

**Social and Economic Development  
and the Fertility Transitions  
in Mainland China and Taiwan**

**Dudley L. Poston, Jr.**

**Texas A&M University  
College Station, Texas 77843-4351  
U.S.A.**

**Revision of a Paper Presented at the  
Conference on Economic Aspects of the Demographic Transition:  
The Experience of Asian-Pacific Countries,  
Taipei, Taiwan, June 20-21, 1998**

**This Draft Completed on October 21, 1999**

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**INTRODUCTION**

Mainland China and Taiwan<sup>1</sup> have experienced dramatic reductions in their fertility rates in the past 40 years, from total fertility rates (TFRs) of greater than 6 in the early 1950s to TFRs in 1997 of less than 2. In Figure 1 we have charted the course of fertility since the 1950s for China and Taiwan. In the 1950s both countries had TFRs of more than 6 children per woman, and in 1997 of less than 2 children per woman. China has followed a somewhat different course than Taiwan, and we discuss below some of these divergencies. A few parts of China, namely Beijing, Shanghai and some of the other cities experienced fertility transitions and changes very similar to those observed in Taiwan (cf., Lee and Wang, 1999, Figure 7), while the transition in China as a whole began some twenty or so years later. Nevertheless it is particularly striking that in the early 1950s and in the late 1990s both countries were at about the exact same fertility levels (Figure 1).

The question we address in this paper is to what degree may the fertility reductions in China and Taiwan be viewed as responses to social and economic development. It is thought

that the declines in Taiwan resulted mainly from voluntary reductions in family size induced in large part by social and economic development (Sun, 1984; Feeney, 1994). The fertility reduction in Mainland China has been due in part to social and economic development (Tien, 1984; Poston and Gu, 1987; among many others), and in part to a “direct and forceful government intervention” in family planning (Wolf 1986, 101; see also Feeney and Wang, 1993). Family planning programs were also influential in Taiwan, but participation in them was largely voluntary (Freedman’s [1998] recent memoir provides details).

In this paper, we examine how social and economic development factors in Taiwan and Mainland China have operated independently and together to influence fertility change. We address this issue cross-sectionally using sub-regional data for a few points in time. One reason for taking this route is that annual time-series data are not available for each of the countries in the kinds of descriptive detail necessary. In our paper, thus, we specifically examine the development and fertility relationship among the sub-regions of Taiwan and China in the following ways: we use data for the provinces and for the counties of China for 1982, 1990, and 1995; and for the counties and cities of Taiwan for 1980, 1990 and 1995. Even though we undertake the cross-sectional investigations for time periods (1980 and 1982) after the transitions in China and Taiwan had already begun, the analyses will be instructive if only because of its sub-regional focus. Most prior cross-sectional investigations of development and fertility have been conducted among countries (for examples see, among many others, Mauldin and Berelson [1978], Tsui and Bogue [1978], Hernandez [1984], Donaldson [1991], Mauldin and Ross [1991], and Livi-Bacci [1997: chapter 5]).

Finally, there are important methodological reservations about the extent to which an essentially diachronic relationship, such as that between social and economic development and fertility, may be investigated with cross-sectional data (Alker, 1969; Lieberman and Hansen, 1974). We hold that our results should provide some insight into processual issues regarding the mechanisms of fertility change in general, and the degree to which social and economic factors play a role in their change and decline.

### **RATIONALE**

The analytic question guiding this investigation of fertility patterns in China and Taiwan is with the extent to which factors of social and economic development are related to fertility among the countries' sub-regions. The broader theoretical model focuses on factors of social and economic development and their direct effects, and indirect effects through family planning programs and behaviors and other more proximate fertility variables, on fertility. Development is typically viewed as providing an aggregate setting which influences fertility directly. Blake (1973) noted many years ago that social and economic structures and institutions tend to influence reproductive motivation and fertility by specifying the reward structures related with childbearing (also see Hernandez, 1984: 11-13). In Tien's (1984) analysis of Chinese fertility patterns he observed that among those sub-areas experiencing the greatest fertility decline that "profound changes in socioeconomic structure may have occurred at the same time" (1984: 385). Birdsall and Jamison (1983) and Poston and Gu (1987) have made similar arguments. And Sun (1984) found similar patterns in his cross-sectional analysis of Taiwan (see also Poston [1988]).

