] See J. Bongaarts 1976: Intermediate Fertility Variables and Marital Fertility Rates, ***Population Studies 30***, pp.227-241.

component of natural fertility amenable to analysis with the above parity data is the non-susceptible period which follows a birth and during which a woman is not at risk of conceiving. Although there is still some debate on the role of nutritional factors in determining the length of this period, it is now widely accepted that differences in breast-feeding practices have a major role to play in any explanation of differences. The mechanism linking the two is believed to be a neurally mediated hormonal reflex initiated by the suckling stimulus, whereby increases in the pituitary hormone prolactin act upon either the hypothalamus or the ovaries to prevent ovulation. One simple way to estimate the mean duration of the non-susceptible period from reproduction histories is to compare the interval between marriage and the birth of a first child (excluding intervals involving pre-marital conceptions) with the subsequent interval between first and second birth, and with intervals among higher parities. The difference should reflect the extent to which the birth interval is extended by non-susceptibility. The effect of lactation on fertility shows that the period of survival of one child is positively associated with the succeeding birth or pregnancy interval in a non-contracepting population. A number of studies have analysed the association between lactation and marital fertility or between lactation and the average birth interval. For example, Knodel and van de Walle observed a negative correlation ranging from -0.38 to -0.64 between indices of breastfeeding during 1904-1911 and indices of marital fertility during the 1880s in the German states of Bavaria and Hessen.[9]

A further factor is sterility. In any population of reasonable size at least a small proportion of couples are unable to bear any children because of physiological impairment to either or both spouses. Although the age pattern of sterility has proved to be very hard

[9]J. Knodel and van de Walle 1967: Breastfeeding, fertility and infant mortality, An analysis of some early German Data, ***Population Studies 21***, pp.109-131.

to estimate with any degree of precision, some estimates have been made to show this pattern, such as those of by Trussell and Wilson (1985:269-286). Demographers distinguish between primary sterility, which is attributable to ageing and its effects on the male and female reproductive systems, and secondary sterility, which occurs as a consequence of a birth or, more generally, of a pregnancy. Primary sterility is straightforward to assess and is the principal component of the overall proportion of couples unable to have children in the populations under consideration here.

Behind all these proximate determinants mentioned above are the background or ultimate determinants of fertility. These background variables include: demographic characteristics of the couple, their socio-economic characteristics, those of the institutions and the community, religion, and nation and cultural factors related to any part of the reproductive system. While the discussion of the determinants of fertility is sometimes limited to the direct link between the proximate determinants and fertility, increasing attention to the system of intervening links between socio-economic variables and fertility makes it essential to consider these, too, in the evaluation of changes in natural fertility. Such factors as food supply, nutritional status, income, education achieved, occupation, type of place to live, social communication, medical services, and so on are very important background determinants of fertility. In particular, the process of modernization, including economic, technical, cultural factors, and environmental, shifts the determinants of fertility both in developed and developing societies. Boserup (1986:239-255) suggested that these shifts had a great impact on fertility regimes, although she only mentioned that most occupational shifts were from occupations with lower to those with higher income, and that income increase unaccompanied by occupational changes was unlikely to lead to reduced fertility. She found that when export prices fluctuated upwards in some African countries, a large share of the increase in income had been used to raise consumption of imported manufactures and food. Nevertheless, it seems obvious that occupation shifts, increased income, better education, improved medical service, and other effects of modernization could produce better consumption and health, and thus have positive effects on natural fertility.

Marriage is the main institution used by society to regulate and sanction the cohabitation of couples and their consequent fertility performance and achievement. As Harris (1969:37-61) suggested, marriage usually had the aim of ensuring legitimacy to the offspring. In most societies, fertility is realized within marriage, which is an important social mechanism for regulating the production of offspring and the level of natural fertility. In particular, the time and frequency of marriage are very important in either delaying or speeding-up the beginning of reproduction. Early and almost universal marriage is characteristic of many societies in natural fertility conditions. The marriage age pattern is also an important determinant of natural fertility. We know that natural fertility in a woman's reproductive history is highest when she is 20-24 years old. If age at first marriage changes, marital fertility changes correspondingly. This might raise a crucial question as to whether changes in natural fertility level over time were due to mean age at first marriage changing from an age of lower reproductive potential to one of peak potential, or the reverse. Thus estimates of natural fertility, M, from data without controlling for age at first marriage could be inflated or deflated.

In many societies, premarital sexual behaviour is frowned upon in the same way as illegitimacy. This was true to such an extent in traditional China that premarital childbirth almost did not exist, especially in rural areas. It appears, therefore, that premarital sexual behaviour and childbirth may have considerably less significant implication on natural fertility in China. The more remarkable aspect of the sexual behaviour concerns the spacing of births, particularly the interval between the time when ability to conceive returns and the time when conception takes place.[10] Obviously, coital frequency determines the length of this conception delay.

The effect of nutrition on natural fertility in human populations has been a subject of considerable discussion. It is well known that nutritional status is likely to affect biological mechanisms directly related to fertility performance, such as age at menarche, reproductive life span, postpartum amenorrhea, fecundability, coital frequency, and pregnancy outcome. Historical data on nutrition, growth, age specific fertility and the ages of reproductive events showed that slow growth to maturity of women and men due to undernutrition, hard work and disease were correlated with a reproductive span which is shorter and less efficient than that of a well-nourished population.[11] Frisch suggested that physical differences in the rate of growth resulted not only in a displacement of the age specific fertility curve in time, but in a difference in the ultimate level: the faster the growth of the females, the earlier and more efficient the productive ability. The well-nourished human female, particularly on diets with a high percentage of calories from fat may have higher oestrogen level, which would result in a higher reproductive efficiency than is found in females with less adiposity.[12] Another analysis which was made of the

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[10]Bourgeois-Pichat, Jean. 1967: Social and biological determinants of human fertility in non-industrial societies, ***Proceedings of the American Philosophical Society 3***, pp.160-163.

[11]R.E. Frisch 1978: Population, food intake and fertility: Historical evidence for a direct effect of nutrition on reproductive ability, ***Science 199***, pp.22-30.

[12]R.E. Frisch, D.M. Hegsted, and K. Yoshinaga 1975: Body weight and food intake at early oestrus of rats on a high-fat diet, ***Proc. Natl. Acad. Sci USA 72***, pp.4172-4176. R.E. Frisch 1977: Food intake, fatness and reproductive ability, in R. Vigersky (ed.) ***Anorexia Nervosa***, New York, Raven Publishing Co., pp.109-133.

effect of nutritional status on fertility among 400 rural Guatemalan women, by Bongaarts and Delgado (1979:120-128), suggested that nutrition was positively related to fertility, and demonstrated a negative relationship between the duration of postpartum amenorrhea and nutritional status.

If we assume that variation of the human biological capacity for reproduction is 'normal', then the natural fertility level depends mainly on the operation and impact of sexual behaviour, and the socio-cultural and economic conditions which govern it directly or indirectly within marriage in the society. The primary socio-cultural influences on sexual behaviour are those concerned with the regulation and custom of premarital unions, the frequency of sexual intercourse within marriage and the interrelated events of breastfeeding, lactation taboo or abstinence from sexual unions after childbirth, and the reappearance of ovulation in the female. In the context of prolonging the period of temporary infecundity and maintaining long birth intervals, breastfeeding and sexual abstinence after confinement are the principal bio-social factors which operate. Both are governed by certain social customs and are also affected by contemporary change in socio-economic conditions.

The combined duration of breastfeeding and abstinence combined varies from society to society. In Africa, it was not uncommon to hear old people asserting that lactation and abstinence periods had traditionally varied as much as two or three years. Indeed, Talbot (1926) reported a varying period of one to three years as the traditional period of post-natal abstinence for tribes in southern Nigeria. However, evidence is beginning to emerge that modernization is now an important eroding factor since with a rise in education, occupation, income, and urbanization, less emphasis is placed on the need for long periods of lactation and abstinence.[13]

Another social controls indirectly affecting the level of natural fertility derives from the social structure and organization of societies. This could create and reinforce cultural conditions and motivations which favour high fertility or encourage tendencies towards the control and reduction of fertility. Fundamentally, family and kinship groups constitute the basic unit of social organization and social control within which procreation is sanctioned and regulated according to the accepted social norms and values. Although the institution of the joint family is considered to be one of the main cultural forces favouring high fertility, this has not been adequately substantiated, since some data indicated that women in joint families had lower fertility levels than those in nuclear families. Nag (1965:160-163) suggested that generational taboo, particularly in joint families where women limited the frequency of coitus after their sons were married, was also possibly relevant. Thus the tendency towards a rising proportion of nuclear families, due to the process of modernization, could be another factor to affect natural fertility.

I.6 Studies of changes in natural fertility and its components

Several historical studies have focused on natural fertility and its proximate determinants, such as the one on England 1600-1799 by Wilson (1984:225-240). He illustrated the crucial role played by post-partum non-susceptibility (and hence breastfeeding) and a lesser role for fecundability. The combination of these two factors could contribute to the highest fertility (highest fecundability and the shortest NSP). The study also showed an increase from 0.213 to 0.248 in predicted fecundability during

[13]J.C. Caldwell and P. Caldwell 1977: The role of marital sexual abstinence in determining fertility: A study of the Yoruba in Nigeria, ***Population Studies 31***, pp.193-218.

1600-1799 and a decline in NSP from 12.7 to 11.53 months over the period of 1600-1749. It is also generally believed that a substantial increase in natural fertility occurred in modern history in the developed world. One study of Greenland from 1851 to 1975, carried out by Hansen (1979:516), showed a dramatic increase in marital fertility between 1851 and 1955 among age groups 15-19, 20-24, 25-29. The trend was consistent even before 1946 when a post world war baby boom took place. Perhaps the most illustrative study on changes in natural fertility is the one by Knodel and Wilson (1981:53-84). They explored the secular trend in fecundity and its components in a sample of German village populations over a century and a half of their demographic history. They found that a substantial rise in the level of fecundity of married couples occurred between the mid-eighteenth and the end of the nineteenth century. They concluded that part of the increase in fecundity was attributable to increased fecundability, some decrease in the non-susceptible period following birth, which was mainly behavioural rather than biological in nature. But there also seems to be a trend in industrialised countries for the average age at menarche, a biological factor of fecundity, to decline slightly with improving standards of living. Brown's (1966:9-14) estimates suggested that the age by which fifty per cent of girls had reached menarche in England in 1845 was over 15, whereas the comparable age in 1962 was less than 13. Another survey in 1976 showed that the mean age of menarche then was at 12.6 years for American girls. The difference was attributed to changes in the social and nutritional environment.

There is mounting evidence that substantial increases in fertility have taken place in various parts of the developing world. One of most comprehensive studies carried out by Dyson and Murphy (1985, 1986) found consistently that a crude birth rate rise occurred before demographic transition in most parts of the developing world. They further suggested that age-standardized fertility rates probably rose even more, as the widespread mortality decline prior to 1960 led directly to reductions in the proportion of population in the childbearing years. Similar evidence also existed in rising marital fertility, which is directly related to natural fertility. Such increases also were shown for the Central Asian Republics of the Soviet Union between 1926 and 1970 in the work of Coale, Anderson and Härm (1979:85-121), who pointed to similar changes in marital fertility in Korea. Some evidence of substantial increase in marital fertility within the age group 20-24, which was least likely group to control its fertility, was also shown for other Asian countries and areas by Knodel (1977:219-249), such as +11% between 1961 and 1974 in Hong Kong, +15% between 1940 and 1970 in Japan, and +14% between 1957 and 1967 in West Malaysia. Some recent studies again reveal that increases in marital fertility are at present under way in a number of African populations. For example, total fertility in Kenya appeared to rise from 6.8 to 8.1 births between the early 1960s and 1980.[14] Another study of 5000 married women between the ages of 20 and 39 living in Taiwan, carried out by Jain, Hermalin and Sun (1979:151-194), suggested that the level of modernization and development could affect the level of natural fertility in various ways: (1) the proportion of women who do not breastfeed their children is likely to increase, (2) the proportion of women who resume menstruation within a short period after childbirth is likely to increase, (3) the duration of lactation and the postpartum period is likely to decrease, (4) the period of lactation beyond the resumption of menstruation is likely to decrease and, (5) the average fecundability is likely to increase with modernization. They found, that the length of the menstruating interval for those who did not breastfeed or who weaned before resuming menstruation decreased from 5.3 months to 3.5 months with an increase in the number of modern objects owned by the

[14] Population Reference Bureau-Intercom, 7, 10, (1980) Fertility in Kenya: Alarmingly High and Continuing to Rise, see Knodel and Wilson (1981), p54, footnote 1.

couple. A comparative study carried out by Hobcraft and Mcdonald (1984:23-24) based on the data of World Fertility Survey, shows that the proportion of the women having a first birth within five years of people's first sexual union in Sudan, Bangladesh and Nepal rose over time, moving from 0.79 to 0.91, 0.6 to 0.81 and 0.58 to 0.69 in respectively for the periods from 16-20 years to 0-5 years before the survey. All these points imply an increase in natural fertility and average fecundability with socio-economic development in some developing countries.

I.7 Modern Chinese fertility and its derived studies

For arguments about Chinese fertility, we can trace history back to the supposition of Montesquieu, that "the climate of China is in any peculiar manner favourable to the production of Children, and that the women are more prolific than in any other part of the world."[15] Such a view of Chinese women was widely accepted and became part of western understanding of how China could maintain such a large population in the face of frequent epidemics, recurrent famines, and ceaseless wars. Later, Mallory (1926:87) confirmed Montesquieu's supposition and acclaimed the fecundity of the Chinese as very high and without parallel. But, in 1934, an average size of Chinese farm family of 5.56 was indicated by J. L. Buck's first Chinese farm survey in 1921-23. This led Penrose (1934:108) to challenge the traditional view by saying that "certain quantitative investigations based on samples do not indicate that there is anything exceptional in Chinese fertility".

However, the Chinese population did not show a clear picture to the world until a

[15]See T. R. Malthus 1960: ***On Population***, The Modern Library, New York, p.206.

second Chinese farm survey was conducted by Buck and his Chinese colleagues during 1929-31. The survey, commonly referred to as the Chinese Farm Survey, covered more than 46,000 farm families in 119 widely dispersed localities in 16 provinces. The general results of the survey were reported by Frank Notestein and Chi-ming Chiao in 1937.[16] The basic findings relating to fertility were, (1), universal and early marriage was the dominant pattern in the country, over 99% of females and 90% of males got married before age 29, (the mean ages at marriage were 18.2 and 20.5 for females and males respectively), and divorce was very rare among males and almost unknown among females. This marriage pattern was believed in the report to be an important factor in the high fertility; (2), The sex ratio of male to female births was higher than the corresponding experience in the West where the vital registration was much more reliable; a marked tendency to understate female births was suggested; (3), The crude birth rate was higher than in Japan and most Western countries, the births per 1000 population was 38.3 for the total sample, 39.0 and 37.4 for South and North China respectively; (4), The conclusion about this high birth rate was that it was not because married women were more fertile in China but because there were more of them, so the universality of marriage in China more than counteracted the effect of the lower fertility of married women, yielding a higher crude birth rate in China than other countries, such as Japan. (5), As regards marital fertility, an average of around 5.28 children for married women aged 45 and over was estimated. The study thus suggested this level of marital fertility was much higher than that observed in the western countries at that time. However, if we compare Chinese marital fertility in 1929-31, as a non-contracepting population, with that of Western non-contracepting populations two centuries earlier, we would naturally conclude that Chinese women were not the most prolific, but rather the

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[16] J. L. Buck 1937: ***Land Utilization in China***, Vol. 1, pp.358-399.

opposite, as the Princeton Population Research Group did, (see Chapter 5).

In 1974, initiated by Taeuber, the Princeton Group, of Barclay, Coale, Stoto, and Trussell, started to reappraise the material of Chinese Farm Survey by means of presently available techniques for demographic analysis of faulty data.[17] The findings from by applying these latest techniques, not only generally confirmed the results reached by Notestein and Chiao: high mortality, early and universal marriage, and moderate fertility, but also reached some stages deeper and further than the previous one. The new findings suggested, (1) The quality of age reporting was acceptable, and quite accurate; (2) Singulate mean ages at marriage (SMAM) were 17.52 and 21.32 for female and male respectively; nearly everyone was married by age 25; (3) The pattern of adjusted marital fertility rates modified for understated births appears to be similar to that of marital fertility which is characteristic of populations in which there is little or no control of births; the level of adjusted total fertility was 5.50; (4) Although the Chinese marital fertility pattern in the 1930s was well within the range of natural fertility described by Henry, the Chinese farmers experienced natural fertility very much lower than that of any other population which he studied. By applying Coale and Trussell's model, a value of natural fertility level, M, of 0.62 was estimated for the whole country, 0.65 and 0.59 for south and north China respectively. (5) The possible reasons for this very low level of natural fertility regime were also suggested, as prolonged breastfeeding among inadequately nourished women, and reduced coital frequency due to suffering from chronic fever and other debilities.

In 1984, Wolf (1984:443-470) raised serious doubt about some of the conclusions

[17] G. W. Barclay, et al. 1976: A Reassessment of the Demography of Traditional Rural China, ***Population Index 42***, pp.606-635.

reached by the Princeton group, asking whether Chinese fertility was as low as they had suggested. Questioning the data quality from the Chinese Farm Survey to start, Wolf believed that the data did not represent China, where total marital fertility should be around 5.78 rather than 5.50 as estimated by the Princeton group, and that the real level of total marital fertility should exceed the Farm Survey figures about by 21 percent. He derived his conclusion mainly from three parallel comparisons. First, he compared the fertility rates derived from a register of births, deaths, and population in the Hai-shan region in Taiwan, then calculated age-specific fertility rates and age-specific marital fertility rates from the registers in this area during the period of 1906-45. These were about 14% higher than those in the Farm Survey. He argued that these registers were essentially complete and more reliable. Second, he compared the age-specific fertility rates of the Chinese farmers with the rates that he derived from the histories of the women aged over 55 whom he interviewed in seven villages of rural China in 1981. Again, the total fertility and total marital fertility were about 5.78 and 7.03 respectively, and 15.0% and 20.9% higher than the Farm Survey figures. Third, he compared the Farm Survey figures with fertility data from another survey conducted at Chiang-yin County (Jiangsu Province, mainland China) by Chen, Chiao, and Thompson in 1931,[18] which showed average total fertility for 1931-35 as 6.38, about 27.9 percent above the Farm Survey rates. Although he believed that the true level of fertility in rural China in the late 1920s and early 1930s was considerably higher than as recorded by the Farm Survey, he agreed the general point made by the Princeton Group that the fertility of Chinese women was much lower than that of European women, and that the pattern of fertility displayed by Chinese population was very similar to the natural fertility.

[18] C. M. Chiao, Warren S. Thompson, and D. T. Chen 1938: ***An Experiment in the Registration of Vital Statistics in China*** (Oxford, Ohio: Scripps Foundation for Research in Population Problems, 1938)

Replying to Wolf's criticism, Coale made a strong defence for the Princeton group's reassessment in a subsequent paper after Wolf's article in 1984 (1984a). He explained the reassessment's position was not to assert the Farm Survey data' accuracy, nor øn acceptance of the figures on fertility and mortality as given in the survey, but rather to subject the survey data to a battery of techniques of analysis recently developed for extracting valid demographic information from inaccurate data, that was, to subject the data to corrections that emerged from the data themselves. By calculating the degree of understatement of births in Farm Survey, the overall upward adjustment was worked out as 9%, but 12% for the South alone. Following Wolf's comparisons, Coale also compared adjusted age-specific marital fertility in the assessment the with the fertility schedule of Hai-shan from Taiwan, and with the fertility rates that Wolf derived from the histories of older women whom he interviewed in seven villages of rural China. The agreement in both parallel comparisons were very good. The average total fertility rate for the period 1906-45 for the Hai-shan area was 5.46, for the Chinese farmers 5.50 (adjusted), and for Wolf's respondents 5.76. The slightly higher figure for Wolf's respondents' fertility could be due to the fact that they might have experienced slightly higher marital fertility in the 1940s or 1950s than in the 1930s, as Coale suggested. Finally, Coale tried to justify the adjusted farmer fertility by logical deduction from the population growth and the mortality, under the circumstance of an average life expectation, which was only 24 years, and an infant mortality as high as 300 per 1000. Fertility estimates derived from the age distribution and from the estimated infant and child mortality were also very nearly the same as those based on adjusted numbers of births for the year before the survey.

Prior to 1949, the time of founding of the People's Republic of China, national statistical data for China were of questionable validity and frequently useless. After 1949, population censuses were conducted in 1953, 1964, and 1982 (recently 1990) in order to discover the basic demographic facts, such as births, deaths, total population and their trends. However, for over 30 years after 1949, the population statistics collected about China were seldom published. The field of demography was taboo, so that important demographic indicators were not measured, and there were no representative sample surveys. During the early 1980s, a major transformation took place in the quality and availability of China's collected demographic data. Some crucial demographic data from the last three decades were finally published, and their relatively high quality has been recognised by many western demographers. In addition, as China's family-planning programme was so successful on a scale not previously seen anywhere, all these data have attracted interest from a range of people. Since the early 1980s, studies of the Chinese population have been frequent in the demographic literature of both China and the western world. This was especially so after publication of the 1982 census which was more comprehensive and carefully planned than the previous two, and the 1/1000 Fertility Survey, which was the first retrospective fertility survey in China. As regards the fertility, major focuses of these studies about Chinese population have been oriented to Chinese population policies and birth control programmes, fertility transition and its socio-economic implications, and population trend and projections. Such were studies by Arid (1978, 1981), Yu (1979), Dernberger (1981), Liu and Song (1981), Coale (1981, 1984b), Chen and Tyler (1982), Goodstadt (1982, 1986), Birdsall and Jamison (1983), Tien (1984), Caldwell and Srinivasan (1984), Croll, Davin, and Kane (1985), Bongaarts and Greenhalgh (1985), Greenhalgh (1986), Arnold and Liu (1986), Banister (1987), Poston and Gu (1987), Feeney and Yu (1987), Whyte and Gu (1987), Zeng (1988), Wang and Hall (1991), and Peng (1991).

Based on the 1982 Census and the 1/1000 Fertility Survey, the most comprehensive study to document and analyse fertility transition in China since 1949 was carried out by Peng (1991). It describes the fertility level, trends, and differentials in terms of regional and rural-urban residence. He found that China had experienced a dramatic fertility transition, which was supported by the fact that fertility fell by more than 50% in a single decade. China's fertility transition was also a process of diffusion. He suggested that there had been regional differentials in fertility and marriage behaviour, which became more marked during the 1960s and 1970s. The fertility transition in China's urban areas began much earlier and progressed faster than in the rural areas. Sustained fertility decline started in a few large municipalities and some eastern provinces. They were then followed by the northern provinces, and transition gradually spread to the interior. The major determinant of this fertility transition, Peng strongly believed, was the success of the Chinese family-planning programme in which the government and political system played a prominent role. This fact made the fertility transition in China an exception to the classical theory of demographic transition, as it occurred in a society at a relative low level of modernization, but with strong government commitment and an effective family-planning programme. Thus he suggested that China's transition might not have been a natural but rather an induced process. He found that mass mobilization had been a crucial factor in carrying out the family-planning programme, and that a well-built network for birth-control service penetrated every corner of the country. All people in the country were organized to participate in the programme. Apart from the birth control programme, women's education, occupation and their place of residence also played parts in this transition. Women who were less educated, or living in rural areas, or working as peasants tended to have more children. A variety of other forces also combined to create regional diversity in China's fertility transition. The success of the birth control programme depended largely upon the efforts made by local governments, and upon the local political and social environment. However, in the long run, he believed, socio-economic development would ultimately change people's attitudes towards family and childbearing, and lead to a complete fertility transition.

I.7 Studies of Chinese natural fertility, its components

Compared with the study of Chinese fertility, which has advanced rapidly since the 1982 Census and the 1/1000 Fertility Survey, much less research effort has been devoted so far to Chinese natural fertility and it components. Partly though lack of proper data and partly through failing to attract enough attention, Chinese natural fertility remains fairly untouched by scholars. Apart from Barclay et al. (1976), the only exceptions are Lavely (1986), Coale et al. (1988), and Lavely and Freedman (1990). Among these, Lavely's work may be the only qualified study concentrated on the subject of Chinese natural fertility, although his real purpose was to find the change of Chinese fertility regime and its relationship with government policy.

Based on the information from the 1/1000 Fertility Survey, Lavely first estimated single years of age specific marital fertility (ASMFR) for China as whole, and for the urban and rural sections separately. By applying Coale and Trussell's model directly, he estimated natural fertility level (M) and the index of marital fertility control (m) for both urban and rural China. According to his estimations of M, the level of natural fertility rose about 50 per cent from 1950 to 1981 among the rural Chinese, and 290 per cent in the urban areas. To account for these incredible and unrealistic estimates, two sources of error in the model were considered: random variation and systematic deviation. Lavely then tried to remove irregularities from annual fluctuations in childbearing, short-term marriage pattern, or sampling variation by using periodical average estimates. The result of this procedure, he admitted, had very little effect on the estimates of M and m. The irregularities, although they had been improved, still existed substantially, particularly for the urban population in recent years. He attributed this to a poor fit of the model due to systematic deviation and the urban ASMFR "heaping" at ages 23, 25, 27 and 35, which could affect his estimation when the single-year ASMFR, rather than five-year ASMFR by convention, was adopted. By using mse proposed by Coale and Trussell (1978:203), the mean square errors of the model, measuring goodness of fit (see Sheps and Menken 1973:82-83 for more details), he believed that he had achieved a good fit of the model up to 1971-75 and 1976-78 for urban and rural areas respectively.

This statement, in my view, is not robust. The mse in this case, may not be the best measure of the goodness of fit here, simply because it measures only the error or residuals, the part unexplained by the fitted curve, in absolute terms, rather than reporting the proportion of error of the explained part among total variation. In this case, when the age pattern of marital fertility deviated significantly from the standard natural fertility schedule n(a) (under strong pressures from the government's birth control policy after the 1970s), the mse grew above 0.01 very easily, beyond the threshold of "terrible" fit suggested by Coale and Trussell (1978:203). However, this may not necessarily be a "terrible" fit if a fitted curve can explain a substantial part of total variation, say 75 percent. In fact, the most crucial reason which creates the unrealistic estimate of M and m, is not what Lavely suggested, such as sample variation, or poor fit, or ASMFR heaping at certain ages. The vital problems in Lavely's estimation occurred, I believe, at the range of single ASMFR from 23 to 40 selected for estimating M and m, by following Coale and Trussell's recommendation (1978:204). To avoid a high variation in fertility at ages 45-49, they suggested estimating M and m by using values of r(a) from age 22 or 23 to 40 rather than from 15 to 49 (by single year). However, this selection will lead to two biases. First, we know that women's fecundability reaches its peak when they are in the middle of 20s, as Jain confirmed from his study of Taiwan women (1969a:80). Naturally, marital fertility is generally higher at age 23-24 than at 20-24. The pressure of the birth control policy, 'Later-Longer-Less', after the 1960s compressed childbearing after 23, and drove marital fertility even higher at age 23-24 than it would be in a normal situation. Thus selecting an age range to start from 23 will lead estimated M to be much greater than starting from 15 or 20 for the single year case, or 20-24 for the five year case. Secondly, selecting an age range ending at 40 rather than 44 or 49, will also serve to inflate M values here. As m is an average degree of birth control over all ages, a rise in the value of m would be interpreted as a slightly higher level of M by Coale and Trussell's model, given the same marital fertility schedule. Under the family planning campaigns in China, younger age groups were influenced more than the elder ones, and correspondingly the reduction in marital fertility was much more significant among the younger ages. This pushed up the m estimate when the ASMFRs over age 40 were chopped away, thus overestimating M. So cutting away both ends of ASMFR range and shortening the age range from 15-49 or 20-44 to 23-40 would jointly contribute to inflate M estimates. A consequence of this selectivity bias will be discussed in Chapter 5, when my results are compared with the estimates in Lavely's study.

The study carried out by Coale, Li, and Han (1988), in fact, is related to the Chinese birth intervals. They found that fecundability was most surprisingly low; that birth intervals before the first and second births became shorter in rural China from the 1940s to the 1970s; that conception rates were lower following a male birth; that birth intervals were shorter after a child died in infancy; and that some women who lost a second child soon after its birth resumed breastfeeding an older child. In addition, the study suggested that the monthly probability of conception before the first and second births increased in rural areas.

Similar conclusions arose from a preliminary analysis of fecundity and other proximate determinants by the present author,[19] However it appears that several related and interesting questions remain. Did natural fertility change occur generally during the demographic transition in China? If it did, what were the patterns of geographic variation, urban-rural differential and educational divergence? What were the roles played by the background and proximate determinants? Finally, there is a fundamental question of how to apply appropriate measures to estimate underlying level of natural fertility.

[19]Y. Pu 1989: ***Secular Increase in Fecundity in China,*** M.Sc dissertation, London School of Economics.

Chapter 3 The Data, Conception and Measurement of Natural Fertility and Its Proximate Determinants

I.1 Data from demographic surveys

I.1.1 One-Per-Thousand Fertility Sample Survey in 1982

The major source of demographic data used in this study is China's National One-Per-Thousand-Population Fertility Sample Survey(the 1982 1/1000 Fertility Survey), conducted by the State Family Planning Commission in 1982. This was a stratified-cluster sample survey, using China's 1982 Census listing as the sample frame. The stratification of urban and rural population was settled by using the address code of the Census. 815 rural production brigades and urban resident committees were randomly selected as sample units with a total sample population of just over one million, or one per thousand of the national total population.[1] Within the sample population, all women aged 15-67 were interviewed about their marital and fertility histories. Contraceptive practice and women's socio-economic background were also included in the survey questionnaire. Sampling and non-sampling errors were rigorously controlled throughout every stage. This survey was successfully undertaken with relatively high accuracy and the analyses suggest a very low level of error in its reporting of births. Both Coale and Banister have suggested that the fertility and nuptiality information from the survey can be accepted as

[1]See Z. Xiao 1984: The Design of 1982's Fertility Sampling Survey in China, in China Population Information Centre, ***Analysis on China's National One-Per-Thousand-Population Fertility Sampling Survey***, Beijing, pp.24-31.

of high quality.[2] Unfortunately, only tabulated results of the survey are available to this study. Nevertheless, full utilisation of this information enables us to document and analyse in great detail a half century of change in natural fertility and its components in China.

Table 3.1 Sample sizes and sample units of the 1/1000 Fertility Survey in 1982 by region (provinces, municipality cities, minority autonomous regions)

Region	Sample size			Sample units
	Total	Urban	Rural	
Beijing	3103	1941	1162	7
Tianjin	3044	1719	1325	6
Hebei	17030	1575	15455	53
Shanxi	7681	955	6726	30
In. Mongolia	6257	1843	4414	16
Liaoning	12513	4836	7677	22
Jilin	6744	1892	4852	14
Heilongjiang	9599	3133	6466	23
Shanghai	4416	2888	1528	6
Jiangsu	21019	3447	17572	41
Zhejiang	11705	1440	10265	44
Anhui	14357	1662	12695	32
Fujian	7414	826	6588	17
Jiangxi	9509	1094	8415	24
Shangdong	23409	1559	21850	88
Henan	21717	1992	19725	50
Hubei	15638	2419	13219	38
Hunan	16727	1939	14788	50
Guangdong	17692	3020	14672	32
Guangxi	10512	973	9539	17
Sichuan	30114	4385	25729	85
Guizhou	7841	1108	6733	27
Yunnan	10088	1254	8834	16
Shaanxi	8956	1545	7411	35
Gansu	5732	1057	4675	19
Qinghai	1489	283	1206	6
Ningxia	1290	387	903	4
Xingjiang	4418	1241	3177	13
National total	310014	52413	257601	815

[2] See J. Banister 1984: Analysis of Recent Data on the Population of China, ***Population and Development Review 10***, No. 2, pp.241-271; and Coale (1984b:37-38).

The total number of respondents in the survey was 310,014, which was quite exceptional compared with those of many other surveys, such as the World Fertility Survey (WFS) or Demographic and Health Survey (DHS). This was true for most individual provinces. For example (see Table 3.1), in the survey more than thirty thousand women were interviewed in Sichuan province alone. The sample size for each province, on average, was more than ten thousand. But this was not so for some small provinces because of the method of single stage proportional sampling. This is especially true when the sample was further broken down into rural and urban populations. As a result, stochastic variations were much greater in the fertility and nuptiality measures calculated for individual provinces than for China as a whole, and thus varied between provinces. The effects of small numbers were most obvious for the urban populations. Moreover, because people who lived in one place showed a statistical tendency to resemble each other more than people who lived far apart, the implication of clustering on analysis should be borne in mind. Sampling error caused by clustering seems to be larger in major municipalities and small provinces, due to the small number of sample units.

In addition, the extent of reporting errors varied between provinces. It is believed that misreporting was more severe in some interior provinces due in part to low education levels and local customs. Variability in annual rates, therefore, should be treated with some caution. Nevertheless, the original data are used with as little adjustment as possible in order to document genuine fluctuations.

I.1.2 In-Depth Fertility Survey (Phase-I) in 1985

Another source of demographic data available for this study is the In-Depth Fertility Survey (first phase) on the population, fertility and related factors in some provinces and municipalities of China. The objectives of the China In-Depth Fertility Survey are to provide the information needed to improve understanding of the levels, trends and determinants of fertility of the Chinese population and to provide the government with data useful in the formulation of population policy. The first phase involved a large scale representative sample survey on fertility, family planning and related factors in the provinces of Shaanxi and Hebei and the municipality of Shanghai. Table 3.2 shows the distribution of the populations surveyed according to urban-rural residence and level of education.

Table 3.2 Background characteristics of the 1985 In-Depth Fertility Survey's population

Region	Population (*million*)	Urban (%)	Distribution(%)[1]			
			(1)	(2)	(3)	(4)
Shaanxi	28	21	37	36	27	0.5
Hebei	53	17	37	36	27	0.3
Shanghai	11	59	22	27	46	5.0

[1]Women's education level, (1): Illiteracy, (2): primary school, (3): secondary school, (4): higher.

Shaanxi is a typical inland province of China. Although it is a political, economic, and cultural centre for North-west China, this is the most undeveloped area in the country, thus Shaanxi represents the lower level socio-economic development areas. With abundant mineral resources, developed transport facilities and a moderate climate, Hebei is a relatively developed province in terms of industrial and agricultural production.

Situated along the coast of the East China Sea, Shanghai Municipality is the biggest industrial base and one of the main seaports, and scientific, technological and educational centres in China.

The 1985 fertility survey was carried out by the State Statistical Bureau and the related provincial and municipal statistical bureaux during April 1985 in the three regions. All major operations of the first phase were successfully completed. It is very rich in content and covers a number of items never investigated before. The questionnaires were developed from the experience of the World Fertility Survey in many developing countries. The sample was designed with the objective of obtaining completed interviews for a representative sample of around 5,000 eligible women in Hebei, and 4,000 each in Shaanxi and Shanghai.

In Hebei and Shaanxi, cities and counties formed the primary sampling units (PSUs). They were divided into three strata in each province, according to geographic and administrative location: cities, counties in the plains, and hilly counties. The number of units to be selected from each stratum was allocated according to its relative population size within the province, and a total of 34 PSUs in Hebei and 29 PSUs in Shaanxi were selected systematically from geographically ordered lists by probability proportional to population size. The only exception to this general procedure were three large cities in the two provinces which were taken into the sample with certainty. Within each PSU, ultimate area units were selected in three further stages, at each stage selecting by proportional probability to estimated total population using systematic sampling from ordered lists.

In Shanghai, the area units were selected in three rather than four stages, eliminating the first stage of selecting counties. The PSUs consisted of street committees, towns or communes. Three strata were created, one for each of these types of units, from which a total of 54 PSUs was selected systematically by probability proportional to population size. Within each selected PSU, 3 neighbourhood committees/production brigades, and within each of the latter 3 neighbourhood groups/production teams were selected.

The number of households and women selected and successfully interviewed is shown in Table 3.3. About 2.3%, 2.9% and 4.0% of selected households could not be interviewed though absence, illness or occasionally refusal, in Hebei, Shaanxi, and Shanghai respectively. There was some further non-response at the stage of interviewing women because of the respondent being out or for other reasons. The overall response rates for the individual interviews, obtained by multiplying the response rates at the two stages, are high throughout, the lowest being in Shaanxi.

Table 3.3 Response rate(rr, %) of the In-Depth Fertility Survey in 1985

Region	Number of households			Number of women			Overall
	selected	interviewed	rr	selected	interviewed	rr	rr
Shaanxi	5368	5215	97	4248	4084	96	93.4
Hebei	6750	6599	98	5151	5080	99	96.3
Shanghai	6149	5905	96	4178	4143	99	95.2

Accurate reporting of age is of crucial importance in a fertility survey. To ensure this the traditional Chinese method of reporting age was employed in the interviews. By comparing with the age distribution from the 1982 census and computing certain indices of age misreporting, an assessment of the quality of age reporting in the survey at the aggregate level was provided. Table 3.4 compares the age distributions of ever-married women as reported in the 1982 Census, and the this household survey. With the exception of age groups 25-29 and 30-34 in Hebei, the differences found are negligible, indicating very good quality of data.

Table 3.4 Age distributions of married women aged 15-49(%) in 1982 Census and 1985 In-Depth Fertility Survey

Age Group	Shaanxi		Hebei		Shanghai	
	Census	Survey	Census	Survey	Census	Survey
< 20	0.8	1.0	0.6	0.7		
20-24	10.9	14.6	10.4	10.7	5.8	4.4
25-29	23.8	21.2	26.1	22.7	23.2	24.6
30-34	20.5	20.7	22.3	25.1	23.9	25.2
35-39	16.7	16.5	15.5	17.8	16.7	20.1
40-44	14.6	14.2	12.5	11.9	13.2	13.4
45-49	12.7	11.8	12.8	11.0	17.2	12.2

I.1.3 One-Percent Population Sample Survey in 1987

Another major source of demographic data available to this study is China's National One-Percent Population Sample Survey (the 1/100 Population Survey), conducted by the Department of Population Statistics of the State Statistical Bureau and helped by each level of local government in 1987 with a standard recording time of 1st of July. This survey was a stratified-cluster sample survey.

The size of the each sample unit depends on size of representative population. 12540 rural village resident committees or urban resident committees, located in 1045 different counties(cities), were randomly selected as sample units under the ***de jure*** principle. A total sample population of 10.71 million or 2.49 million households (including military personnel), or 0.9999 per cent of the national total population were actually surveyed and enumerated. The sample size for each province, on average, was more than three hundred thousand. (See Table 3.5)

Table 3.5 Sample sizes and sample sex ratio of the One-Percent Population Sample Survey in 1987

Region	Sample Size				Sex ratio F=100
	Total	City	Town	Rural	
Beijing	97936	58018	5356	34562	100.75
Tianjin	82434	52679	5203	24552	101.77
Hebei	571449	104524	95838	371088	103.83
Shanxi	268904	66596	63886	138423	108.96
In. Mongolia	205503	59504	40394	105606	105.79
Liaoning	377337	140941	99979	136417	103.07
Jilin	234964	74831	93106	67027	103.61
Heilongjiang	339080	95221	110050	133809	103.21
Shanghai	123640	68799	6998	47843	98.73
Jiangsu	632598	78640	103472	450487	102.49
Zhejiang	409673	88499	100562	220611	103.10
Anhui	527262	67829	78488	380945	105.98
Fujian	278242	46039	64513	167690	103.28
Jiangxi	355468	50929	46067	258472	103.68
Shangdong	790567	233597	201024	355946	101.38
Henan	792405	86705	75579	630120	101.59
Hubei	506560	73444	128928	304188	102.26
Hunan	576453	48445	103006	425002	106.51
Guangdong	643171	84978	88433	469760	103.09
Guangxi	399929	22851	106424	270653	106.93
Sichuan	1043906	102886	170966	770053	106.57
Guizhou	305477	42353	57707	205417	104.38
Yunnan	350620	55837	45477	249307	102.53
Tibet	20847				96.92
Shaanxi	309411	53538	53732	202142	106.37
Gansu	209725	23801	32108	153816	104.76
Qinghai	41955	7440	3036	31480	100.15
Ningxia	42875	5349	7390	30136	100.33
Xingjiang	140915	35880	21015	84019	104.08
Total	10679308	1930154	2008736	6740417	103.89

Information about geographical distribution, national status, age structure, family, marriage, birth, death, migration and socio-economic background factors such as type of residence, education, occupation, were all reflected in the survey questionnaire, thus it can be regarded as a small census. Within the sample population, all women aged 15-64 were interviewed about their marital status and fertility histories.

The sampling and non-sampling errors were rigorously controlled throughout every stage of the survey. This survey was also successfully undertaken with relatively high accuracy and the analyses suggested a very low level of error in reporting of births from the survey. Given 95% significance, the sample error on fertility level for the first half year of 1987 varies within (-0.011%, +0.011%), and mortality sample error within (-0.006%, +0.006%).[3] Although only tabulated results of the survey, with complete demographic data, are available for only one year (1986), this information enables us to extend our study about changes in natural fertility in China from 1981 to 1986 when major economic reform was taking place and having a significant impact on many aspects of life.

Table 3.6 Age distribution of women (15-49)(%) in 1982 Census and the 1987 1/100 Population Survey

Age group	1982 Census		1987 1% Survey	
	All[1]	Ever-M[2]	All	Ever-M
15-19	24.77	1.64	21.94	1.33
20-24	14.68	11.51	21.18	18.21
25-29	18.04	24.97	12.67	17.41
30-34	14.10	20.46	15.32	21.80
35-39	10.32	15.04	12.14	17.32
40-44	9.10	13.27	8.89	12.70
45-49	8.99	13.11	7.86	11.23
Total	100.00	100.00	100.00	100.00

1, All: All women; 2, Ever-M: ever married women.

Table 3.6 is a comparison of the age distributions of all women and ever-married

[3] Department of Population Statistics, China State Statistical Bureau 1988: ***Tabulations of China 1% Population Sample Survey: National Volume,*** Beijing, China Statistical Press

women as reported in the 1982 Census and the 1987 1/100 Population Survey. The age distribution of all women is quite consistent in these two surveys, a consistent pattern is seen between the five-year age groups in the 1982 Census and the next older five-year age group in the 1987 survey. For example, they are 14.68% and 18.08% in age groups 20-24 and 25-29 respectively in the 1982 Census, while 12.67% and 15.32% in age groups 25-29 and 30-34 respectively in the 1987 1/100 Survey. The age distribution of ever-married women is also consistent between these two surveys, except for age groups 20-24 and 25-29, which is due to a relaxation policy on marriage age after 1981. All of these points indicate that the 1987 1/100 Survey provides very good quality data.

I.1.4 Demographic data from other sources

It should be mentioned that other published demographic data will occasionally be used in this study, such as the Chinese Farm Survey, conducted in rural areas of China in 1929-1931. The main demographic findings have been analysed elsewhere and are presented in the volume reporting the general results of the survey (see Barclay et al. 1976:606-631). They generated some considerable debate and speculation about the Chinese population. The controversies over the interpretation of the survey have been detailed in Chapter 2. However, this body of material has not been reappraised consistently with new demographic data in China on topics such as the study of natural fertility. Other demographic data, such as the 1982 Census and 1988 Two-Per-1000 Fertility Survey from published studies such as Feeney and Wang (1993), will also be used in this study where they are relevant.

I.2 Natural fertility: definition and conception in this study

Ever since it was first proposed by Henry, the concept of natural fertility has been the subject of considerable discussion, even controversy. The principal problems lie in the ability of our demographic techniques to detect this feature of fertility, the comparability of data, and, even more fundamentally, the definition of relevant demographic variables, especially in the conceptualization and explanation of natural fertility. In spite of these points of discussion, here we employ natural fertility as a measure of underlying fertility rather than fecundity. Natural fertility is defined as marital fertility where couples do not alter their reproductive behaviour according to the number of children already born. In practice, this can be taken to mean fertility in populations whose members do not use contraception or induced abortion. In contrast, fecundity is defined as the physiological capability of a man, woman or couple to produce a live birth. It may be contrasted with fertility which is the actual reproductive performance of an individual, a group or a society. Although widely invoked as a factor in determining fertility differentials, fecundity is a purely biological term and still imperfectly understood in quantitative terms.

Analysis of the fertility of populations not deliberately using birth control or induced abortion shows large variations in the levels, though such populations do exhibit common age-specific patterns of childbearing. This is obviously produced by behavioural factors which are probably not originally intended to alter reproductive behaviour but rather are determined by social custom. Two examples of such behavioural factors are the frequency of intercourse, and infant feeding habits. Both are to a large extent socially or culturally determined, yet they interact with the biological processes underlying reproduction and thus influence a couple's real ability to bear children, though not their theoretical physiological capability to produce children. Therefore, different populations could have different levels of natural fertility while their fecundity levels might be the same. In other words, behavioural factors, apart from those of birth control or induced abortion, make the difference between fecundity and natural fertility.

Natural fertility, as a measure to evaluate the fertility level, which only excludes deliberate behaviour to limit the number of births, is thus a more practical way to measure underlying fertility than fecundity. In this study, the measures used are based on a behavioural rather than a purely biological definition of natural fertility. This is true not only for the index of natural fertility proposed by Coale and Trussell, M, which is taken to be an indication of overall natural fertility, but also for the measures to examine the various components of natural fertility. In other words, we are interested not only in the biological processes which determine a couple's ability to reproduce, but also the in behavioural practices which interact with these biological processes, provided they are not linked to volitional attempts to reduce marital fertility.

I.3 Natural fertility: basic model and its adjustment

I.3.1 The model's application problem in the Chinese case

The most widely and successfully used model for estimating natural fertility is that developed by Coale and Trussell in 1974. However, by applying this model to Sweden in 1871-1974, Trussell (1979:46-48) noted that the value of M-estimated Swedish natural fertility declined over the period, when "there is no reason to suppose that, in general, the level of natural fertility should fall as control is increased". As the living conditions in developed countries like Sweden have substantially improved since the last century in ways which could be expected to favour natural fertility, the estimated value of M should be expected to rise rather than decline over the period. Trussell further questioned this phenomenon - "Put another way, there is no plausible reason why the underlying level of natural fertility in the U.S. or U.K. or Sweden in 1975 should be lower than that experienced by any of the populations listed by Henry". Without trying to discover the underlying mechanism of Coale Trussell's (CT) model which caused this problem in the estimation of M, he concluded "in the presence of control, discovery of the underlying level of natural fertility from existing models of age-specific (marital) fertility rates is not possible". A consideration of the model's basic structure and assumptions, however, leads to the possibility of generalizing it and discovering problems in its application.

As defined by Coale and Trussell, the model can be regarded as having two conveniently interpretable parameters. M indicates the underlying level of fertility or natural fertility and m indicates the deviation of the rates from the standard pattern and hence the degree of fertility control. When the transition is basically a move from natural to controlled fertility, and changes in the level of fertility are taken care of by varying M, then changes in m should indicate solely changes in the age profile of fertility. In the model, the control schedule, v, is defined as zero for ages 20-24. This can be understood in two alternative ways: no birth control is practised in age group 20-24, thus the m(20-24) = 0; or age group 20-24 shows the same tendency of birth control as other age groups, but the impact of contraception on fertility is negligible as this age group is at the very beginning of exposure to birth, and hence the observed marital fertility among this age group can be interpreted fully by varying M. In either interpretation, the fertility of age group 20-24 is assumed by the model to be natural.

In many cases, however, such as in the 1970s in China, some developing societies after World War Two, and many developed societies, such as Sweden in this century or even earlier, the existence of birth control among young age groups including age group 20-24 seems likely. The Chinese evidence for the 1970s also shows that marital fertility declined more quickly in young age groups: 25-29, 30-34 and 35-39 than in old age groups such as 40-44 (see Figure 4.2b). Generally speaking, the main reasons for younger women practising birth control are probably twofold. Firstly, young cohorts more easily accept new ideas because of a higher proportion of literacy than among older cohorts. Secondly, they have a higher chance of being employed than older cohorts due to age or education, hence they are more likely to practise contraception. This raises a fundamental issue with regard to the model's assumption that marital fertility at age 20-24 is a natural pattern. Certainly, it is applicable when practising contraception is only moderate, but it would be a misleading interpretation of M in the case of a high degree of fertility control.

One of the weak points arising from this assumption in the model seems to be that the estimate of M is regarded as quite independent from m. However, it appears that estimates of these two parameters must be seen as closely related, and the value estimated for m influences the estimate of M. This is true algebraically since the two parameters are in same equation of the model, and it is unlikely that parameter covariance is zero, but also, from a logical point of view, it is clear that there should be a strong relationship between them. For any observed fertility schedule, m and M represent two different things: the age pattern of fertility and the underlying level of fertility respectively, thus they should be independent. However, the model is a sort of comparison between a standard and a specific fertility schedule. The function of M and m in the model is to try to explain the differences between these two fertility schedules in two parts: the difference in underlying fertility level between the standard and the observed, and the difference in the degree of birth control between them. Thus M and m in the model explain *jointly* the difference between the two fertility schedules, and therefore influence each other.

To pursue some of these points further, we consider the following. Table 3.7 shows three fertility schedules r(a) as given by the model, r'(a) and r''(a). The table sets all age groups' fertility of r'(a) as r'(a) = 0.9·r(a). For the r''(a) schedule, it sets r''(20-24) = r(20-24) and the rest of r''(a) slightly different from r(a) schedule. In the panel where v(a) is applied, the difference between the first two sets of rates is produced by differences in M rather than m. In other words, as m governs the age pattern of fertility, it remains the same when the age pattern of fertility remains unchanged no matter how much the underlying fertility fluctuates. In contrast, the difference between r(a) and r''(a) is mainly in the m value rather than M. As M is determined by the position of r(a) starting from r(20-24) relative to v(a), the impact of change in the age pattern on M is almost negligible while m rises substantially, as a consequence of the model's v(a) working. But in reality, changes in the age pattern of fertility due to birth control should be expected to have some effect on M because M should represent a different level of underlying fertility when the new age pattern of fertility schedule r''(a) is applied. Putting this more precisely, M should indicate a higher underlying fertility level when m rises substantially if the value of r''(20-24) is unchanged from r(20-24). In other words, the model should provide a higher underlying fertility level when birth control is stronger than before if the observed fertility level at age 20-24 remains the same as before. But it scarcely does so. The results in Table 3.7 are based on one of the two procedures suggested by Coale and Trussell (1978:204) which is to use numerical optimization techniques to choose M and m simultaneously.

Table 3.7 Assumed fertility schedules and the parameters

Age group	n(a)	v(a)	v'(a)	r(a)	r'(a)	r''(a)
20-24	0.460	0.000	-0.140	0.308	0.277	0.308
25-29	0.431	-0.279	-0.419	0.286	0.257	0.284
30-34	0.395	-0.667	-0.807	0.247	0.223	0.238
35-39	0.322	-1.042	-1.182	0.190	0.171	0.185
40-44	0.160	-1.414	-1.554	0.088	0.079	0.080
M		v(a)		0.688	0.620	0.691
m		v(a)		0.171	0.171	0.227
M			v'(a)	0.704	0.634	0.714
m			v'(a)	0.171	0.171	0.227

If we use another procedure proposed by Coale and Trussell (1978:203), in which M is determined solely by the value for age group 20-24 as M = r(20-24)/n(20-24), we would expect exactly the same M values in r(a) and r''(a). From the point of any observed r(a), once the m and M value are estimated, their relationship is settled through the equation. However, it is fair to say that the factors used to estimate them are independent, thus they are not related to each other due to the model's assumption that the m value depends on the deviation of observed fertility schedule r(a) from standard fertility schedule n(a) while the M value mainly depends on the level of observed fertility at age 20-24.

From a logical point of view, whatever the m value, if each woman at this age group is at the very beginning of duration of exposure to birth, or only experiences a very limited time period, e.g. less than one year, then the duration may not be long enough for her to start practising birth control yet. Thus, although the practice of birth control has been prevalent in China since the 1960s, the effect of m might have been fairly negligible making it rational to assume no limiting behaviour among 20-24 year old women in this period. However, in a five-year age group each woman has 2.5 years average marriage duration if the ages of entry to marriage are distributed evenly from 20 to 24, and it may not be appropriate to ignore the effect of birth control completely, particularly in the case of China after the 1960s.

I.3.2 The model's adjustment

Following the points made above, an adjustment of the weak points of the model seems necessary in order to measure Chinese women's underlying fertility appropriately. We know the model's vital problem lies in the assumption that at age 20-24 no birth control exists and so v(20-24) was set as zero originally. If this assumption is not true, as women aged 20-24 may use some contraception, we have to adjust the v(a) schedule correspondingly. Here, first, we have to understand how v(a) works and what is its function in the model. As defined in the model, m and M are estimated through a ***linear*** relationship between a set of parameters v(a) and a series of transformed observations Ln[r(a)/n(a)]. This linear relationship, in fact, is the model itself, as has been given by Coale and Trussell (1978:204),

$$Ln[r(a)/n(a)] = Ln M + m \cdot v(a) \qquad (3.1)$$

They explained this relationship: "if we let Ln[r(a)/n(a)] = y, LnM = c, and v(a) = x, we see that (3) (here 3.1) is a linear equation y = c + mx. Thus LnM and m can be estimated simply by ordinary least squares." The underlying assumption is clear: v(a) is acting as the X-axis or a dimension to measure changes of Ln[r(a)/n(a)], therefore it has to be linear with respect to age. In other words, because age has constant intervals, then v(a)'s values, corresponding to age and acting as measurements, ought to have constant intervals as well. So in principle, if v(a) with respect to age is not a monotonic and linear function, it is not qualified to act as a dimension, and the model will lose its legitimate ground for any practical application. However, v(a) with its single-year plots in Coale and Trussell's study (1975:188-189) is only approximately linear and does not display strictly constant intervals (see Figure 3.1). The nonlinearity of v(a) can be explained, however, as v(a) given by Coale and Trussell (1975:188) was the average estimates of 43 sets of v(a) empirically derived from real fertility schedules, selected from the 1965 U.N. Demographic Yearbook. "Schedules known or suspected to be distorted by age misreporting or other forms of faulty data were discarded", so selected 43 schedules "on this basis were provisionally accepted as embodying, each in its own degree, the typical pattern of departure from natural fertility". If we follow the conventional view, such as taken by Wilson, Oeppen and Pardoe (1988), to accept that Henry's assumption of human populations displaying a common pattern of underlying fertility and take the view that CT's model is a simple and reasonable approximation of any real fertility schedule, we would make allowance for the fact that v(a), the empirically derived real fertility schedules, cannot have a perfect linearity. In short, v(a) is a group of empirically derived measurements, rather than something that can be set beforehand like scales on a ruler with constant intervals. Its function might best be seen, therefore, not as being to measure the change of *Ln*[r(a)/n(a)], but how to interpret these changes, or equivalently how to locate M and subsequently m. This depends upon a purely arbitrary assumption about the position at which you start to measure. If v(20-24) is deliberately set as zero, then it is just same as a starting point to measure *Ln*[r(a)/n(a)] chosen at age 20-24. However, other ages could be chosen.

Table 3.8 The v(a) parameters and M, m estimates

Age group	r(a)	n(a)	v(a)	v'(a)	v''(a)
20-24	0.308	0.460	0.000	-0.140	0.000
25-29	0.286	0.431	-0.279	-0.419	-0.558
30-34	0.247	0.395	-0.667	-0.807	-1.334
35-39	0.190	0.322	-1.042	-1.182	-2.084
40-44	0.088	0.167	-1.414	-1.554	-2.828
M			0.688	0.704	0.688
m			0.171	0.171	0.086

Two examples in Table 3.8 can further illustrate v(a)'s function. First, v'(a) = v(a) - 0.14, when v(a) shifts to v'(a), the m value remains the same while M rises from 0.688 to 0.704. This means that fertility r(a) has been measured on a new scale or on the same scale but starting from a new position, which locates r(a) starting at a position where age 20-24 shows some birth control, thus the underlying fertility should be a higher level than when *Ln*[r(a)/n(a)] is located by the original v(a) and the same fertility schedule r(a) is applied. Second, v''(a) = v(a)*2, here, the M value remains the same because v(20-24) = v''(20-24), but the m is value reduced by a half from 0.171 to 0.0855 since each v(a) value doubles. In the second case, the same amount of change in $Ln[r(a)/n(a)]$ is now assessed by a new measurement twice as large as before, but starting from exactly the same beginning point as before (as we set v''(20-24) = v(20-24)), we therefore get only a half value of the previous slope. Obviously, the m value is determined by the scale of each v(a) value (the differences between every two neighbouring v(a) values), while the M value is determined by structure of v(a), or precisely by each v(a) value with respect to age. Clearly, v(20-24) as a starting point crucially determines M, if only r(20-24) to r(40-44) are included in the estimation as recommended by Coale and Trussell (1978:204).

It would be possible to find a new set of v(a) values best suited to this case by fitting Chinese marital fertility schedules into the standard fertility curve, minimising the differences between the two schedules, and thus solving this nonlinear problem optimally, and subsequently setting v(a) to match our case best. However, one feature of the CT model does not allow us to work in this direction, unless we completely give up the whole CT model, which is not our intention. Employing the 43 marital fertility schedules, Coale and Trussell (1975:188) calculated v(a) by setting m = 1.0 in Equation (3.1) and rearranging to get the following equation (3.2):

$$v(a) = Ln[r(a)/(M \cdot n(a))] \qquad (3.2)$$

Given (3.2), obviously, the v(a) can not be calculated without setting M first. As a basic feature, any optimization problem needs to have constraints first, upon which you may minimise/maximise its objective function. These constraints will be transferred into an optimal solution for those free variables whose objective function can be minimised or maximised. So crucially, a genuine optimal solution for any specific unknown variable, such as v(a), should be expressed only by concrete numbers without containing any unknown variable, otherwise no optimal solution can be found. In this case, if the (3.2) is used as an objective function, then we do not have any other equation working as a constraint to solve for an optimal solution. As a consequence, the M value cannot be determined before v(a) is calculated, and v(a)'s setting has to rely on M first. Thus the 'optimization process' to set v(a) here in fact will become an unsolvable loop.

To avoid falling into such a loop, M was chosen by Coale and Trussell (1975:188) so that v(20-24) is set as zero. Let us temporarily ignore the M values chosen by them, and just concentrate on the way v(a) was set first. The equation (3.2) can be expressed as (3.3):

$$v(a) = Ln[r(a)/n(a))] - Ln M \qquad (3.3)$$

Because M could be not computed by the model before setting v(a), Coale and Trussell had to set M arbitrarily first, and then v(a) can be settled by (3.3). As they assumed r(20-24) was natural fertility in any case, they set M = r(20-24)/n(20-24), and *Ln*M = *Ln*[r(20-24)/n(20-24)]. Replacing the right hand side into (3.3), we have (3.4) as the original v(a)'s setting,

$$v(a) = Ln[r(a)/n(a))] - Ln[r(20\text{-}24)/n(20\text{-}24)] \qquad (3.4)$$

Obviously, even if we retreat from the strong assumption that v(a) itself with respect to age is linear, (3.4) indicates that the relationship between *Ln*M or v(20-24) and rest of v(a) is ***linear***, and that the M or subsequently v(20-24) has to be chosen or set arbitrarily anyway. Therefore, any adjustment of v(a), if necessary is simply an exact same amount of ***linear*** shifting from each of original v(a)'s value consistently. Now the question is, if v(a) has to be set arbitrarily anyway, how big an adjustment or shift is appropriate?

To answer this question, we have to come back to address the problem about Coale and Trussell's assumption on fertility of women 20-24. They assumed that married women at ages 20-24 did not practise birth control, thus r(20-24) was natural fertility. As this assumption may not be proper, at least for China after the 1960s, so the question here becomes how to decide an age interval which represents a natural fertility pattern, so as the starting point of v(a) too, i.e. v(20-24). In reality, a complete five-year age interval, in which all women have fully five years marital duration but without any birth control, is almost impossible to find in the modern world. This is because it needs to satisfy two conditions simultaneously. First, all women have to get married before age 20. Second, they must not control their births before age 25.

We know that almost all births in China occur within marriage; cohabitation and illegitimate births are very rare. Thus age at first marriage is a fairly precise date for when sexual union begins. The mean age at first marriage for Chinese women rose from about 19-20 in the 1950s to about 21-22 in the 1970s (see Banister 1987:156, Coale 1989:834). We can also add to this about one and half years of average duration between marriage and first birth during which time birth control is unlikely according to the Chinese custom, as Peng (1991:146) also found. Although China's family planning programme effectively pushed women to get married later, it did not affect childbearing immediately thereafter, as marital fertility of 0-4 year marriage duration rose until the late 1960s and remain unchanged during the 1970s, when the family planning programme went into effect. Here, since we take the marital fertility only in the duration of 0-1.5 years after marriage rather than 0-4 years as 'natural', the assumption is even safer. This is because Chinese women would not commit themselves on birth control until a target of a certain number of children, say one, has been achieved. So we can reasonably assume that fertility, at least in the first one and a half years of marriage, is natural. By adding this one and half to the mean age at first marriage of about 21-22 in the 1970s, we can assume that, on average, the marital fertility of age 17.5-22.5 is a more or less a natural pattern in China, or at least much closer to "natural" than that of those aged 20-24.

We know the assumption made above is not completely true, as we do find evidence that some married women were using contraception even at age 15-19. These women, presumably already had one child at least, and will be even more likely to use birth control when they enter age 20-24 under the 'one child' policy. Moreover, other women in this age group (15-19) who did not practise birth control may join the control exercise when they reach age 20-24 if they achieve the 'birth target' just after 20, thus contaminating the assumption of fertility aged in those 17.5-22.5 being 'natural'. There is evidence to indicate that married women aged 15-19 have been using contraception since the 1970s. About 30% of the married women aged 15-19 in Hebei were using contraception in 1982 in Wang's study (1988:266) based on the 1982 1/1000 Survey, and the national level is expected to be close to this proportion. However, taking a broader view, the total number of married women aged 15-19 was only about a tenth of the numbers married at age 20-24 in Hebei, so the number of married contraception users aged 15-19 against the total number of the married aged 20-24 is 1:40 in Hebei. So the effect of the bias would be limited. A further difficulty is that the age at which women enter marriage is not quite clear-cut, although the majority are married before age 25 in China. So if we shift our assumption of 'natural fertility' towards younger women, say 15-19, to guarantee a more 'natural' fertility, then, the problem is probably over-adjusted when it assumes that fertility only at a younger age interval, say 15-19, is 'natural', and the model will interpret this as an unrealistically high level of underlying fertility. A similar suggestion was made by Lavely (1986:426). So we should not adjust v(a) up to a point which assumes 'natural fertility' only at the very youngest age interval, such as 15-19. On balance, the 'natural' interval is better set at 17.5-22.5.

Here we try another way to justify our adjustment of v(a). As we know, natural fertility is defined as marital fertility where couples do not practise any contraception or induced abortion to alter their reproductive behaviour. Fecundability is defined as the probability of a married woman conceiving during a month in the absence of any deliberate attempt to limit procreation. Although these two ideas differ both in definition and measurement, they share one common feature: they both measure natural human reproductive behaviour in the absence of any deliberate attempt to alter procreation. Therefore they should be linked to each other in some way, in spite of natural fertility usually being seen as a yearly and fecundability as a monthly measurement. In this study of long-term patterns of natural fertility, when the level is found to change over time, changes in its proximate determinants must also occur. This implies changes in fecundability, primary sterility, breastfeeding and so on. Thus changes in natural fertility, M, and in fecundability ought to be found to have a strong relationship, in statistical terms. If estimates of fecundability (FB) are robust and correct, there should be a high and positive correlation between these two sorts of change. This idea provides a simple way to examine the issue of what constitutes an appropriate adjustment of v(a).

According to equations 3.3 and 3.4, v(a) should be a linear function with respect to *Ln*M or its starting value v(20-24). We make an alteration in the following way: shifting the v(a) values by five different amounts: +0.14, 0.0 (original v(a)), -0.05, -0.10, and -0.14 respectively. Like the other four numbers, -0.14 is an arbitrary number which equals half of the v(25-29) as -0.279/2 and is close to the -0.15 originally suggested by Coale and Trussell (1978:211) for v(24) in the single-year estimation of the model. This seems valid as we are here shifting the age interval of no birth control by 2.5 years younger from the 20-24 originally assumed. Here, we assume that marital fertility in the age interval 17.5-22.5 is 'natural'. Corresponding to this assumption, the adjustment of v(a) is -0.14, implying that we assume that some women at 20-24 now control their fertility. Keeping the linearity indicated by equation 3.4, the rest of the values of v'(a) are also consistently shifted by -0.14. If the adjustment on v(a) is +0.14, then the v(a) is shifted in the opposite direction. The way to make the other amounts of adjustments, within these two extreme shifts of +0.14 and -0.14, is the same.

Table 3.9 Age intervals assuming no birth control, related adjustments on v(a), and Correlation coefficients between mean fecundability(FB) and indices of natural fertility(M) from the varying v(a)[1]

Natural Fertility Indices	assumed age interval (no birth control)	adjustment on v(a)	Correlation with FB
NF0	22.5-27.5	+0.14	0.0967
NF1	20.0-24.9	0.00	0.3464
NF11	19.3-24.2	-0.05	0.4446
NF12	18.5-23.4	-0.10	0.5390*
NF2	17.5-22.5	-0.14	0.6091**

[1] 27 annual estimates of M from 1952 to 1978 (see Appendix) are used. Values of FB from 1952 to 75 are estimated from the 1/1000 Survey, and the three values of 1976-78, 0.149, 0.159 and 0.176, are estimated from the 1985 In-Depth Survey, (see Chapter 4). ** 1-tailed Significance 0.001

From Table 3.9, the correlation coefficient 0.6091 between mean fecundability and the index of natural fertility, M, by adjusting v(a) -0.14 is significantly higher than the value (0.3464) between fecundability and the original v(a). The contrast would be much more significant, if we had FB estimates of the period from 1978 to 1986, during which underestimating problem caused by the original model become more severe, (see Chapter 4). This suggests that the adjusted model has a much higher chance of providing a better estimate of natural fertility, at least in the circumstances studied here. The results of shifting v(a) from +0.14 to -0.14, corresponding to assumed different age intervals of 'natural fertility', also indicate that underlying fertility estimates based on the assumption of fertility of women at age interval 17.5-22.5 being 'natural', have the highest correlation with fecundability. So the adjustment on v(a) by -0.14 seems preferable to the other suggested adjustments in Table 3.9.

However, we must acknowledge that the adjustment of v(a) by -0.14 remains essentially arbitrary. Shifting v(a) by this amount is not necessarily the best adjustment for this test, as an even higher correlation with the fecundability seems possible if a further shift (a number greater than -0.14 in absolute terms) can be employed to adjust v(a), given the tendency of the correlation coefficients indicated in Table 3.9. However, we can justify the choice of adjusting by -0.14 for the following reasons.

First, mean fecundability here is a measure based on the first birth intervals, while underlying fertility, M, is the index estimated from marital fertility, which involves all parities of births, so the correlation coefficient may be capable of providing a direction in which the adjustment should be made, but not a uniquely solid criterion upon which an optimal solution can be reached, simply because they are two different measures.

Fecundability is mainly affected by coital frequency, but underlying fertility is also affected by breastfeeding, primary sterility, postpartum non-susceptibility, and other proximate determinants.

Second, it is a feature of the CT model itself that an optimal adjustment on v(a) is unobtainable purely within the terms of the model. Reference must always be made to some external source of information to set v(a). Thus, as we discussed above, v(a) has to be set arbitrarily. Unless ages at entering marriage and childbearing are homogeneous, any arbitrary assumption of the same five-year age interval being 'natural', which can also fit the reality well seems unlikely. In short, so long as there is not a unique and reliable criterion quantitatively to judge the fitness of our present adjustment, the decision that any adjustment on v(a) is better than another alternative is difficult to reach. The best idea is to assess it relative to reality to see whether it provides more plausible results.

Third, as there were some women practising birth control at age 15-19, the adjustment of -0.14, based on the assumption of marital fertility at age 17.5-22.5 being 'natural', will exert on M a downward bias, and thus make the estimates more 'conservative'. On the other hand, this downward bias will be somewhat offset by a different upward bias. Although on average Chinese women got married at about 22 in the 1980s, there still existed a small proportion of women who got married after age 24, and whose fertility at early marriage durations, say up to two years, was 'natural'. However, they would be interpreted by the assumption to be 'controlled fertility', producing a higher level of underlying fertility by the adjusted model (-0.14), resulting in a small upward bias. Although the effect of the downward bias on underlying fertility estimates could not be offset completely by the upward bias, it certainly will be reduced.

Finally, and perhaps most importantly, the downward bias is unlikely to affect our observed increasing trend in underlying fertility. If we can identify such a secular increasing trend by a 'conservative' estimation with a net downward bias, which minimises any estimates of increasing changes on the underlying fertility, rather than inflating the estimates, then our estimation are all the more robust. Moreover, since we are mainly concerned about the changes in the underlying fertility over time rather than with any particular level at a certain time, if the downward bias consistently feeds through all the estimates of each period, the effect on relative changes between every two consecutive periods is negligible.

To sum up, bearing in mind the Coale-Trussell model's implicit linearity and the circumstances of China after the 1950s, I believe that the proposed modification of the model is a profitable way to improve it. First, it establishes a closer link between m and M, while recognizing that m and M are different indices representing in broad terms birth control and natural fertility respectively. Second, having accepted the fact that no optimal adjustment can be achieved, the adjusted model appears to provide improved and more robust estimates for underlying fertility, at least in China after the 1960s. As Table 3.7 shows, the model with v'(a) (shifted by -0.14) gives r''(a) a higher M value 0.714 rather than 0.688 or 0.691. This means that in the new situation with the observed fertility schedule r''(a), with the practice of birth control substantially growing, the m value rises from 0.171 to 0.227, but because r''(20-24) remains the same as r(20-24), the model estimates a higher level of underlying fertility. Obviously, the improvement seems reasonable from the logical perspective of the model itself. However, even though the adjusted model seems plausible, given external information, discovering whether or not it really can give a more insightful interpretation of the actual demographic process needs further empirical testing.

I.3.3 An empirical test and assessment of the adjusted model

Three sets of marital fertility schedules, two from non-mainland Chinese populations, Taiwan and Hong Kong, and one from Japan, are selected to test our adjusted version of the model. The underlying fertility estimates (M), the index of fertility control (m) and goodness of fit by marriage cohort based on both the original model with (v1) and its adjusted version with (v2) for these three populations are listed in Table 3.10. Apart from Hong Kong, where the marital fertility data before the war are not available to the author, the level and pattern of marital fertility schedules from Taiwan in the 1940s and Japan in the 1920s were very close to those of mainland Chinese before the 1960s (see Chapter 5), and were mainly 'natural fertility'. The underlying fertility level rose until the 1960s in both versions of the model. After then the rising trend stopped when assessed by the original model. This phenomenon, similar to what was found by Trussell in the Swedish case, is unlikely to match reality as a dramatic economic development and significant improvements in consumption occurred for all three populations after the post-war period, which makes an arrested increase in trend in underlying fertility very difficult to explain. The problem is clear, the increasing popularity of family planning since the 1960s led younger married women to use birth control, even including those aged 20-24.

Japanese marital fertility for younger aged cohorts, such as those aged 20-24, kept rising until the middle of the 1960s (see Kobayashi et al. 1969:54-55), although the birth control index was already quite high (over 2.0), a level of significant birth control suggested by Coale (1992:340). This feature could be captured by the original model, as it is still close to the assumption in the model that younger women aged 20-24 are not to restrict their fertility. So an increasing trend up to 1965 is still indicated by the original model. However, the end of the rise or even a reduction of young women's marital fertility after 1965 was more likely due to birth control spreading from the older age groups to younger cohorts, rather than socio-economic conditions deteriorating in ways less favourable to natural fertility. In fact, Japan experienced rapid economic growth in the 1950s, and even more dramatic economic growth in the 1960s and 1970s. In this circumstance, the index of natural fertility should be more likely to rise than remain unchanged, as indicated by the original model. Instead, the adjusted model estimates a more realistic trend of M(v2), indicating that the underlying fertility level rose over time. But, the adjustment (shifting -0.14) of the model is based upon the situation of China, for Japan, it may be more or less over-adjusted, so it is always possible that the scale of the rise is overestimated by the M(v2).

Although the postwar economic recovery and growth in Hong Kong was similar to that in Japan, the problem of estimating M is the opposite. The underlying fertility level after 1966 stopped rising and dropped slightly even by the adjusted model, while it fell dramatically according to the original model. The estimates from the adjusted model are obviously closer to the real situation, but some underestimation is still clear. The problem, again, is believed to be related to assumption about v(a). Evidence from Mok's study (1979:193) suggested that the highest proportion of contraception acceptors shifted from women aged 25-29 to those aged 20-24 after the 1960s in the colony. Compared with mainland China after 1979, where fertility of those aged 20-24 was partly controlled and contraception was much less prevalent than for 25-29, Hong Kong, as a British colony and under the western influence much earlier, seems to have stronger fertility control among those aged 20-24. Thus the amount of adjustment (-0.14) may not be adequate to match the real situation, and the scale of the changes in underlying fertility is thus underestimated.

Table 3.10 Marital fertility schedules by marriage cohort from Taiwan, HongKong, and Japan, their underlying fertility estimates (M), index of fertility control (m) and goodness of fit: R^2 and mse, based on both original Coale and Trussell's model (v1) and its adjusted version (v2)

	Age specific marital fertility rates					Underlying fertility estimation				
	20-24	25-29	30-34	35-39	40-44	M(v1)	M(v2)	m	R^2	mse(%)
Taiwan										
1941-45	0.316	0.283	0.243	0.182	0.100	0.675	0.686	0.117	0.76	0.114
1959	0.406	0.374	0.296	0.212	0.100	0.908	0.946	0.295	0.98	0.048
1964	0.433	0.377	0.231	0.132	0.060	0.982	1.091	0.751	0.97	0.447
1969	0.473	0.338	0.162	0.068	0.026	1.064	1.298	1.420	0.99	0.716
1974	0.444	0.277	0.103	0.037	0.011	1.005	1.326	1.978	0.99	0.604
Hong Kong										
1961	0.458	0.368	0.248	0.152	0.066	1.002	1.102	0.680	0.99	0.081
1966	0.499	0.342	0.220	0.119	0.047	1.057	1.210	0.963	0.99	0.094
1971	0.451	0.307	0.174	0.088	0.031	0.980	1.160	1.194	1.00	0.038
1976	0.301	0.241	0.126	0.047	0.014	0.763	0.946	1.529	0.98	1.293
1981	0.284	0.219	0.111	0.037	0.007	0.785	1.030	1.927	0.96	3.687
Japan										
1925	0.340	0.297	0.253	0.196	0.088	0.741	0.765	0.223	0.97	0.041
1955	0.342	0.237	0.132	0.059	0.016	0.804	0.985	1.452	0.99	0.492
1960	0.341	0.238	0.093	0.028	0.006	0.891	1.215	2.213	0.99	1.443
1965	0.357	0.255	0.099	0.022	0.004	1.024	1.467	2.557	0.97	4.915
1970	0.346	0.259	0.095	0.022	0.003	1.060	1.550	2.708	0.97	6.268
1980	0.349	0.239	0.082	0.014	0.002	1.073	1.645	3.042	0.97	6.879

Source: Taiwan, Wolf(1984:455), Sun and Soong(1979:120). Hong Kong, Mok (1979:187), and ***UN Demographic Yearbook***, 1981(p839), 1985(p875). Japan, Kobayashi et al.(1979:53-56), and ***UN Demographic Yearbook***, 1981(p839).

Among the three selected populations, the Taiwanese are closest to the mainland Chinese in terms of socio-cultural background. The marked difference in economic growth between the mainland and the island emerged only from the 1960s, and apart from this, other conditions of the two populations were very similar. Taiwan also has been experiencing economic recovery and growth since the 1950s. Corresponding to this, natural fertility should have risen steadily since then. This increasing trend until 1969 is well shown by the original model, as there is no significant evidence that the assumption of fertility of women aged 20-24 being 'natural' was violated before the 1970s. However, the Taiwan government then started introducing a national family planning programme. The cumulative rate of acceptance of IUDs, which was the main contraception method during the time, rose from 1.1% in 1964 to 21.4% among married women aged 20-24, and about half of those aged 25-29 were users (45%) in 1974, according to Sun et al. (1979:132). This pattern is very similar to what happened on the mainland during the 1970s and 1980s. Under these circumstances, the adjusted model seems able to provide plausible estimates of underlying fertility, in terms of both trend and level. It is noteworthy, for example, that the mean squared error(mse) for Taiwan remains at much more acceptable levels throughout the period studied, while the mse values for Hong Kong and Japan, though very good at first, become poor by the 1970s and 1980s.

Evidence from three selected populations close to the Chinese, particularly from Taiwan, suggests that the modified version of the model is able to provide more realistic estimates of underlying fertility (M) than the original version. However, the amount of adjustment, which is based on the situation in mainland China, may not be the most appropriate to all three populations, as overestimates and underestimates are obvious for Japan and Hong Kong respectively. For the Taiwanese, who had the closest conditions to the mainland (the patterns and levels of marital fertility in both were almost identical), the adjusted model seems able to provide the most plausible estimate. This further indicates that the modified assumption of natural fertility at age interval 17.5-22.5 and subsequently the amount of adjustment, -0.14 on v(a), designed for the Chinese case, is simple but reasonable and sufficient for our purpose. Most applications in the later chapters further suggest this, although underestimation problem still exists on one or two occasions, such as in the estimation for university educated women.

In the remainder of this study we will try to use both the original model (applying v(a) labelled as v1(a)) and its adjusted version (applying v'(a) labelled as v2(a)) as basic measurements to examine changes in underlying fertility in China. Both schedules of v(a) in each version are given in Table 3.11. A visual representation of the adjustment implied here is given in Figure 3.1, which plots the values of v(a) for each age group.

Figure 3.1 Two versions of the model's parameters v(a)

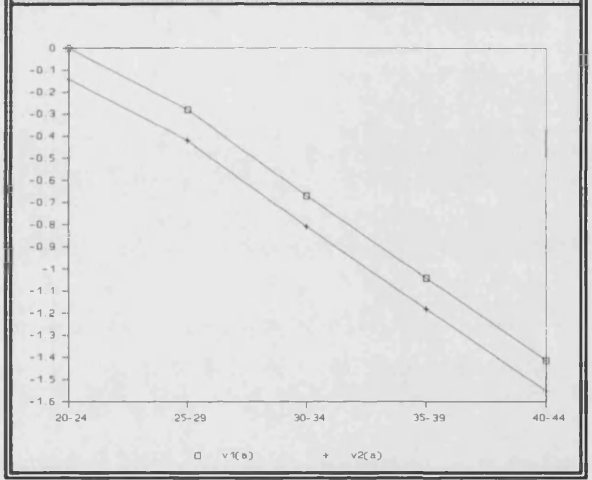


Table 3.11 The n(a) and two versions of the model's parameters v(a)

Parameters	20-24	25-29	30-34	35-39	40-44
n(a)	0.460	0.431	0.395	0.322	0.167
v1(a)	0.000	-0.279	-0.667	-1.042	-1.414
v2(a)	-0.140	-0.419	-0.807	-1.182	-1.552

I.4 Natural fertility and its proximate determinants: measurements and their data sources

I.4.1 Marital fertility and ever-married fertility

The main measurement to estimate the index of underlying natural fertility is the CT model, as it gives levels of both underlying fertility and birth control. Thus, it seems best to begin with those rates most often quoted for historical data: marital fertility rates. The main data available on the trend in China come from the 1/1000 Fertility Survey in 1982 and One-Percent Population Sample Survey in 1987. These include: (1), age-specific ever-married fertility rates by five-year of age groups from 1950 to 1981 and 1986; (2), age-specific fertility rates by five-year age groups from 1940 to 1981 and 1986; (3), age-specific rates of women at first marriage from 1940 to 1981; (4), age distribution of women at first marriage 1940-1981; and (5), age distribution of never married women in 1986. The data from other fertility sample surveys include: (1), age-specific marital fertility by five-year age groups from the Farm Survey in 1929-1931; and (2) age-specific marital fertility by five-year age groups from 1981 to 1984. Now the crucial question is whether or not the data can illuminate the issue in hand.

The time series of proportions of women currently married at each age in different time periods are not available, since the 1982 1/1000 Fertility Survey did not inquire about the timing of divorce, widowhood and separation. It needs to be borne in mind, however, that the proportion of women ever married can be estimated by summing age-specific first marriage rates through the cohort diagram. However, ever-married fertility, which is then available, is a different measure from marital fertility due to mortality and marriage dissolution. Coale and Trussell's study (1974:190), for the purpose of simulating an actual age-specific fertility schedule $f(a)$, expressed their model as follows:

$$f(a) = G(a) \cdot n(a) \cdot e^{m \cdot v(a)} \qquad (3.5)$$

where G(a) is the proportion ever married estimated by the earliest age at which marriage occurred, a_0, and another parameter, k, indicating the degree of variation among couples in age at marriage. In this case, because the real G(a) is available, we can ignore the problem caused by using estimated G(a), and only pay attention to the effect of using ever-married fertility rather than current marital fertility. For this effect, Coale and Trussell (1974:191) wrote that "the proportion of ever married population that is widowed and divorced rises monotonically with age, thus reducing fertility toward the end of childbearing in a way that is topographically similar to the effect of v(a) on marital fertility". So they suggested that "it is probable that modification of natural fertility by proper choice of m by which to multiply v(a) can serve to approximate the effect both of marital dissolution in reducing the fraction married at higher ages and of control of fertility on marital fertility.". In other words, using ever-married fertility to estimate M and m here is possible and reasonable, though we may need to adjust our estimate. This is the matter we now examine.

In this study, one of the benefits of the detailed information that appears in the report of the 1982 1/1000 Survey is the feasibility of computing age-specific marital fertility schedules. To do this the proportion of ever-married women by age is determined from the data on first marriage, a fertility schedule of the ever-married women is then obtained by dividing the overall fertility of women at each age by the proportion ever married. Finally, the marital fertility schedule is derived by a further division of the ever-married women. This last proportion can be estimated as having approximately the same values in different calendar years because of the surprisingly little difference for this distribution between the 1982 Census data and the Chinese farm population in 1930. The proportions of currently married to ever-married women in these three years are as follows:

Table 3.12 The ratios of currently married to ever-married women in 1930, 1982 and 1986

Year	15-19	20-24	25-29	30-34	35-39	40-44
1930	0.991	0.981	0.968	0.953	0.916	0.860
1982	0.990	0.986	0.977	0.960	0.933	0.888
1986	0.990	0.996	0.995	0.987	0.973	0.946

The very slight difference in these ratios of 1930 and 1982, despite the very substantial difference in mortality, implies that the higher incidence of widowhood at the earlier date must have been offset by a high rate of remarriage of widows, as suggested by Coale (1984b:35). Approximate age-specific marital fertility schedules by five-year age groups from 1950 to 1981 can be constructed by assuming that the ratio of currently married to ever-married women in every year is equal to the average of the ratios for 1930 and 1982. However, if we are only interested in changes in underlying fertility over time, rather than comparisons between China and other countries, it would not make any difference if estimation of underlying fertility level was based on either of these two, because the age-specific marital fertility here can be worked out by dividing the ever-married fertility rate by the average (thus a set of constant numbers) of ratios of currently married to ever-married between 1929-31 and 1982. Thus, the marital fertility rate here is simply a linear transformation of ever-married fertility obtained by dividing by a constant number at each age.

An increasing difference by age occurred in these ratios between 1982 and 1986 with no substantial difference in mortality, implying an even higher level of remarriage of widows. It is also possible that this contributes some inconsistency to the estimates of underlying fertility level when they are extended from 1981 to 1986 using data from the 1/100 Population Survey in 1987. However, under the 'One-Child' policy, the effect of this slight inconsistency (most severe in older age groups) is negligible. Ever-married fertility is definitely lower than current marital fertility at comparable ages, so estimates of underlying fertility tend to be lower if based on ever-married fertility. This would minimise rather than exaggerate any increasing trend in underlying fertility. Again, it only makes our conclusion more robust.

In a study analysing the negative relationship between fertility and education in China, Lavely and Freedman (1990:358) also have to use ever-married fertility to apply the CT model. The effect of doing this is to "tend to lower their fertility rates" and thus to make observed trends more conservative, they suggest. In dealing with fertility transition in China, Peng (1991:264) meets the same difficulty: he also believes that it is valid to use ever-married fertility instead of normal marital fertility. As he puts it, "Given the stability of Chinese marriage, combined with the sharp decline in mortality, this is reasonable."

In spite of all these comments, however, we are still not sure precisely how much difference it makes when the estimation of natural fertility is based on ever-married fertility rather than marital fertility, as the original model required. Is it really so very serious that we have modified our estimate if the ever-married fertility is applied as Coale and Trussell suggested? We know, as Coale and Trussell pointed out, that switching from current marital fertility to ever-married fertility inflates m estimates. However, here, our primarily interest lies in the underlying fertility level rather than in the index of fertility control, so the more important question is: how much difference does it make to our estimate of M? Would the level of underlying fertility based on ever-married fertility be considerably underestimated? Table 3.12 presents estimated M and m by both kinds of marital fertility schedule, and for both original CT's model and its adjusted version.

Table 3.13 Estimated index of natural fertility level (M), and index of fertility control (m), based on both current- and ever-married fertility rates, and by original Coale-Trussell's model and its adjusted version.

	1929-1931(Farmer)		1981(Nation)	
	Current-	Ever-	Current-	Ever-
Marital Fertility				
15-19	0.174	0.173	0.202	0.200
20-24	0.287	0.281	0.355	0.350
25-29	0.272	0.264	0.231	0.226
30-34	0.233	0.222	0.075	0.072
35-39	0.171	0.157	0.033	0.031
40-44	0.086	0.074	0.015	0.013
Original Model(v1)				
M	0.641	0.637	0.733	0.729
Adjusted Model(v2)				
M	0.655	0.659	0.925	0.930
m	0.154	0.243	1.673	1.745
R^2	0.919	0.947	0.953	0.960

Note: Marital fertility of five-year age groups from 20-24 to 40-44 are used in estimation as suggested by Coale and Trussell (1978:204). The m and R^2 (goodness of fit) are the same in both the original and the adjusted model.

The results in Table 3.13 confirm Coale and Trussell's comment on m, that estimated m based on ever-married fertility is inflated significantly, although the differences narrowed a lot in 1981. However, it hardly has any impact on the M estimates, as the differences in estimated values of M between two marital fertility schedules are less than 0.005 in all cases. Again, since we are primarily interested in the underlying fertility trend over time rather than in either the absolute level at any given time or the index of birth control, the bias introduced by using ever-married fertility rather than marital fertility is negligible. Given that the ratio of currently married to ever-married women changed little over time, any modification in M estimates seems quite unnecessary.

I.4.2 The estimation of fecundability and its data source

The measurement of fecundability proposed by Bongaarts (see Chapter 2) is based on the proportion of married women who have their first births within nine to eleven months of marriage. The published data of the In-Depth Fertility Survey provide these proportions from the 1950s to the 1980 (for three provinces).

Unfortunately, the published tabulated data of the 1/1000 Fertility Survey provide the distribution of women at first marriage by interval between first birth and marriage only in the following groups of months: 0-7; 8-11; 12; 13-24; 25-36; 37-48; 49+. If categories of 13-24 and 25-36 include those women who bore their first child in the second and third years after marriage, then 0-7, 8-11, and 12 should include those women who bore their children within one year of marriage. But the categories of 0-7, 8-11, and 12 usually mean thirteen months, a possible mistake. It is quite likely that '12' means twelfth month after marriage, thus '8-11' could mean from eighth to eleventh month rather than from ninth to eleventh month after marriage. As in this method the proportion of post-nuptially conceived first births occurring with nine to eleven months of marriage is used to estimate mean fecundability, if the data on the proportion of post-nuptially conceived first births occurring within eight to eleven months of marriage are available, a slight overestimate will be made by the difference between these two proportions. However, since we are again more interested in the trend of fecundability over time rather than in the absolute level at any given time, these biases are of minor consequence for our analysis provided they changed little over time.

I.4.3 The measurement of breastfeeding and its data source

Although the 1/1000 Fertility Survey contributes very limited information about Chinese women's breastfeeding experience, through the In-Depth Fertility Survey the data were collected systematically for the first time in China, providing a unique opportunity for discussion of questions such as whether changes in the average duration of breastfeeding contributed to those in natural fertility.

The broader methodological aspects of the problems of measurement and analysis of breastfeeding have been amply covered by many previous studies. The material available here provides the basic data for average and differential analyses, such as 'distribution of children according to length of breastfeeding by years since birth occurred', 'distribution of children according to length of breastfeeding by current age of the mother'. Here I confine attention to children born at least three years before and exclude children who died before age two from later analyses to avoid the bias resulting from open and closed intervals. The data on mean length of breastfeeding were confined to those weaned in the first 35 months and included those not breastfed as zero. The proportion of children not breastfed is also available.

I.4.4 The estimation of primary sterility and its data source

With the available data, two measures could be used for the study of infecundity. The first is the proportion of women with no living children. This measure captures the linguistic notion of childlessness and its obvious socio-economic importance. However, the measure is influenced by both the fecundity of the couple and the level of mortality to which children are subject throughout their lifetime.

The second measure which could be used is the proportion of women who never had any live birth. This measure remedies the shortcoming of taking living children as a measure of primary sterility, in that the effect of child mortality has been eliminated. However, primary sterility does not necessarily mean that women never experienced any pregnancy. In other words, this measure is still influenced by intra-uterine mortality, and unfortunately information on intra-uterine mortality is very difficult to collect and not available here. However, as most pregnancies lead to a live birth, this measure is a quite reasonable approximation of primary sterility.

One question we could ask is whether there might be women who had no birth because of the absence of sexual relations, or who used abortion or contraception and thus who may really be fecund. There might be such cases in some areas or in some periods in China. For example, hundreds of thousands of husbands left their home towns to find jobs and food during the famine period of 1959-61. In addition, many wives and husbands worked in different towns or areas, such as those in low ranking military service, who usually only had one month's vacation to join their families each year.

However, such problems were often temporary and related to a small proportion, compared with the total population. As we know, in traditional Chinese society, the family and kinship circle were the most important units of organisation to serve the individual's social and economic needs. So getting married and having children were seen as moral obligations. Voluntary childlessness was virtually unacceptable to society, especially to both husband's and wife's parents. According to Confucianism, the greatest sin a son could commit against his parents was not to bring offspring to their family. Since the 1950s women's societal role has been transformed, and more and more women have participated in economic activities, so that both work and motherhood are considered important roles for Chinese women. Nevertheless, popular attitudes still tend to favour motherhood as the primary one. Even in recent family planning campaigns, messages on birth control are always combined with some propaganda to tell people how to have a healthy and intelligent child.

I.5 Data truncation

I.5.1 Data truncation 1: the period 1940-1960

Although age specific and total fertility rates can be derived from data collected in the 1/1000 Fertility Survey, the upper age limit of the survey was set at 67, which means that women aged 67 at the time of the survey were 25 years old in 1940, 35 in 1950, and so forth. As a result, age-specific fertility rates in five-year age groups from 15-19 to 40-44, the information required for directly computing natural fertility level (M), are only available from 1960 on. For the period prior to 1960, we have only truncated fertility rates for younger ages. Although, for the period of 1950-60, only an incomplete set of marital fertility is available, we still have more than two five-year age group marital fertility rates in each year. From this a complete set of marital fertility can be constructed, given the fact that the fertility schedule remained a natural pattern until the 1960s. Thus it enables us to compute natural fertility (M) for this period. A further evaluation and discussion in Chapter 5 suggest that the constructed ever-married fertility rates are rather robust (A full set of ever-married fertility rates from 1950 to 1981 for China as a whole is presented in Table 10.1 in Appendix).

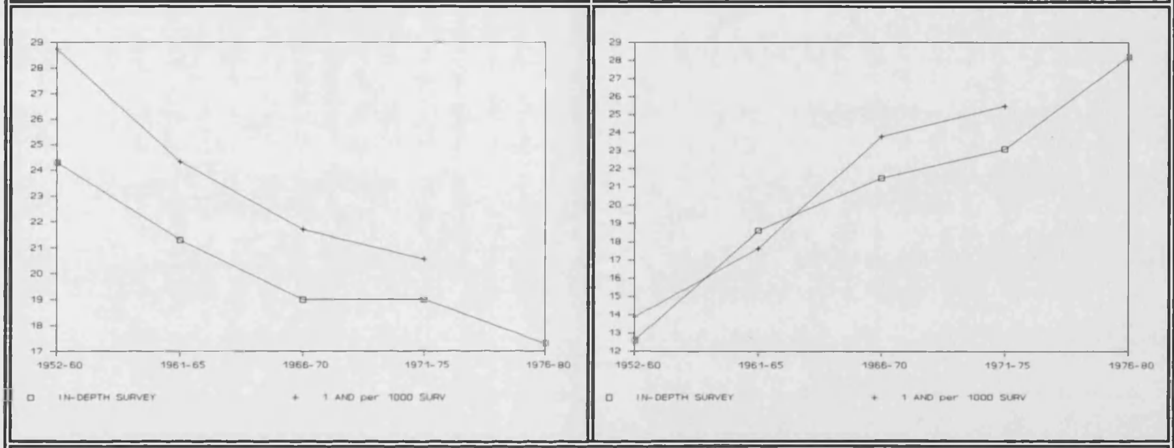
Very few data (two age groups or less) on age specific ever-married fertility from 1940 to 1949 are available. The alternative data on this period are the marital fertility rates by single-year duration since first marriage from 1930 to 1981. Duration-specific fertility is a measure showing the average number of births for ever-married women at each duration since first marriage. Although it is a different index from age-specific ever-married fertility, trends and changes in duration-specific marital fertility do reflect the same underlying fertility as age-specific marital fertility, provided that patterns of the natural fertility and marriage stay consistent. So for the period 1940-49 we can use the trend of duration specific marital fertility to present indirectly the natural fertility level. These two indices were very consistent during the period of 1950-1970, when the fertility pattern was not affected by birth control practices and the marriage pattern remained more or less the same. The 1/1000 Fertility Survey shows that the proportion remaining single among respondents in the survey was less than 1.0 percent at every age above 30. Moreover, female mean age at first marriage in China rose only a little from 17.52 (SMAM) for the Chinese farm population in 1930, to 18.46 in the 1940s for China as a whole, and to 18.68 in 1950. The small increase in age at first marriage occurred without any change in the universality of marriage for women in China. The total first-marriage rate for birth cohorts in China was very near 1.0 in the 1980s. In this context, the unchanged marriage and natural fertility patterns again lead to the possibility of presenting natural fertility trends from 1940 to 1949 by displaying the duration-specific marital fertility at this period.

I.5.2 Data truncation 2: the period 1971-1980

Although the 1/1000 Fertility Survey was conducted in 1982, it fails to provide complete reproductive information on the 1970s, such as the distribution of women at first marriage by interval between first birth and marriage, which is the information needed to estimate birth intervals and fecundability. For example, when we estimate the mean first birth interval, these women should have at least five years of time in observation. Thus, a reasonable estimation of the mean first birth interval was only possible up to 1975 from the truncated data of the 1982 1/1000 Fertility Survey. In this circumstance, it is worthwhile exploring the possibility of providing a full reproductive version up to 1980, by joining information from the two fertility surveys carried out in 1982 and 1985 respectively.

Figure 3.2 Consistency of the two fertility surveys

a: Mean length of the first birth interval (month)	b: The proportions(%) of first births occurring 8/9-11 months of first marriage[1]



[1] The births occurring at 8-11 months in the 1982 1/1000 Survey, and 9-11 months in the 1985 In-Depth Survey, see text I.4.2 in this chapter for more detail.

In Figure 3.2 we present: from the 1/1000 Fertility Survey in 1982 and the In-Depth Fertility Survey in 1985 respectively, (a), mean first birth interval (1953-75) and (1953-1980), and (b), the proportion of post-nuptially conceived first births occurring within eight to eleven months of marriage(1953-75), and nine to eleven months of marriage(1953-80). Despite the fact that the two surveys cover very different sizes of area (three regions in the In-Depth Fertility Survey and twenty-eight regions in the 1982 1/1000 Fertility Survey) there is a broad similarity of pattern. Nevertheless, differences do exist: the mean first birth interval estimated from the In-Depth Survey is consistently lower than that for the 1/1000 Survey. Similarly, the proportions of women whose first births occurred at nine to eleven months of marriage estimated from the In-Depth Survey are also mostly lower than those from the 1982 survey, except for one period (1961-65) which might be due to geographic variation in the severity of the famine. Overall, however, the two surveys illustrate a consistent story and show very similar trends in the two estimates. It is possible, therefore, to join information from these two surveys to show a full picture up to 1980. Of course, a certain caution and appropriate adjustment are necessary when joint information is used and the results are interpreted.

Chapter 4 Natural Fertility: China As a Whole

I.1 General fertility

The information required for directly computing complete sets of age-specific fertility rates is available only from 1964 onward from the 1982 1/1000 Survey. For the period prior to 1964, we have only truncated fertility rates for younger ages. Several efforts have been made. A curve-based extrapolation method has been employed by Chinese demographers based on a standard relation between two sets of age specific fertility rates from different years.[1] This approach provides a complete set of age specific fertility rates by single years of age from 15 to 49 over the period 1940 to 1981. More recently, Coale and Chen have reconstructed total fertility rates by age and total marital fertility rates by duration for the whole period 1940-1982. They estimated the total fertility rate for 1945-1981 from duration specific fertility rates and total first marriage rates.[2] Yearly and single-year age fluctuations were smoothed. The basic assumptions and estimates of the two methods are similar. In this chapter, estimates of TFR between 1945-1963 given by Coale and Chen are accepted with caution. Rates from 1964 onward are derived directly from the survey. Table 4.1 and Figure 4.1 contain the TFR over the 38 years from 1945 to 1986 for China as a whole and the total duration marital fertility rates(TDMFR) separately.

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[1]The data and method can be found in 'An Analysis of a National One per Thousand Population Sample Survey In Birth Rate', a special issue of ***Population and Economy***, Beijing, 1983, pp.10-53.

[2] A. Coale and S. Chen 1987: Basic Data on the Fertility in the Provinces of China, 1940-82, ***Papers of The East-West Population Institute***, No. 104, East-West Population Institute, Honolulu, pp.1-40.

Table 4.1 Total fertility rates(TFR) and total duration marital fertility rates(TDMFR) 1945-86: China as a whole

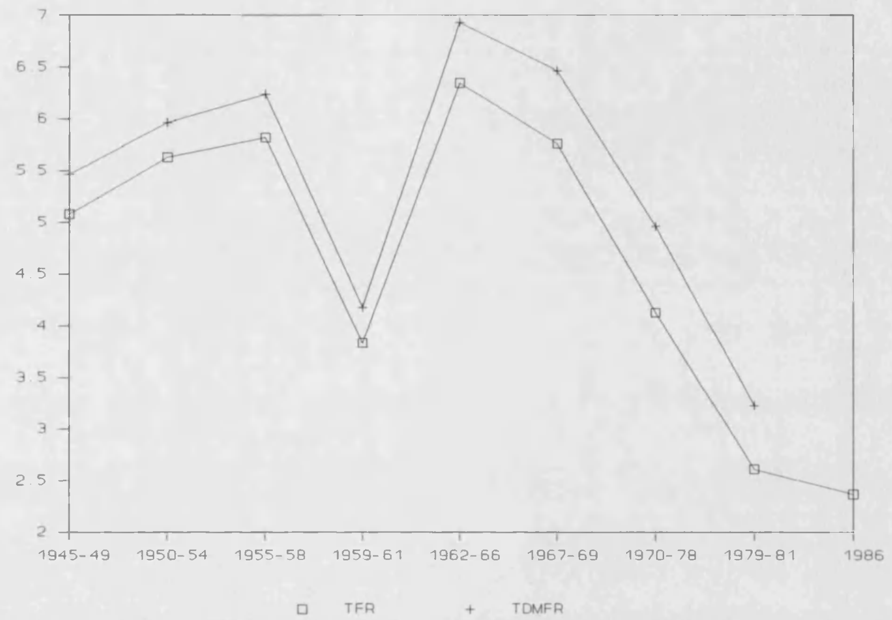
Year	TFR	TDMFR	Year	TFR	TDMFR
1945	4.766	5.154	1966	6.211	6.891
1946	4.999	5.401	1967	5.252	5.894
1947	5.199	5.605	1968	6.370	7.153
1948	4.906	5.271	1969	5.670	6.351
1949	5.537	5.903	1970	5.746	6.455
1950	5.292	5.592	1971	5.396	6.110
1951	5.262	5.555	1972	4.920	5.664
1952	5.973	6.324	1973	4.506	5.337
1953	5.669	6.021	1974	4.150	5.067
1954	5.955	6.337	1975	3.576	4.482
1955	5.978	6.376	1976	3.254	4.162
1956	5.605	5.995	1977	2.866	3.763
1957	6.205	6.656	1978	2.748	3.620
1958	5.496	5.923	1979	2.798	3.649
1959	4.233	4.594	1980	2.316	2.883
1960	3.986	4.350	1981	2.713	3.149
1961	3.280	3.592	1982	2.860	3.024
1962	5.969	6.497	1983	2.420	
1963	7.413	8.020	1984	2.350	
1964	6.120	6.654	1985	2.200	
1965	6.022	6.605	1986	2.420	

Note: TFR and TDFR 1945-81 are from Coale and Chen (1987), TFR after 1981 is from *China Population Yearbook 1989*, 131.

The fertility level before 1950 is not so clear. Although the establishment of the Nationalist government in Nanjing in 1927 signified a new era, it is well known that its authority was accepted reluctantly and only gradually by the provinces. The government was confronted with a gigantic task in seeking to unify the country and renovate the ruling system. Virtually no vital registration or population registration system existed at that time. A national census was to be carried out to count total population in 1928 and the provinces were twice instructed to carry out this task through the county governments, but only 16 provinces reported before the end of 1928 and 12 failed to report up to the mid-1930s. So Ho (1959:79-86) suggested that the figures of national population in the two decades before 1949 were mainly guesswork.

Figure 4.1 Total fertility rates(TFR) and total duration marital fertility rates(TDMFR) 1945-86

China as a whole



However, a TFR of around 5.4 was estimated for the 1940s using the 1982 1/1000 Fertility Survey data. This is a level close to that estimated by George Barclay et al. (1976:614) for the Chinese rural population in the 1930s from information from the Chinese Farm Survey. In the mid-1950s, China's national total fertility rate was around 6 and remained so till the end of the 1960s. In the early 1970s, the fertility transition began in earnest. The national TFR declined from 5.7 in 1970 to 3.6 in 1975, and to 2.31 in 1980. In other words, China's fertility decreased by more than 50 percent in only one decade. In 1985, the TFR reported by a national sample survey on population change was 1.996. More recently, China's fertility has risen slightly, but still remains at a low level.

Before going on to more detailed analysis, let us first divide China's fertility transition into periods constructed so as to be homogeneous with respect to economic conditions and population policy. The dates when marked fertility changes occurred are informative, especially when linked to other socio-economic factors and to the efforts of the Chinese government to control population growth. Here, the emphasis is mainly on fertility change since the founding of the People's Republic of China in 1949; the fertility situation before that year is excluded as being largely unrepresented in the data.

First period: 1950-54. China's fertility during this period rose steadily to a level around 6. Peaceful social conditions after the Japanese War and the civil wars, and the recovery of the national economy were the major factors responsible for this. In particular, by the mid-1950s health had improved to such a extent that one would expect rising natural fertility. The increase can also be attributed to several policy factors, among which the uncritical following of the development strategy of the Soviet Union was important.[3] In fact, government policy in this period was pronatalist. Bearing more children was encouraged and prolific mothers were widely honoured.

Second period: 1955-1958. The TFR remained at a fairly high level around 6 with small fluctuations. Birth control was discussed on some occasions, but no effective family planning policy was implemented. Economic development, health care and education programmes, social welfare improvements, and general modernization all probably contributed to this fertility level. The fertility pattern in this period and before can be regarded as the natural one in China.

Third period: 1959-1961. This was characterised by a huge drop in the fertility level.

[3] Tian Xueyuan 1981: A Survey of Population Growth Since 1949, in Lui, et al., (1981) ***China's Population: Problems and Prospects,*** Beijing, New World Press.

In early 1958, the 'Great Leap Forward' was launched by the government. This movement soon led to an economic breakdown, including a nationwide famine between 1959 and 1961. It is likely that the birth rate dipped because of the low caloric intake during the 'Great Leap Forward' and that the reduced fertility came nine months after widespread and serious food shortages. In consequence, fertility dropped dramatically from 1959 and reached a trough in 1961.

Fourth period: 1962-66. Beginning in 1962, socio-economic situation returned to normal. With consumption levels improving, the TFR rose to a peak value of 7.4 in 1963, the highest since 1949, which was more or less a making up for fertility loss in the last crisis. This post-famine baby boom followed a surge of marriages in 1962, so there was an unusual concentration of first births in 1963. In addition, couples married in earlier years may have had a birth in 1963 to make up for some of the subfecundity, postponed childbearing, stillbirths, and excess infant and child deaths of the famine years. Alarmed by the huge fertility rise, the government started to carry out a birth control programme in this period. This focused first on the urban population and no compulsory measures were adopted. The effect on the national fertility level of this programme was minor as the urban population was only a small proportion. The demographic impact of these measures was discussed by Peng (1987:639-670) in great detail.

Fifth period: 1967-1969. After the massive fluctuation of the two previous periods, the TFR returned to a relatively stable high level. In 1966, the leadership launched the so-called 'Cultural Revolution', and all Chinese people were mobilized to take part in the movement. Socio-economic development was severely disrupted again. Virtually no family planning programme existed during this period. The fertility regime went back to 'natural'. Banister (1987:231) observed that the overall fertility level and pattern in 1970 showed very little difference from that of 1955.

Sixth period: 1970-1978. This period is well-known for its significant fertility decline. Although the people's living conditions saw virtually no improvement, and may even have worsened in many rural areas, the nationwide family planning programme of 'Later-Longer-Less' went to effect from 1971. The appropriate marriage age was set out by local governments, normally around 23-25 for females and 25-27 for males. Women were encouraged, in some circumstances forced, to postpone their marriage. Coale (1984:51-54) estimated that increasing age at first marriage accounted for over 40 per cent of the rapid fertility decline in the 1970s. A well-organized birth control network also played a very important role in reducing fertility from 5.7 in 1970 to 2.7 in 1978.

Seventh period: 1979-1981. The economic reform, especially the implementation of the rural responsibility system, started and was very successful in terms of economic growth and the improvement of living conditions. Meanwhile, the family planning programme was extended and strengthened, and the 'One Child' policy was first put forward. This policy, its implementation and its demographic and social responses have been discussed in great detail in a number of studies, such as Davin and Kane (Croll et al.; 1985:37-113), Banister (1987:183-226). The TFR declined to another trough of 2.3 in 1980.

Eighth period: 1982-1986. The economic reform became widespread. Overall consumption levels rose dramatically in the whole nation. However, the TFR showed a slight increase in 1981 and reached another peak in 1982. The major factors responsible for that were a marriage boom and a relaxation of birth control efforts and of controls on age at first marriage in 1981, when the new marriage law went into effect.[4] This set the legal age of marriage two years higher than in the old marriage law but well below the official requirement prevailing in the 1970s. As mentioned earlier, controlling of the age at marriage in the later 1970s was not through the legal age for marriage, but rather through the recommended age set by local authorities which was usually at least 23 for females. In the 1980s the previous recommended age for marriage ceased to be effective and the only controlling age is the legal marriage age, which is 20 years old for females, set by China's 1980 marriage law. Although late marriage is still strongly encouraged by propaganda and family-planning programmes, it is no longer compulsory. A lowering of the age at marriage is likely to lead to a lower age at first birth, thus prompting a fertility rise. However, Feeney et al. (1989:306) believe that this effect on TFR results from a change in the timing of childbearing and is thus transitory, if there is no big change in completed family size. More recently, Feeney and Wang (1993:70) have argued that the decline in mean age at first marriage began after 1979, with the introduction of the 'One Child' policy, rather than after the 1980 Marriage Law. So a relaxation of late marriage requirements in 1979, which was before the new marriage law, is a more plausible explanation of this recent fertility rise.

I.2 Marital fertility

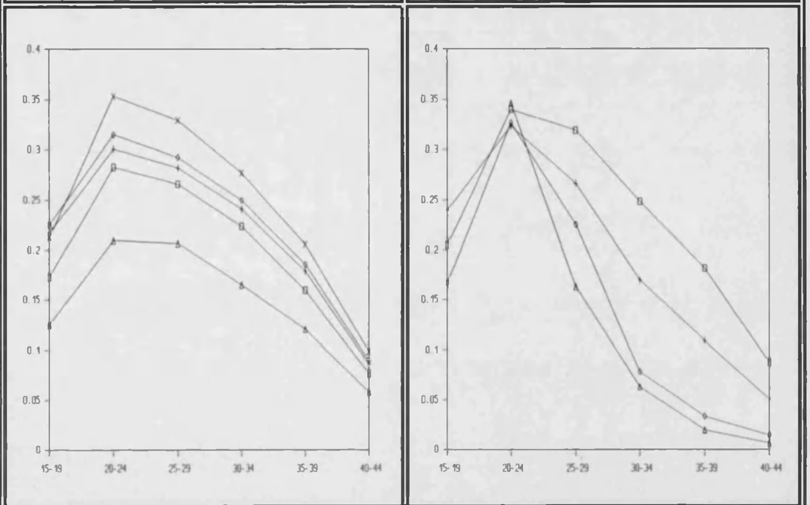
Marital fertility can be estimated from age-specific fertility rates and women's marital status. In this section, all figures refer to period measures of ever-married women's fertility. As we illustrated in Chapter 3, because of the stability of Chinese marriage in

[4]See 'China's Marriage Law', ***Beijing Review,*** 24(11), pp.24-27, (16 March 1981).

the past, this alternative is plausible. The trends in the observed age-specific marital fertility rates at the national level against age and time are plotted in Figure 4.2a and Figure 4.2b for couples married in the periods between 1929-31 and 1986.

Figure 4.2a Age specific ever-married fertility 1930-1986

I. Pre-transition periods: 1930-65 | II. Post-transition periods: 1966-86



Legend (I): □ 1929-31; + 1950-54; ◇ 1955-58; ▵ 1959-61; × 1962-65

Legend (II): □ 1966-69; + 1970-78; ◇ 1979-81; ▵ 1986

In the early 1950s, age specific marital fertility experienced a substantial increase among all age groups, especially among younger married cohorts. Similar patterns were also found in other countries, and are well known as the post war 'baby boom'. However, compared with finding of the Farm Survey, the marital fertility in this period was by no means markedly higher, though a general increase is obvious. We will make further comparison in detail in Chapter 5, but here we can already see that the shapes of the marital fertility curves in 1929-31, 1950-54, and 1955-58 are almost identical (see Figure 4.2a (I)). All were 'natural' fertility schedules. Although the precise levels of marital fertility during the 1930s and 1940s are not known, when the Japanese War and the civil wars were taking place throughout the country, it must have been a crisis period for the fertility, which then returned to the pre-war level after the coming of peace and with the recovering national economy.

A great fluctuation occurred during 1959-1966, when prolonged drought, heavy floods and other natural calamities along with a general disruption to life severely damaged agricultural production and caused famine.[5] Biological studies have proved that nutritional condition can have an impact on fertility, through its effect on menarche, lactation, amenorrhea and other processes affecting reproduction. The decrease in fecundity in the famine period, however, was probably not only caused biologically by malnutrition, as was suggested by Coale (1984a:57), but also by the psychological stresses associated with the crisis. Caldwell and Srinivasan (1984:74) suggested that reduced fertility in this period could be mainly voluntary, due to sexual abstinence and abortion. The pattern of marital fertility in 1959-61 remained 'natural', although a great reduction over all ages was clear. In terms of difference between the age groups, the younger the marital cohort was, the deeper the trough of marital fertility in all regions (see Figure 4.2b), which probably indicates that malnutrition affected young cohorts' fecundability more than that of older ones. This evidence at the national level is consistent with what will be found at the regional in Chapter 6. Figure 4.5 also shows that first birth intervals had a deeper trough than second ones during this period, and obviously on average women who only had their first births were younger than those who had had the second already. Or, perhaps younger women were more affected by separation. After that fertility crisis, another 'baby boom' took place, understandable as a 'compensation' for the opportunities to have children lost during the crisis.

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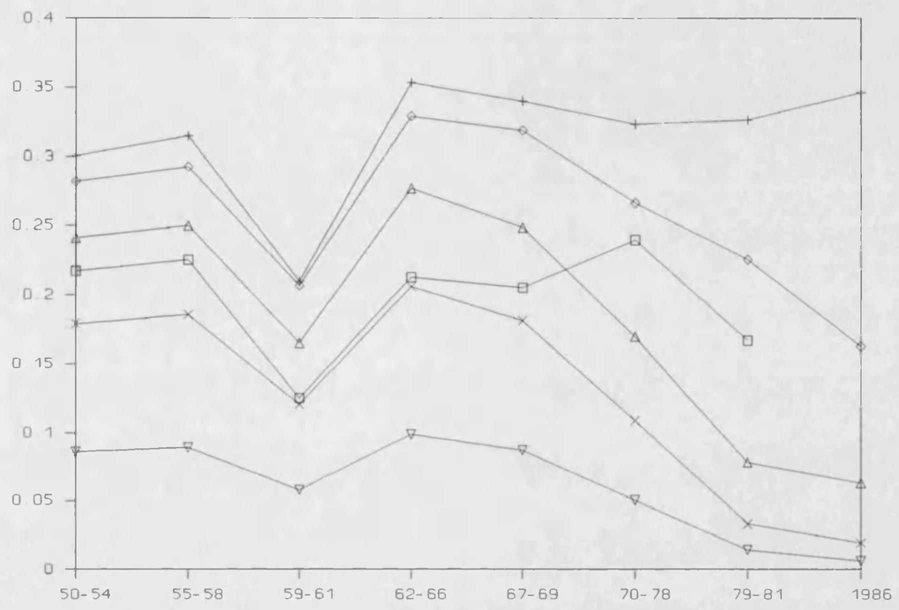
[5] Peng, X. 1987: Demographic Consequences of the Great Leap Forward in China's Provinces, ***Population and Development Review 13***, No. 4, pp.639-670.

Figure 4.2b Age specific ever-married fertility rates 1950-86

China as a whole



■15-19; +20-24; ♦25-29; ▴30-34; ×35-39; ▾40-44;

A transitional period occurred around 1967-1969. Before this a general move towards higher fertility among younger married women is evident, particularly among those aged 15-19 and 20-24, while there was slightly lower fertility among older women. After 1967-69, a dramatic decline in fertility among all age groups of married women took place, except for age group 15-19. The decline undoubtedly reflected the overwhelming increase in the practice of family planning, which was being propagandized by the national government, as well as by local governments. The data show that the trend towards lower fertility among women aged 40-44 before 1970 was mainly due to those women who lived in urban areas practising birth control and thus the trend of fertility among women of this age group was towards a substantially lower level. However, the urban population was a quite low proportion of total national population before the 1970s;

it was only 17.4% in 1970.[6] Thus the impact on the national fertility level of older women in urban areas practising birth control before the 1970s was not very significant, and the shape of fertility of 1966-69 was still close to 'natural'.

Another interesting phenomenon was a national campaign after 1972 to promote family planning. Marital fertility among women of all age groups began to decline, except in age group 15-19, whose marital fertility showed a considerable increase. The increase in fertility among this group is difficult to interpret in terms of volitional control, since these young women were at the very beginning of marriage and thus the least likely to limit fertility deliberately. Instead, the rise in fertility among young married women appears to be due to the rising mean age at marriage, as suggested by Peng (1991:146), and to an increase in natural fertility and its proximate determinants, such as fecundability. For example, the rise in fecundability could be because if women got married later under the pressure of a family planning programme, with a rise from say, 18 to 20, then their fecundability was higher than if they had married younger. It also could be because of another biological effect such as a decrease of age at menarche, and or a behaviourial effect, that people might want children as soon as possible to avoid anticipated further pressure from the 'Later-Longer-Less' policy. Meanwhile the birth control programme did not affect women's fertility in the early stage of marriage, at least between marriage and first birth. Thus the net effect of the family planning programme on the younger marital cohorts, particularly those aged 15-19, was not to depress, but rather to promote marital fertility.

The shape of marital fertility after 1970 changed dramatically, from a 'natural' and

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[6] China State Statistical Bureau 1988: ***1988 China Statistical YearBook***, Beijing, p97.

convex profile to more and more steeply concave. It reflects the fact that family planning campaigns influenced much more strongly younger married cohorts than the old. However, the marital fertility of very young cohorts remained unchanged, and presumably these were at earlier durations of marriage. It is probably not correct, as Coale claimed (1989:837), that family planning policy did not have an effect on their fertility. Evidence does suggest that although they were not practising birth control as much as the older cohorts, this does not mean no practice at all, as observed by Wang (1988:266) from Hebei province. My interpretation is that the reduction effect on younger cohorts' fertility, particularly the 20-24 group, who had relative longer marriage duration than 15-19 group, was offset by the rising natural fertility. In other words, without the government's birth control policy, we should have been able to observe an increasing trend in marital fertility among these younger married women.

A sharp increase in marital fertility occurred among young cohorts between 1981 and 1986. Feeney et al. (1989:306-307), Luther et al. (1990:342) and Zeng et al. (1991:453), also noticed an increase in marital fertility between 1984 and 1987, for which the relaxation of the fertility control policy in rural areas, by officially allowing more couples to have a second child, was generally held responsible. Apart from this, several other factors may also have contributed. Firstly, a natural fertility increase due to better living conditions, as a by-product of economic reform. Secondly, fecundability rise due to changing reproductive behaviour, for example, increased frequency of intercourse. Evidence of persistent shortening of the interval between marriage and first child after 1980 does confirm this possibility. Thirdly, I suspect that another boom in marriage and birth occurred in the mid 1980s. This is the result of women born during the post famine baby boom of 1962-64 entering the marriage and childbearing age. Kaufman et al.

(1989:708) also refer to it as an 'echo baby boom'. Although Coale et al. (1991:391, 393) suggest that total rate of first marriage rose above 1.0 in 1980 and remained above 1.0 through 1987 unchanged. Finally, perhaps there was also an increase in pre-marital conceptions which led to births within marriage and which are counted as legitimate (see Table 4.4), thus pushing up the marital fertility, particularly among young age cohorts.

I.3 Natural fertility

As has been already stated in Chapters 2 and 3, the model proposed by Coale and Trussell enables an estimation of the underlying level of natural fertility, M, in populations where birth control is practised, while m, the index of fertility control, indicates the extent to which deliberate family limitation is practised. Here, we present the indices of M and m estimated from original Coale-Trussell's model and its adjusted version in Table 4.2 for marriage cohorts of 33 years for China as a whole.[7] The estimated results from the two versions of the model in Table 4.2 and Table 4.3 are quite consistent; in both the increasing trend in both M and m is evident in all periods before the 1970s, except during the crisis period of 1959-61.

For the periods of 1940-44 and 1945-49, we have only truncated fertility rates for younger ages, which are not enough to estimate the underlying level of natural fertility(M). However, data of the duration marital fertility rates (DMFR) at 0-4 years marriage from 1940 to 1981 is available and shown in Figure 4.3. This measure is less affected by birth control behaviour and thus the best proxy for natural fertility in this period, at least before the first family planning campaign in 1962-66. Coale (1989:837)

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[7] The annual estimates of M and m from 1950 to 1986 by the two versions of CT model are presented in Table 10.2 in Appendix.

even claimed that birth control policy did not have any effect on the DMFR in the first five years of marriage. The graph shows that the DMFR moved quite consistently along with the underlying level of natural fertility(M) before 1962-66, when China's fertility was mainly a natural pattern. This increasing trend also matched the similarly rising fecundability during the 1940s (see Table 4.5). In addition, Table 4.1 also shows that fertility began rising in the late 1940's. This consistency leads to the possibility that the underlying level of natural fertility, M, substantially rose during 1940-49 like the DMFR. However, the precise levels of M during the 1940s remain unknown.

Table 4.2 Index of fertility control(m) and underlying level of fertility(M), by Coale-Trussell's model(v1) and its adjusted version (v2) 1950-86: China as a whole

Marriage Cohort	underlying level of fertility		control index/goodness of fit*[8]	
	M(v2)	M(v1)	m	R^2
1950-54	0.690	0.673	0.180	0.954
1955-58	0.720	0.702	0.185	0.968
1959-61	0.495	0.480	0.224	0.905
1962-66	0.810	0.788	0.197	0.971
1967-69	0.791	0.761	0.271	0.964
1970-78	0.765	0.700	0.637	0.973
1979-81	0.876	0.699	1.626	0.959
1986	0.951	0.701	2.175	0.990

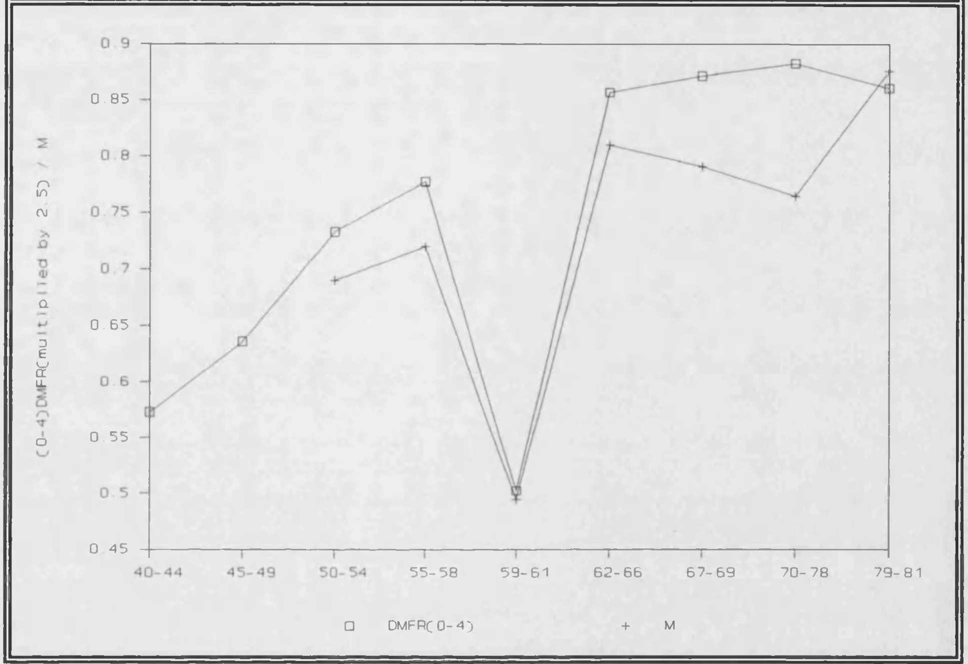
Restriction: the five-year age groups from 20-24 to 40-44 are used for the estimation.
* m estimates and R^2 are same between two versions of the CT model.

The level of underlying fertility in China in the 1950s seems to confirm the general observation of Barclay et al. (1976:615) that fertility in rural China was remarkable low relative to recorded European populations. Their estimate of the natural fertility level in rural China was about 0.62 in 1929-31, which was quite close to the national level of the 1950s (see Table 4.2). Here, the estimated M for China during 1967-69 was about 0.79

[8] In this case to investigate Chinese natural fertility, R^2, as discussed in Chapter 2, is preferred to mse as a measure of goodness of fit, although mse was suggested by Coale and Trussell (1978:203).

(0.76 by the original model), while it was 0.82 for Taiwan in 1956, 1.02 for Hong Kong in 1961, 1.00 for Singapore in 1957, and 0.81 for Korea in 1961, as estimated by Knodel (1977:228).

Figure 4.3 Duration(0-4 years of first marriage) marital fertility rates (multiplied by 2.5) and index of underlying level of natural fertility M(v2) 1940-81: China as a whole



The general increase in marital fertility among younger married women is reflected in the substantial increase in M in successive marriage cohorts before the 1970s in both versions of the model. The increase in natural fertility in the 1950s was supported by Banister's suggestion that improvement in life expectancy and health prompted increase in fecundity at that time (1987:233). The sharp increase in M value in 1962-66, in contrast to the previous periods, was certainly contributed by behaviourial rather than biological factors. It is most unlikely that Chinese women became more capable to bear children physically after the great famine, but instead the post-famine marriage boom, or 'catch-up' baby boom to compensate fertility loss during the famine. Figure 4.2b shows a shift in the age pattern of marital fertility towards a decline with age during the period 1967-1969, indicative of a slightly increasing practice of family limitation, mainly contributed by the urban population, with modestly rising values of m from a quite stable level around 0.19 before 1966, indicative of natural fertility, to a level substantially above 0.2, which suggests at least some fertility control within marriage before 1970.

After 1970 the national family planning campaigns took place, age specific marital fertility of all age groups began to decline, except that of age group 15-19. As Figure 4.2b shows, the most intriguing feature was that marital fertility declined much more quickly in young age groups: 25-29, 30-34 and 35-39 than among old age groups like 40-44. This feature, again, contradicts the assumption set in the original version of Coale and Trussell's model, which assumes that young married women, especially age group 20-24, are much less likely to limit fertility deliberately than older cohorts and that couples commonly practise birth control mainly for stopping rather than for spacing purposes. So, in new circumstances as in China after 1970, M estimated from the original model cannot be taken as an unambiguous estimate of the underlying level of natural fertility.

The main reasons for the marital fertility of older women declining more slowly than that of the younger women are probably twofold. First, there was a higher proportion of illiteracy among older cohorts. The 1/1000 Fertility Survey shows that the illiteracy rates for the cohorts aged 40-44 in 1975 were 79% for the nation as a whole, 89% and 40% in rural and urban areas respectively, while for the 30-34 cohort the rates were only 50% for the nation, 57% and 9% respectively in rural and urban areas. Second, because of age and education, lower proportions of employment were prevalent among older cohorts, thus older women were more likely to be isolated from outside influences. Quite naturally the national family planning campaigns had less influence on them, especially those living in rural areas.

Table 4.3 Change in index of underlying level of natural fertility(M) by marriage cohort 1958-86: China as a whole

Marriage Cohort	Adjusted Model	Original Model
1950-54/1955-58	+0.030	+0.029
1955-58/1959-61	-0.225	-0.222
1959-61/1962-66	+0.315	+0.308
1962-66/1967-70	-0.019	-0.027
1967-70/1971-78	-0.026	-0.061
1971-78/1979-81	+0.111	0.000
1979-81/1986	+0.075	+0.001
1950-54/1986	+0.261	+0.028

In Table 4.3, a dramatic increase in natural fertility after 1979 is indicated by the adjusted model, while almost no change in natural fertility is estimated by the original model. In fact, actual income level, nutrition status from food supply, accommodation conditions, medical services, and social welfare in China were substantially improved after 1979 due to economic reform and the 'Open-Door' policy. This not only contributed to consumption levels but also brought about a change of social ideology, such as the attitudes towards marriage formation and dissolution, sexual behaviour and family patterns. All of these changes were likely to result in a rise in natural fertility rather than almost no change at all. Here, again, Trussell's problem (1979:47-48) is confirmed, as he noted that values of M declined over time in Sweden, when there was no reason to suppose that, in general, the level of natural fertility should fall as control increased. Under these circumstances, the adjusted model is believed to be a more sensitive way to simulate real changes of the underlying level of natural fertility than the original model.

A similar increasing pattern in fecundability in the later 1970s is also found from estimates of mean fecundability. This consistent relationship is reflected in a significant correlation between M(v2), estimated by the adjusted model, and FB, the estimate of mean fecundability, whereas a much lower correlation exists between M(v1), estimated by the original model, and mean fecundability (see Chapter 3).

It is also important to discuss the possibility that the observed trend is wholly or in part an artefact of changing patterns of premarital sexual behaviour. Pre-nuptial pregnancies leading to post-nuptial births artificially inflate marital fertility at ages where newly-weds make up a large proportion of married women. The reason for this is that in the calculation of marital fertility rates, brides who are pregnant at the time of their wedding are treated as if they were at risk of conceiving only from the date of the wedding, when in fact they were obviously exposed to the risk of pregnancy for some period before marriage. This inflated marital fertility leads to M being overestimated.

Historical evidence from several European countries shows that the proportion of brides pregnant at marriage increased during the eighteenth and nineteenth centuries. For example, the study of fecundity in German village populations by Knodel and Wilson (1981:61), indicates that about twenty percent of women from the sample were pregnant at marriage and bore a child on average within four to five months after their wedding, whereas only approximately one percent of Chinese brides were pregnant on the day of the wedding before the 1970s. In China, at least for the majority Han population (about 90% of the total Chinese population), sexual activity outside marriage has been a cultural taboo. Cohabitation and illegitimate births do exist, but are very, very rare. Although there was growing evidence of premarital sexual behaviour in China from 1970s, as shown in Table 4.4, the absolute proportion of pregnant brides in China was still much lower than in many other countries. In order to eliminate the influence on M of from the changing extent of pre-marital pregnancy in this case, M(v2) value is re-calculated on the basis of age-specific marital fertility schedules adjusted for pre-marital pregnancies. A comparison of adjusted M(v2) values in Table 4.4 and unadjusted M(v2) values in Table 4.2 strongly suggests that the influence on M value contributed by pre-marital pregnancies is negligible. Moreover, the fact that some women who were not pregnant at the time of the wedding could also be engaged in pre-marital sexual relationships and hence risked pregnancy before marriage does not bias the marital fertility rate, as long as the probability of conceiving in a given month is independent of having sexual relations in a previous month.

Table 4.4 Proportion(%) of births occurring in 0-7 and 8-11 months of the first marriage, M(v2) adjusted for pre-nuptial pregnancy by marriage cohort 1950-86: China as a whole

Marriage Cohort	Percentage of births of 1st marriage within duration(month)[1]		Adjusted M(v2)
	0-7	8-11	
1950-54	1.14	13.85	0.685
1955-58	1.05	15.30	0.716
1959-61	0.81	10.48	0.493
1962-66	1.18	19.07	0.804
1967-69	1.38	25.02	0.785
1970-75	1.61	25.01	0.757
1976-80[2]	1.81	28.20	0.866
1986[3]	2.21		0.935

1,Proportion of married women who gave birth within the first seven months and from eighth and eleventh month of first marriage respectively. 2,the values for 1976-80 is based on information of the 1985 In-Depth Fertility Survey. 3, the value is estimated from the previous trend.

Perhaps we might ask another related question: In the context of Chinese culture, in which a high premium was placed on pre-marital virginity and conjugal fidelity, was it possible for some people to decide to marry either fully or partly due to fact that their girlfriend or fiancée was pregnant rather than for other reasons, thus artificially inflating marital fertility and fecundability. In fact it seems likely that some people who engaged in pre-marital sexual relationships did often decide to marry, or to brought forward the date of the wedding which was acceptable by tradition and popular as a date for a couple to live together, under the pressure of a girlfriend's or fiancée's pregnancy. After all, bearing an illegitimate child and thus being identified as a non-virgin bride has always been discriminated against by the society.

Table 4.4 indicates that the proportion of women who gave birth in the eighth to eleventh month of marriage increased over time, which logically could be affected not only by rising fecundability but also by pre-marital sex. But, the situation in China was far more complicated than that. It usually took more than a month for a woman to realize that she is pregnant, and in China it was very embarrassing for an unmarried woman to see a doctor to make sure of it. She usually consulted her female friends in the first place, then parents and finally doctors, which usually means more or less publicly, when she felt it really necessary. Before the government relaxation of abortion policy for unmarried women in the middle 1980s, such as waiving the need for permission from her company to have an abortion operation, the usual way to avoid such a 'scandal' was to marry as soon as possible. It also took time to get everything ready for a wedding, such as obtaining legal permission from the local government and from both family's parents (which usually implied financial support from them); choosing the date of the wedding (people usually liked to choose an auspicious day for a marriage, such as New Year's Day or the National Day). For urban couples perhaps the biggest difficulty was to manage to get themselves a bedroom; it was said that it was easier to find a wife than to secure accommodation, even among those who had registered for marriage, as shortage of housing prevented them from living together,[9] and finally they needed to decorate the bedroom and got furniture ready. All this means that it usually took at least a couple of months to prepare for a wedding after realizing the pregnancy if they decided to keep this child. Thus, it is very unlikely, that the increasing proportion of women who gave birth within the first eighth to eleventh month of marriage was mainly due to bridal pregnancies rather than rising fecundability. This is simply because these women did not have enough time to be counted in this proportion. If it was the case that some people marry under the pressure of a pregnancy, then they were much more likely to enter the proportion of women who gave birth within the first seven months of marriage. Nevertheless, this proportion was extremely low (see Table 4.4) and its influence was negligible before the 1980s, although it grew later.

Caldwell and Srinivasan (1984:75-76) noticed that the proportion of marriages experiencing a birth within early durations of marriage (one to three years) had risen since the 1950s in China. The relative constancy of the achieved level of marital fertility for successive marriage cohorts before 1986 stands in marked contrast to the increase (with the one major fluctuation) in the value of M, and is apparently the result of substantial but countervailing increases in family limitation at older ages and in fertility levels at younger ages. After all, a substantial increase in natural fertility for the whole nation is evident, taking place over the 47 years from 1940 to 1986 on the basis of available information.

[9]See Peng (1991) p82.

I.4 Fecundability

Now we can proceed to examine the trends in fecundability. This study is based on using the waiting time to an identified pregnancy to estimate recognizable fecundability, which is lower than total fecundability, the difference being a function of the spontaneous abortion rate in the first few weeks of pregnancy. In Figure 3.1 we presented the proportion of post-nuptially conceived first births occurring within eight to eleven months of marriage (1953-75), and nine to eleven months of marriage(1953-80) from the two fertility surveys respectively. And in Table 4.5 and Figure 4.4 (three-year moving average trend) we present mean fecundability for China as whole. To avoid selectivity and truncation biases (see Chapter 3), we combine the data from the two surveys, to provide a complete picture of fecundability from 1940 to 1980, thus all women who had enough time (five years) under observation were in the samples.

In Figure 3.1 both surveys give us an illustrative version: the proportion of first births occurring within eight/nine to eleven months of marriage increased significantly and dramatically. These proportions allow us apply the Bongaarts' model, as adjusted by Knodel and Wilson, to estimate the mean fecundability level(FB) for China as a whole from 1940 to 1980. FB estimates before 1975 are based on the proportion of first births that occurred within 8-11 months after marriage from the 1/1000 Fertility Survey.[10] After 1975 they are based on the proportion of first births which occurred from the ninth to eleventh month after marriage from the 1985 In-Depth Fertility Survey. As this survey covered only three provinces which represented a slightly higher proportion than the

[10] See **I.3.2 The estimation of fecundability and its data source** in Chapter 3.

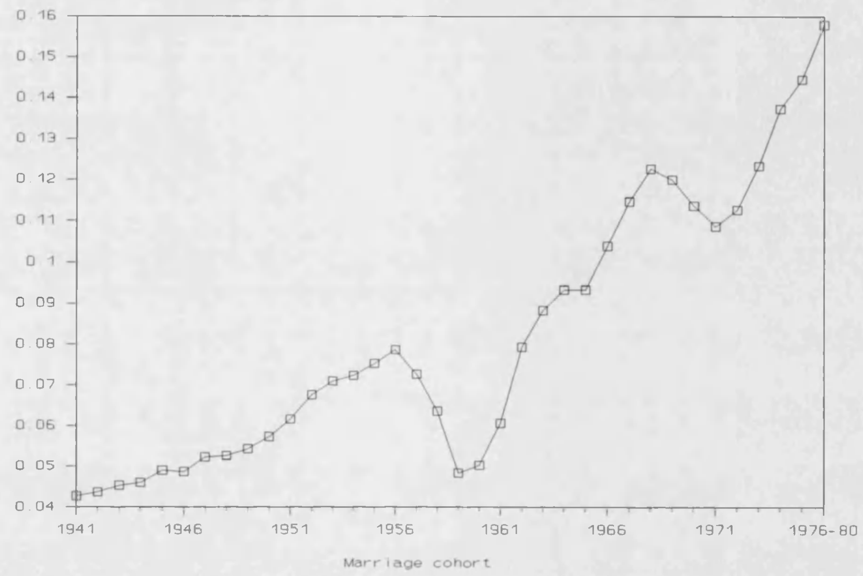
national average, this proportion is adjusted to fit the national level before being used to estimate the mean fecundability. The same procedure is done for the mean of first birth interval as presented in Table 4.5, 4.7 and Figure 4.4, 4.5.

Table 4.5 Mean fecundability (FB) by marriage cohort 1940-80: China as a whole

Marriage Cohort	FB	Marriage Cohort	FB	Marriage Cohort	FB
1940	0.042	1953	0.070	1966	0.095
1941	0.043	1954	0.075	1967	0.119
1942	0.043	1955	0.072	1968	0.130
1943	0.045	1956	0.079	1969	0.119
1944	0.048	1957	0.085	1970	0.111
1945	0.045	1958	0.054	1971	0.111
1946	0.054	1959	0.052	1972	0.104
1947	0.047	1960	0.039	1973	0.123
1948	0.056	1961	0.060	1974	0.143
1949	0.055	1962	0.083	1975	0.146
1950	0.052	1963	0.095	1976	
1951	0.065	1964	0.087	-80	0.158
1952	0.068	1965	0.098		

The most marked feature of the estimated mean fecundability was the extremely low level of fecundability in China, also noticed by Coale et al. (1988:17), compared with the level in historical European populations, such as the German village populations studied by Knodel and Wilson (1981:68), where mean fecundability increased from 0.212 during 1750-74 to 0.284 by 1875-99. Similar evidence will be discussed in the next chapter, which shows that the marital fertility of European "noncontraceptive" populations two centuries earlier was substantial and significantly higher than that of modern Chinese. Here, this difference may introduce two fundamental questions. First, is our estimated Chinese mean fecundability here appropriate and robust? Subsequently, a second question: if Chinese fecundability or natural fertility was really so low, then how can we explain the well known pattern of population growth in China?

Figure 4.4 Mean fecundability (three-year moving average) by marriage cohort 1941-80: China as a whole



To pursue the first question, we can compare our estimates of mean fecundability without standardizing age by Bongaarts' model, with the average monthly conception rates with standardized age estimated by Coale et al. (1988:19) in Table 4.6. Although the difference in rural Chinese mean fecundability between the two estimates was growing, which was probably due to the rise of mean age at marriage, the two sets of the estimates are very close. As indicated by another study on fecundability in relation to age on 2443 married women in Taiwan in 1962 carried out by Jain (1969a:80), one year's difference from age 19 at marriage could make about 0.030 more or less to estimated fecundability. If age at marriage rose after 1951-53, which was true in China (see Table 4.11), then our estimates would naturally diverge from Coale's estimates. Nevertheless, a very low level but an increasing trend of fecundability are clear and consistent in both estimates. In addition, a brief comparison also suggests that my estimates of mean fecundability also match that from an another method and source remarkably well: urban Chinese fecundability during 1963-65 is shown in Table 4.6 to be very close to that of Taiwanese women in Taichung City during 1962-63 as studied by Jain (1969a:80). This shows that Chinese women living in Taiwan, a society slightly earlier industrialized than the mainland, did not enjoy much higher fecundability. The fact that the fecundability of modern Chinese urban women is still substantially lower than that of European populations two centuries earlier may well be related to variety factors, especially Chinese culture and customs, rather than purely to the stage of economic development.

Table 4.6 Chinese mean fecundability estimates: alternative sources

	1944-46	1951-53	1963-65	1970-72
China as a whole[a]	0.049	0.068	0.093	0.108
Rural China[a]	0.045	0.062	0.084	0.099
Rural China(Coale)[b]	0.045	0.061	0.066	0.075
Urban China[a]	0.069	0.096	0.161	0.193
Taiwan(Taichung)[c]			0.163	

(a), Period averages of mean fecundability from Table 4.5, and Table 5.7, without standardizing age. Data source: the 1/1000 Survey (b) Average monthly probability of conception at 0-12 duration after marriage and standardizing age for 18-20 at first marriage. Data source: the 1/1000 Survey. see Coale et al.(1988:19). (c) Mean fecundability of Taichung married women in 1962-63, estimated by Jain (1969a:80). Data source: 1962 Taichung (Taiwan) Intensive Fertility Survey.

Besides nutritional and biological reasons, there are four other possible reasons for such low levels of fecundability in China: (1) The traditional beliefs about good health encouraged men to restrain sexual desire: people believed that letting out sperm did serious harm to their health whatever coital frequency was. The lower the coital frequency, the better, it was always suggested. This explanation was the most popular view about why the Chinese had such a low level of fecundability, as suggested by Barclay et al. (1976:625), and Coale et al. (1988:19). This is confirmed by a recent survey, the first extensive account of sexual activity among married couples in China.[11] (2) Sex was supposed to be 'dirty' or 'private'. Almost no sexual information was available in publications or education in China before the 1980s, and only very limited physiological knowledge was taught in secondary schools after 1950. (3) The traditional pattern in China was to get married according to parents' decision and with the help of matchmakers. So, naturally, sexual behaviour among couples could very well be limited at the beginning of marriage. (4) Parental fatigue after the birth of children, given the fact that both parents worked and many couples were forced to sleep in the same room as their children.

Having established that Chinese fecundability and marital fertility was unusually, perhaps uniquely low, how can we explain the well known Chinese population pattern: such a gigantic size? Historical arguments about Chinese fertility have been fully traced and followed in Chapter 2. Given the fact that fertility remained 'natural' up to the 1960s but relatively lower than that of other noncontraceptive populations, there must be other underlying factors operating in behind this mystery. Here, I believe it was early and universal marriage as well as universal childbearing that played the most important roles in this scenario. The proposition of early and universal marriage and childbearing has been well proved by most studies on Chinese demography, such as Notestein and Chiao (1937:377), Barclay et al. (1976:610), Banister (1984:248), Coale (1984:39) and (1991:392), Luther et al. (1990:343), and Feeney and Wang (1993:71). This pattern implies that almost all Chinese got married early and did not deliberately control their

[11]The survey was conducted by Geng Wenxiu and Zha Bo from late 1988 to early 1990, in a random sample of around 2000 urban men and women in four of China's biggest cities and several smaller cities, The report of the study was published by the Australian National University's contemporary China centre. A brief description of it is given by Geoff Maslen: No sex please, we're Chinese, ***The Times***, Higher Education Supplement No 1029, July 24, 1992, p11.

reproduction at all before the 1970s. In a defence of the so called 'very low' historical marital fertility estimated by Barclay et al., Coale argued (1984:477) that if early marriage were combined with a very high level of natural fertility, the resultant very high overall fertility would lead to very rapid population growth, which was not in fact what happened in China. If it was not the case that a rapid population growth had been sustained in China over centuries, then any supposed high fertility must therefore be associated with high mortality. Indeed, an infant mortality rate of 300 and life expectancy only 24 years (1930s) would fairly well match the actual population, any mortality level higher than that seems very unlikely. So the supposed very high fertility was unrealistic given such a level of mortality and population growth rate. Instead, it was the regime of 'universal' marriage and 'natural' fertility that made the Chinese population so large. In other words, had not the mortality been at that high level in history, this reproductive regime alone, without associating a high level of marital fertility and fecundability, could have enabled the population to grow even faster and be even larger. In fact, the Chinese population did not grow very quickly until the 1950s and has doubled since then. The fast growth after 1949[12], I believe, should be mainly connected with improvements in health and lowered mortality. Life expectation increased from about 24 years for Chinese farmers during 1929-31, to 57 in 1957, 66 in 1978 (Banister 1987:86) and 69 in 1982 for whole nation (Rong and Wang 1991:206). This and an increasing trend in fecundability since the 1940s jointly accounted for the size of the Chinese population today.

[12]See Coale (1984b:47), Banister (1984:254-255).

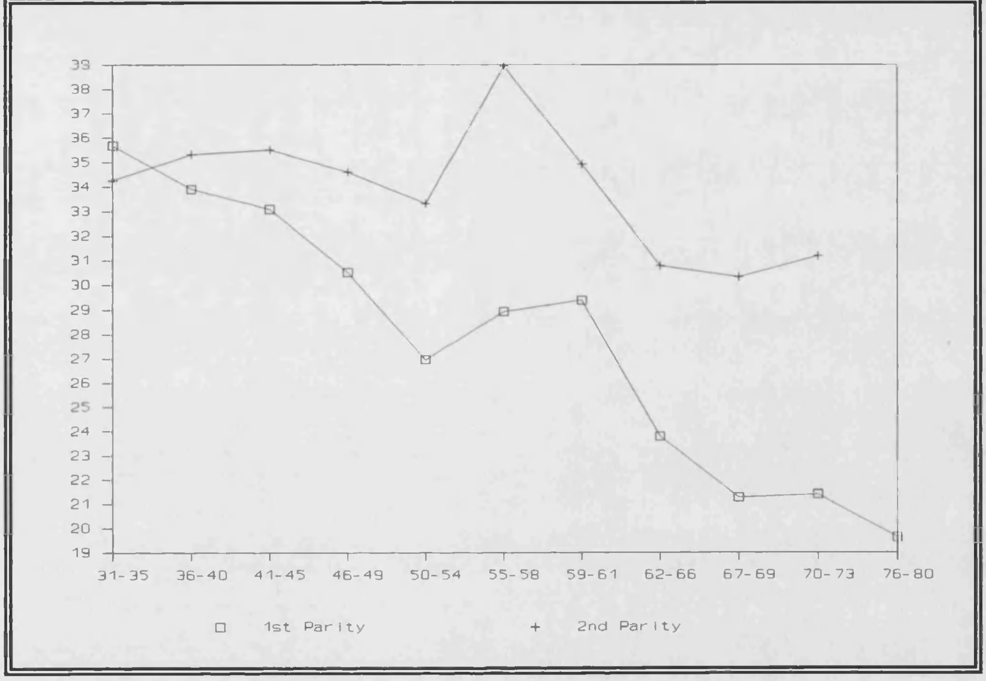
Table 4.7 Mean length(months) of the first and second birth intervals by year of first marriage and first birth respectively 1930-87: China as a whole

Year	First	Second	Year	First	Second
1930	41.1		1955	26.1	34.9
1931	38.9	33.8	1956	26.0	37.5
1932	36.5	33.5	1957	29.6	41.9
1933	34.3	34.3	1958	34.0	41.5
1934	34.4	33.8	1959	32.4	38.1
1935	34.2	35.9	1960	30.1	35.2
1936	33.6	34.4	1961	25.6	31.5
1937	34.3	35.6	1962	24.1	30.1
1938	34.1	35.2	1963	24.1	30.7
1939	34.1	35.3	1964	24.3	31.7
1940	33.5	36.1	1965	23.4	31.3
1941	33.9	35.9	1966	22.9	30.1
1942	34.0	36.3	1967	21.3	29.9
1943	33.1	35.4	1968	21.1	30.3
1944	32.7	35.1	1969	21.4	30.8
1945	31.7	34.9	1970	21.8	30.8
1946	31.0	35.0	1971	21.6	31.2
1947	31.0	34.9	1972	21.6	31.4
1948	30.2	34.2	1973	20.4	31.4
1949	29.9	34.3	1974	19.7	
1950	29.4	34.4	1976-80	19.7	34.6[1]
1951	27.0	32.7	1981-83	16.3	37.3
1952	26.5	33.1	1984-86	16.1	39.5
1953	25.7	32.7	1987	14.8	39.7
1954	26.0	33.6			

Note: Information for both birth intervals from 1935 to 1974 is from the 1/1000 Survey, the first interval of 1975-80 is based on the In-depth Survey. Information for first birth interval after 1980 and second interval after 1973 are periodical averages from annual estimates in Feeney and Wang (1993:73,77) based on information from the 2/1000 Survey. 1, for the 1974-80.

Given that Chinese fecundability was historically low, a substantial rise in it after 1940, especially after 1950 was evident. It rose slightly from the later 1940s, when World War Two finished with the Japanese surrender. The national economy then recovered somewhat, only to worsen again with the outbreak of the civil war. During the mid 1940s, fecundability remained around 0.045. It then increased substantially from 0.052 for women married in 1950 to 0.085 in 1957 for China as whole. There was a predictable trough of 0.039 for those married during the troubles of 1958-60, with a steady rise after 1961. Finally, a substantial increase occurred in the later 1970s to 0.16, the total rise amounting to 250 percent for the whole nation over the forty years. The most recent evidence on first birth interval also indicates that this increasing trend still holds in the 1980s.

Figure 4.5 Mean length(months) of the first two birth intervals:1930-80
China as a whole



The impact of this increase on the interval between marriage and first birth can be seen in Table 4.7 and Figure 4.5, where the observed mean first birth interval for the nation is given together with the mean second birth interval. As can be seen, the observed mean first interval fell from around 40 to about 20 months between the 1930s marriage cohorts and the later 1970s ones, and to about 15 months in the middle of the 1980s, as indicated by Feeney and Wang (1993:77). When Coale (1989:836-837) noticed that the early duration marital fertility, say 0-4 and 5-9, increased from the 1950s to the 1970s, he suggested two possible reasons, both mainly to do with shortening interbirth intervals, caused by shorter duration of breastfeeding and higher monthly probability of conception. The suggestion seems confirmed in this study. The early birth interval for Chinese women shortened consistently over the decades, and similar evidence was found in other Asian countries where it had been partly attributed to increases in age at marriage and trends towards romantic marriage.[13]

The trend of the intervals between first and second births is also presented in Table 4.7 and Figure 4.5. To avoid the bias of data truncation, only the data for 1931-1973 are used to guarantee that those women who had second birth intervals as long as nine years could be included in the estimation. The mean second birth intervals presented in Table 4.7 are based on closed birth intervals occurring within nine years of the first birth. Because it is very difficult to know exactly the part of birth interval distribution beyond nine years, part of the duration beyond nine years has been cut off. Moreover, the proportion of women who had a second birth after nine years from first birth was less than 2% over the period. Compared with the first birth interval, the second interval kept more or less steady, though a substantial decline is still obvious in the fall from 35 months in first birth cohorts of the middle 1940s to 30 months in the late 1960s. As Table 4.7 and Figure 4.5 show, a slight rise occurred in the 1970s and accelerated during the 1980s, probably due to the influence of the first national family planning campaign earlier and the 'One Child' policy later, as suggested by Feeney and Freedman (1993:76), while changes in demographic factors such as a reduction of breastfeeding and the diminishing of traditional practices affecting fecundability only tend to shorten intervals. Overall, a substantial decrease in second birth interval before the 1970s is clear and may also be related to a rise in fecundability, though at this stage this is conjectural.

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[13] See R. Rindfuss and S. P. Morgan 1983: Marriage, Sex, and the First Birth interval: The Quiet Revolution in Asia, ***Population and Development Review 9***, No. 2, pp.259-278.

I.5 Breastfeeding

Another major component of natural fertility amenable to analysis with available data is the length of breastfeeding. This is widely accepted to play a major role in differences of the non-susceptible period which follows a birth and during which a woman is not at risk of conceiving. Clinical studies indicate that lactation affects a woman's level of serum prolactin - frequent and intense suckling raises the prolactin in the blood - which in turn inhibits ovulation. Thus women who continue to breastfeed after the resumption of menses may have a higher incidence of anovulatory cycles stemming from an elevated level of serum prolactin. High levels of serum prolactin may also interfere with a fertilized ovum's ability to implant in the uterus. The result of these effects is that prolonged, intense breastfeeding is associated with lower fecundability and thus lower natural fertility.

One of the disappointments of the 1/1000 Fertility Survey is its lack of information with which to estimate the length of breastfeeding. Although we can estimate the mean duration of the non-susceptible period to examine indirectly the role breastfeeding played in the rise of the natural fertility, by comparing the first and second birth intervals, this estimate is a rather crude approximation for several reasons. The most crucial is rising fecundability, which over time would tend to shorten the first birth interval. This certainly makes the comparison ambiguous. Fortunately, the 1985 In-Depth Fertility Survey offers some information about breastfeeding, though it is limited to only three regions and the most recent two decades. However, it still enables us examine the effect of lactation on natural fertility in a quite relevant way. In Table 4.8 we present the mean length of breastfeeding by year the births occurred for Hebei, Shaanxi and Shanghai regions as a whole, estimated from the distribution of children according to length of breastfeeding by years since the birth occurred.

Table 4.8 Mean length(months) of breastfeeding and proportion of children without breastfeeding by year the births occurred 1960s-1982: three regions as a whole

Year	Mean Length	No BF(%)	Women
-1967	16.46	1.73	6778
1968-72	16.58	2.29	6207
1973-77	17.26	2.65	5888
1978-82	11.67	3.49	6074
Total	15.51	2.51	24945

*based on the distribution of children according to length of breastfeeding and confined to children born at least three years before, and excluding children who died before age two. The means were confined to those weaned in the first 35 months and include those not breastfed as zero.

Table 4.9 Mean length(months) of breastfeeding and proportion of children without breastfeeding by mother's current age: three regions as a whole

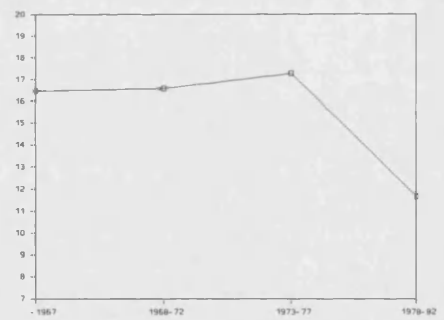
Mother's Age	Mean Length	No BF(%)	Women
< 30	11.21	2.45	11653
30-39	15.22	2.63	11155
40+	16.63	2.29	2139
Total	15.51	2.51	24947

Apparently, the average duration of breastfeeding in the three regions as a whole stayed at more or less the same level of 17 months until the middle 1970s; thus it was somewhat higher than that of other developing countries (see Trussell 1992:301). Then it declined dramatically to 11.7 months, which was consistent with the patterns of natural fertility and fecundability shown in Tables 4.2 and 4.5 respectively, i.e. it remained more or less at the same level (with a slightly rising general trend) until 1977 and rose strikingly afterwards. Lavely (1986:430) suggested that declining length of breastfeeding would reduce the length of postpartum amenorrhea, which would reduce the interval between early births at a time when high-order births were under control, and thus contribute to fecundability rising. The proportion of children not breastfed is another indication of the importance of breastfeeding in developing countries.[14] As we can see, the proportion of children who were never breastfed was very low but rose steadily from 1.73% to 3.49%. The breastfeeding patterns also show marked differences between the three regions, which we will discuss in Chapter 6.

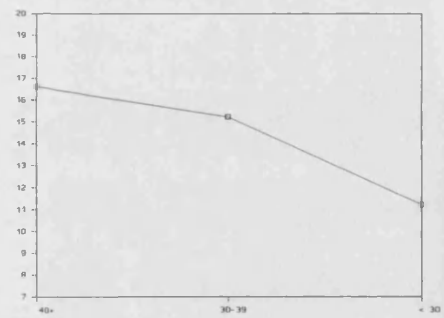
Figure 4.6 Children's breastfeeding 1960s-82: three regions as a whole

I. The mean length (months) of the breastfeeding

a: By year the births occurred

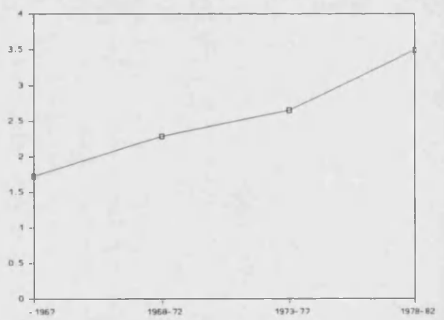


b: By mother's current age

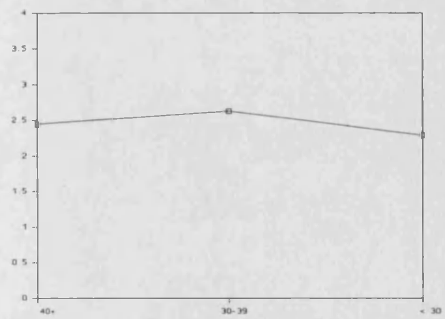


II. The proportion of children who were not breastfed (%)

c: By year the births occurred



d: By mother's current age



[14] B. Ferry and D.P. Smith 1983: Breastfeeding Differentials, ***Comparative Studies***, No.23, (WFS)

If the average duration of breastfeeding remained at a stable level before 1977, the duration differential between each cohort is much clearer. In Table 4.9 and Figure 4.6, we present the mean length of breastfeeding that children ever had, which is estimated from the distribution of children according to length of breastfeeding by current age of the mother. There appears to be an increase in breastfeeding duration with age, again, this was consistent with the findings in other developing countries.[15] The more recent a cohort a woman belonged to, the shorter the breastfeeding she undertook, especially among those aged under 30 in the In-Depth Survey (1985). This might be due to the trend of increasing education and employment opportunities for Chinese women over time, and a fundamental change in the socio-economic structure and ideology after 1978. This evidence may support the argument that degree of modernization (urbanization) was negatively associated with breastfeeding duration and that reduction of that duration was inevitable as modernization spread.[16]

A very interesting phenomenon shown from Figure 4.6 is that the proportion of children who were not breastfed at all increased substantially according to the time the births occurred, while it remained quite stable by the mother's current age. This might suggest that the proportions were influenced by birth cohort rather than age cohort effect. Possible reasons could be that changes in socio-economic factors like employment level and women's social status affected mothers' breastfeeding behaviour. Chinese people traditionally believed that a mother's milk was the most nutritious food for her newborn baby, so to breastfeed her child was a mother's moral obligation, no matter how old she

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[15] See Ferry and Smith (1983).

[16] See M. M. Kent: ***Breastfeeding in the developing World: Current Patterns and Implications for Future Trends***, (Washington, Population Reference Bureau, 1981)

was, unless physical incapable. Thus, an age effect was reflected in the length of breastfeeding, but not in whether or not it began. Only the cohort effect appears to contribute to the proportion of children non-breastfed. However the proportion was still under 4%, which might be due to sample variation, or though very unlikely, due to an increasing number of women who were physically incapable of breastfeeding. It may also reflect increasing availability of improved efficient and nourishing baby food such as infant formula to substitute for mothers' milk. The ultimate reasons for this proportion's rise by birth cohort and its lack of change by age cohort must remain unknown.

I.6 Primary sterility

Caldwell and Srinivasan (1984:76) observed that the fraction of marriages without a birth during the first five years declined over time in China, which they attributed to a decline in arranged marriages and a decline of pathological sterility. However, to measure primary sterility precisely, unfortunately, detailed data are required for estimates to be made with certainty. This detail is only available in the rare cases of family reconstitution studies, for example those on French Canadians in the eighteenth century studied by Henripin (1954). Childlessness has been used as a proxy to measure primary sterility in most studies, such as Romaniuk (1980:299-302), Knodel and Wilson (1981:63-66), and Vaessen (1984). These studies suggested that in any population of reasonable size, at least a small proportion of couples were unable to bear children because of physiological impairment to either or both spouses. Using childlessness as an alternative, although it may suffer from various kinds of bias, is rational and logical. In many societies infertility is no proof of sterility, but in populations not practising birth control, a fecund couple, given sufficient time, must have children. The study of these populations should permit the measurement of human fecundity.

As we know, universality is one of the major characteristics of the Chinese marriage pattern. Getting married upon reaching a certain age is accepted by the society as a moral obligation. Remaining unmarried by a certain age, say the late 20s, is seen by the public as abnormal, and spinsters and bachelors have never been encouraged by Chinese tradition. Zeng et al. (1985:734) and Feeney and Wang (1993:65) suggested that virtually all women in China got married by age 35. In traditional Chinese society, the family and the kinship circle were the most important units of organisation to serve the individual's social and economic needs. Every couple should have children, in particular boys, both for preserving the family line and for security in old age. So the traditional attitude was "the more children the better" and "more sons, more prosperity" as pointed out by Whyte and Gu (1987:474). Thus, even nowadays virtually all Chinese women get married, as in the past, and voluntary childlessness among married women has been almost non-existent. This position has been confirmed by Luther et al. (1990:343) and Coale et al. (1991:392), who observed that a first birth is almost universal for married couples in China. Under this circumstance, we can take the proportion of older married women who had no live birth as an approximate value of primary sterility. Before we interpret this, we need to assume that mortality among a given age group of women was the same, whether they had a live birth or not, that the change of intra-uterine mortality (foetal wastage) over 25 years was negligible, and that women whose marriages remained intact until they reached the end of the reproductive age span were not unusual.

The last assumption is more controversial, and deserves further discussion. We know that divorce rates were very low in China. Traditionally, there were rigid institutional restrictions on divorce so as to enforce family solidarity. After 1949, the freedom of divorce was guaranteed in both the 1950 and the 1980 marriage laws in principle. However, society and cultural tradition stressed the stability of the family, and divorce was still looked down upon in Chinese society. Most Chinese marriages are stable, and couples are always expected to stay married for life. Both local kinship and government policies encourage such stability. When a marital dispute occurs, various attempts at mediation ensue, in order to get the couple back together. Only when such mediation fails is the case sent to a local court. Divorce is to be avoided if at all possible. The 1980 marriage law gives more freedom of divorce and places more emphasis on the emotional factor in ensuring happy marriages and preserving family life. Partly as a result of that, the number of divorces for the whole nation increased rapidly from 113,600 in 1979 to 427,000 in 1982.[17] But, if population increase is taken into account, the divorce level of 1982 was similar to the average for the years between 1950 and 1981. Data from the 1982 1/1000 Survey show that among all ever married women aged 15-49, only 0.27 per cent were reported as currently divorced at the national level, and the proportion was even lower before the 1980s. Again, information from the 1982 Census confirms that among all women aged 15-49, 96.2 per cent were reportedly still in a marital union, and 89.1% of these were created by first marriage. The survey also reveals that 12.9% of women aged 50 and over were remarried, 19% were widowed, and less than 0.5% were currently divorced. These remarried women might be either previously divorced or widowed. All of this suggests that Chinese women are more likely to live in marriage than to stay single. Therefore, the changes in the number of women with no live birth due to interrupted marriage rather than to primary sterility can reasonably be ignored, as it can not in other parts of the world today.

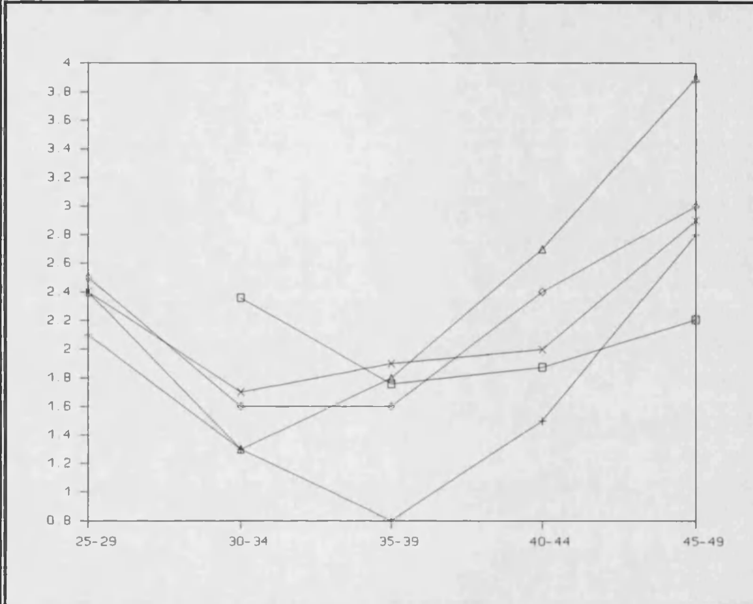
[17]Li Ning 1985: How does China Deal with Divorce?, *Beijing Review*, 5(4 Feb.1985), pp.18-21.

Table 4.10 The proportions(%) of ever-married women who never had a live birth by age in the two surveys: China as a whole

Age Group	1982 Survey	1987 Survey
15-19	69.298	64.645
20-24	40.321	32.050
25-29	10.404	6.974
30-34	2.359	1.807
35-39	1.758	1.244
40-44	1.875	1.243
45-49	2.206	1.434
50-54	3.215	1.844
55-59	4.726	2.848
60-64	5.406	4.467
65-67	6.263	

In the present analysis our prime interest lies in changes in primary sterility over time, in particular in discovering whether a decline in primary sterility could be responsible for, or contribute to, the observed increase in natural fertility indicated by the rise in M. The percentage of married women who had no live birth can be taken as an approximate value of primary sterility among married couples. These percentages, based on information from the 1982 1/1000 Fertility Survey and the 1987 One-Percent Population Survey, are presented in Table 4.10, which gives the proportions of ever married women with no live birth by age group in the two surveys. In China, such a universal and early marriage society, a married women over 35 is believed to have had enough time to have a child, otherwise she is very likely infecund. This speculation is consistent with the information in Table 4.10, which shows that the proportion of women with no live birth decreased by age until 35-39, as more and more married women had enough time. There is a strong probability of their being infecund if they were over 40 and had had no live birth yet.

Figure 4.7 Childless: international comparison

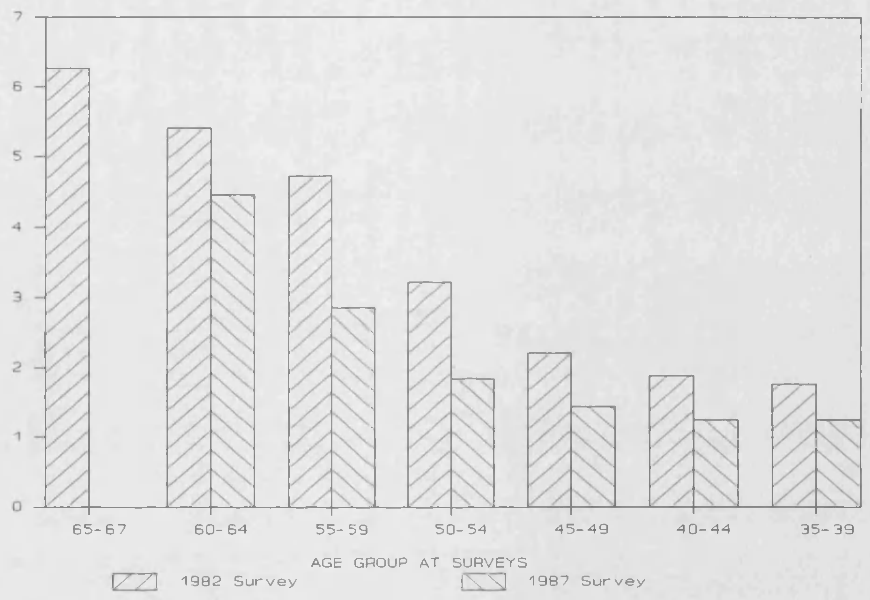


■ *China*; + *Korea*; ♦ *Thailand*; ▲ *Malaysia*; × *Philippines*

This U-shape pattern has been found in other studies as well. An example is one in Zaire during twenty years after 1955-58 carried out by Romaniuk (1980:300), who observed reduction in childlessness from old age groups to young in most regions, particularly in the two largest cities. More convincingly, a comprehensive cross-national study on childlessness and infecundity based WFS and carried out by Vaessen (1984), suggested a closely parallel and correlated movement between having no living children and no pregnancy over the reproductive age span in the majority of 28 countries, a reduction of childlessness, thus producing a U-shape. The percentages of childless among Chinese women (from the 1982 1/1000 Survey) along with those of other nations in East Asia, cited from Vaessen (1984:30), are plotted in Figure 4.7. Vaessen's figures were from women in the married state for at least five years, and thus not fully comparable with young age groups of childless Chinese. By moving to older groups, this problem diminishes and finally vanishes when age is over 35, as nearly all Chinese women were married by 30. Compared with other East Asian nations, Chinese women showed relatively a low proportion of childlessness at comparable ages. This phenomenon has also been noticed by Feeney and Yu (1987:81), Coale (1991:393), Feeney and Wang (1993:71). Misreporting of adopted children as natural offspring was generally suspected, although nothing can confirm this. Apart from this, the levels and particularly the U-shape of childlessness were similar between these nations. The South Korean women had the largest reduction of childless over age groups, which again, is plausible.

Figure 4.8 indicates a decline in the proportion of Chinese women with no live birth from the oldest age group, 65-67, to the youngest one, 35-39, in both surveys, and a huge drop from 50-54 to 45-49. In fact, the decline may be even larger than it appears, since women who had not reached the end of the reproductive age span may still have children, especially those in younger age groups such as 35-39 and 40-44. Thus we may be slightly underestimating this trend of declining primary sterility. This tendency might be partly due to the fact that elderly women often have great difficulty in recalling children who died as infants, which was suggested by Wolf's experience during his retrospective survey (1984:445). But more plausibly, it resulted from a significant improvement of medical service and public health programmes in the 1950s to control and cure venereal diseases and tuberculosis, which happen to be the main causes of sterility. The declining trend over different age groups in the two surveys suggests not only that primary sterility fell substantially up to the 1970s, but also that the trend continued during the 1980s. In addition, as shown in Table 3.11, there was a significant rise in the ratios of currently married to ever-married in all age groups between 1982 and 1987, especially among older age groups, which further implies both declining mortality and increasing remarrying after divorce or widowhood during the 1980s. This trend is also observed by Feeney and Wang (1993:71), who find that the 1988 Two-Per-1000 Fertility Survey has significantly lower proportions of Childless than the 1982 1/1000 Survey. They also show that period proportions per 1000 of women progressing from marriage to first birth in China kept growing from 1967, and this rising trend continued after 1981 up to 1987, the latest year the 2/1000 Survey allows.

Figure 4.8 Primary sterility: Proportions(%) of ever-married women who never had a live birth by age in the two surveys: China as a whole



One important contribution to declining primary sterility by the public health programme is perhaps that venereal disease (VD) has been completely eradicated from most areas and has been completely under control throughout China since the late 1960s. VD virtually did not exist in China until the sixteenth century. The old western colonialists introduced syphilis into Guangdong province and it soon spread widely. Until this century, VD was very common in China; in Horn's study (1969:83), it was suggested that the nationalist armies had a syphilis rate of about 20%. The incidence of syphilis in Chinese districts or villages was directly proportional to the size and the duration of stay of invading US, Japanese and nationalist armies.

One of the most harmful effects of VD is to cause sterility and then to reduce natural fertility. Related demographic effects are a high miscarriage rate and a large number of babies born dead. All these effects would result in a woman having no live birth, which is our substitute measure of primary sterility here. This depopulation effect was much more severe in the ethnic minority regions where sex outside marriage might not be as restricted as among Han Chinese. In the traditional society of Han Chinese, wealthy males, soldiers, or bachelors might seek prostitutes, but seducing or having a affair with a married woman, or a married woman having sex with a man other than her husband were great sins, and could lead to the death penalty if found out. This custom to some degree limited the spread of VD, while among some ethnic minority groups, where this custom did not exist, the spread would be quicker, and sterility would be more prevalent. In one example reported by Horn (1969:87), an investigation of 2334 nomadic families revealed that 58% were childless in the Hulunbu League in Inner Mongolia, which numbered 10,386 in 1933, but had fallen to 7670 in 1950.

Within a few years after 1949, when the communist government took power, VD was under completely control and soon eradicated from most areas. Again, Horn (1969:87) provided the following evidence: In Xingguo and Ningdu counties in Jiangxi province, a follow-up study five years after the anti-syphilis campaign revealed no new case or recurrence. In 1960, a complete dermatological examination of the entire population in Chaoan county (population 746,495) in Guangdong province, and Haian county (population 225,305) in Jiangsu province, revealed only one case of secondary recurrent syphilis, and a resurvey of 50% of the population of these two counties in 1964 showed not a single infectious case. This outcome resulted from several measures: eliminating prostitution, massive political campaigns against VD and a comprehensive and effective medical programme. In addition, women's socio-economic status was enhanced substantially, and traditional customs were imposed on private life, such as advocating virginal marriage and disgracing or even applying a criminal penalty on sex outside marriage.

As far as the differences in proportion between the same age groups in the two surveys are concerned, on average they were over 1% and got wider by age. These facts indicate a further decline in primary sterility in the 1980s, and the decline in the proportion between the two surveys might also be one factor to contribute to the dramatic rise in natural fertility in the 1980s. The overall declining trend in primary sterility could also be identified by examining period parity progression (PPP) ratios from marriage to first birth for China in the study carried out by Feeney et al. (1987:81), which indicated that the PPP ratios rose from 0.965 in 1955 to 0.993 in 1981, and Luther et al. (1990:344)'s study confirmed this rising trend up to 1987 by the same measure.

I.7 Age at first marriage

Nuptiality is an important determinant of fertility levels and trends. Marriage patterns, especially the age at marriage and the prevalence of marriage, are directly relevant to the study of natural fertility. As we know, in China the overwhelming majority of conceptions take place within marriage owing to Chinese custom. Thus the age at first marriage can be used with confidence as an indicator of the beginning of a

Chinese woman's exposure to the risk of childbearing. The traditional Chinese marriage pattern has been generalized as early and universal marriage. One question arises from this feature. We know that natural fertility in a woman's whole reproductive history is highest when she is 20-24 years old, so when age at first marriage changes, marital fertility changes too. In addition, as Lavely and Freedman (1990:359) suggested, women who married earlier may have lower fertility at comparable ages because of reduced intercourse with longer marriage duration. In other words, rising age at marriage leads more women aged 20-24 at earlier duration of marriage, thus indirectly pushing up the marital fertility. Thus the question is, then, whether or not the increase in natural fertility in China was purely due to the mean age at first marriage rising from a less reproductive to an age of peak reproductive potential. We do find that mean age at marriage was rising over the past four decades in China. Table 4.11 shows that since the early 1940s the mean age at first marriage kept rising until the early 1980s, as noted by many studies, such as Banister (1987:152-165) and Coale (1989:834-837). This rise was relatively slow before 1970 and accelerated in the 1970s. The national level for the mean age at first marriage rose by 2.6 years over the 1950s and the 1960s, and by 1.6 years over the 1970s.

Table 4.11 Mean age at first marriage(MAFM) by marriage cohort 1940-81: China as a whole

Marriage Cohort	MAFM	Marriage Cohort	MAFM
1940-44	17.78	1962-66	19.16
1945-49	18.06	1967-69	19.65
1950-54	18.32	1970-78	20.92
1955-58	18.65	1979-81	22.47
1959-61	19.03	1982-87	21.99[1]

Note: MAFM in 1982-87 is periodical average from annual estimates in Feeney and Wang (1993:69) based on information from the 2/1000 Survey.

We know that marital fertility rose, and at the same time the mean age at first marriage also rose. A sensible way to find out whether the rise in marital fertility was due to the rise of mean age at first marriage is to show the trend of marital fertility controlled for age at first marriage. Table 4.12 shows the trend of marital fertility in marriage duration of 13-24 months over the three decades by age at first marriage. This shows a consistent increasing trend over three decades. It also shows a consistent pattern among age groups of 15-19, 25-29, 30-34, as well as 20-24. So it appears that not only changes in age at first marriage but also changes in natural fertility were responsible for changes in marital fertility.

Table 4.12 Marital fertility in first marriage duration 13-24 months by age at first marriage and marriage cohort 1950s-1970s: China as a whole

Age At 1st Marriage	1950s	1960s	1970s
15-19	310.8	350.9	406.7
20-24	419.6	488.5	530.4
25-29	404.7	493.9	562.8
30-34	421.4[1]	396.7	499.1

1,In the 1950s, very few women in age group 30-34 had borne their children in the first year after first marriage, thus they concentrated their births in their second year of marriage.

Table 4.13 Mean length(months) of first birth interval by age at first marriage, and marriage cohort 1960s-1980: the three regions as a whole

Marriage Cohort	Age At First Marriage				Total	Women
	<17	17-19	20-22	23-25		
-1960	26	23	23	24	24	1473
1961-65	22	22	19	19	21	1349
1966-70	21	20	18	17	19	1829
1971-75	26	20	19	17	19	1831
1976-80	18	20	18	16	17	2678

A similar question to be borne in mind is the possibility of a relationship between changes in nuptiality and fecundability, and birth intervals. We know that the estimate of fecundability or mean birth interval was biased when the proportion of women who married at their peak reproductive age of 20-24 increased over time. This is certainly true in China during 1940-81 as we noted above. Here to get rid of this nuptiality effect, we show the trend of the distribution of the first birth by controlling age at first marriage.

From information provided by the 1985 In-Depth Survey shown in Table 4.13, we can also see that the mean length of the first birth interval decreased consistently over time after controlling for age at first marriage. The exceptions were those married in the period 71-75, when the 'Later-Longer-Less' campaign was first launched. It is understandable that they tried to postpone their births, especially the younger marriage cohorts. Coale et al. (1988:17-20) also observed a substantial fecundability rise in rural China between 1944 and 1972 after controlling for age at first marriage. Given the fact that over 83% of the total nation was a rural population before the 1980s, and that a substantial fecundability rise occurred over the same time in urban areas too (see Table 5.8), it is reasonable to believe that a substantial fecundability rise throughout China is not purely related to age at marriage, but rather contributed by other determinants, such as changes in coital frequency and duration of breastfeeding.

I.8 Summary

Our examination of evidence from the reproductive histories of couples married between the 1940s and the 1980s convincingly suggests that natural fertility increased significantly over the period in China as a whole. In the 1940s, although we lack data of age-specific marital fertility and are unable to estimate natural fertility, the consistent relation between natural fertility and duration marital fertility, and other indices such as TFR and fecundability suggest that natural fertility might have risen in this decade as well.

In seeking to measure natural fertility, the adjusted version Coale-Trussell model seems to give more plausible and consistent estimates, while the original version is less consistent, as it suggests a flat trend for natural fertility after 1979. This failure is believed due to the improper assumption for the China after the 1970s that younger married women did not limit their births at all. The adjusted model modified the control schedule v(a) to take into account this feature. So in circumstances such as those in China after 1970, M estimated from the adjusted model provides a closer estimate of the underlying level of natural fertility.

The estimated mean fecundability for China was extremely low, which seems to confirm observations from other studies such as Coale et al. (1988). Main causes are believed to be limited coital frequency and long durations of breastfeeding. However, this comparatively low level of fecundability did not prevent the Chinese population's growth. It was 'universal' marriage and 'natural' fertility patterns that overcame the high mortality and kept the Chinese population growing slowly before 1950. The fast growth after 1950 was mainly connected with increased marital fertility resulting from rising fecundability, shortened birth intervals and duration of breastfeeding, combined with improvement in health and dropped mortality.

The average duration of breastfeeding in China before the 1970s was longer than that in other parts of the developing world, based on the 1985 In-Depth Survey. It stayed more or less at 17 months until the middle 1970s, then declined dramatically to 11.7 months. This change in people's reproductive behaviour may be associated with the anticipation of a further harsh birth control policy and the improvement in employment resulting from economic reform.

Following the conventional approach, childlessness is used as a proxy to measure primary sterility. Here this is more rational and robust than in many other places, given that marriage and childbearing are universal in China. The U-shape of proportion of childless is consistent with observations from other developing countries. The percentages of childless among Chinese women (from the 1982 1/1000 Survey) were close to those of neighbouring nations in East Asia, though Chinese women had relatively lower proportions of childless at comparable ages. This phenomenon may be partly associated with misreporting of adopted children as natural offspring. But more plausibly, it resulted from significant progress in medical services and public health programmes in the 1950s to control and cure venereal diseases and tuberculosis, which are major causes of sterility.

From the early 1940s the mean age at first marriage kept increasing until the 1980s. This increase was relatively slow before 1970 and accelerated over the 1970s. The national level for the mean age at first marriage rose by 2.6 years over the 1950s and the 1960s, and by 1.6 years over the 1970s. However, after age at first marriage is controlled for, we still find that the trend of marital fertility rose at the marriage duration of 13-24 months over three decades from the 1950s to 1970s, and the trend of first birth intervals compressed after the 1960s. This makes clear that the increase in natural fertility was not purely due to the mean age at first marriage rising from an age of less reproductive potential to an age of peak reproductive potential.

Chapter 5 Natural Fertility: Urban-Rural Differentials

I.1 Literature review: urban-rural differentials

The study of differential fertility is important, because its existence is a valuable key to determining the causes of fertility transition. As we saw above, the average number of births is universally higher for women living in rural areas than for those living in urban areas, and on the whole current residence is somewhat more important than childhood residence. Although the type of residence appears to be of minimal importance in some developed countries such as Italy and Belgium,[1] where problems of definition might be responsible, the urban-rural differentials tend to be much larger in developing countries, in so far as the definitions can be taken at face value. In fact, an urban-rural differential in fertility is very common in developing countries today.

Similar differentials exist according to the level of education: the average number of births is generally less for women having more education than for those with less, though type of residence and level of education are usually not independent of one another. A similar connection appears between type of residence and occupation, perhaps social class as well. However, many studies which have standardized other variables, such as education or occupation, suggest that urban-rural variation at least partly accounts for differentials in fertility. Therefore, an interesting question here is whether an urban-rural differential in natural fertility exists in China as well.

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[1] Elise F. Jones 1982: Socio-Economic Differentials in Achieved Fertility, ***Comparative Studies***, No. 21 (WFS).

The 1982 1/1000 Fertility Survey produced separate estimates of fertility for China's urban and rural areas. In this survey, the "urban" population was narrowly defined as those persons living in cities and towns who were consuming commercial grain rations as of the survey date and therefore were called "non-agricultural". In 1982 this "non-agricultural" proportion comprised only 14.5% (see Table 8.3) of China's total population, a point worth keeping in mind when analysing urban-rural differentials. The 1/1000 Fertility Survey provides annual data on fertility and nuptiality for the rural and urban populations. This information makes it possible to examine urban-rural differentials in both levels and trends in natural fertility, and more illustratively, in fecundability, birth intervals, and primary sterility. A first discussion of urban-rural differentials in breastfeeding practices has become possible with information from the 1985 In-Depth Fertility Survey. It is also possible to assess the impact of the dramatic social and economic changes of the 1980s on natural fertility with fertility data from the 1987 One-Percent Population Survey.

I.2 A brief introduction to urban-rural differentials in socio-economic aspects in China

The central feature of urbanisation in China is that the process has been controlled to a large extent by the state and its bureaucracy. This was made possible by policies adopted soon after 1949, which included the nationalisation of urban land and large industries. The state or local agents also took control of urban housing, along with larger retail and service establishments. More significant were the rationing systems for essential goods and the permit system for place of residence. Overall, Chinese urban residents have many advantages over their rural counterparts.

Table 5.1 Some socio-economic annual indices of urban and rural China 1952-85 (*per capita*)

Year	Consumption *yuan*[1]		Grain *k.g.*		Meat(pork) *k.g.*	
	Urban	Rural	Urban	Rural	Urban	Rural
1952	148	62	240	191	8.9	5.5
1957	205	79	196	204	9.0	4.3
1960	217	65	193	156	2.7	1.2
1962	226	88	184	160	3.8	1.9
1965	237	100	210	177	10.3	5.4
1970	261	114	202	184	10.3	4.8
1975	324	124	209	187	14.9	5.9
1978	383	132	205	193	13.7	6.3
1981	487	194	215	220	17.0	9.7
1985	754	324	239	258	19.7	12.6
Year	**Sugar *k.g.***		**Eating Oil *k.g.***		**Hospital Beds (*per 10,000*)[2]**	
	Urban	Rural	Urban	Rural	Urban	Rural
1952	3.0	0.6	5.7	1.7	14.63	0.79
1957	3.6	1.1	5.1	1.8	20.78	1.37
1960			3.6	1.5		
1962	3.5	1.2	2.4	0.8	38.77	4.52
1965	3.5	1.1	4.8	1.1	37.75	5.10
1970	4.5	1.5	4.2	1.1	41.76	8.46
1975	5.8	1.5	4.6	1.0	46.10	12.30
1978	8.1	2.4	4.1	1.6	48.76	14.07
1981	9.1	2.9	6.9	2.0	47.33	14.69
1985	11.8	4.2	12.3	3.4	46.64	15.10

Source: ***China Social Statistical Materials 1987,*** p70-73; Chen (1987) ***Chinese People's Consumption in 2000,*** p31. 1, portion of gross consumption in the national income divided by the population, without eliminating inflation factor. 2, number of beds per 10,000 population

Apart from employment, education, medical services and social welfare, food supply is another strong factor, which affects nutritional status and thus is crucial in determining the natural fertility level. In 1953 the Chinese government took complete control of grain production and consumption, and a rationing system was introduced.[2] Under this system, grain consumption for the majority rural population was dependent on local grain

[2] See Vaclav Smil 1981: China's food: Availability, Requirement, Composition, Prospects, ***Food Policy***, Vol 6, No. 2, pp.69-77.

production and government grain procurement which consists of agricultural tax, central purchase and optional sales.

In some circumstances, such as natural disasters, or during irrigation construction, the state did provide some subsidiary grain, but this was very limited. To feed themselves was their own responsibility, so the grain consumption of the rural population varied by area and time. In contrast, the main source of grain for the non-agricultural population, mostly urban residents, was and still is the government supply. They receive grain in the form of a fixed ration at a fixed price. This means that they can always rely on the state, no matter what the quality of the last harvest. e.g. during the great famine, the average annual fall in per capita food grain consumption in urban areas was only 1.7 percent, but in rural areas it was 23.5 percent(see Table 5.1). Basic food availability for the urban population is usually guaranteed and on average better provided.

I.3 Differentials in general fertility

Table 5.2 and Figure 5.1 provide us with TFR and TDMFR from 1945 to 1981 for the urban and rural populations separately. Comparing Table 5.2 with Table 4.1, although there was some minor difference of fertility level between the rural population and the whole nation, the fertility trend was virtually identical. This is not surprising, since the majority of Chinese live in the rural areas. The urban fertility trends showed some differences, though they were broadly similar, as can be seen from Figure 5.1. Generally speaking, the urban TFRs were always lower than rural ones. The urban-rural differential in fertility before 1945 is not so clear. TFRs of around 4.8 and 5.2 were roughly estimated for urban and rural areas respectively in the 1940s using China's fertility survey data. As we know, since the 1950s, the pattern of urban-rural differentials has changed, from almost no difference to a large divergence. Total fertility rates in 1950 were 5.3 and 5.29 for urban and rural areas respectively, but 1.5 and 2.8 in 1982.

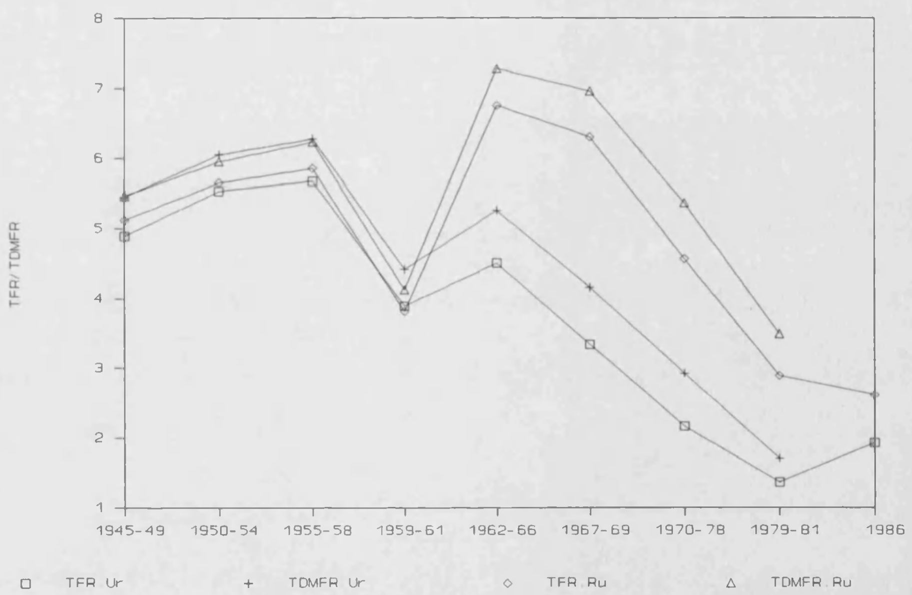
First two periods: 1950-54 and 1955-58. Both urban and rural fertility during these two periods rose steadily to a level around 6. Likely reason for the increase, apart from those mentioned before, are that the land reform of 1950-51 redistributed land to previous landless peasants and tenant farmers, thus they needed more family labour to work it and subsequently to inherit that land, and they would be able to feed more children from their newly acquired land, as suggested by Kane (1987:154). In these two periods, the urban fertility was virtually as high as the rural, and there were only minor differences. The high urban fertility level was certainly affected by rapid urban expansion in these two periods, as the overwhelming majority of the new immigrants to the towns and cities were young adults who included the most fertile age groups of the female population. Such a high urban fertility could also be affected by the government's pronatalist policy in this period, therefore, urban fertility was mainly a natural pattern. Although birth control was promoted in some urban areas, as Lavely and Freedman's study (1990:366) also found the evidence suggests that urban residents started to limit family size, and this was initiated by rising level of health and education, but with little help from the government. After all, the propaganda was mainly oriented towards women and children's health concerns, thus the effects on urban fertility were negligible.

Table 5.2 Total fertility rates(TFR) and total duration marital fertility rates(TDMFR) 1945-86: Urban and rural China

Year	Urban		Rural	
	TFR	TDMFR	TFR	TDMFR
1945	4.439	4.947	4.842	5.190
1946	4.786	5.379	5.043	5.405
1947	4.952	5.540	5.250	5.617
1948	4.801	5.335	4.928	5.259
1949	5.512	6.059	5.543	5.874
1950	5.300	5.762	5.290	5.560
1951	5.136	5.588	5.289	5.549
1952	5.683	6.228	6.038	6.342
1953	5.510	6.044	5.705	6.016
1954	6.041	6.631	5.935	6.280
1955	5.670	6.242	6.048	6.403
1956	5.403	5.987	5.651	5.996
1957	6.165	6.824	6.213	6.623
1958	5.452	6.053	5.506	5.897
1959	4.360	4.910	4.204	4.530
1960	4.195	4.760	3.940	4.266
1961	3.130	3.593	3.313	3.591
1962	4.911	5.642	6.200	6.669
1963	6.341	7.241	7.645	8.176
1964	4.416	5.151	6.496	6.969
1965	3.779	4.485	6.526	7.057
1966	3.101	3.785	6.905	7.544
1967	2.899	3.635	5.776	6.378
1968	3.797	4.764	6.938	7.669
1969	3.301	4.060	6.196	6.843
1970	3.216	3.966	6.313	6.989
1971	2.831	3.500	5.963	6.649
1972	2.589	3.294	5.430	6.144
1973	2.362	3.132	4.975	5.776
1974	1.944	2.762	4.623	5.506
1975	1.759	2.610	3.966	4.833
1976	1.604	2.385	3.605	4.481
1977	1.571	2.301	3.143	3.977
1978	1.575	2.275	3.001	3.848
1979	1.401	1.952	3.100	3.934
1980	1.196	1.523	2.563	3.111
1981	1.474	1.630	2.988	3.413
1982	1.500	1.478	2.860	3.299
1986	1.925		2.606	

During the 1959-1961, This period was characterised by a huge drop in both urban and rural fertility. The pattern of fertility decline among the urban population was similar to the rural one and indicates that both rural and urban populations were affected by the 'Great Leap Forward' and national famine at that time. Because food consumption for the urban population was usually guaranteed, they suffered somewhat less food from shortage during this period. As a consequence, urban fertility, though generally lower than rural, dropped only moderately to a trough in 1961. The drop in rural fertility, however, was dramatic.

Figure 5.1 Total fertility rates(TFR) and total duration marital fertility rates(TDMFR) 1945-86: Urban and rural China



During 1962-66, socio-economic development returned to normal, with consumption levels improving, and the TFR rose to peak values of 6.3 and 7.6 for urban and rural areas respectively in 1963, the highest for both since 1949. The urban population suffered relatively less in the early period of the disturbance, but the rural population recovered much earlier and more rapidly. The government started to implement a birth control programme focused on the urban population in this period. The response to it was such that the urban TFR experienced a sharp reduction from 4.4 to 3.1 in three years from 1964 to 1966. Caldwell and Srinivasan (1984:75) believed that apart from the government policy, the timing of urban fertility decline here was also explained by socio-economic change and owed much to the increasing availability to women of jobs and incomes outside the home. But this was much less true in the rural areas. It was from this period that a substantial difference between urban and rural fertility emerged and urban fertility transition began.

Urban-rural fertility differentials became wider in the period of 1967-69. The rural TFR declined slightly from the peak level of previous years, which can be regarded as a 'catch-up' offset for the 1959-61 crisis, to return to a normal and relatively high stable level. In urban areas existing networks for manufacturing and distributing contraceptives were disrupted by the 'Cultural Revolution'. However, because some urban residents might continue their birth control practice privately and normal family life suffered severe disturbance as a consequence of most urban people taking part in this highly disruptive movement, urban fertility kept declining in this period.

During the period of 1970-78, a significant fertility decline was mainly contributed by birth control practices in rural areas. Although both urban and rural living conditions saw virtually no improvement, and they may even have worsened in many rural areas, the nationwide family planning programme went into effect in rural areas from 1971 and resumed in urban areas. The fertility declined from 3.2 to 1.5 and from 6.3 to 3.0 for urban and rural women respectively in this period. In addition, a large number of urban youths, almost all of the students who graduated from middle schools in urban areas during the 1969-75, about 17 million in total, were sent to the countryside,[3] which led to postponement of marriage among urban youths, another cause of decline in fertility.

The TFR in both urban and rural areas declined to another two troughs of 1.2 and 2.5 in 1980 after the 'One Child' campaign was launched. However, a difference between these two divisions may reflect not only timing factors, but also a different degree of difficulty in the implementation of the policy, (Croll et al. 1985:34, Kane 1987:193-203, Feeney et al. 1989:298). After the 1980 economic reform, overall consumption levels rose dramatically in both urban and rural areas. The TFR also showed an unexpected increase in urban areas and a much less than expected decrease in rural areas, given that the 'One Child' policy was still being carried on officially. Besides major nationwide factors for both areas, such as a marriage boom and a relaxation of birth control efforts and controls on age at first marriage in 1981, a change in the definition and measurement of "urban" also contributed to inflation of urban TFR estimates. As a consequence of this change, a large proportion of previously rural residents was counted as urban population. This is shown in an implausible statistic: according to the official definitions, the proportion of urban population rose from 20.2% in 1981 to 41.4% in 1986.[4]

Demographic transitions began in the urban section first, creating a gap which diminished as urban behaviour diffused into rural areas. Whyte and Parish (1984:159-166) stress that education, shortage of housing, and work involvement of wives played powerful roles in urban fertility decline, as in rural areas without such powerful programmes. Whyte and Gu (1987:479) also suggested that urban China presented an

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[3]Zhao Weigang and Yu Huilin 1983: Changes of Women's Age at First Marriage since the Liberation, in the special issue of ***Population and Economy***, Beijing.

[4]State Statistical Bureau 1989: ***1988 China Statistical Yearbook***, Beijing, p97.

environment decidedly favourable to low fertility. In addition, there is mounting evidence that China's most recent *de facto* fertility policy permits only one child in urban areas but two in rural. If this policy continues, it will produce different demographic structures for rural and urban populations. The urban-rural differential in the age pattern of fertility seems unlikely to diminish as long as current policies continue.

I.4 Differentials in marital fertility

Estimated marital fertility rates in 1950-54 for urban and rural China, along with other marital fertility schedules for Chinese farmers, Taiwan, Japan, Canada, and England, are shown in Table 5.3. Women of Taiwan Hai-shan, a native region, where more than three-fourths of the surveyed population were tenant farmers, seems to have enjoyed slightly higher fertility than their mainland counterparts, particularly for age group 15-19. The substantial higher marital fertility at 15-19 among Hai-shan women could have resulted from their earlier marriage pattern and entering into reproductive age earlier than mainland women. The practice termed 'minor marriage' by Wolf, in which the bride was adopted at an early age and reared by her future husband's family, was counted at more than 50% before 1931-35 in the survey, while it was much less popular on the mainland. The prevalent minor marriage pattern implies an earlier marriage pattern among the Hai-shan at that time. The data in Wolf's study (1984:453-457) show that marital fertility at 15-19 for Hai-shan women was above 0.245 before 1920, and above 0.310 between 1920 and 1945. When Coale (1984b:474) compared fertility data for Hai-shan with adjusted fertility rates of Chinese farmers in 1929-31, he suggested that such a very high fertility at 15-19 was not ordinarily found in a very early marrying population, thus it could be the result of somewhat higher incidence of adolescent subfecundity among the Chinese farmers, or some form of minor bias in the Taiwan data. The extended comparison here, after adding fertility schedules from the 1/1000 survey and Wolf's survey, further confirms Coale's suggestion that such a high fertility at 15-19 was exceptional among Chinese.

Table 5.3 Marital fertility rates in selected noncontracepting populations

Age	Urban[1]	Rural[2]	Farmer[3]	Wolf's[4]	Taiwan[5]	Canada[6]	England[7]	Japan[8]
	1950-54	1950-54	1929-31	1920s-60s	1931-35	1700-30	1560-1629	1925
15-19	0.243	0.215	0.174	0.255	0.336	0.493	0.412	0.325
20-24	0.311	0.305	0.287	0.309	0.311	0.509	0.467	0.340
25-29	0.282	0.292	0.272	0.308	0.291	0.495	0.403	0.297
30-34	0.225	0.258	0.233	0.264	0.259	0.484	0.369	0.253
35-39	0.148	0.201	0.171	0.189	0.188	0.410	0.302	0.196
40-44	0.063	0.103	0.086	0.076	0.096	0.231	0.174	0.088

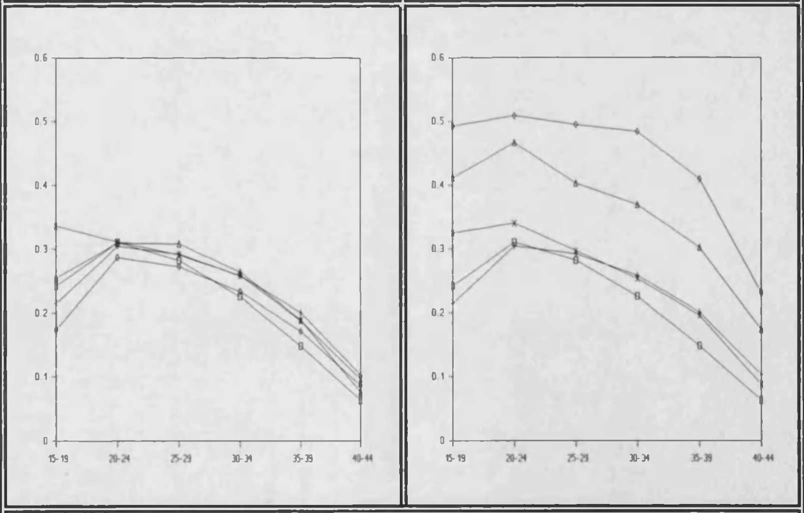
1-2, China urban and rural marital fertility rates in 1950-54, estimated by dividing ever-married fertility rates by average ratios of current married to ever married women in 1929-31 and 1982 (see Table 3.12). 3, Adjusted farmer' marital fertility from the Farm Survey in 1929-31, from Barclay et al. (1976:614). 4, China rural marital fertility, from Wolf's retrospective fertility survey in 1981, see Wolf(1984:459). 5, Marital fertility rates for Hai-shan women, Taiwan, from Wolf (1984:455). 6-7, Marital fertility for Canada(1700-1930) and England(Colyton, marriage 1670-1769), from Leridon(1977:107-108). 8, Marital fertility rates for Japan in 1925, from Kobayashi et al.(1963:22).

Mainland farmers' fertility in 1929-31, even after adjustment by Barclay et al., still shows as lowest of all. At that time they were in a relatively peaceful and stable period in the history, but civil wars between warlords, and between communists and nationalists still took place locally, short-term events like floods and droughts occurred from place to place when the farmer survey was carried out. Urban marital fertility of young age groups in 1950-54 was understandably slightly higher, but not for the older age groups, which may be the consequence of some older urban women having started practising birth control already. Wolf's (1984:457) survey respondents also had relative high marital fertility; those women were born between 1896 and 1927, but 82% after 1910, and 47% after 1920. Although their childbearing years were cross-cut by the Japanese War, the civil war, even the crisis of Great Leap Forward, the major part was during the peaceful period after 1949, and thus could have a slightly higher level of fertility. More important, information from this kind of retrospective survey may suffer a selectivity bias, as these elderly women were survivors who were probably healthier and stronger as young women than their deceased peers, and thus may not be fully representative of their cohort. In general, the pattern and level of 1950-54 marital fertility, as constructed from the 1/1000 Fertility Survey here, were astonishingly close to those derived from the other sources, as was demonstrated in Figure 5.2(a). The underlying similarity of marital fertility between data constructed from the 1/1000 Survey in this study and that from the other sources, such as accurately recorded data from Taiwan's and Wolf's surveys, again confirms that constructed ever married fertility from truncated information (before 1964) of the 1/1000 Survey is rather robust.

Figure 5.2 Chinese urban and rural marital fertility 1950-54

a: Comparing historically

b: Comparing internationally



Legend (a): □ Urban(1950-54); + Rural(1950-54); ◇ Farmer(1929-31); ▵ Wolf's respondents; × Taiwan(1931-35).

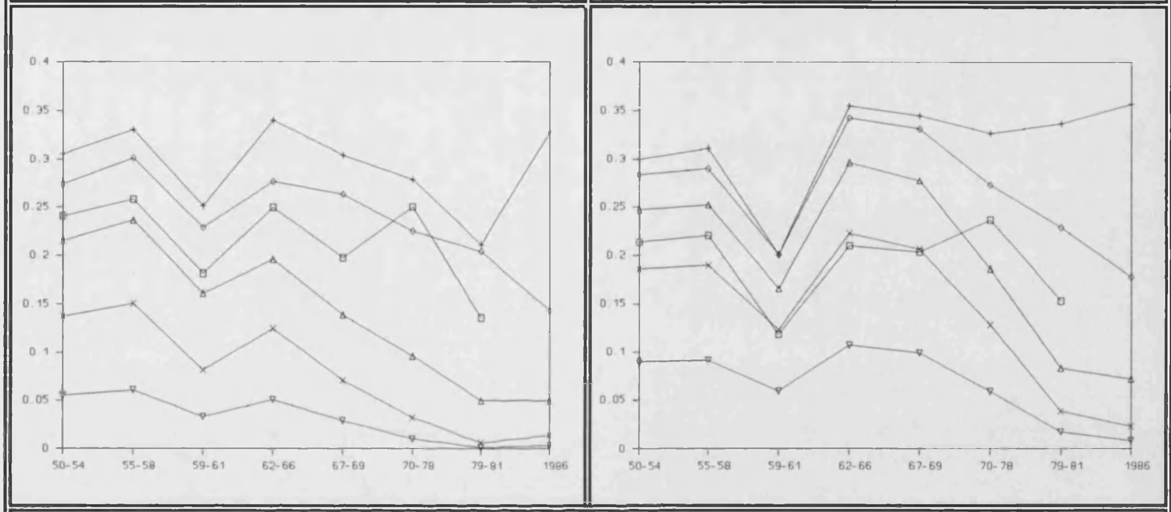
Legend (b): □ Urban(1950-54); + Rural(1950-54); ◇ Canada(1700-30); ▵ England(1560-1629); × Japan(1925).

In contrast, the marital fertility differences between noncontracepting Chinese populations in this century and noncontracepting European populations in earlier centuries were substantial and significant. The difference was even greater when compared with Canada's population in the eighteenth century, which was originally from Europe (see Figure 5.2(b)). The possibilities leading to this differential have already been discussed in the last chapter. Meanwhile, note that the age structure of the different marital fertility schedules is comparable from age 15 to age 44, with the implication that all of these populations were essentially subject to 'natural' fertility and not characterized by a high degree of voluntary control through the practice of contraception or abortion. Such a low level of Chinese 'natural' fertility was also found by Coale et al. (1979:108-110), who indicated that marital fertility in Central Asia of the Soviet Union in the early part of this century was very low and very close to that of Chinese farmers in 1929-31 and Koreans in 1930. Here, again, the Japanese fertility schedule in 1925 was also close to Chinese fertility, although the fertility level of young age groups was higher. The shape of age structure of the Japanese fertility after age 20-24 also showed a little steeper than that of others and dropped slightly to a level almost identical to that of rural Chinese in 1950-54 (see Figure 5.3b). This may imply a minor proportion of practising birth control among the older Japanese women similar to the situation in urban China during 1950-54. Thus the age patterns of these two fertility schedules were closest, although the level of Japanese fertility was consistently higher over all age groups than that of urban Chinese, and the underlying similarity is again evident.

According to Peng's estimate (1991:145), during the period 1954-1981, the urban Total Marital Fertility Rate (TMFR) declined by 56%, against 41% in the rural areas. The general trends of fertility within marriage were similar to those of total fertility. There were minor urban-rural differences in the TDMFR in the 1950s (see Table 5.2), but during the period of 1959-66, the fluctuation of TDMFR in the rural population was more severe. Urban marital fertility started to decline in the mid-1960s and suffered a setback in the early phase of the 'Cultural Revolution'. Since the early 1970s a sustained fertility decline has occurred in both urban and rural areas.

Figure 5.3 Age specific ever-married fertility rates 1950-1986

a: Urban China | b: Rural China



Legend: ■ 15-19; + 20-24; ♦ 25-29; ▴ 30-34; × 35-39; ▾ 40-44.

Age specific marital fertility experienced a substantial increase among all age groups in both areas, especially among younger married cohorts before the period of 1962-66 (see Figure 5.3). During the periods of demographic disturbances in 1959-61 and 1962-66, the fluctuation of marital fertility among the whole urban population and older groups of rural population was less severe. Historical evidence shows that famine-induced separation and divorce rates rose sharply in some rural areas during the crisis period,[5] Moreover, separation must have happened with one partner moving away to find a job and food for the family. Grain supplies for the urban population also declined in this

[5] See X. Peng 1987: Demographic Consequences of the Great Leap Forward in China's Provinces, ***Population and Development Review 13***, No. 4, pp.639-670.

period, especially in 1961. But *per capita* grain availability for urban residents never reached the same low level as for the rural population. Food shortage was much more severe in the rural than in the urban areas.

Total marital fertility started to decline around 1967-1969 and 1970-78 for urban and rural respectively. Before the 1967-69 period a general move towards higher fertility among younger urban married women was evident, while a similar rise was found among almost all rural age groups. The propaganda of family planning began ten years earlier in urban (1960s) than in rural areas (1970s), and in some metropolitan cities such as Shanghai as early as the 1950s. The data show that the trend towards lower fertility in urban areas among older women(age 40-44) before 1970 was mainly due to those women practising birth control and thus the trend of fertility of this age group was towards a substantially lower level.

A sharp increase in marital fertility among age group 15-19 occurred in both areas from 1979-1981 to 1986. General consensus on the causes of this rising marital fertility, particularly in the middle of the 1980s, such as studies by Zeng et al. (1991:436-437) and Feeney et al. (1993:74), were a marriage boom with a relaxation of restrictions on both age at first marriage and the one child policy, and perhaps an increase in pre-marital conceptions. Particularly, the one-child policy was relatively strict in urban areas and more relaxed in rural areas (Feeney et al. 1989:298). In addition, economic incentives to have more children, and the weakening of the local administrator's authority to enforce family planning policy following the economic reforms, have also been advanced as contributory factors in rural areas, suggested by many studies, such as Croll et al. (1985:57-61), Whyte and Gu (1987:472), and Kaufman et al. (1989:727).

I.5 Differentials in natural fertility

It is a common approach to the description of a demographic phenomenon to consider its level and its trend over some time dimension. Such an approach can usefully be applied to the study of natural fertility. Here, we have the indices of M and m estimated from original Coale-Trussell's model and its adjusted version: they are presented in Table 5.4 and 5.5 for marriage cohorts of 33 years for urban and rural China respectively. The estimated results from the two versions of the model are quite consistent, and in both versions an increasing trend is evident in all periods before the 1970s, except for the crisis period of 1959-61. For the periods of 1940-44 and 1945-49, again, when we plot the duration marital fertility rates (DMFR) of 0-4 years marriage from 1940 to 1978 with M in Figure 5.4, it shows good consistency in changes in DMFR and M in all periods before 1962-66, when China's fertility was mainly a natural pattern. It certainly raises the possibility that the underlying level of natural fertility, M, rose in both populations substantially in the 1940s, although the real level of M in this period remains unknown.

The general increases in marital fertility among younger married women in both areas are reflected in the substantial increase in M in successive marriage cohorts before the 1970s in both versions of the model. Similarly, Figure 5.3 shows a shift in the age pattern of marital fertility towards a decline with age during the periods 1967-69 and 1970-78 for urban and rural respectively, indicating of a difference in the timing of the beginning of family limitation. After 1970 the national family planning campaigns took place, rural marital fertility, following decline in the urban areas, began to drop as well.

This reduction in fertility also included the younger age groups. However, urban young married women still showed more controlled fertility schedules. This feature, as we discussed in Chapter 4, is not captured by Coale and Trussell's original model. Naturally the estimates of underlying level of natural fertility, M, by the original model can be considerably underestimated. Thus they are unable to reflect the facts fully, leading to unrealistic results in Tables 5.5 and 5.6: values of M were much lower in urban areas than in rural, and it dropped in urban areas after 1979. In fact, actual income level, nutritional status from food supply, accommodation conditions, medical service, and social welfare are much better in urban areas, and were substantially improved after 1979 due to socio-economic development and cultural change in both areas. All of these changes are likely to result in a higher level in natural fertility in urban areas over time, but a rise in natural fertility rather than a decline in the both areas after 1979.

Figure 5.4 Duration (0-4 years of first marriage) marital fertility rates (multiplied by 2.5) and index of the underlying level of natural fertility M(v2) 1940-81: Urban and rural China

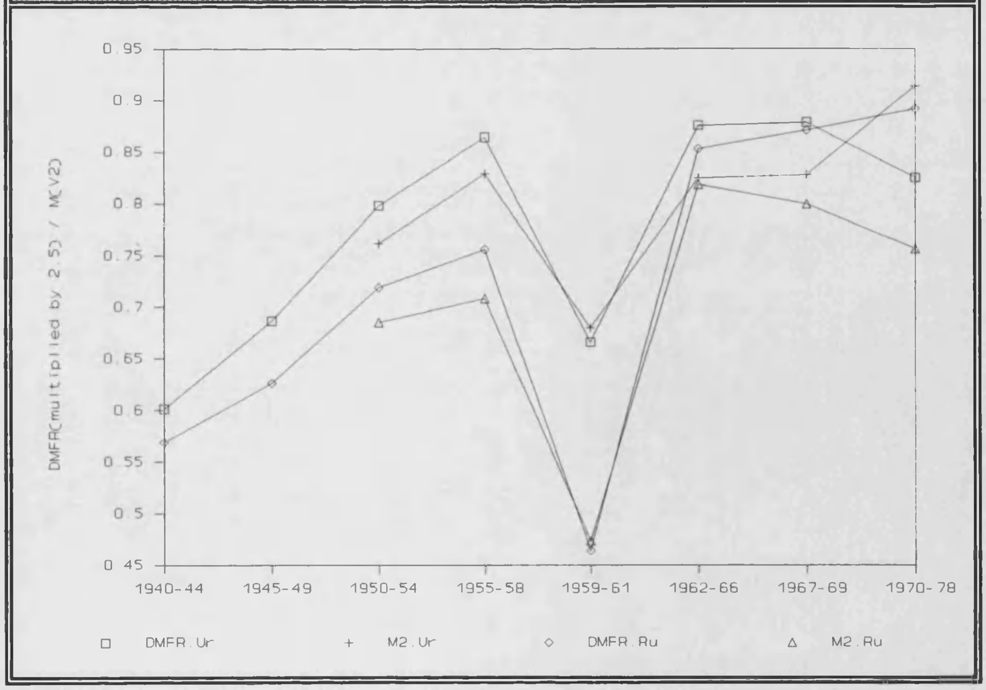


Table 5.4 Index of underlying level of natural fertility(M), and index of fertility control(m) by marriage cohort and by adjusted Coale-Trussell's model (v2) 1950-86, and Lavely's estimates 1951-81: Urban and rural China

Marriage Cohort	Urban		Rural	
	M	m	M	m
50-54	0.762	0.504	0.685	0.145
55-58	0.829	0.497	0.708	0.154
59-61	0.680	0.783	0.473	0.170
62-66	0.825	0.645	0.819	0.140
67-69	0.827	1.502	0.799	0.180
70-78	0.914	1.776	0.757	0.510
79-81	1.018	2.955	0.864	1.495
1986	1.035	2.879	0.960	2.012
Lavely's estimate				
51-55	0.76	0.38	0.68	0.03
59-61	0.60	0.52	0.49	0.17
62-66	0.82	0.71	0.84	0.14
71-75	1.01	2.10	0.78	0.49
76-78	1.32	3.28	0.76	1.25
79-81	1.54	4.23	0.89	1.94

* Five-year age groups of marital fertility from 20-24 to 40-44 are used in the estimation, suggested by Coale and Trussell (1978:204). Lavely's estimates are from Lavely (1986:425). * The goodness of fit by adjusted model are present in Table 5.5, because they are the same as those from the original CT model

Table 5.5 Index of underlying level of fertility(M), by marriage cohort and by original Coale-Trussell's model(v1) 1950-86: Urban and rural China

Marriage Cohort	underlying level of fertility(M)		Goodness of fit(R^2)	
	Urban	Rural	Urban	Rural
50-54	0.710	0.685	0.960	0.921
55-58	0.773	0.708	0.953	0.956
59-61	0.609	0.473	0.955	0.839
62-66	0.754	0.819	0.998	0.878
67-69	0.715	0.799	0.976	0.927
70-78	0.713	0.757	0.979	0.976
79-81	0.766	0.864	0.954	0.953
1986	0.693	0.960	0.998	0.985

Restriction: the five-year age groups from 20-24 to 40-44 are used in the estimation. * The estimates of m by original model are present in Table 5.4, because they are the same as those from the adjusted CT model.

Comparing Lavely's estimates, the two sets of M are very close until 1962-66 for the urban and 1971-75 for the rural. The divergence started to grow during the 1970s, and accelerated in the 1980s, particular by for the urban section. As I pointed out in Chapter 2, using the age range 23-40 of ASMFR to estimate M, as Lavely's study did, will systematically feed through an upward bias, and this bias is minor when the degree of birth control m is relatively insignificant, such as in his rural estimates, but it will become severe for his urban estimates after the 1970s. However, the upward bias in Lavely's study has been minimised, as it applied the original v(a) schedule without adjustment, which assumes no birth control among ages 20 to 24. As we demonstrated before, this would result in a downward bias in estimating M, and thus offset the upward bias. For his rural estimates, the upward bias was minor due to a relatively small m and therefore offset more by the downward bias. For his urban estimates, the upward bias had been diminished by the downward bias but is still substantial. As a consequence, the urban M estimates for 1971-75 were significantly greater than that from all European historical populations and modern Asian populations selected and estimated by Knodel (1977:228), and Barclay et al. (1976:615).

Table 5.6 Change in index of underlying level of natural fertility (M) by marriage cohort 1950-86: Urban and rural China

Marriage Cohort	Adjusted Model		Original Model	
	Urban	Rural	Urban	Rural
1950-54/1955-58	0.067	0.023	0.063	0.022
1955-58/1959-61	-0.149	-0.235	-0.164	-0.231
1959-61/1962-66	0.145	0.346	0.145	0.341
1962-66/1967-70	0.002	-0.020	-0.039	0.023
1967-70/1971-78	0.087	-0.042	-0.002	-0.075
1971-78/1979-81	0.104	0.107	0.053	-0.004
1979-81/1986	0.017	0.096	-0.073	0.023
1950-54/1986	0.273	0.275	-0.017	0.053

As we mentioned before, pre-nuptial pregnancies leading to post-nuptial births could artificially inflate marital fertility at ages where newly-weds make up a large proportion of married women. Then the inflated marital fertility leads to M being overestimated. Table 5.7 again reflects the fact that extremely low proportions of women engaged in pre-nuptial sexual activities. Less than three percent of urban Chinese brides were pregnant on the day of the wedding, and less than two percent in rural areas. On average, urban areas had a slightly higher level with a more rapid rise than rural areas. This suggests that sexual activity outside marriage as a cultural taboo might be slightly less restricted in the urban environment. Despite lack of statistical data, there was growing evidence of premarital sexual behaviour in both areas from the later 1970s and perhaps much more in the 1980s, especially in urban areas. However, the absolute proportion of pregnant brides in both areas was well below 5%--a much lower level than in many other countries. Thus the influence on M value contributed by the pre-marital pregnancies is negligible (see Chapter 4).

Table 5.7 Proportion(%) of births occurring in 0-7 and 8-11 months of first marriage by marriage cohort 1950-75: Urban and rural China

Marriage Cohort	Urban		Rural	
	0-7	8-11	0-7	8-11
50-54	1.02	20.31	1.16	12.41
55-58	1.59	23.49	0.92	13.33
59-61	1.31	20.51	0.72	8.52
62-66	1.49	31.28	1.14	17.09
67-69	1.90	37.47	1.33	22.93
70-75	2.67	37.70	1.46	23.22

I.6 Differentials in fecundability

In Table 5.7, the proportion of first births occurring within eight to eleven months of first marriage increased both in urban and rural areas significantly and dramatically. Again, these proportions allow us to apply the Bongaarts' model, as adjusted by Knodel and Wilson, to estimate the fecundability levels(FB) for the urban and rural areas from 1940 to 1975. After 1975 they remain unknown, as the published data from the 1986 In-Depth Fertility Survey fail to provide information on birth intervals by urban and rural divisions. In Table 5.8 we present mean fecundability from 1940 to 1975 based on Bongaarts' model for urban and rural China respectively, and plot the three-year moving average trend in Figure 5.5,

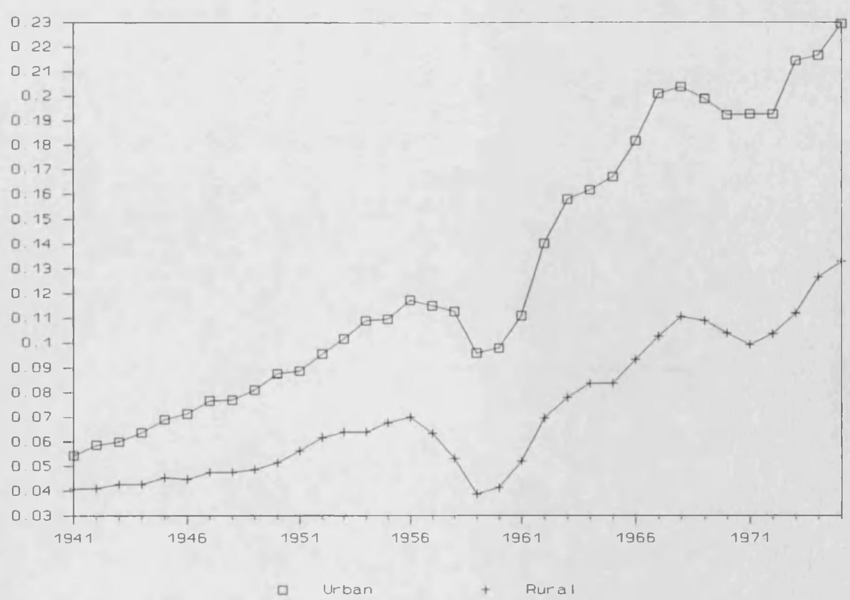
The level of fecundability in rural China was extremely low, as confirmed by Coale et al. (1988:18). There was also a wider and growing difference in level of mean fecundability between urban and rural areas, as a result of urban fecundability rising faster than rural. Similar evidence was found from Taiwan in 1962, that women from non-farmer families had a substantially higher fecundability than those from farmer families. Besides nutritional and socio-economic reasons, there are three other possible reasons for such low levels of fecundability in rural areas: (1) The traditional arranged marriage pattern was much more popular in rural areas than in urban, thus sexual behaviour among couples could be expected to be more limited at the beginning of marriage in the rural areas (See Chapter 8). (2) The mean age at first marriage was about two years younger for the rural population than that for the urban population (see Table 5.13), which means that rural brides were often in a lower reproductive status than their urban counterparts. On the other hand, rural women, who on average married earlier, may have low fertility at comparable ages because of reduced coitus frequency with longer marriage duration and loss of reproductive capacity with higher parity, as suggested by Lavely and Freedman (1990:359). (3) Something may also be related to the practice called "delayed transfer marriage" in rural areas like Huian county in Fujian province, suggested by some studies such as Coale et al.(1988:20). In such marriages, the bride returns to her parental home after one night with the groom. Visits occur only on special occasions for a year, or longer. After the woman becomes pregnant, or certainly after the birth of the first child, the couple live together. To the author's best knowledge, this form of marriage does exist in a few areas, such as in Huian county, but is very limited, and is now close to being extinct. The reasons discussed above may account for some urban-rural difference in fecundability, but more fundamental, I believe, are the differences in coital frequency and length of breastfeeding.

Table 5.8 Mean fecundability (FB) by marriage cohorts 1940-75: Urban and rural China

Marriage Cohort	Urban	Rural	Marriage Cohort	Urban	Rural
1940	0.054	0.040	1958	0.102	0.044
1941	0.064	0.039	1959	0.103	0.041
1942	0.045	0.043	1960	0.083	0.031
1943	0.067	0.041	1961	0.108	0.052
1944	0.068	0.044	1962	0.142	0.073
1945	0.056	0.043	1963	0.171	0.084
1946	0.083	0.049	1964	0.161	0.077
1947	0.075	0.042	1965	0.152	0.090
1948	0.072	0.052	1966	0.187	0.084
1949	0.084	0.049	1967	0.205	0.106
1950	0.087	0.045	1968	0.211	0.118
1951	0.092	0.060	1969	0.195	0.108
1952	0.087	0.064	1970	0.191	0.101
1953	0.108	0.061	1971	0.191	0.103
1954	0.110	0.067	1972	0.196	0.094
1955	0.109	0.064	1973	0.191	0.114
1956	0.110	0.072	1974	0.256	0.128
1957	0.133	0.074	1975	0.203	0.138

In any event, a substantial rise in both areas after the 1940 marriage cohorts, especially after 1960, is evident. Fecundability rose slightly during the mid-1940s, just after the Japanese War ended, then worsened again with the outbreak of the Civil War. Among the mid-1940s cohorts, the urban-rural differential in mean fecundability was minor around 0.02-0.03. It then increased substantially from 0.03 for women married in 1950 to 0.06 in 1957, which indicates that fecundability rose more quickly in urban than in rural areas. There was a predictable trough for those married during the crisis of 1958-60 in both areas, while fecundability suffered more severe and longer damage in rural areas. Finally, a substantial increase occurred in both areas during the 1970s. The total rise amounted to 300 and 200 percent for the urban and rural areas respectively during the thirty-five years, and the difference also reached its highest level among the 1970s cohorts.

Figure 5.5 Mean fecundability (three-year moving average) by marriage cohort 1941-75: Urban and rural China



The growing gap between urban and rural fecundability over time may be due to differences in marriage and breastfeeding practices. Freer mate selection and courtship, typical of the urban population, could shorten the interval between marriage and first birth by increasing coitus frequency after marriage. For later births, Lavely suggested (1986:430), apart from marriage, breastfeeding durations in urban areas might also matter, as they were probably much shorter in urban areas, where powdered milk was available earlier and more women were employed. This suggestion is confirmed by this study later. Three months more of urban-rural difference in breastfeeding duration have remained since the 1960s. However, breastfeeding could not affect the time taken to conceive for the first time.

The impact of the increase in fecundability on the interval between marriage and first birth can be seen in Table 5.9 and Figure 5.6a, where the observed mean first intervals for the urban and rural areas are given together with mean second birth interval. The observed mean length of first interval fell from 31 and 34 months to 16 and 20 months for the urban and rural areas respectively between the 1940 cohort and the later 1970s cohorts, and the difference in mean first birth interval between urban and rural populations was growing wider after the 1930s and reached a peak during the crisis period of 1959-61. The shortening trend of early birth intervals continued until the later 1980s in rural areas, but only up to the early 1980s in urban areas and even reversed to rise instead slightly afterwards, which led to not much difference in the first birth interval according to types of residence during 1981-87. This convergence is due to a reversing trend on the urban side and seems more likely to suggest that urban birth control behaviour spread from after to before the first birth in the middle of the 1980s, rather than a convergence of relevant behaviour and/or conditions between urban and rural areas, as suggested by Feeney and Wang (1993:74).

Table 5.9 Mean length(months) of the first and second birth intervals by year of first marriage and first birth respectively 1935-87: Urban and rural China

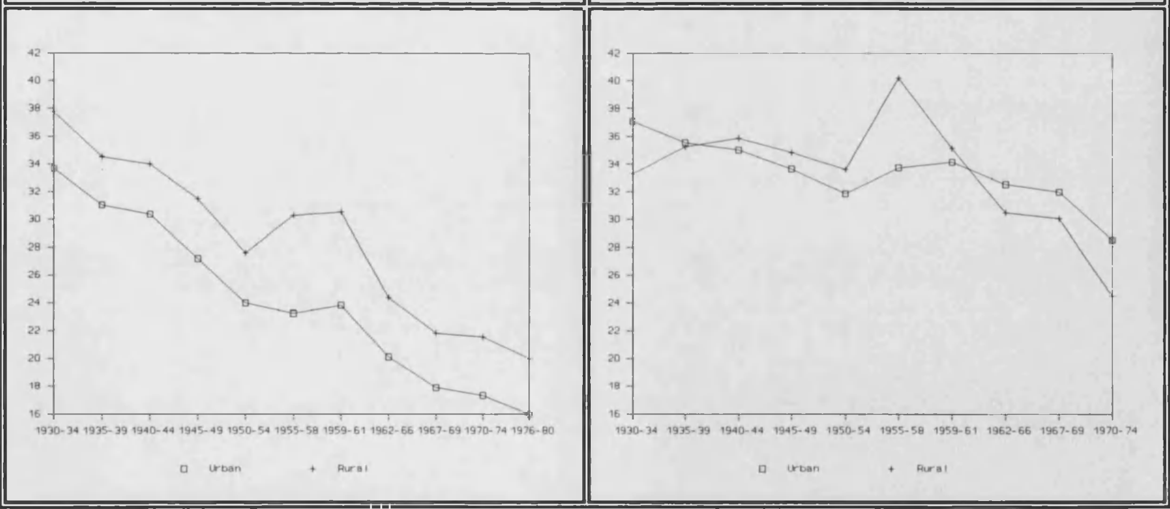
Year	Urban		Rural	
	1st	2nd	1st	2nd
1935	30.86	37.25	34.77	35.68
1936	30.73	33.80	34.01	34.54
1937	31.68	37.41	34.72	35.32
1938	30.69	34.93	34.62	35.23
1939	31.26	34.40	34.55	35.47
1940	30.96	35.72	33.98	36.14
1941	30.42	36.17	34.52	35.81
1942	31.07	34.32	34.49	36.58
1943	30.11	35.54	33.66	35.36
1944	29.25	33.36	33.41	35.42
1945	28.11	34.23	32.45	35.02
1946	28.26	34.48	31.55	35.12
1947	26.96	33.64	31.77	35.15
1948	26.51	33.28	30.92	34.36
1949	26.10	32.69	30.72	34.59
1950	25.67	33.93	30.22	34.50
1951	24.62	32.23	27.53	32.84
1952	23.78	31.96	27.15	33.29
1953	22.49	29.86	26.50	33.33
1954	23.39	31.29	26.65	34.15
1955	21.76	31.05	27.08	35.76
1956	21.70	33.08	27.06	38.48
1957	23.31	34.45	31.25	43.66
1958	26.23	36.39	35.76	42.92
1959	25.21	36.28	34.05	38.59
1960	24.61	34.34	31.20	35.49
1961	21.67	31.89	26.32	31.37
1962	20.36	32.36	24.82	29.69
1963	20.71	32.99	24.74	30.29
1964	19.68	33.92	25.03	31.31
1965	20.29	33.56	23.90	30.99
1966	19.51	29.92	23.37	30.17
1967	17.56	30.63	21.94	29.78
1968	17.61	31.60	21.72	30.05
1969	18.47	33.78	21.82	30.36
1970	18.16	34.44	22.32	30.24
1971	17.90	35.40	22.12	30.66
1972	17.11	35.79	22.22	30.88
1973	17.60	36.94	20.83	30.71
1974	15.88		20.36	
1975-80	16.00	44.16[1]	20.00	33.36[1]
1981-83	15.72	50.04	16.72	36.12
1984-87	16.68	53.43	15.84	38.40

Note: Information for both birth intervals from 1935 to 1974 are from the 1/1000 Survey, first interval of the 1975-80 is based on the In-depth Survey. Information for first birth interval after 1980 and second interval after 1973 is periodical average from annual estimates in Feeney and Wang(1993:73,77) based on information from the 2/1000 Survey. 1, 1974-80.

The trend of the interval between first and second births is presented in Table 5.9 and Figure 5.6, and to avoid bias due to data truncation, only the data from the 1/1000 Survey for 1935-73 are used to guarantee that those women who had second birth intervals as long as nine years could be included in the estimation. Compared with the first birth interval, the second kept more steady, though a substantial decline is still obvious in both areas, with falls from about 36 months in the 1940 first birth cohort to 30 months at the middle of 1960s cohorts in both areas. After that, it rose steadily in the 1970s and accelerated in the 1980s in the urban areas, while in the rural areas it remained unchanged in the early 1970s and picked up afterwards. The observed lengthening of birth intervals is likely to reflect mainly the influence of the 'Later-Longer-Less' policy rather than conditions being less favourable to fecundability.

Figure 5.6 Mean length(months) of the first two birth intervals by year of first marriage and first birth respectively 1930-80/74: Urban and rural China

a: First birth interval (1930-1980) | b: Second birth interval (1930-1974)



A most noticeable feature is a minor difference in mean length of second birth interval between the urban and the rural areas before the 1970s. (See Figure 5.6b) However, the mean length of second interval of the urban population is only about one month shorter in the 1940s and three months shorter in the 1950s, but two months longer in the 1960s. This is because of a dramatic rise in second interval among the urban population, probably due to the much earlier urban family planning campaigns of the 1960s, almost one decade ahead of rural China. Another measure proposed by G. Feeney and J. Yu (1987:82-83), period parity progression for urban China, shows similar trends. Progression ratios from first to second birth began to decline in 1963 in urban areas, whereas they remained quite stable in rural China until 1979. Taken altogether, a substantial decrease in second birth interval occurred in both areas and may be affected by a rise in fecundability.

I.7 Differentials in breastfeeding

From the overall results provided by the analysis of the WFS,[6] with a few exceptions, it was clear that urban women breastfed for shorter durations than their rural counterparts, a situation which occurred in nearly every country. In Table 5.10 we present the mean length of breastfeeding by year the birth occurred and by urban-rural divisions from the information of the 1985 In-Depth Fertility Survey, which is estimated from the distribution of children according to length of breastfeeding by the year the births occurred and the mother's current age. Apparently, the average duration of breastfeeding in the two areas stayed more or less same as before, at 14 and 17.6 months respectively, until the middle of the 1970s, then declined dramatically to 8.5 and 12.6 months respectively. Compared with other countries based on the WFS and DHS (Demographic and Health Survey), the pre-1970s pattern here shared similarity with other developing countries in Asia, the Pacific and Africa, which showed about 14 months, and

[6] Benoit Ferry and David P. Smith 1983: Breastfeeding Differentials, ***Comparative Studies***, No. 23, (WFS).

18 months for urban and rural respectively in retrospective data, while the European population (Portugal) only had 1.4 and 1.8 months of duration for urban and rural areas separately. More details are available in studies by Trussell et al. (1992:300).

Table 5.10 Mean length (months) of breastfeeding and proportion of children without breastfeeding by year the births occurred 1960s-1982: Urban and rural areas (three regions as a whole)

Year	Mean length	No BF(%)	Women
Urban			
-1967	14.20	4.36	2063
1968-72	13.60	6.16	1444
1973-77	14.30	6.99	1158
1978-82	8.50	10.15	1330
Rural			
-1967	17.50	0.56	4755
1968-72	17.50	1.11	4759
1973-77	18.00	1.59	4730
1978-82	12.60	1.62	4744

*based on the distribution of children according to length of breastfeeding and confined to children born at least three years before, and excluding children who died before age two.

Table 5.11 Mean length(months) of breastfeeding and proportion of children without breastfeeding by mother's current age: Urban and rural areas (three regions as a whole)

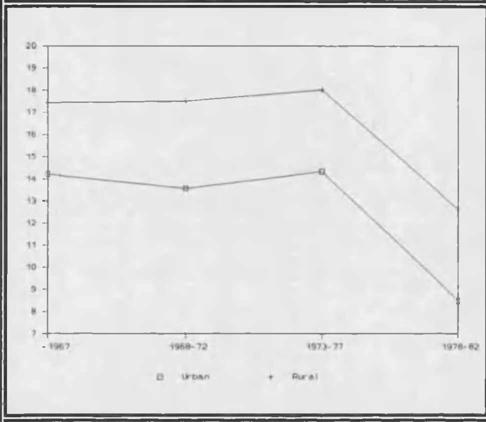
Mother's Age	Mean Length	No BF(%)	Women
Urban			
< 30	7.60	7.64	301
30-39	11.80	7.04	2315
40+	14.00	6.18	3379
Rural			
< 30	11.90	1.41	1838
30-39	16.10	1.47	8840
40+	17.80	0.92	8274

*based on the distribution of children according to length of breastfeeding and confined to children born at least three years before, and excluding children who died before age two.

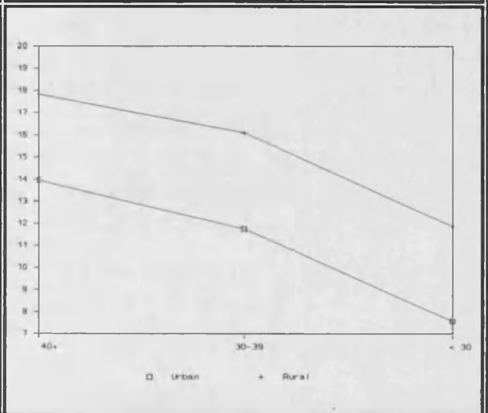
Figure 5.7 Children's breastfeeding 1960s-82: Urban and rural areas (three regions as a whole)

I. The mean length (months) of breastfeeding

a: By year the births occurred

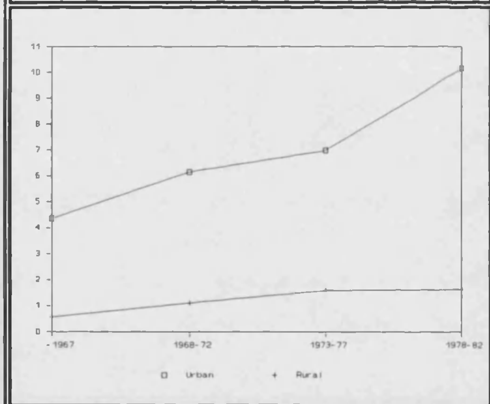


b: By mother's current age

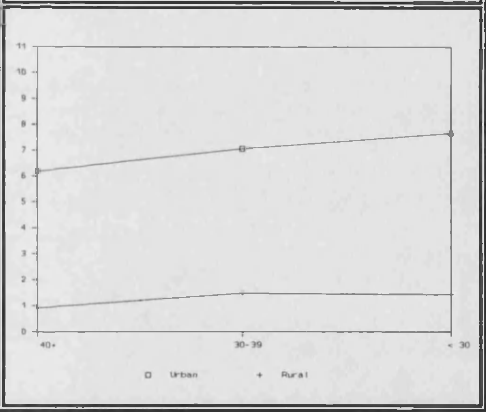


II. The proportion of children who were not breastfed (%)

c: By year the births occurred



d: By mother's current age



Meanwhile the proportion of children who were never breastfed rose steadily from 4.36% and 0.56% to 10.15% and 1.62% for the two areas respectively, though this proportion was always very low in rural areas. The urban-rural differentials in the mean length of breastfeeding and the proportion of non-breastfed children are very significant. A four month differential in the mean length of breastfeeding was consistent over time, while the differential in the proportion of non-breastfed children widened from less than 4% to over 8%. This might be due to an urban-rural differential in the momentum of improving education and employment opportunities for women, and an earlier fundamental change in the socio-economic structure and ideology in urban China after 1978.

I.8 Differentials in primary sterility

Marriage of women remains essentially universal and voluntary childlessness has been virtually non-existent in China, the differences by type of residence are negligible. This statement is confirmed up to most recent times by Feeney and Wang (1993:68-71). In these circumstances, the proportion of married women who had no live birth can be taken as an approximate value of primary sterility. The assumptions on intra-uterine mortality and marriage stability are the same as before. Data from the 1982 1/1000 Fertility Survey show that in 1982 the proportion of women aged 35-49 remaining in marital unions created by first marriage was 92.5 and 88.3 for urban and rural populations respectively. The higher proportion in urban areas may reflect the fact that the life expectancy of the urban population is higher than that of their rural counterparts. Among ever married women aged 15-49, only 0.73% and 0.19% were reportedly currently divorced for urban and rural populations respectively. This suggests that rural women are more likely to stay in marriage than urban females.

The data from the 1982 1/1000 Fertility Survey and the 1987 One-Percent Population Survey presented in Table 5.12 are the proportions of ever married women with no live birth by age group and type of residence in the two surveys. A fecund woman should have children when she has sufficient time in marriage. The proportions of married women with no live birth in Table 5.12 reached a trough at age groups 40-44 and 35-39 for urban and rural respectively. It is very likely that married women were generally infecund when they never had a live birth by age 44 for urban women or 39 for rural wives in China such a universal and early marriage society.

Table 5.12 Proportions(%) of ever-married women who never had a live birth by age in the two surveys: Urban and rural China

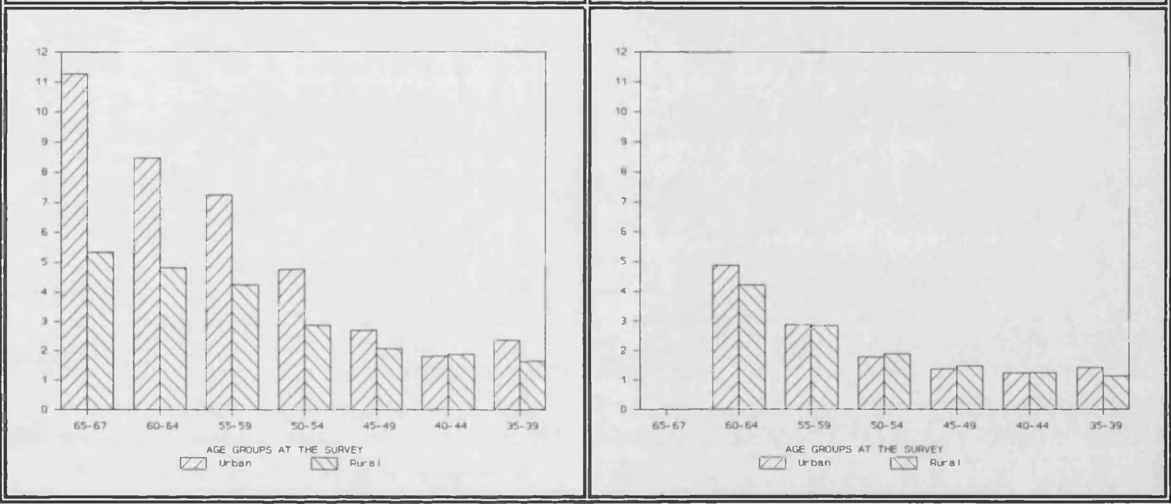
Age group	1982 Survey		1987 Survey	
	Urban	Rural	Urban	Rural
15-19	58.33	69.49	64.74	64.65
20-24	62.75	37.92	36.63	29.74
25-29	23.15	8.12	9.38	5.21
30-34	5.32	1.81	2.37	1.42
35-39	2.36	1.65	1.42	1.13
40-44	1.83	1.89	1.24	1.24
45-49	2.70	2.08	1.37	1.48
50-54	4.74	2.87	1.78	1.89
55-59	7.23	4.22	2.87	2.84
60-64	8.46	4.80	4.89	4.22
65-67	11.27	5.34		

In Figure 5.8, information from the two surveys indicates a decline in the proportions of married women with no live birth from the older age groups(65-67 or 60-64) to younger ones(35-39) in both urban and rural China, and a large drop from 50-54 to 45-49 which might be partly due to a significant improvement of medical services and public health programme in the 1950s, especially in urban areas. This trend over different age groups in the two surveys suggests that declines in primary sterility contributed somewhat to the natural fertility rise in both areas over time. Similar trends can be found from Feeney and Yu's study (1987:83-84), which indicated that PPP ratios from marriage to first birth had been rising from 0.956 and 0.966 in 1955 to 0.986 and 0.993 in 1981 for urban and rural areas respectively. As far as the differences of the proportion between same age groups in the two surveys are concerned, on average these differences were over 3% and 1% for urban and rural respectively and they widened by age in both areas. These facts indicate an overwhelming decline in primary sterility in urban and a modest decline in rural areas in the 1980s. Such a decline in the proportion in both areas over the two surveys' same age groups might also be one of the reasons contributing to the dramatic rise in natural fertility in the 1980s.

Figure 5.8 Primary sterility: Proportions(%) of ever-married women who never had a live birth by age in the two surveys: Urban and rural China

a: 1982 Survey

b: 1987 Survey



A very unexpected phenomenon shown in Figure 5.8 is that the proportions of ever-married women who never had a live birth were consistently higher over age groups in urban areas than in rural areas, especially in the 1982 survey. As discussed earlier, natural fertility was consistently higher in the urban than in the rural areas over time, and this is also reflected in the proximate determinants such as fecundability, birth intervals and breastfeeding. But for primary sterility, it seems this might not be true. However, as we take the proportion of no live birth women as a proxy for primary sterility, this unexpected urban-rural differential could possibly be due to something else. As Feeney and Wang (1993:72) show, period progressing proportions from marriage to first birth are consistently higher for urban than for rural areas since 1967.

As we know, an ever-married woman without live birth is not necessarily definitely infecund. For example, it could be because of her husband's infecundity. It was especially true in China where the divorce rate was extremely low and sexual relationships outside marriage scarcely existed. Although divorce was never encouraged in China, widowers or widows were allowed to marry again when they were young and particularly if childless. Thus we come to another possibility. There has been a higher level of mortality in rural China over time and thus a higher remarriage rate of rural widows, who then had more chance to switch from an unreproductive to a reproductive marriage, finally contributing to the lower percentages of primary sterility. As we saw in Table 3.12 in Chapter 3, there was only a very slight difference in the ratios of currently married to ever-married women in the rural population in 1930 and the whole nation in 1982, despite the very substantial difference in mortality. This implies that the higher incidence of rural widowhood at the earlier date must have been offset by a high rate of remarriage of widows. Obviously, a higher remarriage rate in rural China could provide new chances of motherhood for widows who were physically normal but whose ex-husbands were infecund, thus contributing to a lower proportion of women without children in the rural areas. Another possible reason for this lower proportion could be a higher rate of reporting error in rural China where some adopted children were deliberately misreported as natural children, to conceal the truth from adopted children and thus prevent them from going back to their natural parents when they grew up, as suggested by Wolf (1980:207-209) from evidence in Taiwan villages. Similar reporting errors but generated by women's own appreciation of their fecundity status were found many other countries in the world fertility survey.[7] A further possible reason is that urban spouses were more likely to have been separated by occupational assignments, as suggested by Lavely and Freedman (1990:366). Although this was not an unusual phenomenon in urban China, it seems unlikely, to be a big factor.

Another possible reason for this unexpected urban-rural differential for elderly cohorts could be due to the higher incidence rate of VD in urban areas before 1949. As the main VD carriers, such as prostitutes, sailors, and invading soldiers, were mainly living in urban areas, except when those with the nationalist armies might stay in rural areas during battles and when moving. According to Horn's (1969:86) estimate, in the urban areas, the incidence was about 5% and between 1% and 3% in rural areas on average. This estimate, at least, gave a consistent explanation, although the urban-rural difference of no live birth rates was not as large as that of VD incidence rate. However, VD was not the only disease to cause sterility then, others such as tuberculosis were also very common in China before 1949, and they could also lead to sterility. Urban residents might stand a greater chance of cure, as medical facilities were much better in urban than rural areas then and particularly after 1949. The achievement of control of VD in urban areas was also more marked and earlier than in rural areas. In a paper by another western doctor, Ma (1966:21), at a conference on dermatology and VD in 1956, specialists from eight major cities which used to have high infection rates reported that a total of only 28 cases of infectious syphilis had been discovered in their areas in the four years 1952-55. And an investigation of infectious syphilis in seven major cities during the 1960-64 showed that the early syphilis rate was less than 20 cases per 100 million population per year.

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[7] Martin Vaessen 1984: Childlessness and Infecundity, ***Comparative Studies***, No. 31, (WFS), p25.

We might also mention that these differences almost vanished in the information from the 1987 survey, which shows that the proportion of urban women without child decreased in each age group compared with data from the 1982 survey, while it decreased much less for the rural population. A possible reason, again shown in Table 3.12, is an enormous rise in the ratio of currently married to ever-married in all age groups from 1982 to 1987, especially among older age groups, which could be produced by mortality decline and/or rebuilding families after divorce in rural areas. While urban areas were mainly due to an increase in the number of marriages as a consequence of rising divorce rather than a decline in mortality in the 1980s.

I.9 Age at first marriage

The question here, again, is whether or not the increase in marital fertility in both urban and rural China was significantly influenced by the mean age at first marriage rising from an age of less reproductive potential to an age of peak potential. A similar question is, again, whether or not the urban-rural differential in natural fertility was principally created by the differential in mean age at first marriage which is an indication of different levels of reproductive potential. We find in Table 5.13 that the mean age at marriage has been rising over the past four decades in both areas. This increase was relatively slow before 1970 and accelerated during the 1970s. The mean age at first marriage increased by 3.3 over the 1950s and 1.4 years over the 1960s. For the 1970s, when the rise of natural fertility was strikingly marked, the mean age at first marriage increased by 2.5 and 2.7 years for the urban and rural populations respectively, the difference in the increasing mean age at first marriage between the two areas was thus trivial.

Table 5.13 Mean age at first marriage by marriage cohort 1940-81: Urban and rural China

Marriage Cohort	Urban	Rural
1940-44	18.46	17.65
1945-49	18.78	17.91
1950-54	19.17	18.13
1955-58	19.96	18.33
1959-61	20.65	18.71
1962-66	21.59	18.77
1967-69	22.06	19.24
1970-78	23.28	20.56
1979-81	24.55	21.97

*Source: the 1982 1/1000 Fertility Survey

Table 5.14 Marital fertility in first marriage duration 13-24 months by age at first marriage and marriage cohort 1950s-1970s: Urban and rural China

Age at 1st Marriage	1950s	1960s	1970s
Urban			
15-19	419.8	475.6	569.2
20-24	495.9	562.0	595.4
25-29	418.5	510.9	589.4
30-34	482.4	394.0	460.8
Rural			
15-19	292.5	343.5	402.4
20-24	386.4	461.9	520.1
25-29	393.8	476.1	532.1
30-34	387.5	377.6	500.8

*Source: the 1982 1/1000 Fertility Survey

In Table 5.14, marital fertility rates during the second year of marriage by age at first marriage in the two areas are presented. They show a consistent increasing trend over three decades in both urban and rural areas. That also shows a consistent pattern among age groups of 15-19, 25-29, as well as 20-24, but a slightly different pattern for the age group 30-34. The reason for this exception is that very few women in age group 30-34 had borne their children in the first year duration of first marriage, possibly due to lower fecundability that age, thus they concentrated their births in their second year of marriage duration. Again, the urban-rural differential in duration of marital fertility is significant after controlling for age at first marriage. All these points suggest that not only changes in age at first marriage but also changes in natural fertility were responsible for changes in marital fertility in the two types of area. Secondly, not only differences in age at first marriage but also in other fertility determinants were responsible for urban-rural differential in natural fertility.

Table 5.15 Average monthly probability of conception (***per 1000***) leading to a live birth in marriage duration of 6-12 months in rural China in 1944-72

Marriage Cohort	Age At First Marriage		
	<18	18-20	>20
1944-46	24	40	46
1951-53	42	58	62
1963-65	47	59	67
1970-72	52	66	75
Change 1944-46/1970-72	+28	+26	+29

Source: the 1982 1/1000 Fertility Survey, selected from Coale et al.(1988:19).

In terms of rising fecundability and mean age at first marriage, we show the trend of the distribution of first birth by controlling age at first marriage. From Table 5.15, we can see a substantial fecundability rise in rural China between 1951 and 1972, after controlling for age at first marriage. Although similar data for the urban population are not available, it is reasonable to believe that a substantial fecundability rise occurred in both urban and rural China during the period 1944-72, even after controlling for age at first marriage.

Table 5.16 Mean length(months) of first birth interval by age at first marriage and marriage cohort 1950s-1980: Urban and rural areas(three regions as a whole)

Marriage Cohort	Age At First Marriage				Average	Women
	<17	17-19	20-22	23-25		
Urban						
-1960	24	20	20	22	21	474
1961-65	17	20	17	19	19	356
1966-70	15	16	16	15	16	506
1971-75	20	16	16	15	16	463
1976-80	--	18	17	16	16	763
Rural						
-1960	26	25	25	27	26	999
1961-65	24	23	20	19	22	993
1966-70	22	21	19	18	20	1323
1971-75	21	20	20	18	20	1368
1976-80	18	20	19	17	18	1915

*Source: 1985 In-Depth Fertility Survey

From the 1985 In-Depth Survey shown in Table 5.16, we can also see that the mean length of first birth interval reduced consistently over time after controlling for age at first marriage. The exceptions were intervals in the period 1971-75 in both areas, when the national birth control campaign stressing later marriage and childbearing was launched, thus it is understandable if people postponed their births, thereby stopping the reduction in the length of birth intervals in the rural areas. In the urban areas, the declining trend in the length of birth intervals was reversed after 1971-75, especially for those who married before age 20, almost certainly for similar reasons.

I.10 Summary

The pattern and level of marital fertility in 1950-54, estimated from the 1/1000 Fertility Survey, were very close to those derived from other sources. This underlying similarity, again, confirms that estimated marital fertility from truncated information (before 1964) of the 1/1000 Survey is rather robust. In contrast, the marital fertility differences between the noncontracepting Chinese population in this century and noncontracepting European populations in earlier centuries were substantial and significant. This provides support to the argument that Chinese 'natural' marital fertility was low. However, the evidence from the three surveys also strongly suggests that natural fertility increased significantly the 1940s and the 1980s in both urban and rural China, though natural fertility was generally lower among rural women than urban. There were only slightly more pre-marital conceptions in urban areas, not sufficient to fully account for the urban-rural differential in underlying fertility.

The estimated mean fecundability for rural China was extremely low. The main causes are believed to be the longer duration of breastfeeding and the limited coitus frequency owing to arranged marriage and young age of entering the union. Reform towards free-marriage and rising age at marriage, and reduction in breastfeeding were possible factors to promote fecundability in both urban and rural areas. As a consequence, birth intervals, in particular the first interval, reduced dramatically after the 1930s, although this compressing trend for the second interval was less obvious after the 1960s, when reproductive behaviour was mixed with birth control practice.

The average duration of breastfeeding in China before the 1970s was longer in rural areas than in urban. Corresponding to this, the proportions of urban women who breastfed their children were consistently higher than rural. One possibility to explain this could be the increasing job prospects and availability of effective baby food for women in urban areas, but much less so in rural areas. An interesting phenomenon is that these proportions of the non-breastfed were mainly influenced by birth cohort effects rather than age effects, particularly in urban areas. While duration of breastfeeding was mainly influenced by the mother's age.

Childlessness is seen to drop over the age span in both urban and rural areas, but unexpectedly to be higher in urban areas. Possible explanations are, that higher remarriage rates resulted from worse mortality in rural areas and may indirectly act as a reducing factor to childlessness, and a higher rate of reporting error in rural China, where some adopted children were deliberately misreported as natural children, and that urban areas may have had higher incidence of venereal disease before 1949, and finally that urban spouses were more likely to have been separated by occupational assignments.

Chapter 6 Natural Fertility: Regional Variations

I.1 Literature review: regional variations

The study of natural fertility involves the consideration of nuptiality, fecundability and primary sterility both individually and in combination. How these determinants change, and how they are spatially distributed over various of socio-economic, environments, are other fundamental questions. In China, apart from regional or geographic differences in socio-economic development, the situation was also quite different in each region regarding the cultural characteristics, such as diet, marriage pattern, social customs, and religion, which naturally affected proximate determinants such as age at first marriage, breastfeeding, coital frequency, birth interval and so on.

Information from the 1/1000 Fertility Sample Survey in 1982 and the In-Depth Fertility Survey in 1985 provides an opportunity to study the first marriage distribution, age specific fertility rates, birth intervals in some particular years, and parity distribution in 28 regions, which include twenty provinces, three municipality cities and five ethnic minority autonomous regions (both are equivalent to provinces in administration), that is, coming directly under the national government (Tibet is the only region in mainland China where work was carried out by neither survey). Thus natural fertility, birth intervals and primary sterility in each region can be estimated from these data. Unfortunately, regional variation in fecundability could not be assessed as no regional information about distributions of first birth interval is available.

As far as the regional variation of natural fertility level is concerned, it seems that the cross-regional differential in levels of natural fertility is more interesting than the time trends in each individual region which closely corresponded with the national trend. Thus 28 regions' differentials in natural fertility over time can present a quite illustrative picture of regional variations of natural fertility, though the pattern of variation before 1940 remains unknown. However, the most salient features of the different fertility or indices of proximate determinants mentioned in the main body of the paper will be introduced into discussion. Because the degree of comparability that could be achieved was inevitably limited, the discussion focuses more on the patterns of association rather than on the specific levels shown for any particular region.

I.2 A brief introduction to regional background

Regional variations in China can be seen as indicators of inherited inequalities. This is well illustrated by the distribution of modern industry. Virtually all industrial activities in 1949, when the communists took power, were located in two areas, both now considered to be part of the eastern coastal region. (See Figure 6.1) There were, first, the highly localized developments in cities - most of them ex-treaty ports(e.g.. Shanghai, Tianjin, Qingdao) - on the coastal fringe. Second, that in the northeast provinces, where Russian and later Japanese colonisation and exploitation led to the development of raw material resources and heavy industry, much of it originally serving the needs of their economies. The rest of the country was virtually devoid of modern industry. After 1952, many new industrial cities were developed, such as Taiyuan (Shanxi Province), Wuhan (Hubei Province). Nevertheless, regional variations in every aspect still exist and may even have widened.

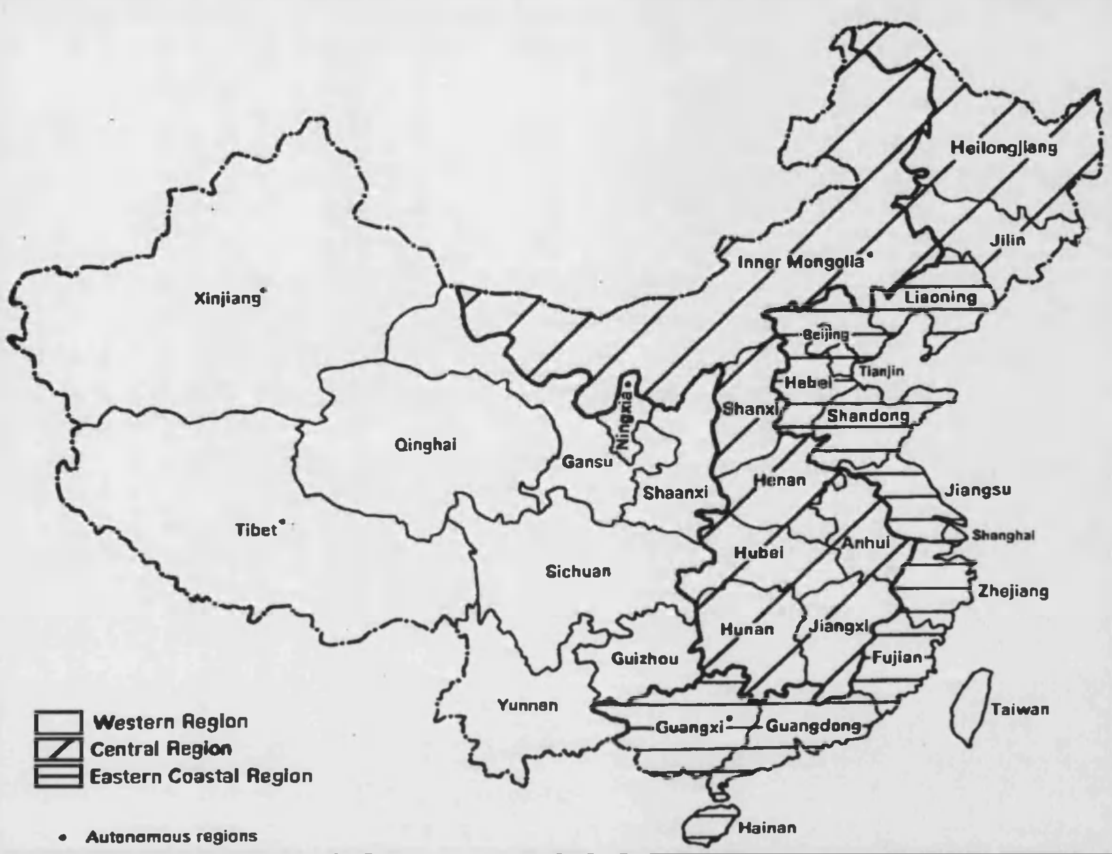
Table 6.1 Proportions of urban and ethnic minority population, and Gross Industrial and Agricultural Product (GIAP) in 1964, 1982: 28 regions

Region	Urban population(%)		Ethnic minority (%)		GIAP[1]
	1965	1982	1964	1982	1982
Beijing	65.08	64.85	3.80	3.50	47.50
Tianjin	68.38	2.10	2.10	2.12	52.36
Hebei	9.34	13.82	1.50	1.60	11.92
Shanxi	16.40	21.25	0.30	0.30	13.54
Inner Mongolia	25.46	29.12	13.00	15.50	10.57
Liaoning	40.31	42.01	6.90	8.10	27.59
Jilin	35.33	39.59	8.60	8.10	15.85
Heilongjiang	38.75	39.90	5.40	4.90	19.41
Shanghai	63.80	58.93	0.40	0.40	100.00
Jiangsu	14.88	15.67	0.20	0.20	21.17
Zhejiang	14.31	25.48	0.40	0.40	16.41
Anhui	11.81	14.37	0.50	0.50	9.42
Fujian	20.28	21.04	0.90	1.00	10.07
Jiangxi	16.84	19.21	0.05	0.10	9.63
Shangdong	11.59	19.16	0.50	0.50	13.85
Henan	10.99	13.63	1.00	1.10	8.99
Hubei	13.84	17.68	0.60	3.70	14.92
Hunan	10.41	15.00	3.40	4.10	10.88
Guangdong	16.95	18.49	1.40	1.80	12.12
Guangxi	9.86	12.24	37.70	38.30	8.25
Sichuan	12.11	14.13	2.60	3.70	9.33
Yunnan	12.36	18.85	23.40	26.00	6.20
Guizhou	12.04	12.52	31.30	31.70	7.72
Shaanxi	15.58	18.87	0.50	0.50	10.61
Gansu	15.82	15.85	7.50	7.90	9.98
Qinghai	18.70	20.36	38.60	39.40	10.19
Ningxia	18.06	22.39	30.80	31.90	9.74
Xinjiang	18.88	28.50	68.10	59.60	11.07
mean	21.10	25.76	10.41	10.60	18.19
s.d.	14.70	15.50	16.27	15.41	19.00

[1]GIAP: Gross Industrial and Agricultural Product ***per capita***, set Shanghai's GIAP ***per capita*** as 100.

Table 6.1 shows some socio-economic features of the 28 regions which are relevant to demographic patterns. As we can see, the three municipality cities Beijing, Tianjin, and Shanghai, have a majority urban population, a very small proportion of ethnic minority population, and the highest GIAP ***per capita***. Similar features could be found in coastal provinces like Liaoning, Jilin, Jiangsu, Zhejiang, Shangdong, and Guangdong. In general, inland regions (Central Region and Western Region) are areas with lower proportions of urban population and GIAP ***per capita***.

Figure 6.1 China's province-level administrative divisions



* Tripartite regionalisation used in the Seventh Five-Year Plan 1986-1990

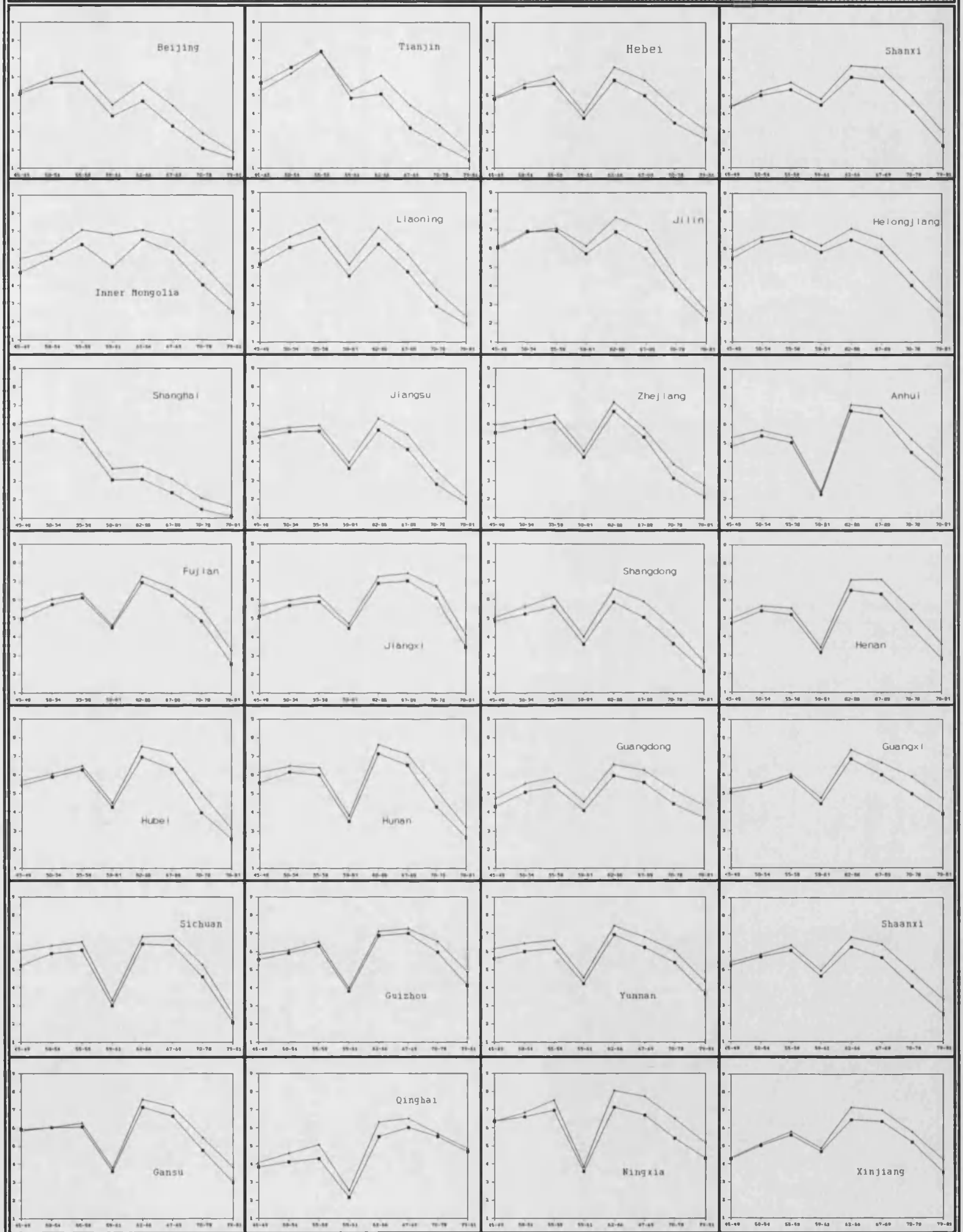
Among the inland regions, the western regions (see Table 6.1) with their higher proportions of ethnic minority populations are those with the lowest GIAP ***per capita***. However, they are not necessarily those with the lowest proportion of urban population, because there are very sparse populations in those rural areas, so that a larger proportion lives in urban areas. Areas such as Inner Mongolia, Qinghai and Xinjiang, are mostly pasture land or even desert. In addition to urbanization and economic development, different ethnic minority regions with different custom and religions show diverse demographic patterns. For example, if we consider information from the 1982 Census about two neighbouring provinces Ningxia and Qinghai, Ningxia had 31.7% Moslem population, and showed a quite high level of fertility; while Qinghai province had 19% Tibetan population, who were Tibetan Buddhists with a high proportion of monks, and showed a very low level of fertility.

I.3 Variations in general fertility

Table 6.2 and Figure 6.2 provide us with the TFR from 1945 to 1981 for the 28 regions separately. One can see from the figures that all regions experienced a great fertility decline over four decades or so. However, such a transition was by no means homogeneous. There were substantial regional differences in the original level of fertility, the timing, and the path of the decline. The regional variation in fertility before 1945 is not so clear. However, using data from China's fertility surveys, a TFR of around 4.5 was estimated for the 1940s for those less developed, mainly inland, regions, and 5.5 for the more developed provinces or regions, mainly coastal one like Shanghai and Jiangsu. As we can see from Table 6.2, since 1950, the fertility levels of all regions consistently rose until the 1970s, while geographic differentials in TFR were getting wider. The standard deviation (s.d.) of the TFR rose from 0.558 in 1945-49 to 1.124 in 1970-78, before dropping in the 1980s.

All regions' fertility during the 1950s (which here refers to 1950-1958) rose steadily from a level of about 5 in the 1945-49 to around 6, a high fertility which was a national phenomenon. The only exception was Shanghai, where a birth control campaign began to be launched in the late 1950s. The regional differences in the TFR were relatively small compared with those in later years. There was no clear-cut geographic pattern, but the TFRs in three northeastern provinces, Liaoning, Jilin and Heilongjiang, were among the highest.

Figure 6.2 Total fertility rates(TFR) and total duration marital fertility rates(TDMFR) 1945-1981: 28 regions



Legend: ▬ TFR; + TDMFR

X Axis: 45-49; 50-54; 55-58; 59-61; 62-66, 67-69; 70-78; 79-81.
Y Axis: 1; 2; 3; 4; 5; 6; 7; 8; 9.

Table 6.2 Total fertility rates(TFR) 1945-81: 28 regions

Region	45-49	50-54	55-58	59-61	62-66	67-69	70-78	79-81
Beijing	5.10	5.69	5.69	3.87	4.68	3.31	2.09	1.55
Tianjin	5.67	6.53	7.42	4.84	5.07	3.21	2.30	1.43
Hebei	4.80	5.42	5.65	3.76	5.83	4.99	3.49	2.60
Shanxi	4.39	5.03	5.34	4.50	6.04	5.82	4.13	2.22
In. Mongolia	4.73	5.51	6.28	5.03	6.55	5.86	4.04	2.52
Liaoning	5.16	6.06	6.58	4.52	6.23	4.75	2.89	1.95
Jilin	6.09	6.93	6.94	5.74	6.90	6.00	3.81	2.20
Heilongjiang	5.50	6.40	6.68	5.84	6.51	5.84	4.04	2.45
Shanghai	5.38	5.65	5.20	3.06	3.09	2.35	1.47	1.10
Jiangsu	5.33	5.60	5.62	3.64	5.68	4.66	2.80	1.79
Zhejiang	5.53	5.80	6.09	4.25	6.69	5.33	3.14	2.13
Anhui	4.82	5.40	5.04	2.25	6.74	6.49	4.51	3.11
Fujian	4.97	5.75	6.12	4.49	6.93	6.21	4.87	2.56
Jiangxi	5.12	5.68	5.88	4.46	6.87	7.00	6.06	3.46
Shangdong	4.87	5.27	5.63	3.59	5.88	5.04	3.62	2.14
Henan	4.72	5.41	5.21	3.16	6.54	6.34	4.52	2.81
Hubei	5.45	5.89	6.26	4.27	6.96	6.31	3.97	2.56
Hunan	5.57	6.14	5.98	3.50	7.13	6.54	4.28	2.65
Guangdong	4.30	5.08	5.37	4.07	5.94	5.58	4.44	3.69
Guangxi	5.05	5.34	5.90	4.46	6.87	6.01	4.99	3.90
Sichuan	5.22	5.89	6.08	3.01	6.41	6.36	4.60	2.08
Yunnan	5.56	5.92	6.30	3.79	6.88	7.00	5.97	4.13
Guizhou	5.61	6.01	6.16	4.22	6.92	6.22	5.39	3.65
Shaanxi	5.25	5.72	6.07	4.64	6.26	5.67	4.06	2.52
Gansu	5.91	6.03	6.06	3.60	7.13	6.64	4.76	2.98
Qinghai	3.84	4.11	4.29	2.16	5.50	6.02	5.51	4.68
Ningxia	6.36	6.60	6.96	3.58	7.13	6.70	5.42	4.31
Xinjiang	4.28	5.02	5.61	4.69	6.45	6.37	5.21	3.52
mean	5.16	5.71	5.94	4.04	6.28	5.67	4.16	2.74
s.d.	0.558	0.554	0.639	0.854	0.871	1.122	1.124	0.885

The high fertility level was certainly affected by rapid economic recovery, but also could be attributed to the government's pronatalist policy in this period. Even in those provinces with a higher proportion of urban population, such as Beijing, Tianjin, Jilin, Liaoning, Jiangsu, Shangdong and Hebei, the fertility was mainly natural. Tien (Croll et al. 1985:121-122) suggested that, given a background of continuing high fertility, population growth was more pronounced in coastal areas and municipalities, probably due to controlling diseases and improving living conditions which resulted in an earlier decline in mortality in these provinces than in the inland regions.

The massive fertility crisis in the later 1950s hit all regions. However, there were great regional diversities. Fertility suffered a catastrophic fall in inner regions like Anhui, Sichuan, Guizhou, Henan, Hubei, Gansu, Qinghai, and Ningxia, and even in those areas with higher proportions of urban population like Tianjin, or Shangdong. Less severe falls were seen in northern regions like Jilin, Heilongjiang, Inner Mongolia, Xinjiang, and some southern ones like Guangdong and Guangxi. On the other hand, the crisis in both Jiangsu and Zhejiang was moderate. Overall, fertility in 1960 in all regions dropped to its lowest point in modern history.

Most regions recovered from the crisis in 1962 and their fertility returned to the pre-crisis level in 1963. In fact, the TFR in the most regions rose to its peak in 1963, the highest since 1949. Recovery was much less marked in those regions which suffered least damage, such as the three municipality cities and provinces like Jilin and Heilongjiang. Then the Chinese government launched its first effective birth control programme in the urban areas. The response to this programme was such that in those regions with majority urban populations like the three municipality cities, fertility experienced a sharp reduction from the pre-transition levels by 1962-66. It was from this period that regional differentials began getting wider, and fertility transition in some regions-mainly in three municipality cities-began.

By 1967-69, a third of the regions had experienced substantial fertility decline, four of them, including Beijing, Tianjin, Liaoning, Shanghai and had more than 25%, and

Jiangsu had 17% fertility reduction. Regional variations in fertility became wider in this period. By contrast, the TFR in Anhui, Henan, Hunan, Sichuan, Yunnan, Gansu, and Qinghai, showed big rises from the pre-crisis level in 1955-58, although in most regions the TFR in this period declined slightly, compared with the peak level in 1962-66 (which can be regarded as a 'catch-up' era after the 1959-61 crisis), and returned to a normal and relatively stable high level. The exceptional regions, where TFR continued to rise from 1962-66, were those where a harsher fertility crisis took place during 1959-61, thus it is understandable that the fertility compensation period lasted longer.

During the 1967-69, regional fertility showed another major fluctuation. This was clearly related to the process of the 'Cultural Revolution'. Fertility successively declining in some regions may reflect continuation of the downward trend that started several years before. Such was the case in the three municipality cities and some provinces like Liaoning and Jiangsu. This might be explained by the fact that these regions had relatively high proportions of urban population, and some of them might have continued their birth control practice privately; it might also result from the chaotic events of the 'Cultural Revolution'. As virtually no family planning programme was carried on during this period, TFR in some regions, like Jiangxi, Yunnan, and Qinghai, kept rising to further peaks. The rest of the regions kept TFR at a quite high level between 5 and 6.

The 'Later-Longer-Less' programme was launched officially in 1971. This programme, unlike the previous one, penetrated the vast rural areas. Although fertility decline occurred in almost all regions, the speed and extent of the reduction varied greatly. More developed regions, mainly coastal provinces such as Liaoning, Jilin, Shangdong, Jiangsu, Zhejiang and Hubei and the three municipality cities experienced dramatic fertility declines, while fertility fell moderately in the less developed regions, especially those with a high proportion of ethnic minority, such as Inner Mongolia, Guangxi, Guizhou, Yunnan, Gansu, and Qinghai, where birth control policies were more relaxed. Thus it pushed regional differentials in TFR to their highest level (s.d. = 1.124) in recent history. Although the level of socio-economic development varied greatly from region to region, the overall consumption level showed no substantial improvement, especially in inland and ethnic minority regions, yet a nationwide family planning programme went into effect in most regions, as the mean TFR of the 28 regions fell from 5.67 to 4.16 in this period.

The downward trend of fertility continued throughout the second half of the 1970s. By 1979 there was no province with TFR above 5, which was the lowest value in the previous two decades. However, the momentum of decline slowed down in the early 1980s, when only a marginal further reduction occurred, even though a much more vigorous birth-control policy, the 'One Child' policy came into effect in 1979. The mean TFR of these regions dropped to a second trough of 2.74 in this period. However, a still quite large degree of regional variation (s.d. = 0.885) of TFR may reflect not only timing factors, but also different degrees of difficulty in the implementation of the policy. Kaufman et al. (1989:726) also pointed out that although a strong normative and putatively compulsory family planning policy existed in rural China, wide variations occurred in its interpretation and enforcement by provinces, and even within provinces by local officials. TFR in those more developed provinces like Liaoning and Jiangsu as well as in the three municipality cities dropped to below 2, while it was over 2 but below 3 in most other regions, and over 4 in some ethnic minority regions. Jowett (Cannon & Jenkins 1990:109) also suggested that lower levels of socio-economic development and concentration of the ethnic minorities in these regions explained their higher levels of fertility.

I.4 Variations in marital Fertility

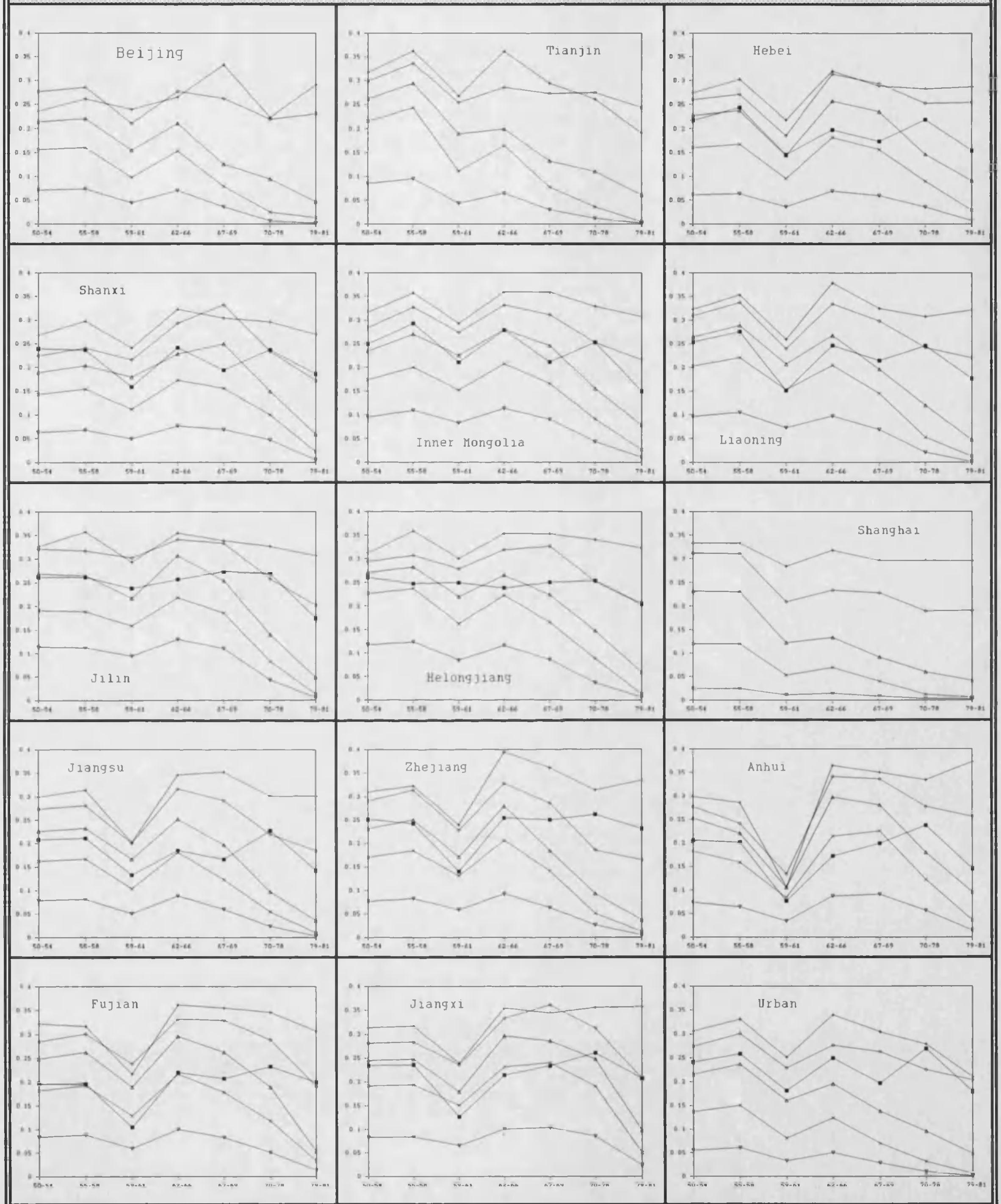
The total duration marital fertility rates for the 28 regions are presented in Table 6.3. The trends of the observed age-specific ever married fertility rates for 28 regions are plotted in Figure 6.3 for couples married between 1950 and 1981. And the Total Duration Marital Fertility Rates (TDMFR), for 28 regions are shown in Table 6.3 and plotted with TFR in Figure 6.2. The general trend of marital fertility was similar to that of overall fertility. However, regional differences seem more considerable. During the 1950s, TDMFR experienced a substantial increase in most regions. As Table 6.3 and Figure 6.2 show, there were relatively minor regional variations in the TDMFR from 1945 to 1958. During the periods of demographic disturbances in 1959-61 and 1962-66, it can be seen that regional variability rose steadily. Marital fertility in Anhui, Sichuan, Qinghai, and Ningxia dropped by as much as 50% of the level under normal conditions at that time. However, northern regions such as Jilin, Heilongjiang, Inner Mongolia, Xinjiang, and Shanxi witnessed only about 15% decline from previous levels. The rest of the regions varied from 20% to 40% decline in marital fertility. Peng (1987:639-670) found that famine-induced separation and divorce rates rose sharply in some regions, notably Anhui.

Table 6.3 Total duration marital fertility rate(TDMFR) 1945-81: 28 regions

Region	45-49	50-54	55-58	59-61	62-66	67-69	70-78	79-81
Beijing	5.25	5.93	6.34	4.48	5.70	4.44	2.91	1.89
Tianjin	5.28	6.19	7.35	5.25	6.07	4.45	3.35	1.88
Hebei	4.88	5.63	6.06	4.06	6.55	5.83	4.34	3.10
Shanxi	4.40	5.27	5.75	4.84	6.69	6.57	4.92	2.98
In. Mongolia	5.49	5.91	7.09	6.81	7.07	6.66	5.18	3.36
Liaoning	5.79	6.64	7.28	5.15	7.13	5.69	3.78	2.35
Jilin	5.97	6.88	7.10	6.15	7.69	7.01	4.61	2.67
Heilongjiang	5.85	6.66	6.97	6.20	7.12	6.56	4.77	3.00
Shanghai	6.08	6.32	5.89	3.63	3.75	3.12	2.05	1.56
Jiangsu	5.57	5.82	5.92	3.95	6.29	5.45	3.51	2.09
Zhejiang	5.96	6.20	6.50	4.58	7.19	5.79	3.86	2.76
Anhui	5.32	5.70	5.32	2.41	7.08	6.91	5.24	3.71
Fujian	5.48	6.04	6.33	4.62	7.26	6.65	5.56	3.27
Jiangxi	5.66	5.98	6.22	4.71	7.24	7.42	6.71	4.11
Shangdong	5.09	5.62	6.14	3.99	6.60	5.91	4.49	2.63
Henan	5.01	5.67	5.57	3.42	7.12	7.15	5.47	3.58
Hubei	5.69	6.05	6.49	4.49	7.53	7.15	5.02	3.10
Hunan	6.14	6.49	6.38	3.81	7.62	7.12	5.19	3.19
Guangdong	4.72	5.53	5.88	4.55	6.56	6.23	5.19	4.36
Guangxi	5.25	5.51	6.06	4.77	7.37	6.68	5.90	4.70
Sichuan	6.06	6.33	6.54	3.29	6.84	6.86	5.27	2.52
Yunnan	5.84	6.07	6.52	3.99	7.12	7.27	6.55	4.88
Guizhou	6.15	6.46	6.63	4.55	7.40	6.8	6.04	4.31
Shaanxi	5.43	5.86	6.38	4.95	6.82	6.42	4.91	3.31
Gansu	5.85	6.03	6.27	3.79	7.58	7.16	5.47	3.81
Qinghai	4.07	4.59	5.06	2.53	6.31	6.5	5.67	4.85
Ningxia	6.35	6.83	7.52	3.83	8.05	7.74	6.51	5.15
Xinjiang	4.34	5.12	5.80	4.87	7.15	6.99	5.77	4.23
mean	5.46	5.98	6.33	4.42	6.89	6.38	4.94	3.33
s.d.	0.577	0.511	0.591	0.971	0.793	1.004	1.088	0.962

The transition process continued throughout the 1970s in all regions, yet its regional variations were getting wider. By 1970-78, TDMFR declined over 40% in Beijing, Tianjin, Liaoning, Jilin, Shanghai, Jiangsu, and Zhejiang, but less than 20% decline occurred in Guangxi, Guizhou, Jiangxi, Yunnan, Qinghai, Ningxia, and Xinjiang. The other regions had moderate reductions in marital fertility.

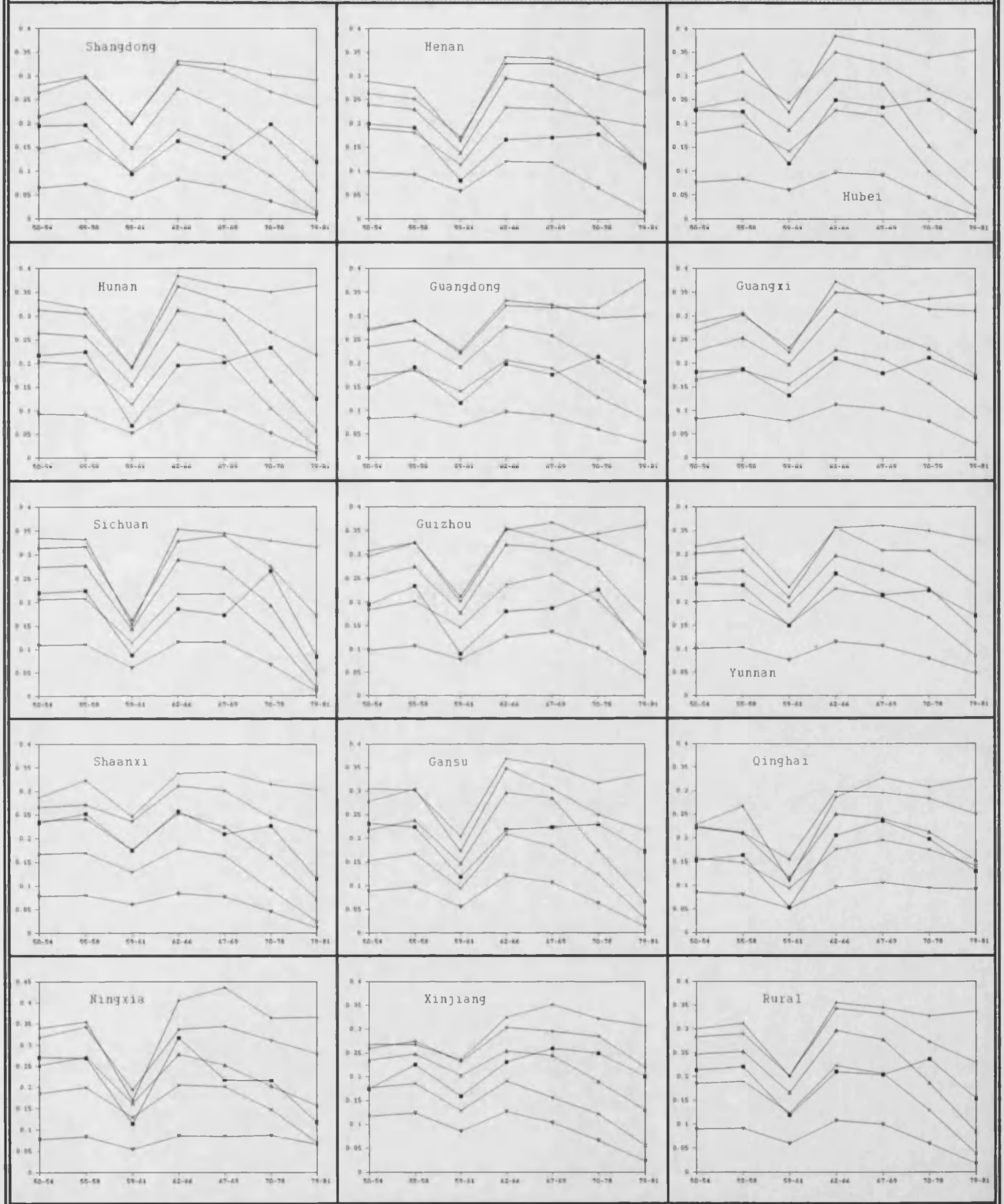
Figure 6.3 Age specific ever-married fertility rates (Part I) 1950-81: 28 regions



Legend: ■ 15-19; + 20-24; ♦ 25-29; ▴ 30-34; × 35-39; ▾ 40-44.

X Axis: 50-54; 55-58; 59-61; 62-66; 67-69; 70-78; 79-81.
Y Axis: 0; 0.05; 0.1; 0.15; 0.2; 0.25; 0.3; 0.35; 0.4.

Figure 6.3 Age specific ever-married fertility rates (Part II) 1950-81: 28 regions



Legend: ■ 15-19; + 20-24; ♦ 25-29; ▲ 30-34; × 35-39; ▼ 40-44.

X Axis: 50-54, 55-58, 59-61, 62-66, 67-69, 70-78, 79-81.
Y Axis: 0, 0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4.
Y Axis: (Ningxia) 0.05, 0.1, 0.15, 0.2, 0.25, 0.3, 0.35, 0.4, 0.45

Table 6.4 Mean age at first marriage by marriage cohort 1945-81: 28 regions

Region	45-49	50-54	55-58	59-61	62-66	67-69	70-78	79-81
Beijing	17.5	18.5	19.3	21.2	21.0	21.6	23.5	24.5
Tianjin	18.3	18.9	19.3	19.9	21.1	21.8	24.2	25.1
Hebei	17.7	18.3	18.7	19.3	19.3	20.1	21.6	22.9
Shanxi	16.3	17.2	17.5	17.3	17.6	18.3	19.5	21.3
In. Mongolia	16.9	17.5	18.6	19.1	19.5	19.9	20.4	22.3
Liaoning	18.1	18.7	19.0	19.5	20.1	20.8	22.1	23.6
Jilin	17.5	17.9	18.4	18.7	19.1	19.8	21.0	22.5
Heilongjiang	17.6	18.0	18.2	18.6	18.8	19.2	20.4	21.9
Shanghai	20.1	19.9	21.4	22.8	22.8	23.1	24.0	25.3
Jiangsu	18.6	18.9	19.1	19.7	20.1	20.3	21.9	23.2
Zhejiang	17.6	18.0	18.1	18.7	18.2	18.7	20.2	21.8
Anhui	18.5	18.2	18.6	19.1	19.0	19.2	20.6	22.0
Fujian	18.2	18.0	18.0	18.3	18.1	18.3	19.5	21.1
Jiangxi	17.7	17.5	17.8	17.7	17.7	18.1	19.1	20.4
Shangdong	17.8	18.7	19.2	19.3	19.8	20.5	21.8	23.3
Henan	17.9	18.0	18.5	19.0	19.0	19.7	21.1	22.9
Hubei	18.1	18.0	18.1	18.5	19.0	19.7	21.2	22.4
Hunan	18.1	18.0	18.2	18.5	18.6	19.1	20.7	21.9
Guangdong	18.9	19.2	19.8	19.9	20.1	20.2	21.2	22.3
Guangxi	18.7	19.0	19.5	19.7	19.9	20.2	21.3	22.6
Sichuan	18.7	18.6	18.9	19.3	19.3	19.7	20.9	22.7
Yunnan	18.9	18.9	19.0	19.6	19.5	19.4	20.4	21.7
Guizhou	18.2	18.7	18.9	19.0	19.3	19.4	20.2	21.5
Shaanxi	17.1	17.3	17.6	17.9	18.3	18.6	20.2	21.9
Gansu	16.4	16.5	17.2	17.6	17.3	17.5	19.0	20.3
Qinghai	17.4	18.9	18.7	19.9	19.3	19.2	19.3	18.8
Ningxia	16.5	17.0	17.3	17.6	19.0	19.2	20.3	21.1
Xinjiang	16.0	16.9	17.2	17.8	18.1	18.5	18.6	20.1
mean	17.8	18.2	18.6	19.1	19.2	19.7	20.9	22.2
s.d.	0.88	0.77	0.88	1.13	1.13	1.19	1.37	1.42

Under the influence of the 'Later-Longer-Less' campaign, marriage was widely postponed and birth consequently delayed (see Table 6.4). This nuptiality effect and marital fertility worked together in the same direction to create relatively large differences in overall fertility. Peng (1991:264) noticed that by the early 1980s marital fertility had declined by about 50% in almost half of all provinces during the previous one and a half decades. The regional differential narrowed a little but remained marked. In places such as in Shanghai, Tianjin, and Jilin, the reduction was more than 60%. In contrast, the decline in some provinces was very moderate. Guangdong and Guangxi were the two with the smallest decline, having less than half of the national average.

The uneven progress of the regional family-planning programme and local institutional settings were major sources of the regional variation. Although the declining trend continued in the 1980s, as a result of differences in local government's interpretation of the recent modification of population policies, and in the degree of relaxation of control over marriage and reproduction, the regional diversity remained considerable. Zeng et al. (1991:443-444) found that the greatest increases in crude birth rates were attributable to the declining age at marriage that occurred in the well developed regions such as the three municipality cities and two coastal provinces (Shangdong and Liaoning), while this was much less obvious in the less developed regions such as Qinghai, Xinjiang, Ningxia, and Gansu. The offered explanation is, that in the advanced regions more strict controls over age at first marriage were imposed but after the New Marriage Law took effect, age at first marriage fell, leading to a surge of births.

One point worth mentioning is that birth control policies were implemented in most regions, except among those ethnic minority populations, so as expected (see Figure 6.3), in those regions with high proportions of ethnic minority population, such as Yunnan, Qinghai, Ningxia and Xinjiang, the decline in age specific marital fertility was comparatively less significant. Whyte and Gu (1987:471-492) also found that women from the well developed areas were more likely to prefer two children, but three and more were favoured in less developed, and hilly or ethnic minority areas.

I.5 Variations in natural fertility

Now we come to the discussion of natural fertility by considering both its level and its spatial distribution. Here, we have the indices of M and m estimated by original Coale-Trussell's model and its adjusted version for each region respectively. They are presented in Tables 6.5, 6.6, and 6.7 for 32 years' marriage cohorts. The estimated results from the two versions of the model are quite consistent in most regions before the 1980s, and suggest that, apart from the crisis period of 1959-61, a trend towards increase is evident in all regions and periods before 1978, except for a few developed regions, such as Shanghai where birth control practice was undertaken earlier, thus the both versions of the model, or even adjusted version, may underestimate the underlying level of natural fertility M. For the periods of 1940-44 and 1945-49, again, we plot the duration marital fertility rates (DMFR) from 1940 to 1978 with M estimated by adjusted model in Figure 6.4.

Figure 6.4 shows a pattern of M consistent with DMFR in all regions, until 1962-66, when China's fertility was mainly a natural pattern. The noteworthy exception is Shanghai, again, for the well known reason: it was the earliest region to practise birth control, thus the DMFR was no longer that of a natural pattern. As DMFR(0-4) rose substantially in all regions during 1940-1949, this, again, leads to the possibility that the underlying level of natural fertility, M, during 1940-49 rose substantially for all regions as well. The general increase in marital fertility among younger married women in all regions is reflected in the substantial increases in M in successive marriage cohorts before the 1970s in both versions of the model. The increase in the standard deviation of the mean of the birth control index, m, during the period from 1967 to 1981 in Table 6.6, is indicative of differences in timing of the beginning of the practice of family limitation.

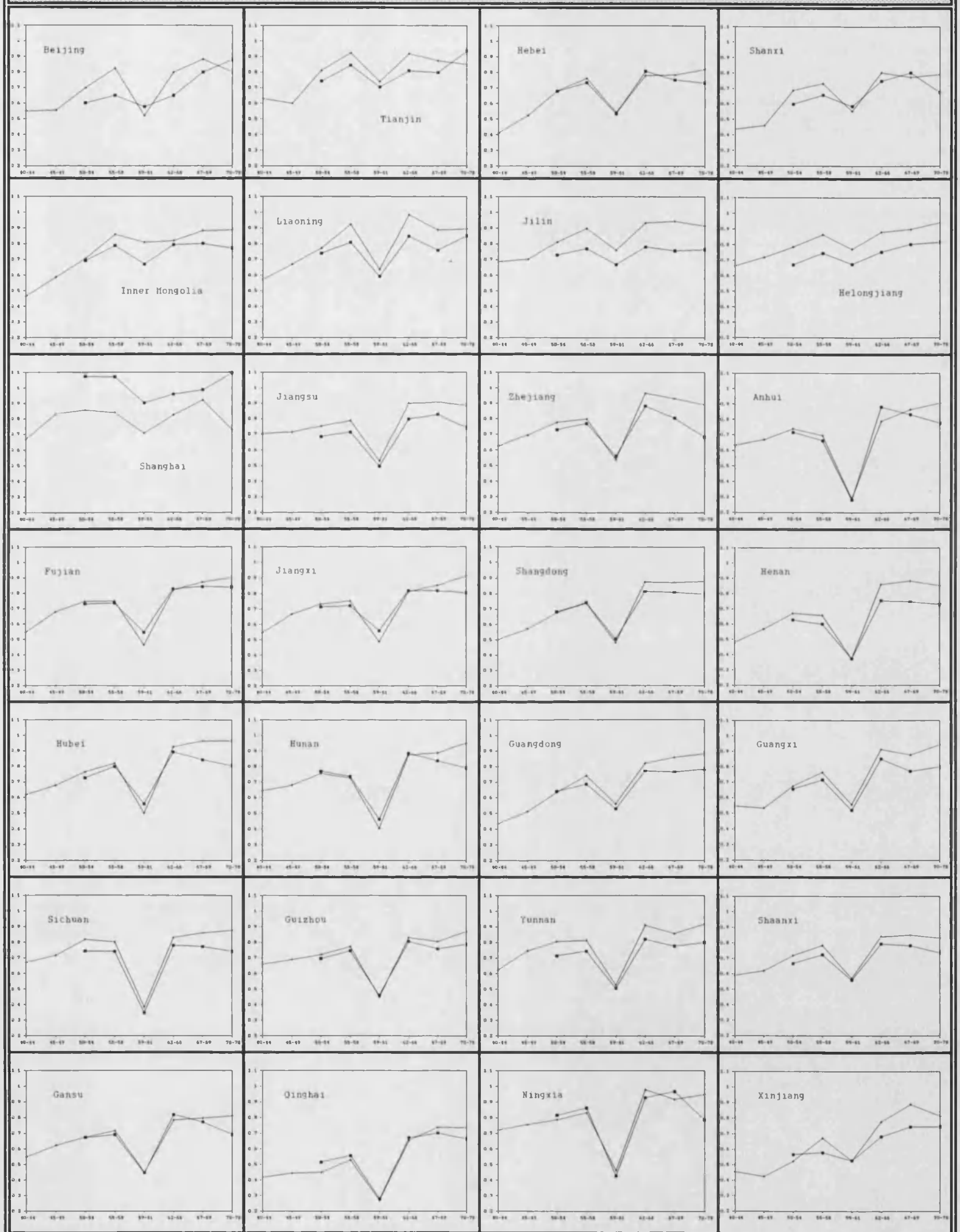
Table 6.5 Index of underlying level of natural fertility(M) by marriage cohort 1950-81 and by adjusted Coale-Trussell's model (v2): 28 regions

Region	50-54	55-58	59-61	62-66	67-69	70-78	79-81
Beijing	0.603	0.651	0.578	0.651	0.800	0.881	1.426
Tianjin	0.743	0.845	0.705	0.810	0.798	0.935	1.151
Hebei	0.680	0.735	0.536	0.808	0.753	0.733	1.054
Shanxi	0.599	0.658	0.586	0.750	0.803	0.760	0.864
In. Mongolia	0.693	0.788	0.670	0.794	0.802	0.773	0.895
Liaoning	0.741	0.810	0.593	0.849	0.759	0.851	1.406
Jilin	0.731	0.771	0.671	0.783	0.758	0.765	0.965
Heilongjiang	0.672	0.746	0.676	0.755	0.803	0.817	0.984
Shanghai	1.074	1.072	0.902	0.959	0.987	1.096	1.181
Jiangsu	0.686	0.714	0.497	0.797	0.826	0.742	0.984
Zhejiang	0.731	0.770	0.563	0.883	0.805	0.682	0.893
Anhui	0.716	0.662	0.281	0.882	0.831	0.777	1.047
Fujian	0.732	0.738	0.549	0.832	0.846	0.843	0.733
Jiangxi	0.714	0.722	0.559	0.821	0.820	0.807	0.805
Shangdong	0.680	0.739	0.503	0.813	0.807	0.795	0.977
Henan	0.627	0.600	0.374	0.756	0.747	0.729	0.970
Hubei	0.726	0.799	0.561	0.893	0.843	0.805	1.069
Hunan	0.769	0.736	0.461	0.886	0.837	0.792	0.975
Guangdong	0.639	0.686	0.528	0.772	0.764	0.783	0.971
Guangxi	0.655	0.715	0.519	0.851	0.771	0.799	1.006
Sichuan	0.743	0.742	0.348	0.781	0.772	0.742	0.791
Yunnan	0.696	0.746	0.459	0.807	0.759	0.788	0.896
Guizhou	0.714	0.744	0.506	0.820	0.777	0.800	0.722
Shaanxi	0.667	0.724	0.561	0.794	0.783	0.737	0.874
Gansu	0.673	0.691	0.446	0.819	0.771	0.693	0.877
Qinghai	0.522	0.557	0.353	0.672	0.702	0.664	0.618
Ningxia	0.815	0.861	0.426	0.928	0.967	0.787	0.784
Xinjiang	0.566	0.578	0.526	0.681	0.745	0.746	0.804
mean	0.700	0.740	0.530	0.810	0.800	0.790	0.950
s.d.	0.095	0.095	0.128	0.070	0.059	0.084	0.180

Apart from the three municipality cities, fertility in all regions remained more or less a natural pattern until 1966. Among these three cities, fertility in Beijing and Tianjin followed a natural pattern until 1958. In Shanghai, however, birth control already existed before 1949. The colonized city, with high prostitution, was under the influence of

Western countries, where contraception was popular as early as last century.

Figure 6.4 Duration(0-4 years of first marriage) marital fertility rates (multiplied by 2.5) and Index of underlying level of natural fertility M(v2) 1940-78: 28 regions



Legend: ▬ M; + (0-4) years DMFR(multiplied by 2.5);

X Axis: 40-44; 45-49; 50-54; 55-58; 59-61; 62-66; 67-69; 70-78.
Y Axis: 0.2; 0.3; 0.4; 0.5; 0.6; 0.7; 0.8; 0.9; 1.0; 1.1.

Table 6.6A Index of fertility control(m) by marriage cohort 1950-81 and by Coale-Trussell's model: 28 regions

Region	50-54	55-58	59-61	62-66	67-69	70-78	79-81
Beijing	0.189	0.227	0.505	0.265	0.922	1.949	3.173
Tianjin	0.182	0.190	0.602	0.463	0.975	1.650	3.128
Hebei	0.328	0.358	0.538	0.365	0.414	0.799	2.015
Shanxi	0.281	0.297	0.421	0.305	0.401	0.607	2.147
In. Mongolia	0.160	0.149	0.222	0.128	0.296	0.755	1.793
Liaoning	0.145	0.148	0.185	0.244	0.417	1.278	3.094
Jilin	0.089	0.143	0.167	0.040	0.142	0.799	2.400
Heilongjiang	-0.034	0.017	0.209	0.073	0.328	0.876	2.274
Shanghai	1.080	1.082	1.558	1.427	1.846	2.637	3.108
Jiangsu	0.243	0.253	0.316	0.275	0.581	1.160	2.678
Zhejiang	0.284	0.264	0.294	0.290	0.520	1.088	2.403
Anhui	0.252	0.302	0.130	0.287	0.219	0.570	1.714
Fujian	0.229	0.191	0.254	0.195	0.342	0.677	1.580
Jiangxi	0.200	0.200	0.206	0.160	0.139	0.284	1.240
Shangdong	0.342	0.316	0.413	0.295	0.447	0.843	2.217
Henan	0.051	0.050	0.049	0.030	0.038	0.307	1.238
Hubei	0.269	0.279	0.238	0.244	0.237	0.756	2.118
Hunan	0.189	0.175	0.236	0.170	0.207	0.676	2.028
Guangdong	0.145	0.154	0.161	0.161	0.217	0.519	1.088
Guangxi	0.189	0.163	0.061	0.143	0.137	0.374	1.105
Sichuan	0.096	0.085	-0.030	0.093	0.090	0.443	1.985
Yunnan	0.129	0.108	0.002	0.048	-0.054	0.171	0.844
Guizhou	0.107	0.124	0.061	0.109	0.140	0.350	0.720
Shaanxi	0.169	0.221	-0.060	0.287	0.353	0.706	1.825
Gansu	0.207	0.152	0.250	0.115	0.159	0.447	1.732
Qinghai	0.124	0.116	0.125	0.114	0.096	0.141	0.213
Ningxia	0.332	0.315	0.116	0.360	0.419	0.357	0.693
Xinjiang	-0.077	-0.106	0.082	0.003	0.209	0.470	1.182
mean[1]	0.210	0.220	0.270	0.240	0.370	0.770	1.850
s.d.	0.189	0.186	0.293	0.255	0.362	0.546	0.782

Note: estimates of m are the same for both versions of CT models. [1] computed from absolute values of m.

As discussed in the earlier chapters, the original CT model tends to underestimate M. So in particular, for those regions with a higher proportion of urban population and a comparatively good standard of living, such as Shanghai, Tianjin, Jilin, Shangdong, Jiangsu, and Zhejiang, the figures estimated from the original model were more seriously underestimated than for less developed regions and thus unrealistically much lower than those of less developed regions, although their residents were in a much better socio-economic condition. Again, the adjusted model seems to be a more sensitive way to interpret underlying level of natural fertility in both the cross sectional differentials and dynamic trends (see Table 6.8).

Table 6.6B Goodness of fit (R^2) in both versions of the Coale-Trussell's model: 28 regions

Region	50-55	55-58	59-61	62-66	67-69	70-78	79-81
Anhui	0.77	0.88	0.22	0.84	0.78	0.97	0.97
Henan	0.95	0.95	0.25	0.60	0.57	0.53	0.58
Tianjin	0.62	0.66	0.94	0.94	0.96	0.94	0.89
Hebei	0.80	0.86	0.97	0.84	0.83	0.98	0.97
Mongolia	0.81	0.80	0.84	0.79	0.89	0.96	0.97
Beijing	0.52	0.72	0.98	0.84	0.94	0.95	0.97
Fujian	0.98	0.89	0.72	0.91	0.97	0.99	0.92
Gansu	0.72	0.56	0.78	0.54	0.61	0.92	0.95
Guangdong	0.72	0.78	0.73	0.73	0.84	0.96	0.98
Guangxi	0.95	0.85	0.37	0.90	0.66	0.95	0.97
Guizhou	0.82	0.67	0.32	0.34	0.22	0.92	0.99
Hubei	0.94	0.96	0.71	0.92	0.91	0.96	0.98
Hunan	0.93	0.88	0.89	0.90	0.93	0.94	0.95
Jiangsu	0.98	0.99	0.86	0.98	0.97	0.96	0.97
Jiangxi	0.89	0.89	0.80	0.76	0.56	0.99	0.94
Liaoning	0.91	0.92	0.96	0.99	0.93	0.98	0.99
Jilin	0.35	0.57	0.49	0.13	0.50	0.92	0.95
Heilongjiang	0.89	0.07	0.91	0.57	0.87	0.98	0.94
Shanghai	0.85	0.85	0.96	0.96	0.98	0.99	0.96
Zhejiang	0.96	0.92	0.94	0.98	0.94	0.92	0.96
Shaanxi	0.90	0.97	0.95	0.98	0.98	0.97	0.96
Shanxi	0.98	0.97	0.95	0.98	0.82	0.96	1.00
Shangdong	0.94	0.89	0.91	0.87	0.96	0.98	0.93
Sichuan	0.84	0.77	0.14	0.85	0.61	0.95	0.93
Yunnan	0.91	0.98	0.93	0.75	0.91	0.98	0.89
Qinghai	0.68	0.52	0.56	0.51	0.58	0.61	0.26
Ningxia	0.94	0.91	0.28	0.98	0.95	0.73	0.61
Xinjiang	0.22	0.36	0.16	0.01	0.50	0.89	0.98

Note: Goodness of fit (R^2) are the same for both versions of CT models.

Table 6.7 Index of underlying level of fertility(M) by marriage cohort 1950-81 and by original Coale-Trussell's model(v1): 28 regions

Region	50-54	55-58	59-61	62-66	67-69	70-78	79-81
Beijing	0.588	0.631	0.538	0.627	0.703	0.672	0.916
Tianjin	0.724	0.823	0.648	0.759	0.696	0.743	0.744
Hebei	0.649	0.699	0.497	0.768	0.711	0.656	0.796
Shanxi	0.576	0.631	0.552	0.718	0.759	0.621	0.640
In. Mongolia	0.678	0.772	0.650	0.780	0.769	0.696	0.697
Liaoning	0.726	0.794	0.578	0.820	0.716	0.712	0.913
Jilin	0.722	0.755	0.655	0.778	0.743	0.684	0.691
Heilongjiang	0.675	0.744	0.656	0.747	0.768	0.723	0.716
Shanghai	0.923	0.922	0.726	0.786	0.763	0.759	0.766
Jiangsu	0.663	0.689	0.475	0.768	0.762	0.632	0.677
Zhejiang	0.702	0.743	0.540	0.848	0.749	0.639	0.586
Anhui	0.692	0.635	0.276	0.847	0.806	0.717	0.825
Fujian	0.709	0.719	0.530	0.808	0.807	0.767	0.588
Jiangxi	0.694	0.702	0.543	0.803	0.805	0.775	0.677
Shangdong	0.649	0.708	0.475	0.780	0.758	0.707	0.717
Henan	0.623	0.596	0.372	0.753	0.743	0.699	0.816
Hubei	0.699	0.769	0.542	0.863	0.815	0.724	0.795
Hunan	0.749	0.718	0.446	0.865	0.813	0.721	0.737
Guangdong	0.626	0.671	0.516	0.755	0.741	0.728	0.834
Guangxi	0.638	0.699	0.515	0.834	0.756	0.758	0.862
Sichuan	0.733	0.733	0.350	0.771	0.763	0.698	0.600
Yunnan	0.684	0.735	0.459	0.802	0.765	0.769	0.796
Guizhou	0.703	0.731	0.502	0.807	0.763	0.762	0.653
Shaanxi	0.652	0.702	0.565	0.763	0.745	0.668	0.677
Gansu	0.654	0.676	0.431	0.806	0.755	0.651	0.689
Qinghai	0.513	0.548	0.347	0.661	0.692	0.651	0.600
Ningxia	0.778	0.824	0.420	0.882	0.912	0.749	0.712
Xinjiang	0.572	0.587	0.520	0.681	0.723	0.698	0.681
mean	0.680	0.710	0.510	0.780	0.760	0.710	0.730
s.d.	0.074	0.077	0.107	0.059	0.044	0.044	0.091

Table 6.8 Change in index of underlying level of fertility(M) by marriage cohort 1950-81 and by adjusted Coale-Trussell's model(v2): 28 regions

Region	50-54/ 55-58	55-58/ 59-61	59-61/ 62-66	62-66/ 67-69	67-69/ 70-78	70-78/ 79-81	50-54/ 79-81
Beijing	0.05	-0.07	0.07	0.15	0.08	0.54	0.82
Tianjin	0.10	-0.14	0.10	-0.01	0.14	0.22	0.41
Hebei	0.06	-0.20	0.27	-0.06	-0.02	0.32	0.37
Shanxi	0.06	-0.07	0.16	0.05	-0.13	0.19	0.26
In. Mongolia	0.10	-0.12	0.12	0.01	-0.03	0.12	0.20
Liaoning	0.07	-0.22	0.26	-0.09	0.09	0.56	0.67
Jilin	0.04	-0.10	0.11	-0.03	0.01	0.20	0.23
Heilongjiang	0.07	-0.07	0.08	0.05	0.01	0.17	0.31
Shanghai	0.00	-0.17	0.06	0.03	0.11	0.08	0.11
Jiangsu	0.03	-0.22	0.30	0.03	-0.08	0.24	0.30
Zhejiang	0.04	-0.21	0.32	-0.08	-0.12	0.21	0.16
Anhui	-0.05	-0.38	0.60	-0.05	-0.05	0.27	0.33
Fujian	0.01	-0.19	0.28	0.01	0.00	-0.11	0.01
Jiangxi	0.01	-0.16	0.26	0.00	-0.01	0.00	0.09
Shangdong	0.06	-0.24	0.31	-0.01	-0.01	0.18	0.30
Henan	-0.03	-0.23	0.38	-0.01	-0.02	0.24	0.34
Hubei	0.07	-0.24	0.33	-0.05	-0.04	0.26	0.34
Hunan	-0.03	-0.28	0.42	-0.05	-0.04	0.18	0.21
Guangdong	0.05	-0.16	0.24	-0.01	0.02	0.19	0.33
Guangxi	0.06	-0.20	0.33	-0.08	0.03	0.21	0.35
Sichuan	0.00	-0.39	0.43	-0.01	-0.03	0.05	0.05
Yunnan	0.05	-0.29	0.35	-0.05	0.03	0.11	0.20
Guizhou	0.03	-0.24	0.31	-0.04	0.02	-0.08	0.01
Shaanxi	0.06	-0.16	0.23	-0.01	-0.05	0.14	0.21
Gansu	0.02	-0.24	0.37	-0.05	-0.08	0.18	0.20
Qinghai	0.04	-0.28	0.39	0.03	-0.04	-0.05	0.10
Ningxia	0.05	-0.43	0.50	0.04	-0.18	0.00	-0.03
Xinjiang	0.01	-0.05	0.15	0.06	0.00	0.06	0.24
mean	0.04	-0.21	0.28	-0.01	-0.01	0.17	0.25

* Values without any sign indicate positive change or increase.

I.6 Variations in birth intervals

Because of the lack of regional information on the proportions of first births occurring within eight to eleven months of first marriage, it is impossible to apply the Bongaarts' model to estimate the mean fecundability for each region. As we found in earlier chapters, the impact of the increase in fecundability on the first two birth intervals at the national level was that the observed mean first interval fell substantially between the 1940 cohort and the end of 1970s cohorts. Similar findings were made by Lavely and Freedman (1990:365), who pointed to a mean first birth interval decline from 1952-55 to 1973-76 for the Upper Yangzi regions (Sichuan and a few counties in neighbouring provinces) and North China regions (Beijing, Tianjin, Hubei, Shangdong, Henan, most of Shanxi, the northern parts of Jiangsu and Anhui, and small parts of Shaanxi and Inner Mongolia). Thus we have reason to speculate that the birth intervals in most regions fell substantially as well.

Table 6.9 Median(years) of first two birth intervals by 1957, 1964 and 1970 marriage/first birth cohorts: 28 regions

Region	First Interval (Years)			Second Interval (Years)			% of Births Occurred Four-Years After					
							First Marriage			First Birth		
	1957	1964	1970	1957	1964	1970	1957	1964	1970	1957	1964	1970
Beijing	2.40	2.61	1.58	3.07	2.94	2.77	33	17	0	24	27	13
Tianjin	1.83	1.62	1.89	2.61	2.44	2.23	4	0	4	17	4	15
Hebei	2.43	2.16	2.08	3.42	2.62	2.54	20	13	9	36	13	14
Shanxi	2.28	2.25	1.94	3.39	2.67	2.63	17	19	10	37	24	26
In. Mongolia	2.03	1.91	1.91	2.71	2.62	2.39	14	3	5	25	19	10
Liaoning	1.85	1.77	1.63	2.66	2.61	2.55	11	7	3	20	13	13
Jilin	1.95	1.85	1.74	2.40	2.33	2.28	13	3	5	14	14	9
Heilongjiang	2.11	1.86	1.81	2.54	2.43	2.37	16	9	8	22	16	8
Shanghai	1.85	1.60	1.48	2.39	2.47	3.50	10	6	3	18	12	16
Jiangsu	2.46	1.82	1.59	3.27	2.45	2.40	27	12	5	35	12	10
Zhejiang	2.56	1.93	1.73	3.08	2.47	2.48	26	8	6	27	8	12
Anhui	3.31	2.33	1.98	4.22	2.45	2.45	41	16	7	58	8	11
Fujian	2.36	2.28	1.87	3.00	2.68	2.61	26	14	9	34	12	12
Jiangxi	3.00	2.42	2.25	3.12	2.41	2.49	34	20	15	38	7	11
Shangdong	2.36	2.36	1.92	3.84	2.70	2.40	25	12	8	42	14	10
Henan	3.25	2.38	1.99	4.08	2.62	2.53	35	15	11	54	15	12
Hubei	2.34	1.92	1.75	2.97	2.47	2.35	32	11	6	35	8	9
Hunan	3.30	2.30	1.96	3.81	2.54	2.52	40	16	11	46	10	12
Guangdong	2.57	2.17	2.07	2.84	2.47	2.38	29	16	11	31	9	8
Guangxi	2.44	2.19	1.93	3.22	2.57	2.45	30	14	11	35	16	10
Sichuan	2.41	2.15	1.95	3.65	2.54	2.50	33	16	9	43	13	11
Yunnan	1.95	2.16	1.90	3.33	2.43	2.35	20	14	8	39	13	7
Guizhou	2.59	2.55	2.41	3.10	2.56	2.42	33	25	21	35	14	15
Shaanxi	2.18	2.24	2.12	3.09	2.81	2.65	21	17	9	26	18	17
Gansu	3.50	2.88	2.41	3.45	2.53	2.54	43	20	15	40	11	16
Qinghai	2.67	2.73	2.50	4.22	2.91	2.57	36	33	22	41	26	18
Ningxia	1.81	2.29	2.06	4.17	2.58	2.58	23	0	7	53	14	0
Xinjiang	2.43	2.50	2.25	2.75	2.65	2.35	29	24	18	24	14	11
mean	2.44	2.19	1.95	3.23	2.57	2.51	26	14	9	34	14	12
s.d.	0.47	0.32	0.25	0.54	0.15	0.23	10	8	5	11	5	4

Here we are fortunately able to show median intervals between first marriage and first birth, and between first and second births for some selected marriages and first birth cohorts as this information is available from the 1982 1/1000 Fertility Survey. As only information for the cohorts of 1957, 1964 and 1970 was available to the author, analysis and interpretation of these results should be more cautious. The behaviour of the cohorts of 1957 was markedly affected by the nationwide economic depression and famine; conditions for the cohorts of 1964 and 1970 were more favourable, though their reproductive behaviour might have been disturbed by the 'Cultural Revolution'.

It may be seen from Table 6.9 that median intervals by the first marriage and first birth cohorts declined generally: the national averages of first birth intervals were 2.44, 2.19 and 1.95 years for 1957, 1964 and 1970 marriage cohorts respectively; the national averages of median intervals to second births were 3.23, 2.57 and 2.51 years for the three first birth cohorts respectively. First birth intervals for the 1964 marriage cohort in all regions were shorter than for the 1957 cohort, except in Ningxia, Yunnan, Beijing, Shaanxi, Xinjiang and Qinghai. As five of these six exceptions were border and ethnic minority regions, which suffered much less severely from the famine, this leads to the possibility that the falling trend was due to the influence of famine in prolonging intervals for the 1957 cohort in most regions rather than to rising fecundability and falling intervals between 1957 and 1964. But as the first birth intervals of the 1970 cohort in all regions (except Tianjin and Inter Mongolia) were also shorter than those for the 1964 cohort, a general trend of falling first intervals does indeed seem to be confirmed.

Compared with the first birth interval, the second kept more or less steady, though a decline is still apparent in most regions; The mean fell only slightly from 2.57 to 2.51

years from 1964 to 1970. This apparently was because of family planning campaigns in the urban areas in the 1960s, and nationwide in the 1970s. In general, a substantial decrease in second birth intervals occurred in most regions and may be due to a rise in fecundability. The consistency of these two birth intervals being compressed over time in most regions suggests that, apart from a postponement of births by the 1957 first marriage and first birth cohorts as a common reaction to the disturbances of the famine during 1959-61, fecundability in most areas did rise over time. The fact that the standard deviations of regional median birth intervals were getting smaller also suggests that a nationwide trend of falling mean birth intervals did occur.

We have also made additional comparisons of births by duration since marriage, and the first birth for the cohorts of 1957, 1964 and 1970. The proportions of births which occurred over four years after first marriage and after first birth for these three cohorts in each region are also presented in Table 6.9. Throughout China (except Tianjin), the proportion of first births which occurred over four years after first marriage declined between the 1957 cohorts to the 1970 cohorts: the differences of these proportions over the three cohorts are particularly striking in some regions: Liaoning, Ningxia, Beijing, Hebei, Henan, Sichuan, Shangdong, Anhui, Shanghai, Zhejiang, Jiangsu, Fujian, Hunan, and Hubei, which are mostly more developed regions. This trend remained true for the proportions of second births.

I.7 Variations in breastfeeding

The 1985 In-Depth Fertility Survey offers some information about children's breastfeeding in the three regions: Shanghai, Hebei, and Shaanxi. In Table 6.10 we present the mean length of breastfeeding by year and region, which is estimated from the distribution of children according to length of breastfeeding by years since the birth occurred and the mother's current age. The overall trend of the three regions has been presented in Chapter 4, the average duration of breastfeeding in the three regions kept level more or less until the middle 1970s, then contracted dramatically to 12.6, 13.4 and 11.1 months for the three regions respectively.

Table 6.10 Mean length(months) of breastfeeding by year the births occurred 1960s-1982 and mother's current age: Hebei, Shaanxi, Shanghai

	Hebei	Shaanxi	Shanghai	Total
By year the births occurred				
-1967	17.2	17.7	13.5	16.46
1968-72	17.4	18.1	11.5	16.58
1973-77	18.4	18.5	11.8	17.26
1978-82	12.6	13.4	7.1	11.67
Total	16.3	17.1	11.1	15.51
By mother's current age				
40+	17.5	18.0	12.6	16.63
30-39	16.1	17.0	10.4	15.22
<30	11.6	13.4	4.9	11.21
Total	16.3	17.1	11.1	15.51

*based on the distribution of children according to length of breastfeeding and confined to children born at least three years before, and excluding children who died before age two.

As far as regional variation is concerned, a huge differential in the duration of breastfeeding existed between Shanghai and the other two regions, with almost no difference between Hebei and Shaanxi. A difference of four to five months in the mean length of breastfeeding between Shanghai and the other two was consistent over time. This might be due to differentials in original socio-economic conditions and in the momentum of improving education and employment opportunities for women, or in part to an earlier fundamental change in the socio-economic structure and ideology in some regions like Shanghai, which was an ex-treaty port open to the West much earlier than the other two. For Hebei and Shaanxi, we can see from Table 6.1, there were almost no substantial differences in the GIAP ***per capita*** or the proportion of urban population between them.

Table 6.11 Proportion(%) of children without breastfeeding by year the births occurred 1960s-1982 and mother's current age: Hebei, Shaanxi, Shanghai

	Hebei	Shaanxi	Shanghai	Total
By year the births occurred				
-1967	0.815	1.756	2.991	1.73
1968-72	1.202	1.906	5.350	2.29
1973-77	1.518	2.526	5.742	2.65
1978-82	1.496	2.769	8.815	3.49
Total	1.267	2.201	5.528	2.51
By mother's current age				
40+	1.160	2.288	5.037	2.45
30-39	1.380	2.127	6.045	2.63
<30	1.197	2.083	5.618	2.29
Total	1.267	2.201	5.528	2.51

*based on the distribution of children according to length of breastfeeding and confined to children born at least three years before, and excluding children who died before age two.

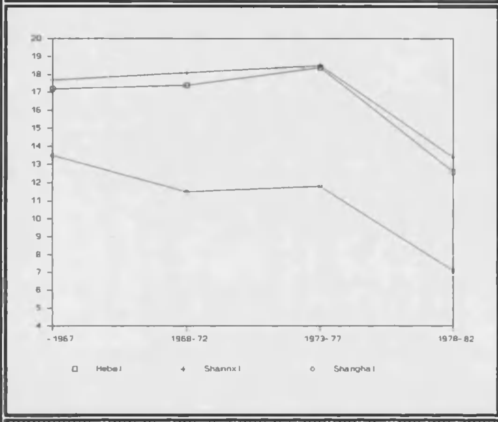
Meanwhile the proportion of children who were never breastfed by year the births occurred rose steadily from 0.82%, 1.8 and 3% to 1.5%, 2.8% and 8.8% for the three regions respectively. This widening regional differential was mainly contributed by a dramatic rise in the proportion of non-breastfed children in Shanghai. Although the marked regional differential remained when the proportions of non-breastfed children were presented by the mother's current age, it shows a more or less stable regional pattern over time, compared with the trends by year the births occurred(see Figure 6.6

c and d).

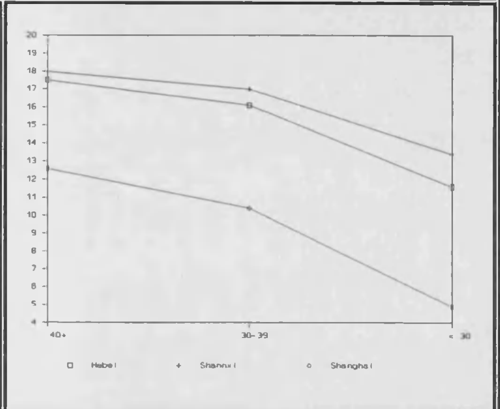
Figure 6.6 Children's breastfeeding 1960s-1982:
Hebei, Shaanxi, Shanghai

I. The mean length(months) of breastfeeding

a: By year the births occurred

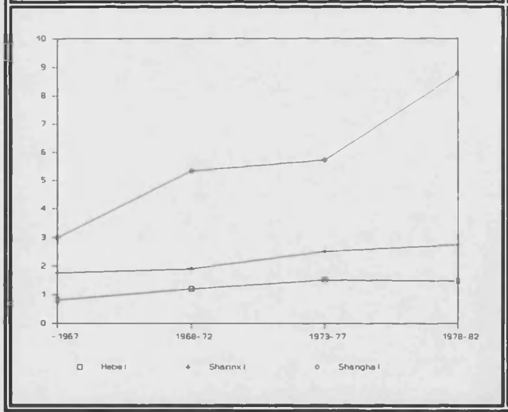


b: By mother's current age

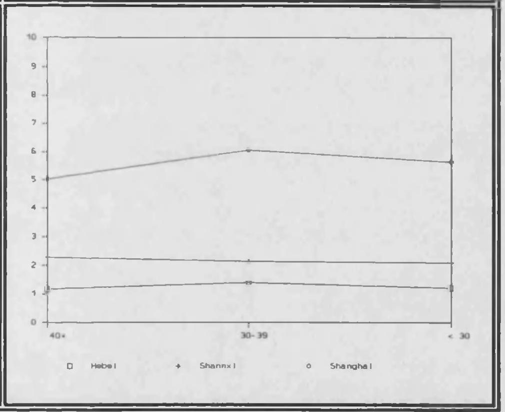


II. The proportion of children who were never breastfed (%)

c: By year the births occurred



d: By mother's current age



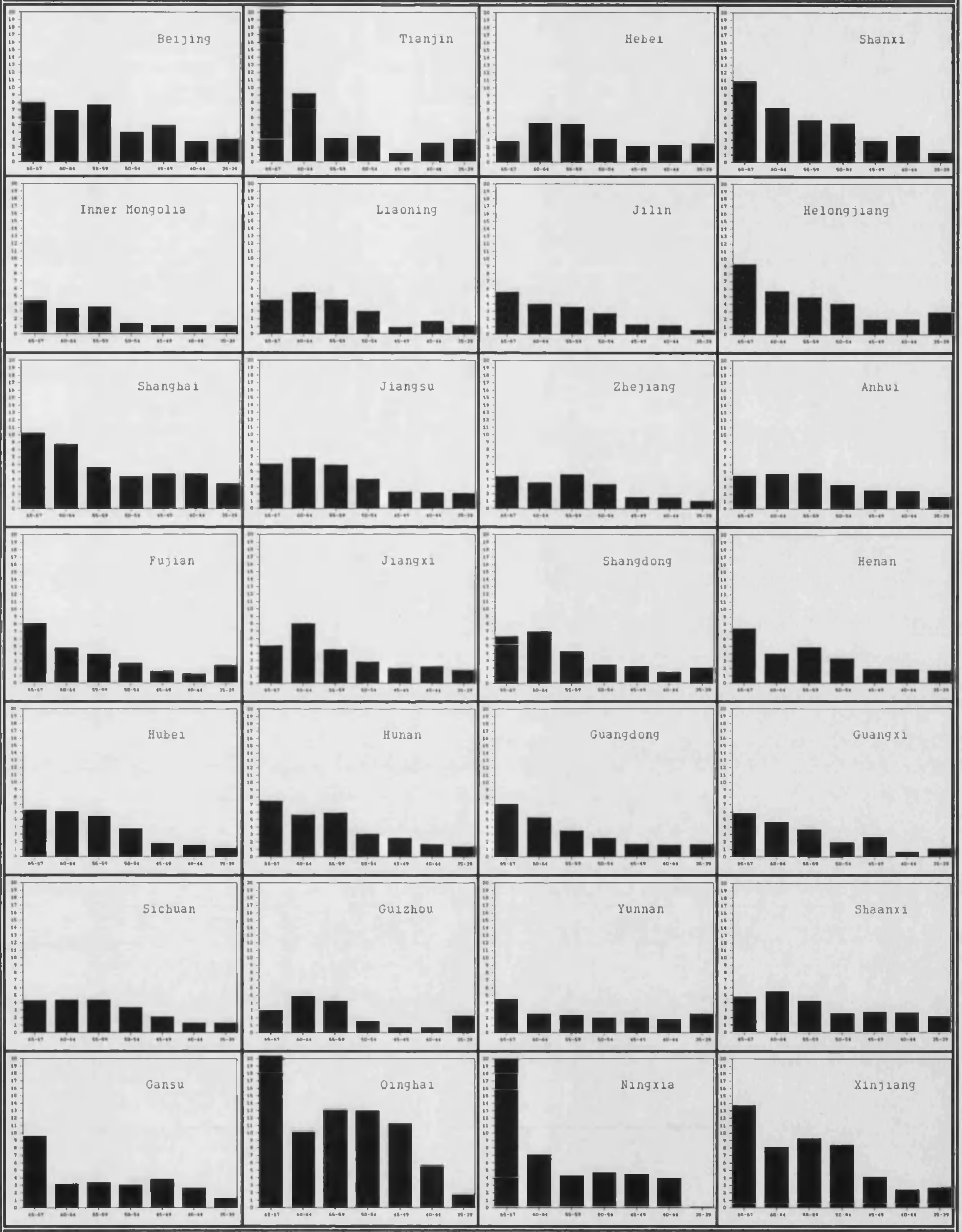
I.8 Variations in primary sterility

We can see from Table 6.12 that the proportions of women with no live birth reached a trough at age 35-39 in most regions, but at age 40-44 in some more developed regions such as Beijing, Tianjin, Shangdong, Guangdong and some ethnic minority regions such as Guangxi, Yunnan, Guizhou, and Fujian. For these developed regions, this might be due to a later-age at marriage pattern, thus requiring a longer duration and later age for all married women to have sufficient time for childbearing. For the ethnic minority regions, it might be due to lower fecundability level thus also taking a longer marriage duration to reach the minimum level of no live birth. In general, it was very unlikely that married women were fecund but never had a live birth before their later forties. As we mentioned before, the decline may be even larger than it appears, since women who had not reached the end of the reproductive age span might still have children, especially those in relative younger age groups such as 35-39 and 40-44. Thus we may be slightly underestimating this declining trend of primary sterility.

Table 6.12 The proportions(%) of ever-married women who never had a live birth by age in the 1982 1/1000 Survey: 28 regions

Region	65-67	60-64	55-59	50-54	45-49	40-44	35-39	30-34	25-29	20-24	15-19
Beijing	8.00	6.93	7.74	3.98	4.93	2.73	3.03	4.44	23.19	67.19	100.00
Tianjin	20.93	9.22	3.21	3.51	1.21	2.56	3.08	8.25	31.85	78.90	
Hebei	2.83	5.32	5.21	3.18	2.27	2.33	2.54	2.42	11.86	53.57	72.27
Shanxi	10.84	7.37	5.74	5.27	2.94	3.65	1.31	1.67	8.16	41.46	64.29
In. Mongolia	4.40	3.35	3.56	1.45	1.12	1.13	1.08	2.21	10.31	38.26	63.33
Liaoning	4.48	5.51	4.52	3.01	0.94	1.71	1.16	2.71	13.44	45.43	75.00
Jilin	5.56	4.00	3.61	2.75	1.29	1.21	0.56	2.03	9.33	38.04	79.41
Heilongjiang	9.30	5.70	4.88	4.05	1.97	2.01	2.92	2.91	9.60	35.50	60.95
Shanghai	10.22	8.70	5.63	4.34	4.71	4.69	3.36	8.93	31.40	53.10	
Jiangsu	6.05	6.85	5.91	4.00	2.25	2.15	2.05	2.37	11.96	46.28	67.24
Zhejiang	4.38	3.53	4.65	3.34	1.55	1.49	1.04	1.85	5.90	35.16	64.35
Anhui	4.58	4.76	4.85	3.34	2.55	2.45	1.64	1.54	7.83	36.64	54.19
Fujian	8.09	4.78	3.97	2.68	1.61	1.27	2.39	2.13	5.87	32.86	66.93
Jiangxi	5.05	8.03	4.50	2.84	1.98	2.21	1.76	2.54	4.46	22.49	61.31
Shangdong	6.31	6.93	4.26	2.56	2.28	1.47	2.14	2.59	8.94	46.04	75.50
Henan	7.40	4.02	4.90	3.36	1.95	1.86	1.69	1.67	13.74	51.41	79.67
Hubei	6.33	6.11	5.50	3.79	1.89	1.63	1.25	2.21	8.96	38.65	58.70
Hunan	7.49	5.60	5.86	3.03	2.54	1.70	1.36	1.93	7.84	32.70	75.62
Guangdong	7.07	5.23	3.47	2.48	1.69	1.57	1.64	2.18	10.40	30.45	75.85
Guangxi	5.80	4.64	3.66	1.89	2.59	0.69	1.09	1.99	11.95	37.17	75.29
Sichuan	4.32	4.36	4.36	3.35	2.15	1.31	1.29	1.87	66.02	43.29	75.00
Yunnan	3.03	4.92	4.28	1.53	0.78	0.74	2.28	2.40	8.33	34.15	75.68
Guizhou	4.50	2.55	2.37	2.03	2.00	1.79	2.54	2.33	7.20	35.01	70.49
Shaanxi	4.76	5.58	4.23	2.58	2.76	2.66	2.18	1.88	6.02	43.87	79.31
Gansu	9.68	3.20	3.41	3.06	3.87	2.64	1.32	2.67	5.36	33.56	68.98
Qinghai	30.77	10.20	13.19	12.96	11.20	5.71	1.88	4.94	6.62	29.55	72.37
Ningxia	20.00	7.14	4.35	4.76	4.55	4.00	0.00	1.30	5.61	29.63	68.00
Xinjiang	13.70	8.13	9.26	8.40	4.15	2.41	2.67	3.65	10.30	27.04	64.74
mean	8.42	5.81	5.04	3.70	2.70	2.21	1.83	2.84	12.94	40.62	70.93
s.d.	6.10	1.89	2.07	2.21	1.97	1.13	0.79	1.78	12.24	11.83	8.89

Figure 6.7 Primary sterility: Proportions(%) of ever-married women who never had a live birth by age in the 1982 Survey: 28 Regions



X Axis: (Age groups) 65-67; 60-64; 55-59; 50-54; 45-49; 40-44; 35-39.

Y Axis: (%) 0; 1; 2; 3; 4; 5; 6; ... 15; 16; 17; 18; 19; 20.

In Figure 6.7, information from the 1982 1/1000 Fertility Survey indicates a consistent decline in the proportion of women with no live birth from elder age groups 65-67 or 60-64 to younger ones, 35-39 or 40-44, in all regions, and a huge drop from 50-54 to 45-49, which was mainly contributed by a dramatic improvement of medical services and public health programmes in the 1950s, especially in the coastal regions. An exception was Hebei province where this percentage was lower at age group 65-67 than 55-59 and 60-64. This might be because of sample variation, as there were only a relatively small number of women in this group. A similar possibility exists for Tianjin where this percentage was implausibly high.

The pattern of regional variation seems familiar. Those developed coastal regions such as Heilongjiang, Beijing, Shangdong, Shanghai, and Guangdong, which opened to western influences earlier, and some ethnic minority regions, particularly nomadic areas such as Qinghai, Ningxia, Xinjiang had relatively high proportions of childless. Some less developed areas, such as Inner Mongolia, Anhui, Jiangxi, Sichuan, Guizhou and Yunnan, had comparatively low levels of childlessness. This phenomenon, again, could be contributed by a higher rate of misreporting adopted children as live births by women in less developed regions, thus deflating the percentages. On the other hand, it could also be produced a lower level of mortality and thus a lower remarriage rate of widows in those well developed regions, and thus less chance to switch from an unreproductive to a reproductive marriage, finally producing the higher percentages of primary sterility. Another possibility is to try to explain it from the angle of VD. The higher childless rate regions were mainly of two sorts: coastal regions and some ethnic minority regions, the former were more or earlier opened to the outside, but the later perhaps had less restricting of extra-marital sex and widow-remarriage and more poverty. One exception was Inner Mongolia, where a high rate of VD incidence was reported in Horn (1969:87), though it did not have a very high rate of childlessness presented here. This indicates that VD was not the only mechanism to determine childlessness here. The real reasons seem to be beyond discovery as regional mortality information is not available for analysis in detail.

The other regions showed a quite normal pattern: more developed regions like Jilin, Liaoning, Jiangsu, Hubei, and Shaanxi had a lower level of primary sterility, and less developed regions like Henan, Fujian, and Gansu had a higher level. Another extremely high case was Qinghai: apart from reasons mentioned above, it also could be due to the high proportion there of Tibetans, who had the highest proportion of monks and the lowest fertility in China. In general, the facts indicate a significant decline over time in all regions in primary sterility though the exact reasons for some particular regions remain unidentified. Similar evidence can also be found in Feeney and Wang's study (1993:86-91); all four regions in their discussion, Jilin, Shaanxi, Jiangsu, and Guangdong, showed period progression ratios from marriage to first birth rising from the 1960s onwards.

I.9 Summary

The regional variations in socio-economic conditions still exist and may even have widened since 1949, particular between coastal and inner regions. In general, the coastal regions, including the three municipality cities, have a large urban population, very smaller ethnic minority populations, and higher GDP *per capita*. These features contributed to regional variation in fertility regimes.

General fertility and marital fertility in all regions rose from the 1940s to the 1950s, when fertility was basically uncontrolled. Exceptions were Shanghai and Beijing where contraception practice started among the elder age groups and the fertility was more likely to be controlled already. During the Great Famine, fertility suffered catastrophic falls in most regions, although less severe falls were seen in some northern regions and some southern ones. After the middle of the 1960s, the government started to carry out a birth control programme focused on the urban population: as a consequence, in those regions with higher proportions of urban population, fertility experienced a sharp reduction. However, a massive fertility reduction in most regions started in the early 1970s, when the national family planning campaigns were launched. Fertility reductions in all regions were gathering momentum after the 'Later-Longer-Less' and 'One Child' campaign, although these policies were more relaxed in the ethnic minority regions.

All the regional evidence also confirms the national trend of a rise in natural fertility after the 1940s. The regional trends of increase were not homogeneous; generally, they were more significant in coastal areas and municipality cities. One exception was Shanghai, where the increase of natural fertility was not as remarkable as in the two counterpart cities. The possible reason was a more controlled marital fertility of women aged 20-24 in Shanghai than in the other regions, thus even the adjusted model may not be 'adjusted' adequately to fit this reality, and leads to an underestimate of natural fertility. Between the regions, the level of natural fertility was also not clear-cut, as it was generally lower in inner provinces or ethnic minority areas. Nevertheless, what is striking, is the remarkable similarity of regional trends.

Corresponding to this pattern, similar evidence on birth intervals and breastfeeding can be found from a regional division. The birth intervals of early parities particularly the first birth interval in most regions shortened. The evidence on the second birth intervals is less clear from a few well developed regions such as Tianjin, Heilongjiang, Jilin, and Shanghai where control behaviour might play a role in this scenario. For breastfeeding, mothers in Shanghai generally offered about four months less breastfeeding to their children than mothers from less developed regions. Similarly, the proportion of non-breastfed children was substantially higher in well developed regions such as Shanghai.

Childlessness dropped substantially over age spans in most areas, though again, coastal regions were generally more significant and their levels were generally lower. Exceptions do exist, such as the three municipality cities which had the highest proportions of childlessness historically, which might be contributed by severe venereal diseases in those areas. As in earlier findings, a lower proportion of childlessness was located in some inland and less developed regions such as Yunnan, Guizhou, and Inner Mongolia.

Chapter 7 Natural Fertility: Educational Differentials

I.1 Literature review: educational differentials

It is generally believed that countries display a strong association between the level of education achieved, on the one hand, and a range of demographic behaviour, on the other. Most scholars interested in this topic have concentrated on the mechanisms through which mass education produces decline in fertility and mortality, or alters the propensity for migration. Almost no one has ever talked about the relationship between natural fertility and education. As we know, despite a tradition of seeing education as producer of progress and a received wisdom about the educational contribution to fertility behaviour, the empirical results and the explanatory formulation are less than entirely satisfactory. Although education has an effect independent of urbanization, education levels may serve as proxies for other community-level factors. Higher proportions of better educated women are associated with large cities, which have better health services and stricter family planning programmes. Even in rural areas, the better educated are likely to live in areas of high incomes and proximity to cities or towns, where again the conditions may favour underlying fertility. Thus we have few clear guidelines as to what to expect in examining the 'pure' relationship between education and natural fertility.

Andorka (1978:259-265) suggested that any special direct impact of education on fertility does not seem to be demonstrated by themselves. Fertility differentials by education seem to be similar in nature to those by socio-economic status. It is generally true that education is closely associated with occupation, and thus with income and social status, which are key factors in the level of consumption. Consumption, especially food consumption, is one of the main influences on the level of nutrition and thus natural fertility. Therefore, in a developing country like China, where people have to spend over 60% of their income on food, education and occupation contribute indirectly to the level of natural fertility. Besides income and nutrition, education also changes people's reproductive behaviour. As already mentioned, in traditional Chinese society, the attitude towards frequency of intercourse was "the less, the better for health.". Breastfeeding as an obligation for mothers was also universal behaviour. A very interesting question, therefore, would be, whether the changes in people's education level have changed their reproductive behaviour, such as sexual behaviour and so on, and therefore have some impact on natural fertility.

One of the main benefits of the 1/1000 Fertility Survey is that it provides information on fertility and nuptiality by women's education levels achieved throughout the period 1950-1981, as well as information on birth intervals between different parities by year the births occurred and mothers' education (1930-1980), and the age distribution of married women by different parities and education (15-64). The In-Depth Fertility Survey also provides information on mean duration of breastfeeding by mother's education. These data allow us to explore the link between education and natural fertility which can contribute not only to our knowledge of the demographic past in China, but also to a general understanding of the demographic situation in the world today.

I.2 A brief introduction to educational differentials in socio-economic status

After 1949, the Chinese education system more or less followed the Russian. There are five main education levels in this system: no schooling: illiteracy; then primary school education taking 5-6 years. Middle (secondary) school education is divided into two levels: junior middle school and senior middle school, each of which takes about 2-3 years schooling. Finally, university and college education take about four years to complete an undergraduate (bachelor degree) study. (A master's degree study takes about 2-3 years and a Ph.D takes again 2-3 years extra after a master's degree). Here we can effectively group these five levels into two clusters: the less educated, which includes illiterate women or those educated in only primary school; and the better educated, which includes women educated secondary school and above, such as junior middle school, senior middle school, and finally university and college (including both undergraduate and postgraduate studies).

Table 7.1 Chinese people's occupations by education level in 1987

	Worker	Peasant	Official	Intellectual
Illiteracy	5.5	10.5	1.9	--
Primary	11.0	30.8	1.9	0.8
Junior	37.7	43.6	15.4	3.0
Senior	41.7	14.9	38.9	18.3
University	4.1	0.0	41.9	77.9
Total	100.0	100.0	100.0	100.0

Education differentials in socio-economic status in China contain aspects of inherited inequalities. Before 1949 when the communists took power, a professor could earn more than a hundred time as much as a shop assistant. It was always generally assumed in China that the longer you were educated, the better socio-economic position you would obtain. Although, after 1950 a sense of equality was introduced and the status of the working classes rose, education was never discouraged, except during the 'Cultural Revolution' in 1966-75. Social mobility in China is difficult but possible, e.g. a peasant's son could migrate into an urban area as a resident if he could pass the national examination for university admission and then he would be provided with a job in an urban institution after he graduated from a university or college.

Table 7.2 Consumption of the non-peasant population in 1958*

	Industries		Service Worker	Teacher[1]	Government Functionary
	Worker	Engineer			
Food consumption (*k.g.*)					
Grain	167.8	161.5	158.4	160.6	161.9
Vegetable	116.8	125.9	113.9	119.7	121.6
Meat	8.6	10.4	8.9	10.4	10.8
Oil	4.1	4.2	4.2	4.0	4.4
Sugar	1.6	1.7	1.7	2.0	2.0
Clothing(*meter*) and medical expenses(*yuan*)					
Clothing	9.6	9.8	6.7	7.3	7.5
Medical	4.2	5.5	3.8	5.0	4.5

* China State Statistical Bureau: ***A survey of workers and staffs' family budget in 1956 1957 1958***[1].
1, Primary and secondary school' teachers.

There is a strong positive relation between length of education and socio-economic status of occupation. A special survey on intellectuals' situation was carried out in Beijing and its rural suburbs in 1987.[2] The sample size was 1700 with a 95.9% response rate.[3] The published results presenting the relationship between education levels ever achieved and current occupations are shown in Table 7.1. The results, although with some variation, indicate that the less educated are mainly manual workers and peasants, while the better educated are employed mainly as professionals, or teachers and government

[1] Lin Baipeng 1987: ***China Consumption Structure Study,*** Economic Science Press, Beijing.

[2] In China, the definition of intellectuals was set by the government as people who are either government functionaries with education of above technical secondary school and polytechnic, or professionals and teachers in all educational institutions.

[3] Zhang Ming and Hu Jiafeng 1989: A analysis of intellectuals' survey in Zhou Fengliang (ed) ***A Study of Intellectuals' Economic Policies: Difficulties and Solutions,*** Spring and Autumn Press, Beijing .

functionaries.

As in other countries, differentials in occupation are always related to income divergence, and thus naturally related to differentials in consumption. Although a rationing system for main consumption goods, such as grain, cooking oil, sugar, and clothing, was implemented from the 1950s, thus the diminishing the effect of differential income on consumption, the differential in level and structure of consumption from occupation is still clear in Tables 7.2 and 7.3.

Table 7.3 Income and consumption by occupation in 1987*

	Rural Peasant	Urban Resident	Junior Officer	Engineer[1]	Senior Engineer[2]
Income and Living Expenses(*yuan*)					
Income	462.5	1012.2	1078.9	1203.8	1561.2
Expense	398.3	884.4	928.4	931.8	1294.6
Food Consumed(*k.g.*)					
Grain	211.0	133.9	138.2	135.0	134.6
Vegetable	130.0	142.6	134.9	139.0	147.6
Meat	12.8	25.3	25.0	26.4	36.2
Oil	4.7	6.4	6.4	6.6	7.7
Sugar	1.7	2.5	2.6	2.8	4.8

* Source: China State Statistical Bureau 1989: ***1988 Statistical Yearbook.*** 1, Including those who have professional titles of equivalent level to lecturer, or editor and so on. 2, Including those who have professional titles of equivalent level to professor, senior editor and so on.

As shown in Table 7.2, due to the rationing system, there was no substantial difference in consumption of grain, sugar, and cooking oil by people with different occupations, (some differences in main food were set by the government, e.g. manual workers had a larger ration of grain than others), but for those goods and services beyond the rationing system such as meat, vegetables, and medical services, differentials by occupation did exist. Government functionaries, professionals and teachers were in much better positions for consumption of food and other relevant services than other occupations. A similar pattern existed in 1987, (see Table 7.3), when the economic reforms were being carried on successfully and the income level of peasants and workers had greatly improved.

I.3 Differentials in general fertility

Table 7.4 and Figure 7.1 show the TFR from 1950 to 1986 for cohorts of the five education levels separately. The educational differentials in the level of fertility before the 1950s are not so clear. After 1950, the fertility pattern of educational variation was quite consistent over time: on average, the longer education a woman undertook, the fewer children she bore. A similar view is maintained by Lavely and Freedman (1990:358) that there was lower marital fertility among the better educated, both before and after the intensive family planning programme in China. However, it is also clear here that the educational differentials in general fertility rose over time until the middle of the 1970s, then narrowed down afterwards. Total fertility rates in 1950 were about 4 and 5.2 for the better educated and the less educated women respectively, while they were about 1.5 and 2.8 in 1982. Generally speaking, the TFR of the less educated was always higher than that of their counterparts.

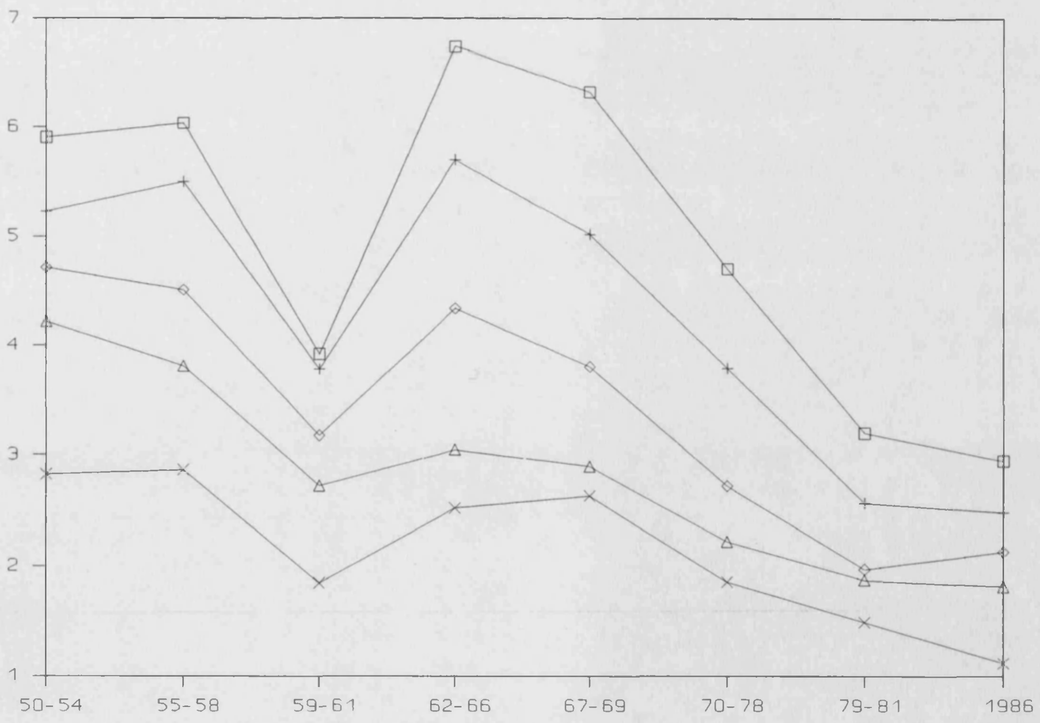
In the early 1950s, all cohorts' fertility at different education levels rose steadily. By 1954, the fertility had increased significantly among the less educated cohorts to a level of 6, with only relatively minor increases among the better educated. From the middle of the 1950s, TFR stayed at high levels among the less educated, but dropped a little among the better educated, which could be due to improvement in employment so that educated women were more prompted to go out to work, and thus postpone or reduce their childbearing. Especially, before 1958 when the premature industrialization campaign "Great Leap Forward" was launched, restrictions on contraceptive use were lifted, and abortion and sterilization were legalized, which were greatly welcomed by those better educated and working women such as government functionaries.

Table 7.4 Total fertility rates(TFR) 1950-86: five education levels

Year	Illiteracy	Primary	Junior	Senior	University
1950	5.494	5.129	4.898	3.874	2.418
1951	5.458	5.003	4.515	4.705	2.528
1952	6.410	5.346	4.544	4.466	2.988
1953	5.972	5.059	4.494	3.975	2.381
1954	6.213	5.631	5.128	4.071	3.805
1955	6.233	5.484	4.850	4.418	2.416
1956	5.842	5.170	4.423	3.634	2.553
1957	6.413	6.037	4.574	3.796	3.638
1958	5.682	5.336	4.191	3.401	2.844
1959	4.359	4.157	3.575	2.966	2.010
1960	4.068	3.944	3.058	2.646	1.874
1961	3.341	3.251	2.904	2.555	1.658
1962	6.214	5.350	4.627	3.221	3.231
1963	7.741	7.162	5.435	4.439	3.860
1964	6.412	5.620	4.223	2.836	2.167
1965	6.502	5.199	3.768	2.207	1.897
1966	6.842	5.206	3.668	2.537	1.466
1967	5.776	4.467	3.344	2.183	2.415
1968	6.960	5.658	4.206	3.502	2.591
1969	6.247	4.945	3.870	3.010	2.887
1970	6.352	5.046	3.805	3.021	2.374
1971	6.001	4.861	3.545	2.736	2.749
1972	5.516	4.430	3.184	2.513	2.092
1973	5.107	4.142	2.903	2.467	2.219
1974	4.809	3.816	2.561	2.075	1.639
1975	4.133	3.386	2.329	1.830	1.331
1976	3.827	3.088	2.061	1.691	1.325
1977	3.352	2.732	2.064	1.761	1.434
1978	3.258	2.663	2.047	1.883	1.556
1979	3.426	2.732	2.027	1.870	1.692
1980	2.805	2.298	1.776	1.722	1.229
1981	3.372	2.674	2.109	2.027	1.549
1986	2.948	2.482	2.130	1.814	1.116

Source: 1950-81 fertility rates were estimated by the truncated age-specific fertility by education from China Population Information Centre(1988), 1986 fertility rates by education were directly available from China State Statistical Bureau, Department of Population Statistics (1988), 1959-1961 was, again, the period of a nationwide famine typified by a consistent and huge drop in the fertility of all cohorts of five education levels, but the differential is clear: the less educated a group was, the deeper the trough of fertility was. Comparatively the better educated women suffered much less food shortage during this period, because most of them were either originally from urban areas (hence living in urban areas), or were recruited into the non-agriculture sector, thus migrating into urban areas, where food was better supplied and usually guaranteed. In consequence, the fertility of the better educated women, although generally lower than that of their counterparts, dropped less than that of less educated cohorts in 1959-61.

Figure 7.1 Total fertility rates(TFR) 1950-81: five education levels



legend: ■ *Illiteracy*; + *Primary*; ♦ *Junior*; ▲ *Senior*; × *University*.

The TFRs recovered during the 1962-66 and rose to their peak values for the cohorts of all education levels in 1963, the highest since 1949. Illiterate women had a TFR of 7.74 and primary school educated women had a very close level: 7.162. These was no exception for the better educated women, such as those with university education level, whose TFR also reached the highest level, of 3.86, in its post-1949 history. A dramatic fertility decline of the better educated cohorts began immediately after the fertility surge in 1963, and dropped in 1966 to levels lower than in the mid-1950s. In contrast, less educated cohorts' fertility in 1966 returned to the same level as in the mid-1950s, even with a slight increase among illiterate women, which is believed to be a lagged and larger effect of the fertility compensation after the more severe fertility drop than in other better educated cohorts in the previous years. It was in this period that educational differentials in fertility reached their peak and fertility transition among better educated cohorts began with a small fluctuation in the late 1960s.

During 1967-1969, average levels of fertility for most cohorts were lower than in the preceding period, and reached a trough in 1967. This may reflect the continuation of a downward trend that started after 1963, though this was also clearly related to the chaotic events of the 'Cultural Revolution', when virtually no family planning programme was carried on. Perhaps some of the better educated women might have continued their birth control practices spontaneously, or perhaps normal family life suffered severe disturbance as a consequence of all the better educated people being involved in mass activity, thus fertility did not rise much among them. For less educated women, fertility remained at a high level in the late 1960s.

The 1970-78 period is well-known for its significant fertility decline which was brought about by birth control practices among all differently educated cohorts. The fertility trends also suggest that the effect of education on fertility may increase over time. Compared with the 1950s and 1960s, the reductions of fertility from 1969 to 1975, were 35%, 31%, 41%, 40%, and 55% for the cohorts from those with no education to those with the highest. The effect of education on changes of TFR is clear: the decline was positively related to length of education. Caldwell and Srinivasan (1984:76) also suggested that fertility was higher among those least susceptible to government pressure (mostly illiterate women) who were more likely to find their children productive assets. From 1975 to 1978, fertility kept declining among the less educated women, another 20% for both illiterate and primary school educated women, and 15% for junior middle school educated women. For the two longest educated cohorts, TFR had a slight rise from 1977, which is possibly due to the ending of the 'Cultural Revolution', and the highly educated 'intellectuals' regaining an honourable socio-economic status, thus prompting and recovering their fertility from the harsh 'Cultural Revolution', when most of them were publicly and outrageously criticised, when many of their families were broken or separated, and when most of them lost their jobs and were sent to the countryside to be "re-educated" by peasants.

After 1978, government intervention in childbearing was much stronger than ever before. Intensive mass education and propaganda campaigns were conducted, by which the younger, and better educated were certain to be more affected. In a preferred family size survey carried out in Hongan and Zigui counties, Hubei Province, in 1983, Whyte and Gu (1987:481-483) found a clear relationship between the education level of the women interviewed and their preferred family sizes: women who had at least senior high school education were more likely to prefer one child, and much less likely to prefer three children or more, than were other women. The TFR of all education levels declined to their troughs in 1980. However, after 1980, fertility rose again in 1981, particularly among the less educated women, as a new marriage law was declared in 1980 entailing a relaxation of controls on age at first marriage. Meanwhile, the success of economic reform and decentralizing agriculture production led to relaxation of pressure on birth control in rural areas, where most less educated women were living. Generally speaking, fertility differentials narrowed in this period. Yet the differentials in fertility among the five cohorts still exist but are diminishing; this tendency may be caused by the progress of family-planning programmes. This supports a cross-national study's finding, that educational differentials tend to be smaller in places with an effective birth control programme[4].

The TFR of all five cohorts kept declining as the 'One Child' policy was still being carried on and implemented more widely after 1982. The three better educated cohorts' TFR was recorded below the replacement level in 1986. From 1981 to 1986, the fertility of two extreme cohorts, the illiterate and university level educated groups, had the largest reductions, 13% and 29% respectively. Illiterate women were the only cohort keeping their TFR over 3 until the early 1980s, and thus under the pressure of the 'One Child' policy in the mid-1980s, the family planning programme played a key part in this big reduction. For university educated women, the 29% reduction largely is due to volitional exercise, reflecting an ideology transition among these newly and highly educated women who entered universities after the 'Cultural Revolution' and were under the influences of both economic reform and western culture. The minor changes in TFR among other cohorts after 1981 obviously showed different degrees of difficulty in the implementation

[4]United Nations Department of International Economic and Social Affairs, ***Relationships between fertility and education: A comparative Analysis of World Fertility Survey Data for Twenty-Two Developing Countries,*** ST/ESA/SER.R/48.

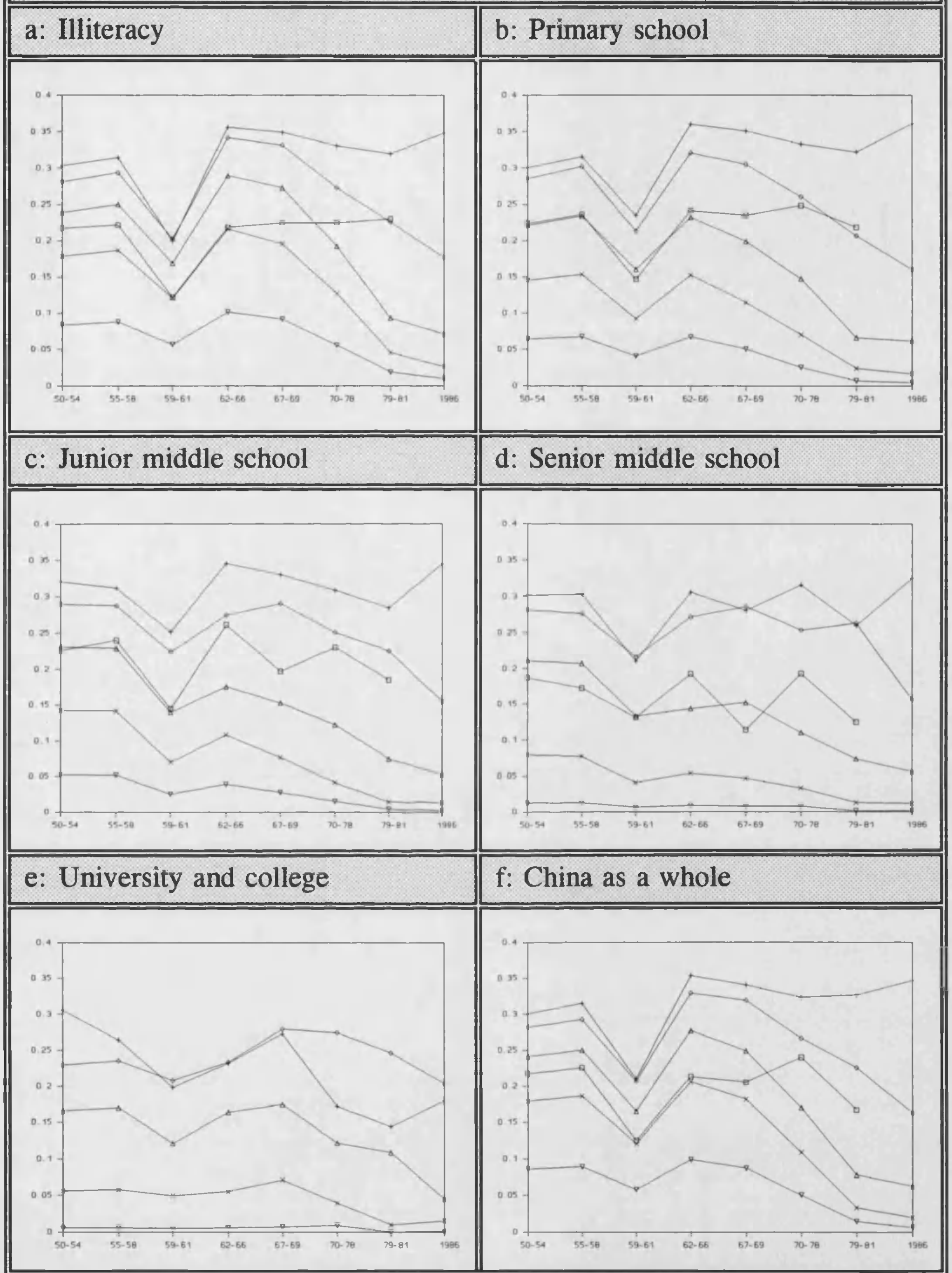
of the policy.

I.4 Differentials in marital fertility

The trends in the observed age-specific ever-married fertility rates for the cohorts of the five education levels are plotted in Figure 7.2 for couples married between 1950 and 1986. The effect of education on marital fertility is clear: the number of children ever born to married women declined consistently with increasing education. The ever married fertility rates show it to be a general pattern that the highest fertility is for women with no education, while women with longest education bear the smallest number of children. In terms of time trend, in 1950-86, except for the crisis period of 1959-61, age specific marital fertility experienced a substantial increase among younger age groups of all education cohorts before 1967-69. Evidence of extremely low fertility among old but better educated cohorts also indicates that birth control practice was already quite prevalent among the better educated cohorts before the national campaigns in the 1970s.

During the periods of demographic disturbance in 1959-61 and 1962-66, the crisis of marital fertility showed a familiar pattern: the better educated a population was, the less severe were the fluctuations of marital fertility. Within each education level cohort, the marital fertility of younger age cohorts displays a deeper trough than that of old age cohorts, possibly indicating that malnutrition affected young cohorts' fecundability more than older ones, no matter what the level of education achieved. However, younger but better educated women displayed a less steep fertility trough than their counterparts of less educated women.

Figure 7.2 Age specific ever-married fertility rates 1950-86: five education levels



legend: ■ 15-19; + 20-24; ♦ 25-29; ▴ 30-34; × 35-39; ▾ 40-44.

After 1967-69, a dramatic decline in marital fertility among all age groups of married women took place consistently over all education cohorts, except for age group 15-19 of illiterate women. The trend undoubtedly reflected the overwhelming increase in the practice of family planning. The marital fertility decline was less significant among the better educated women, which was obviously due to the fact that these women practised birth control much earlier and thus had a lower level of marital fertility even before the birth control campaigns. So, comparatively speaking, the birth control campaigns in the 1970s altered the better educated women's reproductive behaviour less than that of the less educated.

A sharp increase is evident in marital fertility among the age group 20-24 consistently in all five cohorts from 1979-81 to 1986. Apart from the reasons already noted, such as a large marriage boom with a relaxation of restrictions on both age at first marriage and birth control, others that could be noted are perhaps an increase of pre-marital conceptions, and a nationwide rise in natural fertility, as an result of economic reform and consumption conditions dramatically improving. On balance, these latter factors were probably the more crucial. In contrast to age group 20-24, the older age groups reduced their marital fertility consistently over this period, particularly among the better educated cohorts, which was certainly assisted by both the influences of 'One Child' policy, economic reform and ideology changes.

I.5 Differentials in natural fertility

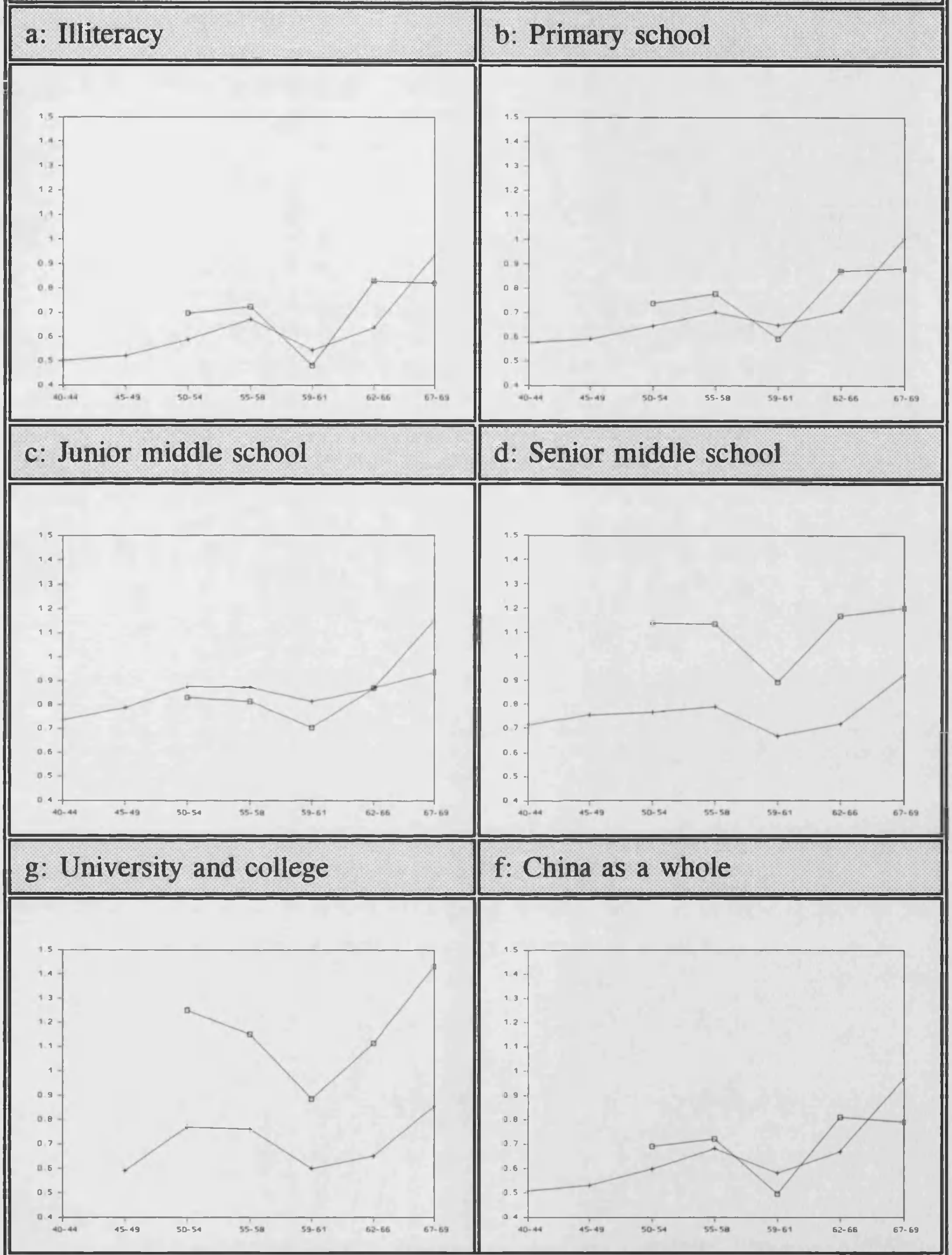
Again, we have the indices of M and m estimated from Coale and Trussell's original model and its adjusted version: they are presented in Table 7.5 for 33 years' marriage cohorts of five education levels separately. The estimated results of the two versions of the model in Table 7.5 are quite consistent, which reflects the fact that the trend of increase was evident in all periods before the 1970s, except during the crisis period of 1959-61.

Again, as data of the duration marital fertility rates (DMFR) on 0-4 years marriage from 1940 to 1981 are plotted with M in Figure 7.3, they show quite consistent changes with M in all periods before 1962-66, when China's fertility was mainly a natural pattern, although this consistency is less clear for the university educated population. The DMFR(0-4) rose substantially in all five cohorts during 1940-1949, especially for the less educated group. This certainly leads to the possibility that the underlying level of natural fertility, M, during 1940-49 rose substantially for all five cohorts, though the actual changes and levels of M before 1950 remain unknown.

The general increases in marital fertility among the less educated married women were reflected in the substantial rises in M in successive marriage cohorts before the 1970s shown in Table 7.5, while decreases in the marital fertility of better educated cohorts due to practising birth control, a trend of increase in underlying fertility is still interpreted by the model as the substantial rises in both M and m since 1950. Similarly Figures 7.2 and 7.3 show the shift in the age pattern of marital fertility towards a decline with age after the period 1967-69 for the less educated cohorts as well, indicative of a difference in the timing of the beginning of family limitation. So far as the differentials are concerned, the pattern is clear and consistent, in both models: the better educated a cohort is, the higher the level of natural fertility. The same evidence was found in the early years of the century, when the population was fully noncontraceptive, by Griffing and Lamson,[5] who showed that literate women with literate husbands bore more children than illiterate women with illiterate husbands.

[5]This literature was reviewed in Herbert D. Lambson, 'Differential reproduction in China', ***Quarterly Review in Biology 10***, (September) 1935, pp.308-321.

Figure 7.3 Duration (0-4 years of first marriage) marital fertility rates (multiplied by 2.5) and Index of underlying level of natural fertility M(v2) 1940-69: five education levels



Legend: ▬ M; + (0-4) DMFR (multiplied by 2.5)

This phenomenon, I believe, is closely related to income and status of wealth, wealthy families normally suffered less starvation, illness, separation from husbands leaving home to find job or food, and disturbance from natural disasters, or war and bandits. When society was pronatalist, the people with advantages would naturally have more children. The Chinese Farm Survey in 1929-31 showed that fertility of families with large farms was somewhat higher than that of families with small farms in the study of Notestein and Chiao (1937:385-386). Wolf (1984:466) also found a clear positive relationship between fertility and status of wealth, and that wealth could stimulate higher fertility, when he analysed data of 1906-45 Taiwan Hai-shan women.

Table 7.5 Index of underlying level of natural fertility(M) by marriage cohorts 1950-86, and by original Coale-Trussell's model and its adjusted version: five education levels

Marriage Cohort	Illiteracy	Primary	Junior	Senior	University
Adjusted Model (v2)					
50-54	0.696	0.741	0.829	1.140	1.250
55-58	0.724	0.779	0.811	1.137	1.150
59-61	0.480	0.593	0.702	0.895	0.886
62-66	0.829	0.872	0.867	1.171	1.060
67-69	0.821	0.881	0.933	1.202	1.201
70-78	0.779	0.912	0.954	1.154	0.793
79-81	0.831	0.988	1.127	1.277	1.000
1986	0.904	1.055	1.168	1.460	1.272
Original Model (v1)					
50-54	0.677	0.700	0.766	0.926	0.947
55-58	0.705	0.737	0.750	0.922	0.883
59-61	0.467	0.548	0.614	0.698	0.685
62-66	0.808	0.813	0.773	0.910	0.818
67-69	0.793	0.799	0.798	0.921	0.935
70-78	0.721	0.776	0.769	0.872	0.636
79-81	0.685	0.738	0.796	1.019	0.690
1986	0.693	0.751	0.787	0.915	0.790

After 1970 when the national family planning campaigns took place, age specific marital fertility of all age groups for the all five cohorts began or accelerated its decline, (except that of age group 15-19 which is not included in the estimation of M). This feature, as was discussed in Chapter 4, is not well captured by original Coale and

Trussell's model. Naturally, the estimates of underlying level of natural fertility, M, by the original model show two unrealistic results in Table 7.5: (1), there are no substantial differences of M values between the less educated women and the better educated groups and (2), M for all five cohorts contracted substantially after 1967-69, a similar underestimate as made for the nation as a whole by the original model.

Table 7.6 Index of fertility control (m) and goodness of fit by marriage cohort 1950-86 and Coale-Trussell's model: five education levels

Marriage Cohort	Illiteracy	Primary	Junior	Senior	University
m					
50-54	0.200	0.405	0.570	1.491	1.989
55-58	0.194	0.401	0.559	1.503	1.900
59-61	0.203	0.563	0.964	1.780	1.839
62-66	0.184	0.496	0.825	1.805	1.859
67-69	0.248	0.706	1.116	1.906	1.792
70-78	0.557	1.160	1.545	2.011	1.581
79-81	1.384	2.093	2.493	3.236	2.659
1986	1.890	2.414	2.818	3.333	3.398
R^2					
50-54	0.965	0.950	0.929	0.846	0.864
55-58	0.953	0.944	0.918	0.853	0.834
59-61	0.810	0.959	0.972	0.877	0.832
62-66	0.913	0.986	0.997	0.927	0.813
67-69	0.945	0.978	0.979	0.904	0.820
70-78	0.994	0.991	0.972	0.973	0.833
79-81	0.972	0.991	0.967	0.940	0.837
1986	0.985	0.994	0.998	0.977	0.890

So in circumstances such as in China after 1970, or for the better educated population even earlier, the fertility schedule has a quite different picture from the assumption of Coale and Trussell's model. In this circumstance, the underlying level of natural fertility for the whole population after 1978, or for the university educated population even after the 1950s, estimated from the original model, can be considerably underestimated and thus unrealistically show only minor differentials in natural fertility among the five cohorts, especially after the 1970s. Particularly after 1979, when socio-economic conditions came to favour natural fertility, this feature is captured much better by the adjusted model. However, in Table 7.7, when compared with the other cohorts, the university level educated population had only a trivial increase in natural fertility even by the adjusted model. As Table 7.5 shows, it had the highest level of natural fertility in all cohorts until the 1960s. But after 1970, it dropped to the second highest position below that of the senior middle school educated. In fact, on average, the university educated women has a much better socio-economic status than the senior middle school educated, in terms of either actual income level, or medical services and other social welfare. Thus, they should have the highest level of natural fertility. This leads to the possibility of a similar problem existing in estimating M even in the adjusted model.

In Coale and Trussell's original model, they assumed that married women at age 20-24 have no birth control practice, while in the adjusted model the assumption is made that on average half of them begin to practise birth control (see Chapter 3). In addition, Table 7.6 presents the birth control index m by education, compared with the same measure in Lavely and Freedman's study (1990:363). Although there are minor differences in the levels of m for the two studies, the increasing trend and pattern of positive relationship between m with education match well. All of this indicates that the university educated women might have a more controlled fertility schedule. As Table 7.16 shows, mean age at first marriage rose to over 26 for university educated population after 1970, and those who married at age 20 to 24 were more likely to practise birth control after the 'Later-Longer-Less' campaign was launched in the middle of 1970s. Because they were the highest educated population in China, we could either suppose that they accepted the government's policy more quickly than others, or that they tended to postpone their childbearing by spacing behaviour for their own reasons. If either or both are true--that they practised birth control stronger and sooner after marriage than even the adjusted model assumed, then even this adjusted model could underestimate their natural fertility (M). In other words, the adjusted model may not be modified enough to display the real underlying level of natural fertility for this particular cohort in China. Although making a further adjusted model for them would be possible, it does not seem necessary as long as we are aware of this possibility of underestimation.

Table 7.7 Change in index of underlying level of natural fertility(M) by marriage cohort 1950-86: five education levels

Marriage Cohort	Illiteracy	Primary	Junior	Senior	University
Adjusted Model (v2)					
50-54/55-58	+0.027	+0.039	-0.018	-0.003	-0.100
55-58/59-61	-0.244	-0.187	-0.109	-0.242	-0.265
59-61/62-66	+0.348	+0.279	+0.165	+0.276	+0.228
62-66/67-69	-0.008	+0.010	+0.066	+0.031	+0.319
67-69/70-78	-0.041	+0.031	+0.021	-0.048	-0.522
70-78/79-81	+0.052	+0.076	+0.172	+0.123	+0.270
79-81/1986	+0.073	+0.066	+0.042	+0.183	+0.092
50-54/1986	+0.208	+0.314	+0.339	+0.320	+0.022
Original Model (v1)					
50-54/55-58	+0.027	+0.037	-0.016	-0.004	-0.064
55-58/59-61	-0.238	-0.189	-0.136	-0.224	-0.197
59-61/62-66	+0.341	+0.266	+0.159	+0.212	+0.169
62-66/67-69	-0.015	-0.015	+0.026	+0.011	+0.239
67-69/70-78	-0.072	-0.023	-0.029	-0.049	-0.374
70-78/79-81	-0.036	-0.038	+0.027	+0.147	+0.068
79-81/1986	+0.008	+0.013	-0.009	-0.104	+0.003
50-54/1986	+0.016	+0.051	+0.021	-0.011	-0.157

Table 7.8 Proportion(%) of births occurring in 0-7 months of the first marriage by marriage cohort 1945-75: five education levels

Marriage Cohort	Illiteracy	Primary	Junior	Senior	University
45-49	0.79	0.39	0.76		
50-54	1.18	1.02	0.90		
55-58	0.99	1.10	1.64	1.05	
59-61	0.73	0.83	1.49	0.96	
62-66	1.07	1.24	1.47	1.68	0.59
67-69	1.30	1.46	1.61	1.91	0.71
70-75	1.27	1.75	2.30	1.84	0.63

Table 7.8 again reflects the fact that extremely low proportions of women in China engaged in pre-nuptial sexual activities. Before 1975, less than two percent of all brides were pregnant on the day of the wedding, the highest value being 2.3 percent for the junior middle school educated. Generally speaking, the better educated had a slightly higher level of pre-nuptial pregnancies with a more rapid rise than the less educated. The exception was university educated women who had only less than 1% births born in the first seven months of marriage. This was most likely due to the fact that they were more aware of contraceptive knowledge and used it more effectively than other groups, thus avoiding this kind of 'scandal' better, rather than that they engaged less in pre-nuptial sexual activities than other groups. All of this suggests that the better educated took a less serious attitude to sexual activity before marriage--a cultural taboo. As we mentioned before, there was growing evidence of premarital sexual behaviour in China from the later 1970s and perhaps much more in the 1980s, although we lack statistical information. However, the absolute proportion of pregnant brides in the whole nation in the early 1980s is believed to be well below 5%, though for some better educated groups it might be slightly higher. Thus the influence on M value contributed by pre-marital pregnancies was still negligible (see Chapter 4).

I.6 Differentials in fecundability

In Table 7.9 and Figure 7.4 (three-year moving average trend), we present mean fecundability based on Bongaarts' model for the five cohorts respectively. To avoid truncation bias (see Chapter 3), we provide a general picture of fecundability only from 1941 to 1975, thus all women who had enough time (five years) under observation to be in the samples. For the university educated population, the estimate is not fully reliable to interpret its fecundability level as the sample size is very limited.

As we found in other chapters, the most striking features of the fecundability estimates (FB) in Table 7.9 are the extremely low level of mean fecundability of illiterate women, and the wide differentials in levels of the mean fecundability of these five cohorts, which grew wider from 1940 onwards. The pattern of the differences also indicates that the positive relationship between the mean fecundability and education persisted over time. The features of the educational pattern of fecundability were consistent with similar findings in Jain's study (1969b:82) on Taiwan urban women in 1962, which showed mean fecundability to be 0.093, 0.131 and 0.149 for women from no education, to primary school, and junior or above respectively. The same finding was also made by Freedman and Takeshita (1969:75). It is also plausible that Taiwan women enjoyed a higher level of fecundability than their mainland counterpart at comparable education level and time.

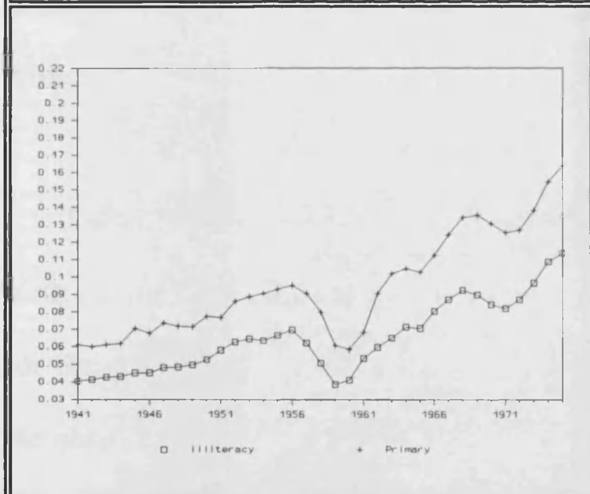
Table 7.9 Mean fecundability by marriage cohort 1941-75: five education levels

Marriage Cohort	Illiteracy	Primary	Junior	Senior	University
1941	0.03928	0.07230	0.06466		
1942	0.04239	0.04979	0.05203	0.07889	
1943	0.04260	0.05827	0.11875	0.08370	
1944	0.04337	0.07541	0.17421	0.14363	
1945	0.04322	0.05151	0.07889	0.09554	
1946	0.04871	0.08431	0.14363		
1947	0.04316	0.06697	0.18566	0.13218	
1948	0.05200	0.06880	0.11802	0.25175	
1949	0.05012	0.07874	0.08243	0.27308	
1950	0.04714	0.06558	0.12081	0.15247	
1951	0.06058	0.08701	0.11019	0.11060	0.09554
1952	0.06588	0.07683	0.09132	0.11519	0.06764
1953	0.06095	0.09434	0.11012	0.19399	0.26031
1954	0.06649	0.09541	0.10227	0.17900	0.18566
1955	0.06399	0.08424	0.14103	0.11433	0.05623
1956	0.06995	0.10071	0.11849	0.09223	0.08474
1957	0.07476	0.10089	0.12840	0.14805	0.10297
1958	0.04059	0.07022	0.12636	0.09554	0.05078
1959	0.03612	0.06915	0.09506	0.15247	0.20373
1960	--	0.04311	0.07912	0.10265	0.04466
1961	0.04607	0.06356	0.11542	0.12820	0.10297
1962	0.06140	0.09788	0.11417	0.16430	0.10601
1963	0.07248	0.10991	0.12186	0.17421	0.17421
1964	0.06219	0.09817	0.14239	0.18884	0.10988
1965	0.07975	0.10687	0.14249	0.13258	0.13218
1966	0.06960	0.10373	0.16882	0.17012	0.18067
1967	0.09122	0.12724	0.18552	0.21445	0.22288
1968	0.10065	0.14270	0.18591	0.18976	0.19068
1969	0.08614	0.13349	0.18193	0.17626	0.24339
1970	0.08260	0.13055	0.14043	0.22467	0.12589
1971	0.08376	0.12936	0.15226	0.17256	0.21422
1972	0.07883	0.11663	0.16747	0.14878	0.14012
1973	0.09985	0.13608	0.14686	0.23642	0.13009
1974	0.11221	0.16214	0.18507	0.18382	0.29030
1975	0.11640	0.16706	0.16788	0.22842	

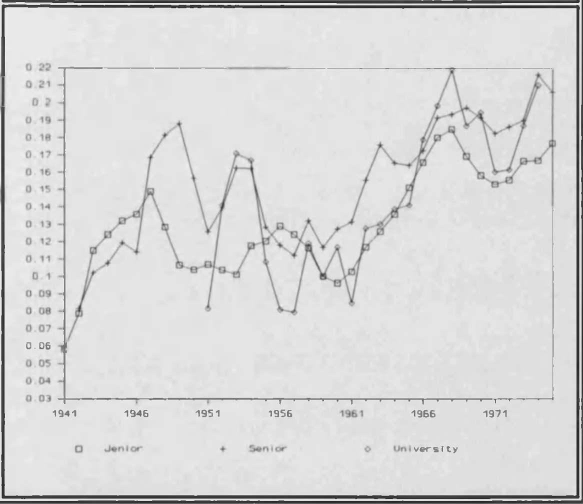
The possible reasons for such low levels of fecundability among the less educated cohorts are obvious. The less educated a woman was, the more likely she was to accept the traditional pattern of arranged marriage, (see Chapter 8) and sexual behaviour among couples could be expected to be more limited at the beginning of such marriages. The mean age at first marriage was about three years younger for the illiterate women than for the better educated, such as women educated until senior middle school (see Table 7.16), which means that illiterate brides were in a less reproductive age category than the better educated brides. Lavely and Freedman (1990:365) also suggest that age at marriage may have another effect at any specific age. As in general the less educated married earlier and thus in longer marriage duration, so they had less intercourse than those who married latter but aged the same. Finally, longer duration of breastfeeding by the less educated was certainly another factor.

Figure 7.4 Mean fecundability (three-year moving average) by marriage cohort 1941-75: five education level

a: The less educated women (1941-75)



b: The better educated women (1941-75)

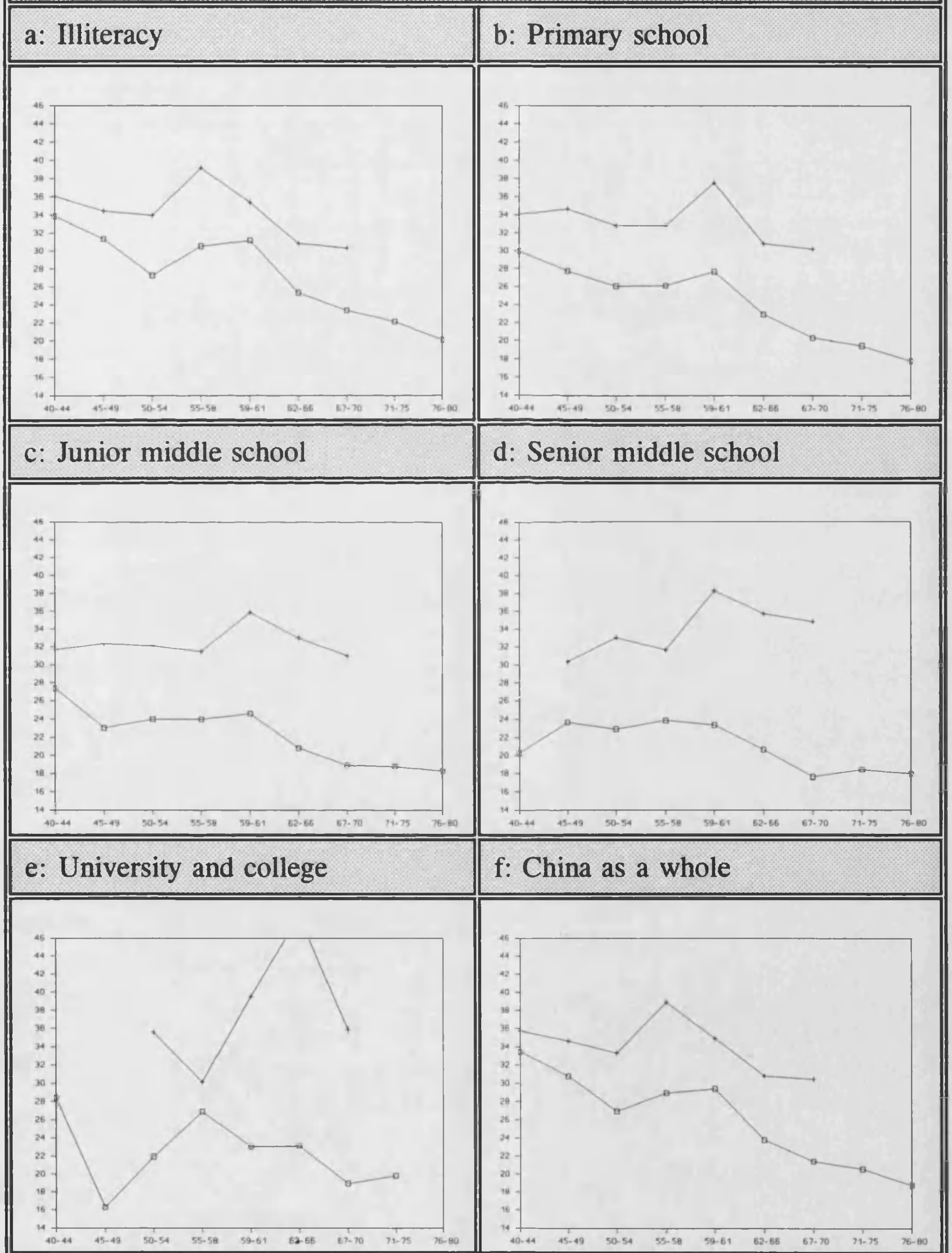


Although variations in the trend of mean fecundability appeared among better educated groups, probably due to the small sample size at the earlier dates, a substantial rise in fecundability is evident for all five cohorts after the 1940, especially after 1960. (see Figure 7.4) It rose slightly during the second half of 1940s, just after the Japanese War was over, then worsened again with the outbreak of the civil war. Among the mid 1940s cohorts, the educational differential in mean fecundability was minor around 0.007-

0.05. It increased substantially to a level of 0.019-0.1 for women married in 1950, and then slightly decreased to 0.03-0.07 in 1957, which indicates either that fecundability rose more quickly among the less educated than the better educated cohorts, or that the better educated groups began to practise birth control earlier than others. There was a predictable trough for those married during the crisis of 1958-60 for all five groups, while less educated women suffered a more severe and longer decline in fecundability. Finally, a dramatic increase occurred in all cohorts from the middle of the 1960s onwards. The total rise amounted to 300 and 270 percent for the less educated and better educated cohorts respectively during the thirty-five years. The difference also reached its highest level in the 1970s cohorts. Among these five cohorts, the women who were educated until primary school or junior middle had the largest increases in fecundability, while those who were educated beyond senior middle school had the least improvement, which might be due to spacing behaviour, especially in the 1970s.

The impact of the increase in fecundability on the interval between marriage and first birth can be seen in Table 7.10 and Figure 7.5, where the observed mean first intervals for the five cohorts are given together with mean second birth interval. As we can see, the observed mean first interval fell from 31 and 25 to 19 and 18 months for the less and better educated cohorts respectively from the 1940 to the late 1970s. Table 7.10 also indicates a generally consistent negative correlation of education and the length of the first birth interval. This finding is confirmed by what is indicated in Lavely and Freedman's study (1990:365) on mean first birth interval by wife's education for two major regions of China (Upper Yangzi and North China) from 1952 to 1976. The gap in the mean first birth interval between these two groups narrowed, reaching its minimum towards the end of the 1970s. As in the pattern of mean fecundability, the women who were educated until primary school or junior middle had the largest decrease in length of first birth interval, while the women who were educated beyond senior middle schools had the least decrease.

Figure 7.5 Mean length(months) of the first two birth intervals by year of first marriage and first birth 1940-80: five education levels



Legend: ▬ 1st parity; + 2nd parity

Table 7.10 Mean length(months) of the first birth interval by first marriage cohort 1940-80: five education levels

1st Marriage Cohort	Illiteracy	Primary	Junior	Senior	University
1940-44	33.88	29.94	27.36	20.29	28.38
1945-49	31.32	27.74	23.04	23.63	16.28
1950-54	27.28	26.07	24.00	22.89	21.91
1955-58	30.50	26.12	24.00	23.83	26.89
1959-61	31.14	27.68	24.60	23.33	23.04
1962-66	25.33	22.92	20.82	20.63	23.08
1967-70	23.36	20.29	18.92	17.63	18.96
1971-75	22.12	19.46	18.77	18.43	19.82
1976-80*	20.07	17.80	18.31	17.98	

*Estimated by the information from the In-Depth Fertility Survey in 1985.

Table 7.11 Mean length(months) of the second birth interval by first birth cohort 1940-70: five education levels

1st Birth Cohort	Illiteracy	Primary	Junior	Senior	University
40-44	36.05	34.05	31.67		
45-49	34.45	34.70	32.35	30.33	35.60
50-54	33.97	32.85	32.12	32.99	30.12
55-58	39.19	32.83	31.49	31.60	39.55
59-61	35.39	37.56	35.90	38.25	48.40
62-66	30.82	30.80	32.98	35.67	35.90
67-70	30.30	30.19	30.98	34.80	

In Table 7.11, we also present the trends of the interval between first and second births. The mean second birth intervals presented in Table 7.11 are based on closed birth intervals occurring within nine years after the first birth. Compared with the first birth interval, the second kept more or less steady, though a substantial decline is still obvious among the less educated groups, in a fall from about 36 months in the 1940 first birth cohort to 30 months for the later 1960s cohorts. However, this declining trend was not totally consistent, as the second birth interval of the better educated group showed no long-run decline at all. A most noticeable feature is a minor difference in length of second birth interval among these five cohorts. There was only about a five-month difference among them over time. After the 1960s this interval for the better educated group was growing longer, which was obviously due to the much earlier (1960s) family planning campaigns in urban areas, where the majority of the better educated population were living. However, a substantial decrease in the second birth interval did occur for the less educated group and may be attributed to a rise in fecundability. But for the better educated group, the relationship between birth interval and fecundability became less clear, as deliberate spacing behaviour appears to cloud the issue.

I.7 Differentials in breastfeeding

It has been broadly found that the length of breastfeeding is negatively related to the length of mother's schooling time. Similarly, from a survey in metropolitan Cebu in the Philippines in 1983, Stewart et al. recently (1991:195) found that highly educated mothers from families in the highest income/asset categories were among the least likely to breast-feed. For every country that could be investigated in the WFS, the length of breastfeeding decreased monotonically with increase in education, with the single exception of Fiji.[6]

In Table 7.12 we present the mean length of breastfeeding by the year the birth occurred and mother's education level by information from 1985 In-Depth Fertility Survey. This is estimated from the distribution of children according to length of breastfeeding by years since birth occurred and mother's current age. Apparently, the gaps of the average duration of breastfeeding between better educated, less educated and illiterate mothers were generally consistent over time. The durations stayed at more or less the same level at 18, 17 and 13 months for three education cohorts respectively until

[6] Benoit Ferry and David P. Smith 1983: Breastfeeding Differentials, ***Comparative Studies***, No. 23, (WFS).

the middle of the 1970s, then declined dramatically to 13, 12 and 8 months respectively. This obviously could be due to differences in the momentum of improvement in employment opportunities for Chinese women with different eduction over time, and an earlier fundamental change in attitudes to reproduction among the better educated women after 1978. Compared with other countries in Trussell et al. (1992:300) study, the pre-1970s pattern here shared similarity with other developing countries in Asia, the Pacific and Africa, where mothers breastfed their children about 18 and 13.7 months for those educated less than three years and above seven years respectively. The downward trend in China was consistent with the patterns of natural fertility and fecundability by education shown in Table 7.3 i.e. it remained more or less at the same level (a slightly rising general trend) until 1977 and rose strikingly afterwards.

Table 7.12 Mean length(months) of breastfeeding by year the births occurred 1960s-1981 and mother's current age: three education levels

	No schooling	Primary	Secondary+	Total
By year the births occurred				
-1967	17.71	15.97	13.10	16.46
1968-72	17.97	16.83	13.05	16.58
1973-77	18.52	17.67	13.45	17.26
1978-81	13.57	12.46	8.53	11.67
Total	17.10	15.86	11.48	15.51
By mother's current age				
40+	17.98	16.52	12.99	16.63
30-39	16.61	15.84	11.22	15.22
<30	13.45	11.75	8.22	11.21
Total	17.11	15.85	11.5	15.51

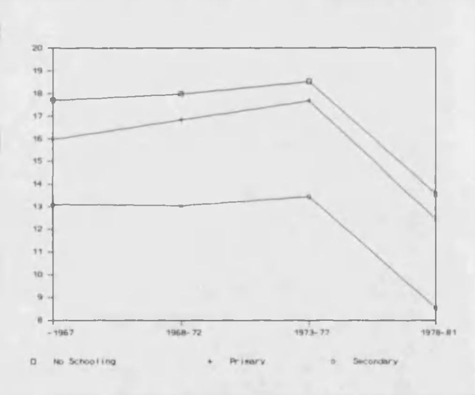
*based on the distribution of children according to length of breastfeeding and confined to children born at least three years before, and excluding children who died before age two.

Meanwhile the proportion of children who were never breastfed rose steadily from 0.65%, 1.78% and 5.8% to 1.17%, 2.72 and 7.3% for the three education cohorts respectively, though it was always low, especially for illiterate mothers. The education differentials in the mean length of breastfeeding and the proportion of non-breastfed children were very obvious. Four months of difference in the mean length of breastfeeding between the less and the better educated was persistent over time, while the differential in the proportion of non-breastfed children grew slightly wider from about 5% to over 6%.

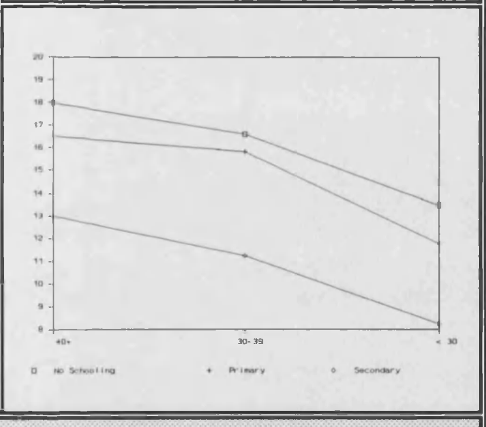
Figure 7.6 Children's breastfeeding 1960s-81: three education levels (three regions as a whole)

I. The mean length of breastfeeding(months)

a: By year the births occurred

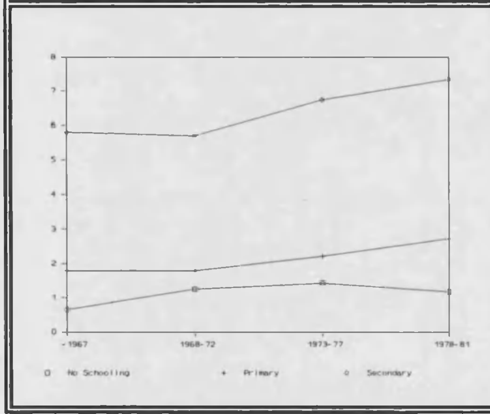


b: By mother's current age

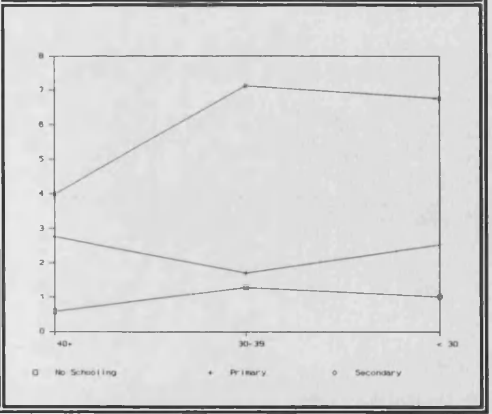


II. The proportions of children who were not breastfed (%)

c: By year the births occurred



d: By mother's current age



A very similar phenomenon but probably not so significant, shown in Figure 7.6 and

Table 7.13, is that the proportion of children who were not breastfed at all increased over time, especially in the better educated group, while it remained relatively stable for the less educated mothers. This suggests that these proportions were affected by education, but not so strongly influenced by age or the time the birth occurred.

Table 7.13 The proportion(%) of children who were not breastfed by year the births occurred 1960s-1981 and mother's current age: three education levels

	No Schooling	Primary	Secondary+	Total
By year the births occurred				
-1967	0.65	1.78	5.80	1.73
1968-72	1.25	1.79	5.70	2.29
1973-77	1.43	2.21	6.75	2.65
1978-81	1.17	2.72	7.34	3.49
Total	1.08	2.11	6.54	2.51
By mother's current age				
40+	0.59	2.76	3.98	2.29
30-39	1.28	1.70	7.13	2.63
<30	1.01	2.52	6.76	2.45
Total	1.08	2.11	6.54	2.51

*based on the distribution of children according to length of breastfeeding and confined to children born at least three years before, and excluding children who died before age two.

I.8 Differentials in primary sterility

Although the 1982 1/1000 Fertility Survey and the 1987 One-Percent Population Survey give us full information on the proportions of ever married women with no live birth by age and education, for the better educated women, especially the university educated population, the information from the 1982 1/1000 Fertility Survey is slightly harder to interpret as the sample sizes of these better educated women are not quite adequate.

Table 7.14 The proportions(%) of ever-married women who never had a live birth by age in the 1982 1/1000 Survey: five education levels

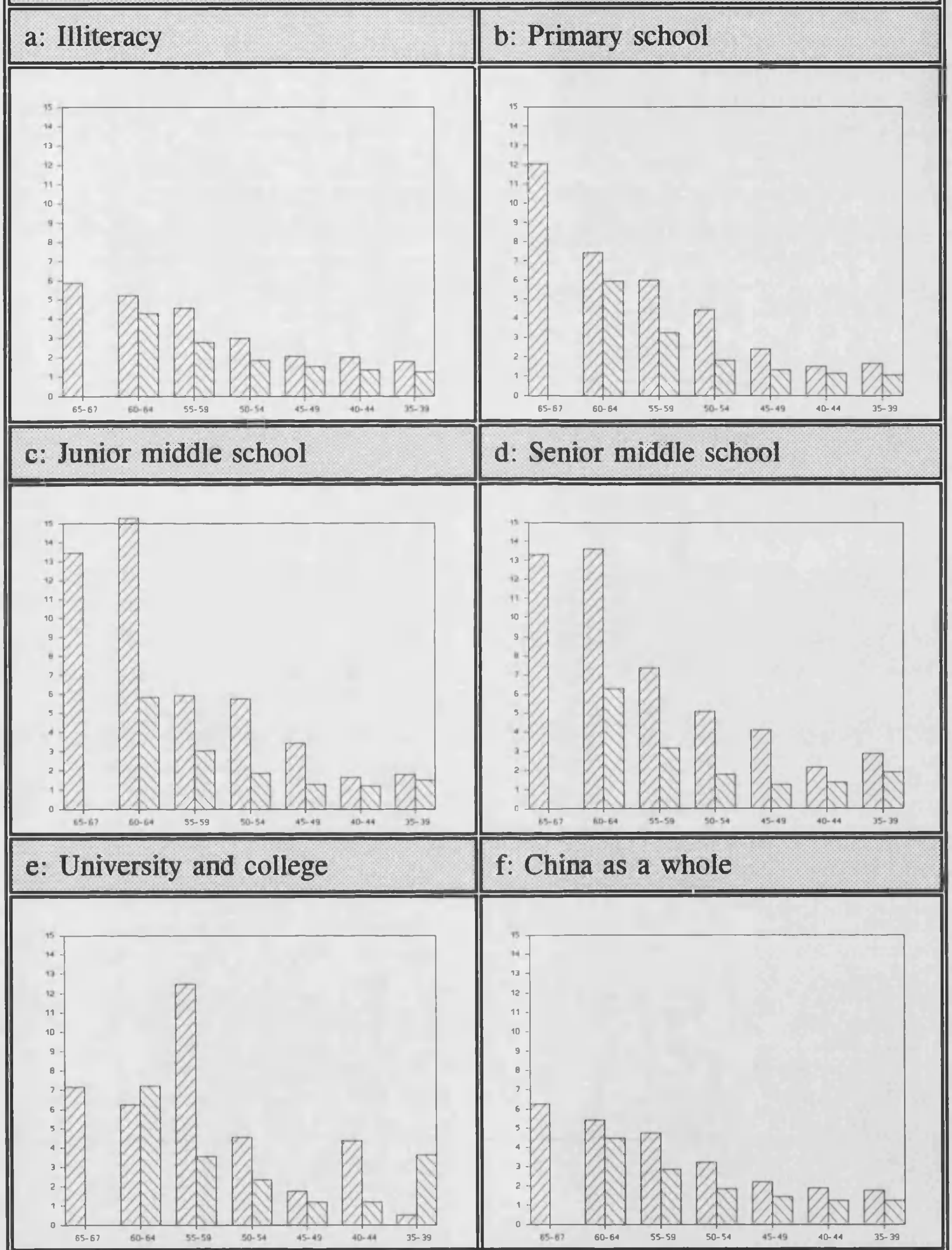
Age Group	Illiteracy	Primary	Junior	Senior	University
15-19	68.71	67.21	70.26	85.83	
20-24	31.06	36.38	49.99	59.36	57.14
25-29	6.20	7.49	17.22	26.85	35.97
30-34	1.89	1.87	4.08	5.06	12.41
35-39	1.77	1.65	1.81	2.86	0.49
40-44	2.00	1.52	1.66	2.14	4.37
45-49	2.06	2.41	3.44	4.09	1.74
50-54	2.98	4.44	5.75	5.05	4.55
55-59	4.56	6.00	5.93	7.34	12.50
60-64	5.23	7.44	18.25	13.64	6.25
65-67	5.87	12.06	13.46	13.33	7.14

Table 7.15 The proportions(%) of ever-married women who never had a live birth by age in the 1987 One-Percent Survey: five education levels

Age Group	Illiteracy	Primary	Junior	Senior	University
15-19	65.88	62.96	66.78	70.56	100.00
20-24	25.23	29.52	34.51	41.37	76.53
25-29	2.19	4.84	7.54	11.49	40.17
30-34	1.47	1.43	2.24	3.05	8.48
35-39	1.24	1.05	1.51	1.87	3.63
40-44	1.34	1.15	1.22	1.36	1.19
45-49	1.52	1.33	1.31	1.24	1.17
50-54	1.85	1.82	1.86	1.75	2.35
55-59	2.78	3.23	3.04	3.13	3.55
60-64	4.28	5.95	5.83	6.26	7.20

The proportions of women without a live birth from the 1982 1/1000 Survey and the 1987 Population Survey are presented in Tables 7.14 and 7.15. A fecund woman should have children when she has sufficient time in marriage, and in China, a universal and early marriage society, a married Chinese woman about 35 years old is believed to have had enough time to have a child, otherwise she is very likely infecund. This is reflected from the fact that the proportions of women without a live birth in Table 7.14 reached a trough at age groups 35-39 and 40-44 for the less educated and the better educated respectively. It is very likely that the married women were infecund if they never had a live birth after age 44 for the better or 39 for less educated.

Figure 7.7 Primary sterility: Proportions(%) of ever-married women who never had a live birth by age in the two surveys: five education levels



*Left-hand histogram: 1982 Survey; Right-hand histogram: 1987 Survey.

In Figure 7.7, information from the two surveys indicates a decline in the proportion of women with no live birth from the older age group 65-67 or 60-64 to the younger one 35-39 in all five cohorts, and a huge drop from 55-59 to 45-49 which might be partly due to a dramatic improvement of medical service and public health programme in the 1950s, especially among the better educated cohorts. The significant declines of the proportions are also revealed by the similarity of patterns in the two surveys, especially among the less educated groups. All of this suggests that declines in primary sterility contributed somewhat to the natural fertility rise in cohorts of all education levels over time.

As far as differences in the proportions between age groups in the two surveys are concerned, on average these differences are about 2% for the less educated cohorts and irregular numbers for the better educated women. They also widen with age. This suggests a marked decline in primary sterility among the better educated and a modest decline among the less educated during the 1980s. The 1987 One-Percent Population Survey provides the information with much more adequate sample size and the proportions show a more regular pattern. The random fluctuation of the 1982 survey's sample size may contribute to the growing differences with age when the proportions in 1982 and 1987 are compared. Overall, however, a decline in the proportions between the two surveys might be one of the factors contributing to the dramatic rise in natural fertility in the 1980s.

A familiar phenomenon shown in Figure 7.6 is that on average the proportions of better educated ever-married women who never had a live birth were substantially higher than those of the less educated, especially in the 1982 survey. This pattern is also consistently shown in urban-rural differentials and regional variations: the proportions of childless were lower in rural areas and less developed regions than in urban areas and more developed regions. Apart from possible reasons discussed in earlier chapters, such as higher mortality leading to higher remarriage rate and hence to the chance of motherhood, and a higher rate of reporting error among the less educated, it is also possible that greater marital disruption rates occurred for the better educated, as these spouses were more likely to have been separated by occupational duties, as suggested by Lavely and Freedman (1990:367).

We might also mention that these unexpected differences diminished in the information from the 1987 survey, which shows that the proportions of better educated but childless women decreased in each age group compared with the same age group in the data from the 1982 survey, while it decreased much less for the less educated population. Apart from the fact that sample size is much more adequate in the 1987 survey, and thus a more regular pattern is shown among those better educated groups in Figure 7.6, this also suggests that significant improvements in primary sterility have happened among cohorts of all education levels, especially the better educated.

I.9 Age at first marriage

The mean age at marriage has been rising over the past three decades in cohorts of all education levels. Table 7.16 shows that after the early 1940s the mean age at first marriage kept on increasing. This increase was relatively slow before 1970 and accelerated over the 1970s for the less educated. The increases were more marked at earlier dates among the better educated. The mean age at first marriage increased by about 1 and over 2 years during two decades of the 1950s and the 1960s, and by about

2 and 1 during the 1970s for the less and the better educated cohorts respectively.

Table 7.16 Mean age at first marriage by marriage cohort 1940-81: the five education levels

Marriage Cohort	Illiteracy	Primary	Junior	Senior	University
40-44	17.72	18.07	19.13	20.28	21.45
45-49	17.98	18.26	19.68	20.92	22.89
50-54	18.22	18.42	19.31	21.29	21.23
55-58	18.42	18.73	19.71	21.77	23.54
59-61	18.86	18.85	19.56	21.78	23.72
62-66	18.85	18.89	20.12	22.66	25.16
67-69	18.97	19.53	21.09	23.36	25.61
70-75	20.20	20.94	22.12	23.56	26.25
79-81	21.75	22.11	23.19	23.22	26.32

Table 7.17 Mean length(months) of first birth interval by age at first marriage and marriage cohort 1960s-1980: three education levels

Marriage Cohort	Age at first marriage				
	< 17	17-19	20-22	23-25	Total
Illiteracy					
-1960	27	24	24	26	25
1961-65	22	25	22	20	24
1966-70	26	22	21	19	22
1971-75	29	21	20	18	21
1976-80	12	19	20	17	19
Primary					
-1960	24	23	25	20	24
1961-65	23	21	19	14	21
1966-70	19	19	18	17	19
1971-75	24	19	19	17	19
1976-80	23	21	17	17	17
Secondary+					
-1960	27	19	17	21	20
1961-65	18	19	17	21	19
1966-70	14	16	16	16	16
1971-75		17	18	16	17
1976-80	18	19	19	16	17

The information on duration marital fertility by age of first marriage and by education levels is not available, thus further discussion of the age impact on increases in natural fertility and related education differentials is not feasible. However, national information in previous chapters shows that duration marital fertility and fecundability have been consistently rising after controlling for age at first marriage. This indicates that, in addition to changes in age at first marriage, changes in natural fertility were also responsible for changes in marital fertility. Yet the detailed impact from changes in age at first marriage on marital fertility at different education levels remains somewhat concealed because of the lack of information.

However, from the information provided by 1985 In-Depth Fertility Survey shown in Table 7.17, we can see that the mean length of the first birth interval of all education groups decreased consistently over time after controlling for age at first marriage. The only exceptions were illiterate women married in the period of 1971-75 and the other two education groups married before age 22 after 1971, when the national birth control and later marriage and childbearing campaigns were launched, leading women to postpone births, especially those who married younger and were educated longer.

I.10 Summary

Education in China contributes to occupation differentials, resulting income and social status differentials, and to consumption, especially of food, which are key factors influencing natural fertility. Since 1949, the Chinese people's education has been enhanced substantially, while educational differences still result in socio-economic conditions varying among people. Information from non-demographic surveys indicates that the well educated generally have a better occupation, which generally leads to higher income and better consumption. This feature seems to contribute to differentials in level of natural fertility and its proximate determinants.

The widely observed negative relationship between duration of education and level of fertility has been confirmed here. The general fertility and marital fertility of the better educated were distinctly lower than those of the less educated, though fertility of all education levels experienced a rise during the 1950s, when fertility was basically 'natural'. In the middle of the 1960s, the government carried out a birth control programme focused on the urban population, to which most of the better educated belonged. As a consequence, fertility among the better educated population experienced a sharp reduction at this time. The declining trend reversed slightly during the 'Cultural Revolution', as the birth control programme was disrupted. However, massive fertility reduction at all levels of education started after the early 1970s, when the national family planning campaigns were launched, while the marital fertility of younger groups such as 15-19 and 20-24, was generally unchanged or even slightly increasing. The end of the 'Cultural Revolution' and the beginning of the economic reform, in one way, acted to restore the highly educated's socio-economic 'privilege' and to link people's occupation and income with the duration of their education. This certainly would improve the better educated's livelihood more than that of the less educated and thus favour their underlying natural fertility.

The observed trend of natural fertility by education divisions supports the main finding from the national level: natural fertility increased substantially over the period in

China. However, this upward trend was not identical for all groups, being more significant among the better educated generally. The one exception was the university and college level educated cohort who had least increase of natural fertility. The most likely reason, similar to the one in the estimation of M for women in Shanghai, is that these women's marital fertility schedules on average were more controlled, thus even the adjusted model may not be 'adjusted' adequately to fit this division, and leads to an underestimate of natural fertility, although an increasing trend over time was still indicated by the adjusted model. Among the different periods, it is also remarkable that from the latter 1970s to the 1980s, the natural fertility of all the education divisions had the greatest boost, particularly among the better educated.

Corresponding to this rise, similar evidence on fecundability, birth intervals and breastfeeding can be found for women by educational divisions as well. Mean fecundability was generally lower before the 1950s, particularly for illiterate women. A significant upward trend in fecundability over all education divisions can be observed after the 1940s. The better educated women seem to have experienced a greater rise in fecundability than less educated women. Factors contributing to this are found to be the shorter birth intervals and duration of breastfeeding. The first birth intervals of all education levels consistently shortened. Again, for university level educated women, the variance of the birth intervals appeared larger due to inadequate sample size. The downward trend in the second birth intervals before the 1970s is less clear among the better educated. This is partly because full information to estimate the second interval is only available up to 1970, and partly because the better educated exercised birth control as early as the 1950s, thus producing second intervals that were much less 'natural' than those that of the less educated. As for breastfeeding, educated mothers generally offered about three to four months less to their children than illiterate mothers. Similarly, the proportion of non-breastfed children was substantially higher among mothers educated at secondary school and above, but the difference in non-breastfed proportions between primary school educated mothers and illiterate mothers was very small.

Childlessness dropped substantially over the age span among all educational levels of women. Contrary to the findings on other proximate determinants, better educated women, within some elderly age groups, generally have more childlessness than the less educated. For this, venereal disease might be difficult to explain it. More likely reasons, apart from that the higher remarriage rate resulting from worse mortality among the less educated might indirectly act as a reducing factor to childlessness, were a higher rate of reporting error when some adopted children were deliberately misreported as natural children by the less educated, and greater marital disruption rates for the better educated, as these spouses were more likely to have been separated by occupational duties.

Chapter 8 Background Determinants

I Background determinants

In the previous chapters, we have documented the changes in natural fertility and its proximate determinants in China as whole, as well as the urban-rural, regional and educational differentials over the past four decades. Here we come to the concluding analysis examining changes in the background determinants of natural fertility. As we illustrated in Chapter 2, fertility determinants may be roughly grouped into proximate determinants and background (ultimate) determinants. Although not covering all the proximate determinants, available data allow us to analyse the most crucial proximate determinants in detail, such as fecundability, birth intervals, breastfeeding, primary sterility, and age at first marriage. Moreover, a good deal of research has been carried out to examine the socio-economic determinants of China's fertility transition. Therefore, our examination is limited to the link between the ultimate variables (such as socio-economic and institutional factors) and natural fertility, to shed light on the general mechanism of natural fertility change, and how the roles played by socio-economic factors over time.

I.1 Economic development and income level rising

China has always been a rural country. In October 1949, the Chinese Communist Party officially took power and has been controlling the entire administration ever since.

For almost thirty years up to 1979 the Chinese government, through the State Council and its associated departments, attempted to practise comprehensive central economic planning. The central economic planners, or policy makers tried to make as many decisions as possible concerning consumption, production of output, employment of input, distribution of income and investment. They assigned labour by directing workers to different factories, and attempted to control the consumption of final goods and services, either by setting the price of goods sold through public retail outlets and letting the consumer decide what and how much to buy, or by rationing goods through coupons.

They also attempted to determine individual incomes. They set factory wage rates but also usually prevented dismissal or reassignment, thus guaranteeing job security. Farmers shared in the overall income of the farm through a system in which the final allocation of output and farm was divided on the basis of each person's working time and quality in his production unit. The planners could vary farmers' income by changing the purchase quotas and prices of farm products. Finally, they tried to determine the ratio of consumption and investment in the national income, by deciding the amounts of consumption and capital goods to be produced. It becomes clear that between 1949 and 1978 the national economy made some progress although there was no programme, policy or plan consistently reaching success. How did this look in detail?

The period 1949-1957 was a period of recovery and substantial progress toward a return to normality after more than a decade of occupation by the Japanese and the civil war. Agricultural production may have returned to its probable peak level of the mid-1930s. The First Five-Year Plan (1953-1957) is generally considered to have been a significant economic success, when national income grew at an estimated annual rate of

9 percent. As shown in Table 8.1, Gross Social Product (GSP) *per capita* increased by 50% during the period from 1952 to 1957, while people's consumption also rose substantially. These developments were associated with the first significant rise in natural fertility since 1940.

During the 'Great Leap Forward' and Great Famine in 1958-1961, the development of industry was affected by policies putting emphasis on investment and the rapid expansion of heavy industry. Thus, much of the growth in industrial output stemmed from investment in heavy industry, from which consumers benefited relatively little. Although the Gross Industrial Product (GIP) *per capita* more than doubled from 1957 to 1960-most of that gain was lost by 1962. One feature of the 'Great Leap Forward' was that the rate of accumulation as a percentage of national income rose from an already relatively high level of 24% in the First Five-Year Plan years (1952-57) to 40%; Such high rates of accumulation for an economy with a low level of income implied little interest in the immediate material welfare of the population.

The Great Famine has been discussed at length in the previous chapters. It was generally implied in most comments at the time that the decrease in grain production of 28 percent--56 million tons--was caused by bad weather conditions. However, it was subsequently noted that of the total decline in grain production for 1959-61, at most a fourth can be attributed to adverse weather; the major reason for the rest of the decline was the implementation of 'Left' policies.[1] For the consumption level, this was the worst time since 1949. During these years, for example, the average annual *per capita* grain consumption fell 19.4 percent for the entire nation. (see Table 8.6)

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[1] Liu Suinian and Wu Qungan 1986: ***China's Socialism Economy: An Outline History (1949-1986)***, Beijing, Beijing Review Press.

The period of 1963-66 was a second recovery time in the post-1949 history. Following the Great Famine, there was a gradual return to normalcy, the agricultural tax and state purchases of grain were reduced substantially in both 1961 and 1962. The labour released from urban workers who had moved to cities during the 'Great Leap Forward' increased the farm labour force by 15% in the spring of 1961 compared with the year before. However, it was not until 1964 that the national income or the combined gross agricultural and industrial output reached the 1958 level. The material consumption also returned to the previous level, which prompted the second fertility boom since 1949.

Table 8.1 Gross social product (GSP), gross industrial product (GIP) and consumption level in real terms 1952-85

Year	GSP[1]	GIP	Consumption
	(per capita)		*(yuan)*
1952	100.00	100.00	100.00
1955	127.19	149.73	115.10
1957	151.94	203.24	122.90
1960	242.93	465.10	105.60
1962	143.08	235.75	103.70
1965	204.61	358.66	132.70
1968	189.72	327.98	137.80
1970	279.26	544.40	147.30
1973	325.58	679.91	161.10
1975	357.07	762.53	163.80
1978	433.42	975.82	177.00
1980	491.34	1131.30	206.70
1982	553.83	1238.81	232.40
1985	792.95	1881.18	313.70

[1] GSP and GIP *per capita* both were set at 100 in 1952 in real terms.
Source: ***1988 China Statistical Yearbook***, p38 and p291.

The 'Cultural Revolution' took place in 1967-76. Some economic rationality and adjustment came to a halt, with the launching of this movement in 1966, which led to domestic turmoil and brought catastrophe to the national economy. Although the GSP *per capita* increased by more than 150% from 1965 to 1975, and capital accumulation as a proportion of national income still kept a relatively high level, the consumption *per capita* in real terms saw virtually no improvement from 1968 to 1976.

From 1978 onwards was a period of the 'Economic Reform'. The Chinese Communist Party set a new economic course and began to carry out 'Reform of the Economic Structure',[2] which emphasized individual incentives and greater reliance on market forces to stimulate economic efficiency and acknowledged that some people must become rich before others can improve their well-being. The impact on people's lives from the change in overall economic policy was marked, and linked with active attempts to influence development through the shift in investment towards consumption.

The first target of reform was to raise the living standard of 800 million peasants. Rural reform consisted of several changes, which included increased financial incentives to peasants, such as reduced taxes on agricultural products and raised agricultural procurement prices, decentralized planning, and most important, changes in agriculture organization by building around the agricultural household responsibility system. Results were almost miraculous, between 1980 and 1990, gross agricultural output rose 204 percent in real terms at an average annual rate of 7.4%, the rural population's income *per capita* rose to 160% at an average annual rate of 5%. Additional data, derived from a survey of over 30,000 peasants in 600 counties, revealed that rural *per capita* incomes increased at an average annual rate of 14.7% between 1978 and 1985, peasant living standards rose in five years after 1978 by more than the total gain that had occurred

[2] Central Committee of the Communist Party of China: Decision of the Central Committee of the Communist Party of China on Reform of the Economic Structure (Adopted by the 12th Central Committee of the Communist Party of China at Its Third Plenary Session on October 20, 1984), reprinted in ***Beijing Review 27***, No. 44, (October 29, 1984).

between 1952 and 1977[3].

The reforms made in the industrial sector were primarily readjustments of the centrally planned administrative command system in the form of decentralized administrative controls. The reforms included campaigns to eliminate losses in state-owned enterprises, the substitution of income taxes for the remission of profits to the state, and expanding local managerial decision-making authority. Results here were even more significant. Between 1980 and 1990, gross industrial output value rose 250% in real terms at an average annual rate of 9.6%, worker and staff income *per capita* rose to 151% at an average annual rate of 4.1% in real terms.

Table 8.2 The proportions(%) of labour force engaged in primary, secondary, tertiary industries 1952-85

Year	Primary	Secondary	Tertiary
1952	83.5	7.4	9.1
1955	83.3	8.6	8.1
1957	81.2	9.0	9.8
1960	65.7	15.9	18.4
1962	82.1	8.0	9.9
1965	81.6	8.4	10.0
1968	81.7	8.6	9.7
1970	80.8	10.2	9.0
1973	78.7	12.3	9.0
1975	77.2	13.5	9.3
1978	70.7	17.4	11.9
1980	68.9	18.3	12.8
1981	68.9	18.4	12.7
1985	61.1	20.7	18.2

Source: ***China Social Statistical Materials 1987***, p41.

Changes consistent with economic development also happened to labour structure after 1949, the proportions of labour engaged in the secondary and tertiary industries rose

[3]Alvin Rabushka 1987: ***The New China***, Pacific Research Institute for Public Policy, Westview Press, Colorado, p75.

over time, except for the fluctuation that occurred during the 'Great Leap Forward' and Great Famine in 1957-1962 (see Table 8.2). Industrialization accelerated after 1978, the proportion of the labour force engaged in primary industry dropped dramatically. When the new economic policies were implemented, peasants were encouraged to start non-agricultural business. This shift brought about a large rise in peasants' income. As we discussed in Chapter 7, occupation is one of the key factors to determine income level, which is strongly related to consumption and thus to natural fertility. So a secular industrialization after 1949 in China contributed to a substantial rise in the national average of private income and therefore indirectly prompted the rise in natural fertility.

I.2 Urbanization

Urbanization can be defined simply as the process of increasing the concentration of a population into towns and cities, usually involving movement of people from rural areas where agriculture and related activities are the main source of livelihood. China is generally considered to be a rural country. Compared with many other developing countries, the level of urbanization in China is low: only 20.8 per cent of its total population lived in urban areas in 1982. However, it is also a country of great cities. There are now more than 400 million urban residents. Although cities of considerable size, and a widespread network of market and administrative towns, are not new in China, it is only really in the last forty years that an urbanization based on industrialization has emerged, largely concentrated in relatively few centres as a result of state-sponsored projects.

China first experienced rapid urban expansion during the decade of 1950s (see Table

8.3), as the consequence of the industrial development of the First Five-Year Plan of 1953-57, with the industrial expansion of long-established administrative cities like Xian and Nanjing and the creation of entirely new cities like Baotau. The proportion of the population living in urban areas was around 10 per cent in the early 1950s, and rose rapidly to about 20 per cent by the end of that decade, mostly due to migration. In the early 1960s, as many as 20 million former peasants were dislodged from urban areas and returned to the countryside. Then in the 'Cultural Revolution' many people were sent to the countryside.

Table 8.3 The proportions(%) of urban population and non-peasant population 1949-85

Year	Population (10,000)	Urban P (%)	Non-peasant P (%)
1949	54167	10.64	
1952	57482	12.46	
1955	61465	13.48	
1957	64653	15.39	
1960	66207	19.75	
1962	67295	17.33	14.59
1965	72538	17.98	14.02
1968	78534	17.62	13.33
1970	82992	17.38	12.68
1973	89211	17.20	12.72
1975	92420	17.34	12.56
1978	96259	17.92	12.93
1980	98705	19.39	14.05
1982	101590	20.80	14.48
1985	105004	36.61	17.11

Source: ***1990 China Statistical Yearbook***, p89.

There was little further change until the early 1980s: the proportion in 1981 was only 20.2 percent for China as a whole. The 1970s showed a remarkable stability in the proportion of urban dwellers until 1979. This was mainly due to the strict control of immigration from rural to urban areas in this period. In the years of the economic reform after 1979, partial but significant increases in the freedom of people to move around, and the commercial growth of parts of rural China, led to new urban growth, including that of many small towns as well as big cities. This growth was also due to a rise in the urban birth rate because of the age structure of the population, which included a larger share of people born in the baby-boom of the 1950s, who were of childbearing age in the 1980s.

I.3 Public health programmes

Since 1949 the Chinese government has had an extensive programme to improve the people's health. A health system and medical care for the whole nation were organized, and attention was also paid to the protection of health of mothers, infants and children. One indicator of the improvement achieved was the decline in the annual death rate from 20 per 1000 in 1949 to 6.4 per 1000 in 1981. Infectious diseases such as plague, smallpox, venereal diseases, kalaazar, recurrent fever and typhus were successively eradicated or brought under control. Mortality caused by respiratory diseases, digestive disease, and acute infectious diseases dropped, and heart and cerebrovascular disease and malignant tumours became the leading causes of death.

One feature of medical services in China is the low cost and the associated low quality as the government is willing to use a large number of physicians, and some of these may not be well qualified. As a result, the number of hospital beds and doctors per 10,000 population rose from 6.7 and 1.48 in 1949 to 13.6 and 21.41 in 1985 respectively for the nation as a whole (see Table 8.4). Most people are able to obtain fairly inexpensive medical care though the quality of service may be doubtful at times. The health care system in China is based on a three-tier system managed and financed locally. In the first tier, part-time (barefoot in rural areas) doctors provide preventive and primary care, and free contraceptives. More serious illnesses are referred to the second tier, factory or commune health centres with junior doctors. The most seriously ill patients are referred to the third tier: city or county hospitals staffed with senior doctors.

Table 8.4 Number of doctors and hospital beds(*per 10,000 population*): 1949-85

Year	Doctors			Hospital beds		
	Urban	Rural	Nation	Urban	Rural	Nation
1949	6.99	6.65	6.7	6.34	0.45	1.48
1952			7.4	14.63	0.79	2.79
1955			8.1			3.60
1957	13.01	7.55	8.4	20.78	1.37	4.56
1960			9.0			9.90
1962			10.2	38.77	4.52	10.25
1965	22.17	8.18	10.5	37.75	5.10	10.55
1968			9.0			12.10
1970			8.5	41.76	8.46	13.39
1973			8.8			16.00
1975	26.57	6.53	9.5	46.10	12.30	17.38
1978			10.8	48.46	14.07	19.38
1980	32.22	7.65	11.7	46.96	14.83	20.17
1982			12.9	47.60	14.60	20.31
1985	34.38	8.43	13.6	46.64	15.10	21.41

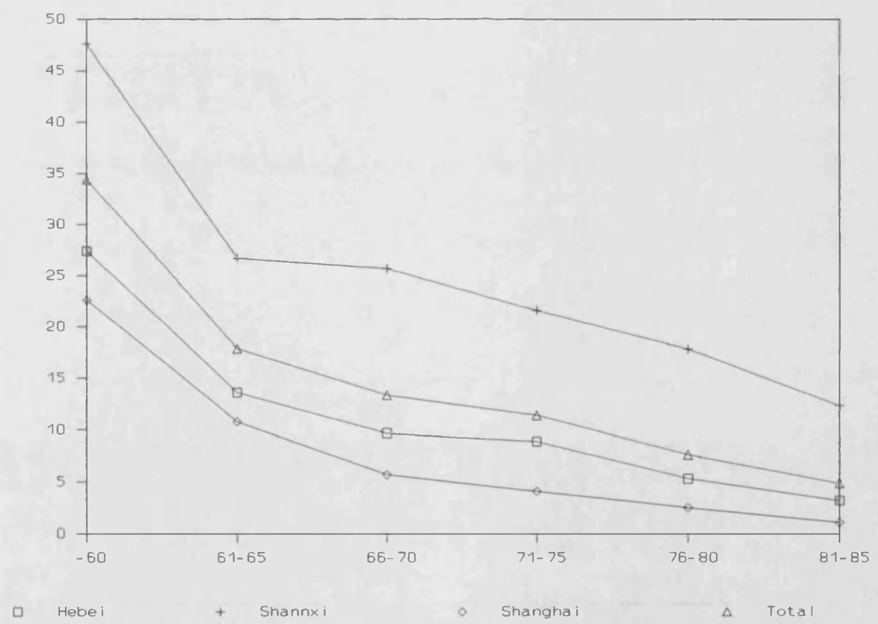
*Source ***China Statistical Yearbook***, 1984, pp.516-517; ***China Social Statistical Materials 1987***, p194.

The effect of health on the fertility level in human populations has not been a subject of considerable discussion in demography, yet it is very obvious that status of health is likely to affect the biological mechanisms directly related to natural fertility, such as age at menarche, coital frequency, reproductive life span and so on. Apparently, the substantial improvement in people's health must be one of the most important factors in the rise of natural fertility in China after the 1940s.

I.4 Marriage pattern

In China, at least for the majority Han population, sexual activity outside marriage has been a cultural taboo. Cohabitation and illegitimate fertility are very rare. Almost all conceptions take place within marriage according to Chinese custom. Thus sexual behaviour, at least in the early stages of marriage, is influenced to a certain degree by the style of forming marriage. It could be expected that sexual activities is initially limited or problematic if a couple did not known each other well before.

Figure 8.1 Proportions(%) of women whose first marriages were arranged 1950s-1985: Hebei, Shaanxi, Shanghai



In traditional Chinese society, marriage overwhelmingly used to be 'arranged marriage'. Since 1950, the general policy in China has been to discourage the practice of arranged marriages and promote marriage as a free association between a man and a woman. It is also believed that the proportion of arranged marriages has been decreasing since 1950. We might expect some indirect impact from this trend on the frequency of intercourse among couples, especially in the early durations of marriage. The In-Depth Fertility Survey in 1985 provides information on the percentage of ever-married women whose first marriage was arranged by marriage cohorts, which allows us to examine indirectly the relationship between marriage pattern and natural fertility.

Table 8.5 Proportions(%) of women whose first marriages were arranged by marriage cohort 1950s-1985, and by age at first marriage and region

By region

	Hebei	Shaanxi	Shanghai	Total
-60	27.40	47.60	22.60	34.40
61-65	13.60	26.70	10.80	17.86
66-70	9.70	25.70	5.70	13.37
71-75	8.90	21.60	4.10	11.40
76-80	5.30	17.80	2.50	7.62
81-85	3.20	12.30	1.10	4.85
Total	9.60	24.50	5.50	12.90

By age at first marriage (three regions as a whole)

	<17	17-19	20-22	23-25	26+
-60	49.22	31.68	18.65		
61-65	30.88	21.41	9.14	10.98	5.39
66-70	22.32	18.71	11.61	4.80	2.90
71-75	30.41	17.57	12.11	3.50	4.29
76-80	13.33	16.93	11.09	4.51	2.09
81-85	13.03	11.22	6.96	3.29	0.31
Total	39.10	21.49	10.49	4.31	1.60

In Table 8.5 and Figure 8.1, we present the proportions(%) of women whose first marriages were arranged, by region and marriage cohort. Evidently, the proportions(%) of arranged marriages in the three regions declined dramatically from 27.4, 47.6, and

22.6 in the 1950s to 13.6, 26.7 and 10.8 during 1961-65 for Hebei, Shaanxi, and Shanghai respectively (see Figure 8.1). Afterwards, the declining trend was slower but still clear. The pattern is also clear: the more developed the region, the lower the proportion of first marriages being arranged.

In Table 8.5, we also present the percentage of women whose first marriages were arranged by age at first marriage. There appears to be a negative relation in the proportions of arranged marriages and age at first marriage. Obviously, those women who married at later ages tended to be better educated or well employed, thus they were more likely to select their husbands at their own wills. Here again, mass education contributed to an improvement in women's social status, and thus indirectly to an increase in natural fertility.

I.5 Nutrition

So far as the biological aspect of natural fertility is concerned, nutrition is a very important factor. The reasons for the association between fertility and nutrition have been fairly well analysed. Biological studies have proved that nutritional status, through its effects on menarche, lactational amenorrhea, intercourse frequency, and other reproductive processes, may have significant implications for the levels of natural fertility, for example, malnutrition can cause a decrease in fecundability. In China, the major crops are wheat and rice, therefore, changes in natural fertility would have been closely associated with the harvest of the previous year, at least in rural areas. Over a long time period, these changes in natural fertility could be expected to have been linked with fluctuation in food consumption *per capita*. Fortunately, the statistical yearbooks provide the information on food (grain, oil, meat, sugar) consumption *per capita* from 1952 to 1985, which enables us to discuss this matter in detail.

Table 8.6 Chinese people's annual main food consumption (*per capita*) 1952-85

Year	Grain (*k.g.*)	Eating oil (*k.g.*)	Meat(pork) (*k.g.*)	Sugar (*k.g.*)
1952	198	2.1	5.9	0.91
1955	198	2.2	4.9	1.29
1957	203	2.4	5.1	1.51
1960	164	1.9	1.6	0.97
1962	165	1.1	2.2	1.60
1965	183	1.7	6.3	1.56
1968	193	1.6	6.3	2.25
1970	187	1.6	5.8	1.96
1973	192	1.7	7.1	2.18
1975	191	1.8	7.4	2.17
1978	195	1.6	7.7	3.42
1980	214	2.3	11.2	3.83
1982	225	3.5	11.8	4.42
1985	254	5.1	14.0	5.60

*Source:***1984 China Statistical Yearbook, p477.***

Table 8.7 Chinese people's daily nutrition from main food in 1952, 1978, 1983

Year	Calorie (*1000c*)	Protein (*g.*)	Fat (*g.*)
1952	2270.0	69.6	28.3
1978	2311.0	70.8	29.9
Urban	2715.0	81.6	49.0
Rural	2224.0	68.5	25.7
1983	2877.4	82.8	47.2
Urban	3182.5	87.5	74.9
Rural	2805.9	81.7	40.7

*Source: ***China Social Statistical Materials 1987, p213.***

Tables 8.6 and 8.7 show Chinese people's annual food consumption and daily nutrition *per capita* for selected years from 1952 to 1985. Obviously, the trend of food consumption was very consistent with that of natural fertility. It rose substantially during 1952-1957, fell to a trough during the great famine, significantly recovered during 1962-1965, then stayed more or less unchanged during the 'Cultural Revolution' from 1966 to 1976, and finally increased dramatically after 1978. Generally speaking, food consumption saw no great improvement from 1957 to 1978. Natural fertility did increase during this period among some minority groups, such as the better educated, those living in more developed regions, and so on, but whether this was mainly contributed by better food consumption or behaviour factors, such as a decline in the length of breastfeeding or a change in attitudes to sex remains unknown, because no detailed food consumption information for these minority groups is available.

I.6 Education

As mentioned above, educational variation might be another key factor contributing to differentials in natural fertility. Besides the cross-sectional analysis of natural fertility of the population with different education levels in Chapter 7, a similar analysis is to examine the dynamic changes in education achieved, and their connections with changes in natural fertility.

China was well behind the developed nations in education in the first half of this century. About 80% of the total population was illiterate and only 20% of children attended schools before 1949.[4] So it was the comprehensive aim of the Communist government to build a new society and a new state for the nation when it took power in

[4] Da Li 1991: Seventy Years' Change in China, ***People's Daily***, (overseas edition) July 18, 1991.

1949. Although economic reconstruction had first priority due to the general problems of maintenance, the importance of transformation in China's society was stressed again and again, i.e., women liberated from the bonds of tradition, mass culture and mass education created for both men and women, illiteracy eliminated, and so on.

The Chinese government has placed a strong emphasis on improving the educational level of the people since 1949, and universal education has been introduced. In detail, attendance at elementary school (primary school) for children was regulated, enabling children seven years or older to attend school and compulsory education was introduced later. Meanwhile, secondary and higher education were strengthened, technical education was stressed, the education of workers during their spare time and that of the cadres at their posts were also strengthened. And finally national physical education was also promoted. The mass orientation in educational policy, on the whole, achieved certain successes. Education institutions were set up and expanded systematically at all levels. Illiteracy was sharply reduced.

Table 8.8 shows official data on the enrolment of Chinese students per 10,000 population by level of school for the selected year from 1949 to 1985. During this period, enrolment in higher education institutions increased more than sevenfold; enrolment in secondary schools increased more than twenty-one times; and enrolment in primary schools about threefold. It is noteworthy from Table 8.8 that during the economic crisis of 1959-61 and the beginning of the 'Cultural Revolution' in 1966-68, student enrolment declined, enrolment of primary school students had its the first trough and that of university students had its second trough in the post-1949 history. Due to the dramatic decline of fertility during the 1960s in urban areas and the 1970s in the whole nation, student enrolment in primary schools and secondary schools began falling after 1978. Table 8.8 also indicates that percentages of female students in each level of school have been rising since the 1950s. In general, mass education has been raising up the class of people's occupations, which are strongly related to rises in income and consumption and thus possibly to a rise in natural fertility.

Table 8.8 Number of students by education level (*per 10,000 population*) and the proportion(%) of female students[1] 1949-85

Year	All students			Female students(%)		
	I	II	III	I	II	III
Before 1949				25.5	20.3	17.8
1949	450	23	2.2			
1952	889	55	3.3	32.9	23.8	23.4
1955	864	73	4.6			
1957	994	110	6.8	34.5	30.2	23.3
1960	1417	225	14.5			
1962	1028	124	12.3	34.8	33.5	25.3
1965	1602	197	9.3	39.3	29.9	38.2
1968	1278	179	3.3			
1970	1269	319	0.6			
1973	1521	392	3.5			
1975	1633	490	5.4	45.2	39.3	32.6
1978	1526	693	8.9	44.9	41.4	24.1
1980	1489	578	11.6	44.6	39.4	43.0
1982	1381	465	11.4	43.7	39.2	26.5
1985	1278	487	16.3	44.8	40.2	30.0

*Source: ***China Population Statistical Yearbook 1989, p216; China Social Statistical Materials 1987 p158***. 1, I: primary schools, II: secondary schools, III: institutions of higher education.

One of the important elements of education in China is political and moral indoctrination. In the early 1950s, Communist Party and Youth League organizations were founded in schools, and political lectures about Marxism and Dialectical Materialism were set compulsorily, to carry out political and ideological work among Chinese youth. Secularization, which might be a side effect of this political education, changes attitudes and ideas towards sexual behaviour generally, which were originally derived from Chinese traditional religions. All old Chinese religions believed that sexual behaviour was dirty and could harm people's health. After the massive programme of education, virtually all people educated after 1949 have no strong religious belief any more (only a handful of religious schools were reopened after 1979). This might also be a factor contributing to the increase in natural fertility.

I.7 Housing condition and family pattern

The rapid decline in mortality and longer lifespan, and higher fertility in the earlier years of the People's Republic produced a big rise in the total population after 1949, but the rise in absolute numbers of people in both urban and rural areas during the time was not matched by sufficient investment in housing and infrastructure. In fact, taking the average floor-space in housing available to inhabitants, arguably a major aspect of the quality of life, the *per capita* square metres of urban inhabitants declined from 4.5 in 1952 to 3.6 in 1978.[5] A survey conducted in 216 cities in 1979 revealed that about one-third of all urban households did not have sufficient living space.[6] Housing pressure in the urban areas was not reduced until the 1980s when the economic reform began and major economic policy shifted from investment to consumption. In general, the larger the cities, the worse the overcrowding and relative lack of investment in infrastructure. In rural areas, although housing has always been privately owned, food and clothing generally took priority over housing. As incomes were so low before 1979, few peasants could afford to build new houses for the increasing size of families. Moreover, they also

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[5]See ***Beijing Review,*** No. 48, 1979, p12.

[6]See Editorial Committee 1981: ***Encyclopedia of China***, Encyclopedia Publish House, Beijing, pp.540-541.

had to apply for permission to use extra land for building, even if funding was available.

State investment in urban housing has increased significantly since 1979. In rural areas, a boom in new house-building has also occurred due to rising income levels and the relaxing of restrictions on the use of collectives' land for private housing. The urban housing expansion has been under the direction of municipal housing bureaux and also that of the state industrial enterprises which have responsibility for their own staffs' housing. The construction boom has become a new and evident feature of both urban and rural landscapes, though regional variations in the scale of construction still exist. An important indicator of the improved living condition is the increased amount of living floor space, from 4.2 and 8.1 square meters in 1978 to 8.5 and 16.0 in 1987 for urban and rural areas respectively, as Table 8.9 shows. This increase in urban areas cannot be used as a check on the increase in real incomes, because the increased space was not determined by each household allocating its income for this purpose, but by decisions about space made by the administrative process. However, the increase in rural areas was roughly consistent with doubled real *per capita* incomes of the peasant population. Since 1979, substantial housing improvement has occurred in most regions, which strongly prompts the tendency towards nuclear family households.

Table 8.9 Housing conditions in China(*sq.m. per capita*) 1978-87

Year	Urban	Rural	Nation
1978	4.20	8.10	7.40
1980	4.96	9.40	8.54
1982	5.61	10.73	9.66
1985	6.66	14.70	11.76
1987	8.50	16.00	

*Source: ***China Statistical Yearbook 1988; China Social Statistical Materials 1987***, p87.

The changing housing conditions and increasing prevalence of the nuclear family might also have some indirect effects on natural fertility. Assuming other factors being the same, sexual behaviour is expected to vary among families according to different living spaces, and between nuclear and non-nuclear families, given that accommodation is not spacious in China. For example, two couples sometimes live in one bedroom or two joint bedrooms in some urban areas. Even in the nuclear families, sexual behaviour is also expected to differ according to whether or not children have separate bedrooms from their parents.

II Multiple analysis of background determinants

For the purpose of examining changes in the socio-economic phases to link with changes in natural fertility, the following socio-economic variables can to be considered, such as *per capita* GNP (here we use GSP) and labour structure, *per capita* annual income, *per capita* main food consumption, percentage of urbanization, doctors or hospital beds per 10,000 population, housing conditions, students enrolled per 10,000 population, female illiteracy rate, and so on. The analysis begins with an examination of correlation coefficients. Positive relationships between natural fertility level and these variables are expected, except with female illiteracy rate and proportion of labour engaged in primary industry. As a fact, economic development is always linked with other developments such as in health and education, thus it will not surprise us if most variables are highly correlated to each other. Therefore is worthwhile to select the variables most relevant to natural fertility by carrying out a multiple regression analysis.

II.1 Data for the study

There are systematic time series data for several socio-economic variables, while some fragmentary information has also been gathered or estimated for China as whole for the selected years: 1952-1981, and 1986. These 31 years are chosen mainly because of data availability. Nevertheless, these dates also cover most of China's development from the early 1950s to the middle 1980s. Thus our focus here can be on information for both the past and the most recent period.

Table 8.10 Nomenclature of the socio-economic variables	
Notation	Definition
NF2	Natural Fertility Level M (by original model)
NF1	Natural Fertility Level M (by adjusted model)
C1	Consumption Level per Capita (*yuan*)
C2	Food Grain per Capita(*jin*) (1 *jin* = 0.5 *k.g.*)
C3	Eating Oil per Capita (*jin*)
C44	Pork Meat per Capita (*k.g* per average month)
C55	Sugar per Capita (*k.g.*)
L33	Proportion of Labour Engaged in Tertiary Industry
L11	Proportion of Labour Engaged in Primary Industry
NP	Number of Newspaper Copies Issued per Million Population
BP1	Number of Radio Stations per 100 Million Population
BP2	Number of Wired Broadcasting Stations per Million Population
EP1	Number of Universities and Colleges Students per Million Population
EP2	Number of Secondary School Students per Million Population
EP3	Number of Primary School Students per Million Population
SP	GSP per Million Population (1952 as 100)
U1	Proportions of Urban Population
M1	Number of Hospital Beds per 1000 Population
M2	Number of Doctors per 1000 Population
ER1	Proportion of Illiterate Women Aged 20-24
ER3	Proportion of Women with Secondary School Education Aged 20-24

Nineteen sets of annual data have been collected and they represent various socio-economic conditions in China. Gross Social Product Value (GSP) is an index used by the Chinese government to reflect the general level of economic development. U1 is the proportion of urban population among the total. C1 is the national average level of *per capita* consumption, which is the consumption part of the gross national income divided by total population. C2, C3, C4, and C5 are *per capita* food consumption of grains, oil, pork, and sugar respectively. M2 and M1 are the number of doctors and the number of hospital beds per thousand population respectively. EP1, EP2, and EP3 are the numbers of students enrolled in primary, secondary school, and university and college per million populations respectively. ER1 and ER3 are the proportion of illiterate and secondary school educated respectively among the female population aged 20-24 derived from the 1982 1/1000 Fertility Sample Survey. BP1 and BP2 are the number of wired and wireless broadcasting stations per million population. NP is newspaper copies per 10,000 population. L11, L22, and L33 are the proportions of labour engaged in the primary, secondary, and tertiary industries. As L11+L22+L33 = 1, only two of them are selected. The notations and definitions for these variable are presented in Table 8.10.

The means and standard deviations of these variables are presented in Table 8.11. These figures represent the unweighted averages of different periods from 1952 to 1986. Generally speaking, some socio-economic factors had no substantial change until 1979, such as urbanization, main food consumption, or labour force of primary industry, whereas consistent improvement took place over time in medical services, education and other cultural aspects. The most significant socio-economic changes happened after the 1970s, indicating the accelerating process of development after 1978 when the economic reform began. Taking *per capita* pork consumption as an example, the value almost doubled from 1977 to 1986. All of this suggests that increase in natural fertility before 1978 was mainly contributed by improvement in social and cultural factors such as education and medical service, while rise in natural fertility after 1978 was mainly due to economic factors, especially improvement in food consumption after 1978, which was much more significant than others.

Table 8.11 The means and standard deviations (in parentheses) by periods from 1952 to 1986

	1952-58	1959-61	1962-66	1967-69	1970-78	1979-86[1]
SP	0.239	0.368	0.317	0.363	0.594	1.014
	(0.055)	(0.075)	(0.064)	(0.037)	(0.084)	(0.326)
U1	0.142	0.191	0.177	0.176	0.174	0.250
	(0.013)	(0.007)	(0.006)	(0.001)	(0.002)	(0.109)
C1	93.100	104.000	122.000	133.300	155.300	280.800
	(10.000)	(9.170)	(6.600)	(1.150)	(11.190)	(114.800)
C2	389.600	339.300	353.500	355.900	376.800	448.000
	(6.190)	(29.710)	(22.850)	(14.240)	(12.960)	(43.750)
C3	4.416	3.663	2.828	3.303	3.277	6.223
	(0.524)	(0.878)	(0.635)	(0.189)	(0.113)	(2.966)
C44	0.451	0.167	0.424	0.538	0.609	0.966
	(0.048)	(0.078)	(0.158)	(0.042)	(0.045)	(0.168)
C55	1.314	1.428	1.563	2.273	2.368	4.395
	(0.244)	(0.417)	(0.182)	(0.141)	(0.485)	(1.158)
L11	0.790	0.684	0.820	0.817	0.772	0.672
	(0.092)	(0.078)	(0.004)	(0.001)	(0.031)	(0.041)
L33	0.097	0.157	0.099	0.096	0.099	0.137
	(0.025)	(0.036)	(0.001)	(0.002)	(0.010)	(0.022)
NP	0.036	0.066	0.052	0.048	0.112	0.150
	(0.011)	(0.016)	(0.010)	(0.003)	(0.024)	(0.022)
EP1	0.056	0.137	0.099	0.033	0.043	0.131
	(0.024)	(0.014)	(0.019)	(0.020)	(0.028)	(0.032)
EP2	0.924	1.912	1.521	1.981	4.929	5.488
	(0.439)	(0.338)	(0.330)	(0.465)	(1.493)	(0.577)
EP3	9.708	13.080	12.740	12.890	14.920	14.550
	(1.622)	(1.395)	(2.448)	(0.478)	(1.274)	(0.573)
M1	0.403	0.940	1.048	1.217	1.662	2.053
	(0.125)	(0.104)	(0.063)	(0.021)	(0.207)	(0.086)
M2	0.800	0.923	1.022	0.900	0.933	1.228
	(0.039)	(0.059)	(0.042)	(0.030)	(0.088)	(0.109)
BP1	10.750	19.780	12.300	10.110	9.597	14.590
	(1.758)	(1.414)	(1.283)	(0.095)	(0.099)	(7.685)
BP2	1.772	3.440	3.067	2.867	2.726	2.578
	(1.220)	(0.251)	(0.123)	(0.016)	(0.064)	(0.117)
ER1	0.803	0.686	0.558	0.438	0.411	0.288
	(0.041)	(0.031)	(0.047)	(0.021)	(0.014)	(0.089)
ER3	0.046	0.088	0.148	0.179	0.228	0.440
	(0.014)	(0.013)	(0.023)	(0.001)	(0.050)	(0.096)

Source: ***China Statistical Yearbook 1983, 1985, 1988.*** 1, The average of 1979, 1980, 1981, 1986's values.

II.2 Correlation analysis

As their names indicate, although background determinants, such as cultural or socio-economic variables, can only influence natural fertility by altering one or more of the proximate determinants, we still wish to seek explanations for the links between natural fertility and these variables, no matter how they are related to each other, directly or indirectly. Here, we measure the annual underlying level of natural fertility by the index (M) labelled as NF2 and NF1 given by adjusted and original Coale and Trussell's model respectively. A starting point in explaining the variation of NF2 is to find out how closely related these socio-economic variables are to the NF2, or how highly correlated the two variables are. Our study begins with an analysis of correlation coefficients. Positive relationships between the natural fertility index NF2 and these variables are expected, except illiteracy (ER1) and low income occupations(L11), Table 8.12 is the multiple correlation matrix which fully displays correlation coefficients between NF2, NF1, and each of the socio-economic variables.

Some important features are revealed in Table 8.12. As we expected, many values of the coefficients between natural fertility and socio-economic variables are relatively high, such as gross social product (SP), pork consumption (C44), medical services (M1, M2), and education level achieved by young women(ER1, ER3), while other socio-economic variables such as BP1, BP2, EP1, EP2, EP3 are not significantly correlated to NF2. Some are even contrary to our earlier expectations. For example, there is a positive relationship between NF2 and L11, although the coefficient is just 0.108, too trivial to mean anything, but as we expected, the proportion of labour engaged in primary industry--overwhelmingly in rural areas, lower income and relatively bad socio-economic background, should have a negative relationship with NF2. This leads us to observe them in detail. Four plots in Figure 8.2 are also very useful for informally examining the strength of the relationship between some socio-economic variables and natural fertility, though such an examination is essentially subjective.

Table 8.12 The correlation coefficient matrix 1:1952-81, 1986 (Part I)

	NF2	NF1	SP	U1	C1	C2	C3	C44	C55	M1	M2
NF2	1.000	0.823	0.503	0.307	0.568	0.496	0.271	0.760	0.587	0.490	0.470
NF1	0.823	1.000	-0.035	-0.083	0.072	0.094	-0.086	0.328	0.057	0.043	0.017
SP	0.503	-0.035	1.000	0.812	0.954	0.671	0.638	0.828	0.951	0.854	0.787
U1	0.307	-0.083	0.812	1.000	0.901	0.525	0.731	0.557	0.788	0.558	0.745
C1	0.568	0.072	0.954	0.901	1.000	0.701	0.727	0.828	0.955	0.750	0.822
C2	0.496	0.094	0.671	0.525	0.701	1.000	0.862	0.790	0.686	0.283	0.432
C3	0.271	-0.086	0.638	0.731	0.727	0.862	1.000	0.595	0.635	0.168	0.427
C44	0.760	0.328	0.828	0.557	0.828	0.790	0.595	1.000	0.845	0.684	0.598
C55	0.587	0.057	0.951	0.788	0.955	0.686	0.635	0.845	1.000	0.813	0.822
M1	0.490	0.043	0.854	0.558	0.750	0.283	0.168	0.684	0.813	1.000	0.740
M2	0.470	0.017	0.787	0.745	0.822	0.432	0.427	0.598	0.822	0.740	1.000
BP1	-0.341	-0.524	0.306	0.698	0.396	0.117	0.508	-0.083	0.249	0.028	0.379
BP2	-0.151	-0.163	0.158	0.258	0.095	-0.338	-0.156	-0.176	0.105	0.360	0.306
NP	0.403	-0.112	0.925	0.608	0.800	0.505	0.405	0.743	0.827	0.910	0.705
L11	0.108	0.496	-0.611	-0.543	-0.503	-0.417	-0.538	-0.285	-0.523	-0.408	-0.452
L33	-0.260	-0.555	0.460	0.580	0.401	0.239	0.495	0.068	0.368	0.237	0.427
ER1	-0.604	-0.230	-0.816	-0.610	-0.770	-0.273	-0.195	-0.715	-0.809	-0.953	-0.707
ER3	0.625	0.108	0.954	0.740	0.928	0.579	0.492	0.848	0.961	0.913	0.871
EP1	-0.147	-0.443	0.393	0.587	0.437	0.206	0.411	0.037	0.383	0.218	0.699
EP2	0.377	-0.083	0.794	0.371	0.617	0.342	0.136	0.636	0.724	0.911	0.581
EP3	0.182	-0.113	0.605	0.343	0.440	0.070	-0.007	0.438	0.486	0.820	0.495

Number of observations for each variable: 31.

Table 8.12 The correlation coefficient matrix 1, 1952-81, 1986 (Part II)

	BP1	BP2	NP	L11	L33	ER1	ER3	EP1	EP2	EP3
NF2	-0.341	-0.151	0.403	0.108	-0.260	-0.604	0.625	-0.147	0.377	0.182
NF1	-0.524	-0.163	-0.112	0.496	-0.555	-0.230	0.108	-0.443	-0.083	-0.113
SP	0.306	0.158	0.925	-0.611	0.460	-0.816	0.954	0.393	0.794	0.605
U1	0.698	0.258	0.608	-0.543	0.580	-0.610	0.740	0.587	0.371	0.343
C1	0.396	0.095	0.800	-0.503	0.401	-0.770	0.928	0.437	0.617	0.440
C2	0.117	-0.338	0.505	-0.417	0.239	-0.273	0.579	0.206	0.342	0.070
C3	0.508	-0.156	0.405	-0.538	0.495	-0.195	0.492	0.411	0.136	-0.007
C44	-0.083	-0.176	0.743	-0.285	0.068	-0.715	0.848	0.037	0.636	0.438
C55	0.249	0.105	0.827	-0.523	0.368	-0.809	0.961	0.383	0.724	0.486
M1	0.028	0.360	0.910	-0.408	0.237	-0.953	0.913	0.218	0.911	0.820
M2	0.379	0.306	0.705	-0.452	0.427	-0.707	0.871	0.699	0.581	0.495
BP1	1.000	0.260	0.139	-0.558	0.769	-0.006	0.174	0.762	-0.109	-0.024
BP2	0.260	1.000	0.228	-0.445	0.476	-0.372	0.181	0.390	0.207	0.586
NP	0.139	0.228	1.000	-0.592	0.387	-0.806	0.889	0.308	0.921	0.761
L11	-0.558	-0.445	-0.592	1.000	-0.906	0.281	-0.468	-0.636	-0.454	-0.440
L33	0.769	0.476	0.387	-0.906	1.000	-0.144	0.323	0.762	0.212	0.296
ER1	-0.006	-0.372	-0.806	0.281	-0.144	1.000	-0.899	-0.107	-0.788	-0.762
ER3	0.174	0.181	0.889	-0.468	0.323	-0.899	1.000	0.365	0.805	0.633
EP1	0.762	0.390	0.308	-0.636	0.762	-0.107	0.365	1.000	0.115	0.152
EP2	-0.109	0.207	0.921	-0.454	0.212	-0.788	0.805	0.115	1.000	0.770
EP3	-0.024	0.586	0.761	-0.440	0.296	-0.762	0.633	0.152	0.770	1.000

Number of observations for each variable: 31.

Figure 8.2 Plots of index of underlying level of natural fertility NF2 (M) against some socio-economic variables 1952-81, 1986

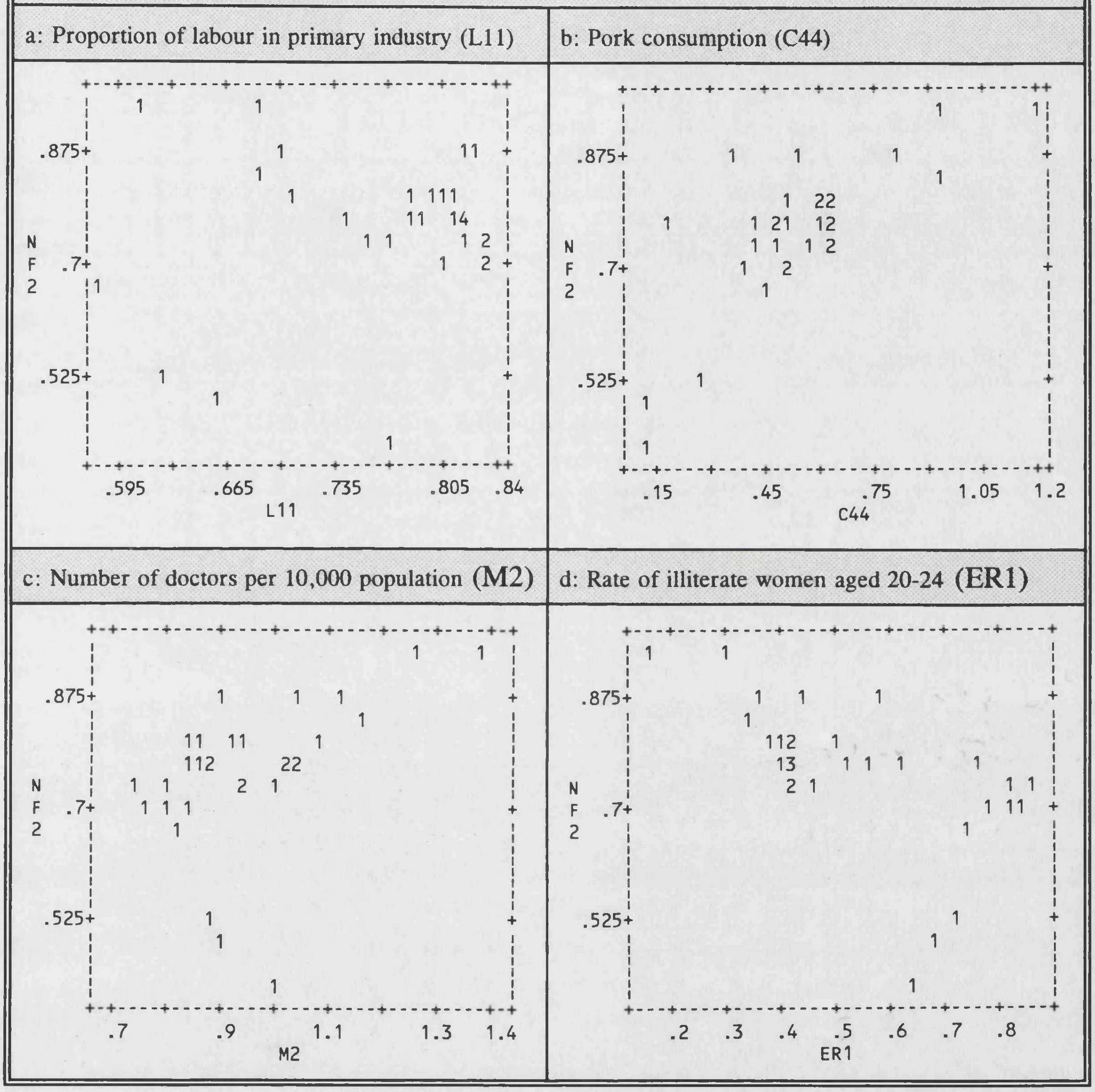

Figure 8.2(a) shows that there are three outliers far away from the majority, which are the observations made during the economic crisis of 1959-61. In fact, with the progress of the campaign for industrialization, millions of commune labourers were diverted from agriculture activities to mine coal and produce iron, in addition, the rural-urban migration was dramatic in the previous year, resulting from the great expansion of industrial construction and the relaxation of central control on worker recruitment. The ratio of industrial to agricultural labour changed spectacularly from 1:13.8 in 1957 to

1:3.5 in 1958. As a result, the rural labour force left for agricultural activities became far less than adequate. There immediately followed a prolonged drought, then heavy floods and other natural calamities which severely damaged agricultural production. Obviously, the three outliers are due to the lower level in natural fertility caused mainly by malnutrition in 1959-1961 and lower proportion of rural labour force caused by earlier labour movement. So without these three outliers, a negative sign of coefficient is obvious between NF2 and L11, and a similar phenomenon can be expected in other relationships which are contrary to our earlier expectations. Some coefficients, although have not been distorted so seriously as to change their signs, like that between NF2 and L11 by the three outliers, would have been much more significant without these three outliers, such as one between NF2 and M2, see plot(c) in Figure 8.2.

The correlation coefficient values between NF1 and the socio-economic variables in Table 8.12 present much more unrealistic signs. NF1, the natural fertility level estimated by the original version of Coale and Trussell's model, counter-intuitively was negatively related to urbanization U1, eating oil consumption C3, and gross social product SP. With variables of other food consumption and medical service, although the signs were positive, as we expected, the values of coefficients were too trivial to mean anything statistically. Thus, again, it suggests that the original version of the model is unable to provide reasonable estimates of natural fertility in this case, and the adjusted version apparently does much better here.

Some concluding remarks can be made. The strong relationships between natural fertility level and some socio-economic variables suggest that increase in natural fertility in China to a large extent matched the pattern of socio-economic development. It is quite obvious that increase in natural fertility was directly or indirectly due to industrialization, and the improvements in food consumption, medical service and education achieved. However, apart from the casual reasons such as the Great Famine during 1959-61, some weak relationships between NF2 and a couple of socio-economic indices perhaps imply that other factors, such as social customs, cultural traditions etc., may also be responsible for changes in natural fertility, for which no numerical information is available.

II.3 Multiple regression analysis

The bi-variate relationships between the index of natural fertility and some selected socio-economic variables have been examined in the preceding section. Some of these variables are highly correlated to each other (see Table 8.12). We therefore should further select those socio-economic variable most relevant to changes in natural fertility by carrying out a multiple regression analysis. Obviously, variable SP is a general index to reflect socio-economic development and represented well by other socio-economic variables. Thus it is strongly correlated with these variables, and therefore should not be chosen for the regression. Similarly, there is no need to include both the number of doctors and the number of hospital beds per 10,000 population in the regression, thus we exclude the number of hospital beds as an independent variable. However, as highly intelligent computing packages have been developed, this job could be done by computer both more efficiently and reasonably provided we set proper criteria. For simplicity, here we use the more conventional approach.

Before we proceed to our multiple regression analysis, it is to be pointed out that this sort of quantitative analysis always has its own limitations. There are several reasons why demographic relationships are inexact. First, demography is a social science that studies the behaviour of people. People do not always behave predictably. Second, no model can include all variables which can fully explain the dependent variable. Such variables as income, education, occupation, culture, nutrition, medical service, - to mention only a few - may be determinants of natural fertility, but certainly not all of them. Often because of shortage of observations (small N) or lack of data, some variables must be excluded from a model. Even if it is assumed that the impact of an omitted variable tends to cancel out or is trivial, this unidentified source of error may be serious. Finally, errors result from problems of measurement and data-collection. The use of a survey questionnaire often leads to measurement error. Or a variable may be ambiguously or poorly defined, thereby causing measurement error. This problem may not be serious if there is an equal probability of positive and negative errors occurring. Given the foregoing reasons, we have to state the assumptions of the multiple regression model before we carry out this analysis:

1, A linear equation can describe the relation between NF2 and other independent (socio-economic) variables.

2, These socio-economic variables are non-random and fixed.

3, The error term is normally distributed, and has zero expected value and constant variance for all observations, that is, the error term is 'homoscedastic' as opposed to 'heteroscedastic'.

4, The error term of any one observation is uncorrelated with any other observation. that is, there is no 'serial or auto correlation'.

Generally speaking, heteroscedasticity, multicollinearity, and autocorrelation are the three main problems in multiple regression analysis. Heteroscedasticity more often occurs in cross-section analyses in which data are collected from units that vary in size. In this case, our data are collected from units that keep the same size, thus we should not have to worry about heteroscedasticity. As we will see, the main problem involved in this case is multicollinearity. In many cases, multiple regression models have been well defined theoretically in both dependent variable and independent(explanatory) variables. Examples of this are many macroeconomic models. But in this case, so far there is no existing multiple regression model available in which natural fertility as the dependent variable and socio-economic determinants as the explanatory variables are both theoretically defined. Thus in practice, it is necessary to include as many explanatory variables as possible (because they are theoretically relevant), and to see empirically whether or not they are important. Table 8.13 presents the result of multiple regression analysis using the SPSS's BACKWARDS method by starting to include all eighteen explanatory variables into the equation.

In Table 8.13, the R square is a measure of the extent to which the independent variables have jointly explained the variation in the dependent variable, and an adjusted R Square value as a goodness-of-fit measure which takes some account of the number of explanatory variables included in the regression relative to the number of observations. Obviously, both R square values are high (0.89 and 0.85 respectively), implying that the major part of variance in natural fertility can be jointly explained by the remaining eight socio-economic variables, attached significance levels (Sig F), which indicate how stable estimated coefficients (B) are to their own variances and how relevant these remaining variables are to the dependent variable empirically. The remaining ten explanatory variables are excluded from the equation because they cannot meet the basic criterion--

Tolerance = 0.01 and F significance = 0.10.

Table 8.13 Multiple regression analysis: stage one (Tol = 0.01, F Sig = 0.10)

Dependent variable: NF2, Index of natural fertility (M)					
1 Variables in the equation					
Variable	B	SE B	Toler	F	Sig F
EP3	-0.039	0.008	0.158	22.08	0.00
ER1	-0.510	0.159	0.074	10.24	0.00
BP1	-0.025	0.007	0.088	13.49	0.00
L11	-0.509	0.242	0.209	4.42	0.05
C44	0.307	0.092	0.147	10.98	0.00
U1	1.560	0.677	0.062	5.32	0.03
C55	-0.116	0.034	0.046	11.35	0.00
M2	0.422	0.115	0.233	13.40	0.00
Constant	1.623	0.367		19.54	0.00
2 Variables not in the equation					
Variable	Partial	Toler	Min Toler	F	Sig F
C3	0.060	0.077	0.035	0.08	0.79
C2	-0.086	0.061	0.029	0.16	0.70
C1	-0.033	0.013	0.013	0.02	0.88
ER3	-0.068	0.007	0.007	0.10	0.76
EP1	-0.061	0.024	0.021	0.08	0.78
L33	0.094	0.059	0.042	0.19	0.67
BP2	0.045	0.136	0.033	0.04	0.84
EP2	-0.161	0.153	0.035	0.56	0.46
SP	-0.213	0.040	0.036	0.34	0.56
M1	0.129	0.032	0.032	0.41	0.53
Goodness-of-fit					
R Square		0.888	F		21.74
Adjusted R Square		0.847	Signif F		0.00
Durbin-Watson		2.378	Standard Error		0.04

As we mentioned before, any insignificant F-statistics which occur may result from multicollinearity. However, it does not follow that if multicollinearity were absent then all the explanatory variables would have significant F-statistics. Conversely, a high degree of multicollinearity will not necessarily result in insignificant F-statistics. As Table

8.14 shows, some of these eight explanatory variables which remain in the equation of Table 8.13 are still highly correlated with each other. The correlation coefficient between C44 and C55 is as high as 0.8449.

Table 8.14 The correlation coefficient matrix 2, 1952-81, 1986

Correlation	U1	C44	C55	M2	BP1	L11	ER1	EP3
U1	1.000	0.557	0.788	0.745	0.698	-0.543	-0.610	0.343
C44	0.558	1.000	0.845	0.598	-0.083	-0.285	-0.715	0.438
C55	0.788	0.845	1.000	0.822	0.249	-0.523	-0.809	0.486
M2	0.745	0.598	0.822	1.000	0.379	-0.452	-0.707	0.495
BP1	0.698	-0.083	0.248	0.379	1.000	-0.558	-0.006	-0.024
L11	-0.543	-0.285	-0.523	-0.452	-0.558	1.000	0.281	-0.440
ER1	0.610	-0.715	-0.809	-0.707	-0.006	0.281	1.000	-0.762
EP3	0.343	0.438	0.486	0.495	-0.024	-0.440	-0.762	1.000

Here, we can see from Table 8.13, although all the eight remaining variables have very significant levels of estimated coefficient (below 0.05), some of them have still very low levels of Tolerance, such as ER1, BP1, U1, C55, which clearly also suggests a high degree of intercorrelation (multicollinearity) among the eight remaining explanatory variables. For example, variable U1 is the index of urbanization, which reflects socio-economic development and is represented well by other socio-economic variables. Thus it is strongly correlated with these variables, and therefore there is no need to keep it in the equation. In SPSS, the Tolerance is a measure to show the relative importance of an explanatory variable when it is not in the equation by one minus a difference of R squares between the equations with and without this variable. So this measure is a tool to detect and correct multicollinearity, which shows the relative importance of an explanatory variable if it is not in the equation. Following this rule, the larger Tolerance value a variable has, the more this variable should be picked up into the equation. If the criterion of the Tolerance value is raised from 0.01 to 0.15, which means raising the threshold to prevent unqualified variables remaining in the equation, and regression is still carried out by the BACKWARDS method, we have a new model given in Table 8.15 to present the second stage of the multiple regression analysis.

Table 8.15 Multiple regression analysis: stage two (Tol = 0.15, F Sig = 0.10)

Dependent Variable.. NF2 Index of natural fertility (M)

1 Variables in the equation

Variable	B	SE B	Toler	F	Sig F
EP3	-0.026	0.006	0.394	16.64	0.00
BP1	-0.012	0.003	0.665	16.69	0.00
C44	0.209	0.066	0.414	9.93	0.00
M2	0.220	0.117	0.327	3.54	0.07
ER1	-0.323	0.117	0.200	7.57	0.01
Constant	1.082	0.188		33.12	0.00

2 Variables not in the equation

Variable	Partial	Toler	Min Toler	F	Sig F
U1	0.264	0.068	0.068	1.808	0.19
C55	-0.416	0.085	0.084	5.019	0.03
L11	0.074	0.388	0.168	0.131	0.72

3 Goodness-of-fit

R Square	0.817	F	22.27
Adjusted R Square	0.780	Signif	0.00
Durbin-Watson	2.078	Standard Error	0.05

Now we have five explanatory variables, EP3, BP1, C44, M2, ER1, and an intercept remaining in the equation to explain changes in natural fertility. In Table 8.15, as we expected, coefficients of explanatory variables 'pork consumption'(C44), 'number of doctors'(M2), are positive values--0.209, and 0.22 respectively. This means that their increases can positively contribute to the rise of natural fertility, while the negative coefficient values (-0.323) of explanatory variables 'illiteracy of young women 20-24'(ER1) mean that drops in values of these variables also contribute to increases in natural fertility.

EP3 as the 'number of primary school students per million population' also shows a negative impact on natural fertility in the equation. Any increase in EP3 could result from an increase in the proportion of primary school aged children among the total population purely due to rising fertility, or to an increase in primary school enrolment due to a mass education policy. Strong evidence indicates that the average education level achieved has risen substantially since 1950. Thus EP3 can be used as a measure representing national education level attained which, as we expected, should have a positive impact on natural fertility, because on average educated people have relatively privileged socio-economic and cultural positions. In the equation, however, the coefficient of EP3 in the equation has a negative value(-0.026). One possible reason is that opportunity costs were relatively high when children were regarded as potential labour--'economic assets'. Even though the Chinese government mostly provided a rather low fee basis, families especially in rural China had to tighten their budgets (over 70% was for food) to spare a 'part labour' to go to school. The result could be a decline in food consumption, while the expected 'profit' from this educational investment would yield a return only in five to ten years. Thus it could be negatively related to the natural fertility.

Similarly, the coefficient of 'number of wireless broadcasting stations per million population'(BP1) also has a negative value(-0.012). The possible reason for this could be that listening to the radio might be a substitute for other enjoyments (say sexual activities) during leisure time. Moreover, the radio itself used to be an expensive economic durable commodity in China and buying one might entail families tightening their remaining budgets. In any event, the value coefficient (-0.012) is too small to bear much interpretation.

In Table 8.15, we have a quite satisfactory result, which we believe fits the reality much better. Although the adjusted R Square falls slightly from 0.85 to 0.82, both F-statistics and Tolerance of the five remaining variables have very significant levels, the F Sig values of each remaining variables are still well below 0.10, after we drop U1, C55, and L11 from the equation. In addition, another important measure, the Durbin-Watson (DW) statistic in Tables 8.13 and 8.15, is the commonly used test for autocorrelation. Because the estimated standard errors of the regression coefficients could be biased downward in the presence of autocorrelation, conclusions drawn from hypothesis tests and confidence intervals can be erroneous, although the coefficients themselves are unbiased estimators. As in this case the DW value dropping from 2.378 to 2.078 is within the zone of 1.6-2.4 where there is no autocorrelation at the significance level of 0.01 given 31 observations, we have no reason to worry about autocorrelation existing in this case. Figure 8.3 suggests that the expected values estimated by the model simulated the actual trend very well.

The results in Table 8.15 present a final version of the model, in which coefficients of variables C44, M2, and ER1 are very significant, while those of EP3 and BP1 are relatively trivial. It suggests that the dynamic trend in improving food consumption and medical services, and the decrease in illiteracy of young women (20-24) explained the major part of the changes in natural fertility. In other words, substantial improvement in food consumption and medical services, and dramatic decrease of illiteracy in young mothers played the key roles in the increase in natural fertility. The coefficients of EP3(Primary school enrolment) and BP1(Radio stations) are too trivial to mean anything.

Figure 8.3 Index of underlying level of fertility NF2(M): observed trend and simulated values by the model 1952-81, 1986

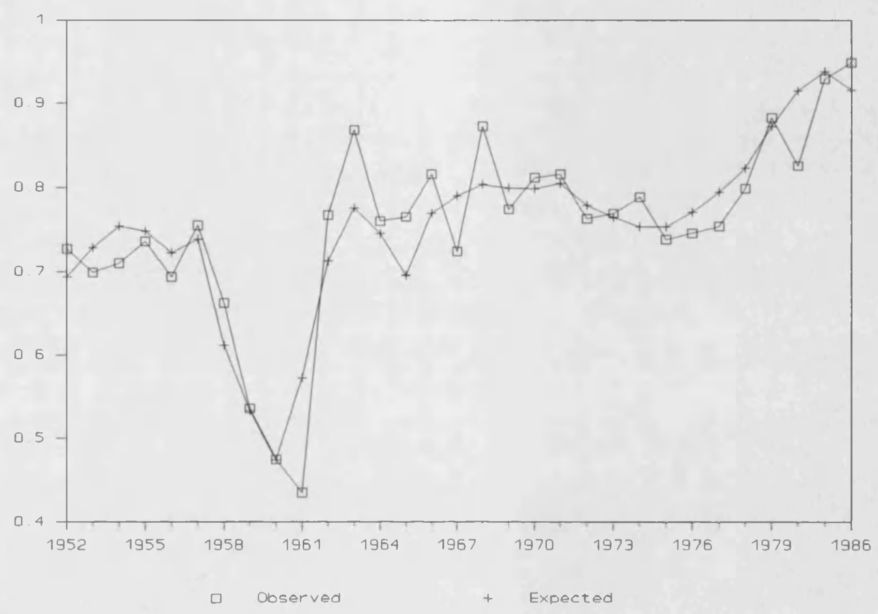

Table 8.14 indicates that there is still some intercorrelation among these remaining variables. In practice, the problem is not so much of determining whether multicollinearity is absent or present, but rather of determining the degree to which it exists, and the consequences this has for the estimated model. It is most unlikely that multicollinearity will be entirely absent from the sample data. Here we believe that if all coefficients of explanatory variables remaining in the model make sense theoretically, and meet all statistical criteria, thus being empirically significant, and finally provide a good simulation of the trend of the dependent variable, then this model is acceptable. Yet, as we mentioned, a statistical model for a social phenomenon can never be fully reliable for a variety of reasons. Therefore it is always wise to be cautious in interpreting the results.

III Summary

After 1949, the whole country of China experienced dramatic socio-economic development. Two of the most important factors with respect to natural fertility, people's real income and consumption, apart from two severe setbacks during the 'Great Famine' in 1959-61 and the 'Cultural Revolution' in 1966-76, have been making substantial improvement during the periods of 1949-57 and 1963-66, and especially 1979 onwards. The dynamics of consumption and in particular of food intake and nutrition, along with changes in other socio-economic elements such as health care, labour structure, education, ..., matched changes in the estimated underlying level of natural fertility. One by-product of the industrialization and urbanization after 1950, which transferred the labour force engaged in primary industry, mainly peasants from rural areas, into better paid industrial sectors in urban areas, contributed to the rise in the average level of people's income and living conditions, therefore indirectly prompted the rise in natural fertility, particularly after 1979.

The increases in natural fertility before 1979 were mainly contributed by progress in social and cultural aspects. Two of the greatest achievements after 1949 were the extensive programmes of health care and education. A health system and medical care for the whole nation was well built. The number of hospital beds and doctors per 10,000 population rose from 6.7 and 1.48 in 1949 to 13.6 and 21.41 in 1985 respectively for the nation as a whole. As an result, people's life expectation was raised from about 25 years in the 1930s, estimated by Barclay et al. (1976:620), to about 67 years in the 1980s. Diseases, such as venereal diseases and recurrent fever, have been successively eradicated. Improved health is likely to contribute to those biological mechanisms that are directly related to natural fertility, such as age at menarche, coital frequency, reproductive life span and so on.

Similarly, the Chinese people's education has been dramatically enhanced since 1949. The mass orientation in educational policy, on the whole, achieved great successes, such as that illiteracy was sharply reduced. The proportions of people educated to different levels among the total population were rising over time, particularly for the female students. In general, mass education has been raising up the nature of people's occupations, which are strongly related to rise in income and consumption.

On the social side, evidence suggests that the proportion of arranged marriages has been decreasing and that of nuclear families rising since 1949, particularly in urban areas. We might expect some indirect positive effect from this trend on the frequency of intercourse among couples. The sexual activities throughout marriage and the way of family life, are influenced to a certain degree by the style of forming the marriage. In a freely associated marriage and an independent nuclear family, sexual life would be relatively more cooperative and harmonious, and the family itself more stable.

Statistical analysis confirms strong relationships between natural fertility and socio-economic variables, such as total national product, food consumption, medical services, and education achieved by young women. Though simple, our method of analysis leads to a regression model which simulates rather well the trend in natural fertility. Given the limited statistical information, it suggests that the dynamic trend in changes of food consumption and medical services, and the decrease in illiteracy of young women (20-24) explained the major part of the changes in natural fertility. Less clear was the impact of changes in other socio-economic aspects.

Conclusion

During the last four decades, China has experienced a dramatic fertility transition. The total fertility rate for the nation as whole, which was around 6 in the mid-1950s fell to 2.31 in 1980. This fact, as an important phenomenon in demography, has been studied at length. However, the level of natural fertility, another very important demographic index, has received little attention. This thesis has tried to redress this imbalance. The data reviewed in this study come from three major demographic retrospective surveys taken since 1949: the 1/1000 Fertility Sample Survey in 1982, the In-Depth Fertility Survey in 1985, and the 1/100 Population Sample Survey in 1987. From this study conclusions have emerged from several aspects.

I.1 General fertility and marital fertility

The pattern and level of age specific marital fertility in 1950-54 constructed in this study from the 1/1000 Fertility Survey were remarkably close to those derived from other sources, such as from the Chinese Farm Survey in 1929-31. This underlying similarity strongly suggests that constructed marital fertility from the truncated information (before 1964) is rather robust. In contrast, the marital fertility differences between the non-contracepting Chinese population in this century and non-contracepting European populations in earlier centuries were substantial and significant. The results further support the argument initiated by Penrose (1934:108) and upheld by the Princeton group (see Barclay et al. 1976, and Coale 1984a) that Chinese 'natural' marital fertility was very low.

General fertility and marital fertility in the whole nation rose from the 1940s to the 1950s, when it was mainly uncontrolled. Exceptions were Shanghai and Beijing where contraceptive practice had already started. During the Great Famine, fertility suffered a catastrophic fall throughout the nation, although less severe falls were seen in urban areas and a few northern and southern boundary regions, and among the better educated. In the middle 1960s, the government started to carry out a birth control programme focused on the urban population. As a consequence, those regions with higher proportions of urban population experienced a sharp fertility reduction. However, as is well known, the mass fertility reduction in the whole nation started in the early 1970s, when the national family planning campaigns were launched. Even then, the marital fertility of younger age groups, such as 15-19 and 20-24, was still increasing, or was only a little reduced, as they were under less pressure from birth control policies. Fertility reductions in the whole nation gathered momentum after the 'Later, Longer, Less' policy came into effect in 1975 and even more with the 'One Child' policy in 1979, although these policies were relatively more relaxed in rural areas and particularly in ethnic minority regions. Again, marital fertility of women aged 20-24 was still rising generally. This may be a joint product from the 1980s' economic reform, which substantially improved people's livelihood and thus favoured underlying fertility, and from an upward trend of mean age at marriage to above 20 thus leading fertility of those aged 20-24 representing an earlier duration of marital fertility than before.

The widely observed negative relationship between duration of education and level of fertility has also been confirmed here. Both the general and the marital fertility of the better educated are markedly lower than among the less educated. The fertility of women at all education levels experienced a rise during the 1950s, when it was basically 'natural'. Since the middle 1960s, when the government started to carry out a birth control programme focused on the urban areas, fertility among the better educated population saw a sharp reduction. The declining trend reversed slightly during the 'Cultural Revolution', as the birth control programme was disrupted. However, massive fertility reduction at all education levels started in the early 1970s, when the national family planning campaigns were launched. The end of the 'Cultural Revolution' and the beginning of the economic reform in some ways restored the better educated's socio-economic 'privilege' and linked people's occupation and income with the length of their education. This enhanced the better educated's livelihood more than that of the less educated and thus favoured their natural fertility.

I.2 Coale-Trussell's model and its adjustment

It was Trussell (1979:46-48) himself who first realised that using original Coale-Trussell's model to discover the underlying level of natural fertility for a contracepting population was not possible. This failure is believed due to the improper assumption that younger married women were not limiting their births at all. In reality, however, in some developing societies after World War Two, like China after the 1960s, and many developed societies like Sweden in this century or even earlier, the existence of birth control among young age groups, including age group 20-24, seems likely. So the problem of the original model is a wider and more profound issue than just an assessment of Chinese trends.

The model's vital problem lies in the assumption that at age 20-24 no birth control exists and then v(20-24) was set as zero originally. So the question becomes, as v(a) has to be set arbitrarily in the first place, how big an adjustment or shift is appropriate? Here, I assume, on average, that the marital fertility of age 17.5-22.5 is much more likely to be 'natural' than that of 20-24 in China after the 1960s. This assumption subsequently assumes that the marital fertility of age 20-24 is partly controlled. This assumption is based on the real situation given that the mean age at first marriage for Chinese women was about 21-22 in the 1970s, plus one and half years of average duration between marriage and first birth, during which time birth control was unlikely according to Chinese custom. As in the model, v(a) is acting as the X-axis or a dimension to measure changes of the ratio of observed fertility to the natural standard, n(a), *Ln*[r(a)/n(a)]. Therefore it has to be linear with respect to age. So any necessary adjustment that has to be made on v(a), is just the same shift applying over all v(a)'s values.

Based on this adjusted assumption and a new v(a) schedule, I estimated M from 1950 to 1986 for China as a whole. To check the plausibility of the new schedule, I carried out a correlation analysis against estimated mean fecundability in 1952-78. The correlation coefficient between mean fecundability and the index of natural fertility (M) by the adjusted v(a) is significantly higher than the one estimated from the original model without any adjustment. This suggests that the adjusted model has a better chance of providing an accurate estimate of underlying fertility, at least in certain cases, such as in this study. The results of adjustments varying the shift on v(a) from +0.14 to -0.14, corresponding to assumed different age intervals of 'natural fertility', also indicate that underlying fertility estimates based on the assumption of fertility of women at age interval 17.5-22.5 being 'natural', have the highest correlation with fecundability. So the adjustment on v(a) by -0.14 seems most preferable. Nevertheless, it is not in a position to claim that assumption of marital fertility of age 17.5-22.5 being natural, upon which the adjustment of v(a) is to be made, is the best or unique. This feature of the unobtainable optimal adjustment on v(a) is decided by the model itself, simply because v(a) has to be set arbitrarily in one way or another. Unless age at entry into marriage and childbearing are homogeneous, any arbitrary assumption of a certain five-years age interval as 'natural', which can also fit reality perfectly well, seems not existing. The best idea is to assess it relative to reality to see whether it is rational.

Three schedules of marital fertility, two from non-mainland Chinese regions, Taiwan and Hong Kong, and one from Japan, were selected to test our adjusted model. The level and pattern of marital fertility schedules from these three populations before the 1960s were very close to those of mainland Chinese, and were mainly 'natural fertility'. The estimated underlying level of natural fertility also rose until the 1960s in both versions of the model. After that the rising trend stopped or even reversed when assessed by the original model. This phenomenon, similar to what was found by Trussell from Sweden, is unlikely to match reality, since a dramatic economic development and significant improvement in consumption have occurred in all three populations since the War, which makes an arrested increase of trend in underlying fertility very difficult to explain. The problem is clear: the increasing popularity of family planning after the 1960s led younger married women to use birth control, even including those aged 20-24. Evidence from these three selected populations, particularly from Taiwan, suggest that the modified version of the model is able to provide more realistic estimates of underlying fertility (M) than the original version. However, the degree of adjustment, which is based on the Chinese situation, may not be most appropriate to all three populations, as overestimates and underestimates are obvious for Japan and Hong Kong respectively. For the Taiwanese, who had the closest conditions to the mainlanders (the two regions' patterns and levels of marital fertility were almost identical), the adjusted model seems to provide very plausible estimates. This further indicates that our assumption of natural fertility at age interval 17.5-22.5 and subsequently the amount of adjustment, -0.14 on v(a), designed for the Chinese case, although simple, is nonetheless reasonable and sufficient for our purpose.

This study has tried to use both the original model and its adjusted version to examine changes in the underlying level of natural fertility in China. The two sets of estimated M values from the two versions are very close until the later 1960s, when the marital fertility was essentially 'natural'. But after that, especially after 1979, the adjusted model seems to be a more sensitive way to capture changes in the underlying level of natural fertility than the original model, as it identifies a growing trend of natural fertility, which matches the situation of rapidly changing conditions favouring natural fertility. After the late 1960s the natural fertility based on the original model seems considerably underestimated, leading to unrealistic results. The same conclusion holds after the two versions of the model are applied to urban-rural, regional and educational divisions.

I.3 The underlying level of natural fertility

The underlying level of natural fertility in China in the 1950s seems to confirm the general observation of Barclay et al. (1976:615) that fertility in rural China in 1929-31 was remarkably low relative to that of recorded European populations. Their estimate of natural fertility in rural China in 1929-31 was about 0.62, which is quite close to an estimated level of 0.68 in the early 1950s for China as a whole. The estimated natural fertility levels for mainland China are also close to those for non-mainland Chinese and other Far East Asian nations, as these were about 0.79 (0.76 by the original model) for the later 1960s for the mainland, and 0.82 for Taiwan in 1956, 1.02 for Hong Kong in 1961, 1.00 for Singapore in 1957, and 0.81 for Korea in 1961, as observed by Knodel (1977:228).

Concerning changes of natural fertility, the evidence from the reproductive histories of couples married between the 1940s and the 1980s in the three surveys strongly suggests that it increased significantly over the period in China as a whole. In the 1940s, although lacking data of age-specific marital fertility to estimate the natural fertility, a consistent trend in the 1950s and 1960s between natural fertility and duration-specific marital fertility, and other indices such as TFR and fecundability, suggests that natural fertility might have risen in this decade. The general pattern of natural fertility rising in China since the 1940s is obviously concentrated in certain periods, and strikingly in three: 1950-57, 1963-68, and 1979 onwards. All three periods are marked by economic development and consumption improvement. Apart from economic factors, each increase has its own characteristics: the 1950-57 rise is related to post-war peace and prosperity, while 1963-68 is attributable to the post-famine baby-boom, and the last rise is prompted by the social and ideological revolution which has swept China since the 1980s.

The urban-rural division confirms the national rising trend in natural fertility, though natural fertility is generally lower among rural women than their urban counterparts. There was only a slightly higher proportion of pre-marital conceptions in urban areas, which may not be sufficient to fully account for the urban-rural differential in underlying level of natural fertility. All the regional and educational division evidence confirms the national trend, but shows that more significant rises occurred in coastal areas and the three municipality cities, and less marked rises in inland provinces or ethnic minority areas; and that more significant rises took place among the better educated generally, with smaller rises for others. Exceptions were trends observed from Shanghai's and university educated women, the increases of their natural fertility were not as distinct as expected. The possible reason is a more controlled marital fertility for these women aged 20-24 than those in other regions or of other education groups so that even the adjusted model may not be 'adjusted' adequately to this particular situation and thus is unable to detect the real amount of the rise.

This rise in natural fertility in the whole nation may be wholly or in part an artefact of changing patterns of premarital sexual behaviour. Pre-nuptial pregnancies can lead to post-nuptial births and thus artificially inflate marital fertility at ages where newly-weds make up a large proportion of married women. This inflated marital fertility leads to M being overestimated. However, observed evidence suggests that extremely few women engage in pre-nuptial sexual activities. Less than three percent of urban Chinese brides were pregnant on the day of their wedding, and less than two percent in rural areas. Despite a lack of the most recent statistics, there was growing evidence of premarital sexual behaviour from the later 1970s and perhaps more in the 1980s. But so far as the observed period in this study is concerned, the proportion of pregnant brides for the nation as a whole was well below 5%--a much lower level than in many other countries. Thus the influence on estimated M values contributed by the pre-marital pregnancies is negligible.

From the early 1940s the mean age at first marriage kept increasing until the 1980s.

This increase was relatively slow before 1970 and accelerated over the 1970s. The national average of age at first marriage rose by 2.6 years during the 1950s and the 1960s, and by 1.6 years during the 1970s. However, after age at first marriage is controlled for, we still found that marital fertility in marriage duration 13-24 months increased over the three decades from the 1950 to 1980, and first birth interval shortened after 1970. This certainly removes any idea that the increase in natural fertility in China was mainly due to the mean age at first marriage rising from an age of less reproductive potential to one of peak potential.

I.4 Fecundability and birth intervals

Our estimate of mean fecundability for Chinese women obtained by using an adjusted version of Bongaarts' well-known model is consistent with other studies, such as the average monthly conception rates estimated by Coale et al. (1988:19) and fecundability for Taiwanese women by Jain (1969a:80). All these estimates confirm the arguments that Chinese women's fecundability was traditionally very low. The fact that the fecundability of modern Chinese women, even among those with better socio-economic status, such as women living in urban areas and or having longer education, was still substantially lower than that of European populations in the past, may well be related to a variety of factors, especially Chinese culture and custom, rather than mainly due to socio-economic underdevelopment. For example, longer durations of breastfeeding and negative attitudes towards sex in traditional beliefs about good health encouraged men to restrain sexual desire. However, this comparatively low level of fecundability did not prevent the population's growth. It was the 'universal' and early marriage and 'natural' fertility patterns that overcame the low fecundability and high mortality and kept the population growing, albeit slowly, before the 1950s. The rapid population growth after 1949 was mainly connected with increasing fecundability, which resulted in a shortening of birth intervals, and with a reduced length of breastfeeding, combined with significant improvements in health and decline in mortality.

The estimated mean fecundability for rural China, and for less educated women, is even lower. The main causes are believed to be the even longer duration of breastfeeding and the more limited coital frequency which probably resulted from the prevalence of arranged marriage and young ages entry into unions. Given that Chinese fecundability was historically low, a substantial rise in the fecundability of the nation as a whole after 1940, especially after 1950 is evident. It rose slightly from the later 1940s, after the War finished with the Japanese surrender. The national economy then recovered somewhat, only to worsen again with the outbreak of the civil war. During the mid 1940s, fecundability remained around 0.045. It then increased substantially from 0.052 for women married in 1950 to 0.085 in 1957 for China as whole. There was a predictable trough of 0.039 for those married around the troubles of 1958-60, with a steady recovery after 1961. Finally, a substantial increase occurred in the later 1970s to 0.16, the total rise amounting to 250 percent for the whole nation over the forty years. The most recent evidence of shortening first birth interval also indicates that this increasing trend was still holding in the 1980s.

Reform towards free marriage, a rising age at marriage, and a reduction in breastfeeding are possible factors to promote the fecundability increase since the 1940s. As a consequence, birth intervals, particularly first intervals, have been reduced dramatically since the 1930s, although the trend among second intervals is less clear after the 1960s, when reproductive behaviour was affected by birth control practice. Similar evidence can be found from women among educational divisions. Mean fecundability was generally lower before the 1950s, particularly for illiterate women. A significant upward trend in fecundability in all educational divisions can be observed since the 1940s. Better educated women seem to have enjoyed a greater rise in fecundability than the other less educated.

The impact of the rise of fecundability on the interval between marriage and first birth can be identified in the observed mean first interval, which fell from around 40 months to about 20 months for the nation as a whole between the 1930s and the later 1970s, and to about 15 months by the middle of the 1980s. Looking at urban-rural divisions, the observed mean length of first interval fell from 31 and 34 months to 16 and 20 months for the urban and rural areas respectively between the 1940s and the later 1970s. Examining regional divisions, it is evident that the first birth interval in most regions has shortened. Again, the first birth intervals for women in all educational divisions have also consistently shortened. Similar trends have been observed in other Asian countries where they have been partly attributed to increases in age at marriage and changes in marriage customs.

Compared with the massive decline in first intervals, the mean second birth intervals, kept more or less steady, though a substantial decline is still obvious in the fall from 35 months in the first birth cohorts of the middle 1940s to 30 months at the end of the 1960s for the whole nation. For the urban-rural divisions, two declining trends were fairly close until the 1960s. Since then, they began to diverge. The second interval has risen, steadily in the 1970s and more rapidly in the 1980s in urban areas. In rural areas, it remained unchanged in the early 1970s and picked up afterwards. This observed lengthening of birth intervals in the 1970s is likely to reflect mainly the influence of the 'Later-Longer-Less' policy rather than of conditions favourable to fertility deteriorating. For the regions, the evidence is somewhat mixed, notably in a few well-developed regions such as Tianjin, Helongjiang, Jilin, and Shanghai where birth control might play a role in this scenario. The downward trend in the second birth intervals before the 1970s is also less clear among the better educated. This is partly because the full information needed to estimate the second interval is only available up to 1970, and partly because the better educated exercised birth control as early as the 1950s, thus leading to second intervals to be much less 'natural' than those of the less educated.

I.5 Breastfeeding

The average duration of breastfeeding in the three regions of Hebei, Shaanxi, and Shanghai as a whole, indicated by the In-Depth Fertility Survey in 1985, stayed more or less unchanged at 17 months until the middle of the 1970s. This was somewhat higher than that in most other developing countries seen in studies such as the one by Trussell (1992:301). Then it declined dramatically to 11.7 months in the 1980s. This matched well with the trends of rising natural fertility and fecundability. The proportion of children not breastfed, another indication of the importance of breastfeeding in developing countries, was very low but rose steadily from 1.73% to 3.49%. The breastfeeding patterns show marked differences between the three regions, although the mean duration dropped in all three surveyed regions, particularly after the 1970s and for those mothers aged below 40. Mothers in Shanghai generally undertook about four months less breastfeeding than those from less developed regions like Shaanxi. Analogously, the proportion of non-breastfed children was substantially higher in Shanghai.

There appears to be an increase in breastfeeding duration with age, which is also consistent with findings in other developing countries. The more recent the cohort a woman belonged to, the shorter the breastfeeding she undertook, especially those aged under 30. This might be due to the trend of increasing education and employment opportunities for Chinese women, and a fundamental change in the socio-economic structure and ideology after 1978. This evidence may support the argument based on cross-sectional findings that the degree of modernization (urbanization) was negatively associated with duration of breastfeeding and that shortening the duration was inevitable as modernization spread. An interesting phenomenon is that the proportion of non-breastfed was mainly influenced by birth cohort rather than by age, while the duration of breastfeeding was mainly influenced by the mother's age.

The average duration of breastfeeding in China before the 1970s was longer in rural areas than in urban. Corresponding to this, the proportions of urban women who did not breastfeed their children were consistently higher than for rural women. Similarly, educated mothers carried out three to four months of breastfeeding less than illiterate mothers. Moreover, the proportion of non-breastfed children was also substantially higher among mothers educated up to secondary school and over, but the difference of non-breastfed proportions between primary school educated mothers and illiterate mothers was trivial.

I.6 Childlessness

Following the conventional approach, we use childlessness as a proxy to measure primary sterility among Chinese women. This is probably justifiable and more robust than in many other countries, given the fact that marriage and childbearing are virtually universal in China. The observed U-shape curve of proportions of childless is consistent with observations from other developing countries. Percentages of childless among Chinese women were close to those of neighbouring nations in Far East Asia, though Chinese women had relatively lower proportions of childless in the same age spans.

The 1982 1/1000 Fertility Survey and the 1987 1/100 Population Survey paint a broadly similar picture of a declining proportion of women with no live birth from the oldest age group, 65-67, to a younger one, 35-39, with a dramatic drop from 50-54 to 45-49. The differences of childlessness over the age groups in the two surveys suggest that changes in primary sterility have contributed somewhat to the natural fertility rise in China. This trend is confirmed by Feeney and Wang (1993:71), who find that in the 1988 Two-Per-1000 Fertility Survey there are notably lower proportions of childless women than in the 1982 1/1000 Survey and this trend continued after 1981 up to 1987, the latest year in the 1988 survey. This tendency over the decades might be partly associated with the fact that elderly Chinese women often have difficulty in recalling children who died as infants. But more fundamentally, it seems to have resulted from the improvement of people's health and medical services, particularly the elimination of venereal diseases and tuberculosis.

For urban-rural divisions, childlessness, as expected, dropped over age spans in both urban and rural areas, but unexpectedly it was higher on the urban side. Possible explanations are (1), higher remarriage rates resulted from worse mortality in rural areas and may indirectly have acted as a reducing factor to childlessness by giving women with sterile husbands a chance to remarry, (2), a higher rate of reporting error in rural China where some adopted children were misreported as natural children, and finally (3), urban areas might have had a higher incidence of venereal disease before 1949. As for regional variations, in the coastal regions childlessness generally dropped more significantly and the proportions were also broadly lower. Exceptions do exist, such as in the three municipality cities which historically had the highest proportions childless. These cities were likely to have been affected by more severe venereal diseases. Similarly, lower proportions of childless were also observed in some inland and less-developed regions such as Yunnan, Guizhou, and Inner Mongolia. Within education divisions, again, there were more childless among the better educated elderly women, generally, than the less educated. This might be difficult to explain as due to venereal disease. Among the better educated, one extra likely reason, apart from the lower remarriage rates and reporting errors mentioned above, were higher rates of marital disruption, as these spouses were more likely to have been separated by occupational duties.

I.7 Socio-economic process and statistical analysis

Since 1949, the whole of China has indeed experienced dramatic changes in its socio-economic make-up. One of the most important factors with respect to natural fertility is people's real income and consumption, which substantially increased during the periods of 1949-57, 1963-66, and particularly during the post-Mao economic reform after 1979. The dynamic changes in people's consumption, and in particular food intake and nutrition, along with changes derived from economic development, such as labour structure and urbanization, matched changes in the estimated natural fertility.

Health care programmes and mass education in China have been other examples of the country's main achievements. As an result, people's life expectation has been raised by about forty years since the 1930s. We can expect that people's improved health most likely led to a rise in natural fertility in China. The people's education has also made dramatic progress since 1949. The mass orientation in educational policy has, on the whole, achieved great successes, and the illiteracy rate has been sharply reduced. The average duration of education has also been rising, in particular for female students. In general, mass education can contribute to people's better health interactively and has played a part in upgrading the class of their occupations, which are strongly related to rises in income and consumption. In social aspect, evidence indicates that the proportion of arranged marriages has been decreasing and the proportion of nuclear families rising since 1949, especially in urban areas. We expect some indirect positive effect from these trends on the people's sexual activities and family's stability.

Correlation analysis also indicates strong linkages between natural fertility and socio-economic variables, such as total national product, food consumption, medical services, and education level achieved by young mothers. Finally, a statistical regression model simulates rather well the trend in natural fertility. Given the limited quantitative information, the model suggests that the dynamic trend in improving food consumption and medical services, and the decrease in illiteracy of young mothers (20-24) explained the major part of the change in natural fertility.

I.8 Further discussion

Some ideas about how to carry this study further are perhaps worth pursuing, since a number of interesting questions remain to be addressed completely, and some arise from the study itself. Further scope to carry on the study could be derived from both availability of more information and methodological development. One great benefit to the study of this topic in future could come from availability of the information from the 1991 National Census. The latest information on the rise in natural fertility in the 1980s came from the 1987 One Percent Population Sample Survey, which only partially covers the 1980s. Ideally, we could estimate M for the rest of the 1980s, and explore relationships between natural fertility and the overwhelming changes in socio-economic and cultural areas in the 1980s more deeply and comprehensively, including geographical and educational variations, by fully exploiting the information from the 1991 Census. The detailed published data from the 1991 Census seem to be available recently.

From a biological point of view, as we mentioned before, the proximate determinants such as fecundability, breastfeeding, primary sterility, and age at first marriage, contributed to the increase in natural fertility. However, we estimated the natural fertility by Coale-Trussell's model and by using marital fertility only from age groups 20-24 to 40-44, which were affected most by the proximate determinants. So the rise in natural fertility studied here was mainly contributed by the changes in fecundability and post-partum non-susceptibility, while behind these two, in fact, coital frequency and breastfeeding played critical parts. Relating to the socio-economic context, we can see, that it was both economic and socio-ideological factors that influenced the natural fertility operating through coital frequency and breastfeeding behaviour. Therefore we can fully recover the underlying mechanism behind natural fertility by gaining and analysing more data on coital frequency and breastfeeding.

As far as breastfeeding is concerned, this study had to rely on the 1985 In-Depth Fertility Survey (Phase-I), which first provided unique information on mainland Chinese women's breastfeeding behaviour. Although it supplies quite comprehensive and detailed statistics about breastfeeding, it fails to provide adequate information either historically or geographically. It covers only three regions, and only starts from the 1960s and is truncated after 1982, so that interesting questions remain to be answered. These include the issue of what was the impact on breastfeeding and thus on natural fertility of the 1980s employment boom induced by economic reform, and when ideological change in the traditional value system was also taking place. The In-Depth Fertility Survey (Phase-II), which covers six more provinces or regions and a more recent period than the survey (Phase-I), has just been carried out ~~a fewer of years ago~~. When ~~the~~ its (Phase-II) information is available, it certainly will provide ~~with~~ this study with more space to explore.

Statistical information on coital frequency hardly existed in China at all, compared with other demographic statistics. However, sex as a cultural taboo is being touched on and has been discussed more openly since 1979. In particular, tentative surveys have been carried out recently, such as the survey carried out by W. Geng and B. Zha during 1988-1990. The comprehensive information on coital frequency with respect to different social strata, occupation, type of residence (urban or rural), time period, and education, will become available at some point. Thus it will provide a new and wider angle to this study.

Apart from advances prompted by extra information in the future, fresh research scope could also be rendered by methodological progress. In Chapter 3, an adjusted version of Coale-Trussell's model has been developed, by deriving a new birth control schedule v2(a), while the other parameters remain the same. This adjusted model proved more sensitive in interpreting the underlying level of natural fertility in this case. Thus, an interesting question concerns the wider implications, such as applying this method to similar cases in other parts of the world, where women's birth control behaviour starts earlier than original Coale-Trussell's model assumed. Perhaps, a more fundamental contribution could be made by developing a general rule to determine or manipulate the v(a) schedule. This general rule could give a standard method whereby v(a) could be adjusted or reset, and should be able to apply to different circumstances where the degree and pattern of birth controlled fertility vary. We may call it a general flexible version of Coale-Trussell's model.

The main purpose of the general and flexible version of the model would be to make comparisons between different populations. We would be able to work out different underlying levels of natural fertility in the countries concerned, and study differences in estimated levels of natural fertility between countries by separating the differences contributed by the model's adjustment, and by the applied marital fertility schedule itself. We could make further comparisons between different Chinese populations, such as mainland Chinese and those in Taiwan, Hong Kong, Singapore, or comparisons among racially close populations, such as comparing the Chinese with the Japanese or Koreans, or even with totally different races. After these sorts of comparisons, we should be able not only to see the different roles played by natural fertility and birth control in each particular fertility regime, but also to go back to the model itself, to see whether its general version could offer insights not provided by the original formulation.

Appendix

Table 10.1 Age specific ever-married fertility rates(China as a whole)

Year	Age Group 20-24	25-29	30-34	35-39	40-44
1950	0.287	0.269	0.224	0.156	0.084
1951	0.277	0.261	0.217	0.151	0.081
1952	0.319	0.302	0.252	0.175	0.094
1953	0.310	0.284	0.236	0.164	0.089
1954	0.311	0.295	0.246	0.171	0.092
1955	0.325	0.301	0.251	0.175	0.094
1956	0.310	0.280	0.236	0.165	0.089
1957	0.334	0.312	0.272	0.189	0.102
1958	0.291	0.278	0.241	0.168	0.091
1959	0.229	0.225	0.184	0.124	0.067
1960	0.219	0.209	0.170	0.141	0.076
1961	0.182	0.187	0.143	0.096	0.052
1962	0.332	0.325	0.266	0.186	0.100
1963	0.397	0.374	0.328	0.258	0.139
1964	0.341	0.314	0.259	0.189	0.102
1965	0.337	0.316	0.258	0.197	0.097
1966	0.361	0.320	0.274	0.200	0.096
1967	0.311	0.293	0.225	0.166	0.079
1968	0.379	0.350	0.276	0.200	0.098
1969	0.330	0.314	0.245	0.179	0.085
1970	0.350	0.315	0.254	0.179	0.084
1971	0.347	0.310	0.229	0.166	0.074
1972	0.323	0.292	0.214	0.147	0.069
1973	0.321	0.281	0.194	0.125	0.058
1974	0.342	0.264	0.171	0.107	0.051
1975	0.314	0.244	0.140	0.087	0.041
1976	0.311	0.239	0.122	0.069	0.034
1977	0.300	0.223	0.105	0.057	0.024
1978	0.305	0.230	0.100	0.044	0.021
1979	0.335	0.243	0.096	0.041	0.019
1980	0.295	0.208	0.066	0.028	0.011
1981	0.350	0.226	0.072	0.031	0.013

*Source: the 1982 1/1000 Fertility Survey.

Table 10.2 Index of fertility control(m) and underlying level of fertility(M), by the Coale-Trussell's model(v1) and its adjusted version (v2) 1950-86: China as a whole

Year	M(v1)	M(v2)	m	mse	R^2
1950	0.635	0.653	0.192	0.0017	0.802
1951	0.615	0.631	0.190	0.0017	0.797
1952	0.709	0.727	0.186	0.0017	0.782
1953	0.679	0.699	0.205	0.0015	0.836
1954	0.691	0.710	0.185	0.0018	0.781
1955	0.716	0.736	0.198	0.0016	0.821
1956	0.675	0.694	0.200	0.0014	0.840
1957	0.739	0.755	0.156	0.0014	0.757
1958	0.650	0.663	0.147	0.0016	0.700
1959	0.520	0.536	0.212	0.0029	0.730
1960	0.472	0.475	0.051	0.0014	0.108
1961	0.420	0.435	0.246	0.0046	0.698
1962	0.748	0.767	0.182	0.0022	0.724
1963	0.863	0.869	0.044	0.0004	0.437
1964	0.742	0.760	0.169	0.0012	0.814
1965	0.746	0.765	0.183	0.0003	0.950
1966	0.790	0.816	0.225	0.0001	0.991
1967	0.697	0.724	0.275	0.0009	0.943
1968	0.841	0.873	0.267	0.0006	0.959
1969	0.745	0.774	0.272	0.0008	0.945
1970	0.778	0.812	0.308	0.0003	0.985
1971	0.772	0.816	0.394	0.0005	0.982
1972	0.720	0.763	0.408	0.0010	0.969
1973	0.714	0.769	0.533	0.0016	0.971
1974	0.719	0.789	0.666	0.0039	0.957
1975	0.662	0.738	0.776	0.0072	0.941
1976	0.655	0.746	0.932	0.0135	0.924
1977	0.643	0.754	1.141	0.0103	0.961
1978	0.666	0.799	1.309	0.0218	0.937
1979	0.722	0.883	1.441	0.0272	0.936
1980	0.647	0.826	1.744	0.0281	0.954
1981	0.729	0.930	1.745	0.0329	0.946
1986	0.701	0.949	2.173	0.0293	0.945

Restriction: the five-years age groups from 20-24 to 40-44 are used for the estimation.
* m estimates, mse(mean square error) and R^2 values are same in two versions of the CT model.

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