Factors of social and economic development may also influence fertility indirectly through family planning programs and behaviors and other variables more proximate to fertility (see Hernandez [1984: 101-102], among others). In this context family planning programs and services are seen as facilitating an already preeminent relationship. Without the prior effects of social and economic development on reward structures, however, there would be little or no effect of family planning on fertility. Many of the analyses investigating the differential impacts of development and family planning on fertility have shown that the effects of development are usually stronger than those dealing with family planning (Schultz, 1971, 1980, 1994; Gertler and Molyneaux, 1994, 1998; Pritchett, 1994a, 1994b; Hirschman and Young, 1998).

Our focus thus is on the effects on fertility of social and economic development. This general idea that fertility rates, as well as mortality rates, fall in response to increases in social and economic development is central to the classical theory of demographic transition, as originally described by Notestein (1953). As Mason has noted “this theory attributes fertility decline to changes in social life that accompany, and are presumed to be caused by, industrialization and urbanization. These changes initially produce a decline in mortality, which sets the stage for – or by itself may bring about – fertility decline by increasing the survival of children, and hence the size of families” (Mason, 1997: 444).

Demographic transition theory per se has been the subject of critical debate among demographers in recent years. Hirschman (1994), for example, has asked about its overall utility. He has correctly observed that “over the past few decades intensive research on demographic change in historical and contemporary societies has revealed complex patterns that do not fit neatly into earlier theoretical schema” (1994: 204). The extensive publications of

the European Fertility Project (see Coale and Watkins [1986] for a summary) have indeed shown many exceptions to the general theory. For instance, in some of the European countries, fertility change was rapid, and in others gradual. Also the initial declines in fertility were not always responses to prior changes in urbanization, literacy, agricultural production, and labor force activity (see, for instance, Knodel and van de Walle [1979] and Kertzer and Hogan [1989: chapter 8]). So extensive have been the critiques of demographic transition theory that Greenhalgh has observed that the “edifice of demographic transition theory has been cracking for well over a decade” (1990: 86), Alter has written that it “has been dramatically shattered” (1992: 13), and Hirschman has stated that the “theory is near death” (1994: 213). And what may be the ultimate embarrassment for demographers is Fricke’s observation about the demise of classic demographic transition theory: “Wielding the hammers that drove the nails into its coffin were demographers themselves ...” (1997: 825).

These critiques notwithstanding, some of the ideas of demographic transition theory “are hard to ignore and ... live on” (Mason, 1997: 444). This is due in part to the fact that, according to Hirschman, “there is no consensus on an alternative theory to replace demographic transition theory” (1994: 214). More importantly in our view is McNicoll’s point that some of its ideas persist because “at least in general terms, many of the [theory’s] associations are quite well substantiated – though allowing ample scope for dispute over emphasis” (1992: 92).

We hold that demographic transition theory and its emphasis on the effects on fertility of social and economic development should not be discarded, but, instead, subjected to a more careful and critical review. The specific components of development need to be

established and their relationships with fertility scrutinized and evaluated. We agree with many scholars that the characteristics of the demographic transition in developing countries, especially China and Taiwan, do indeed differ from the transitions of many of the European countries (Teitelbaum, 1975; Leete, 1987). And we echo Hirschman's observation that "the basic flaw in demographic transition theory ... is the assumption that there is a single monolithic pattern of modernization that could be indexed by any socioeconomic variable ... The real theoretical challenge is to specify more clearly what aspects of modernization are linked to fertility change" (1994: 220). This is precisely our objective in the analyses below of fertility change in China and Taiwan.

Goldscheider (1971) wrote many years ago "that the key to understanding modernization begins with the process of social differentiation, which involves the evolution of specialized role structures from multifunctional structures ... (and in particular) the separation of economic, family and religious, political and stratification systems" (1971: 93). Hernandez (1984) has noted that in the context of modernization and development, social and economic conditions, "and the resulting reproductive motivation of individuals together determine the extent to which individuals limit their own fertility, and hence the extent to which national fertility levels change through time" (1984: 11).

In considering the overall aggregate relationship between development and fertility, we follow Goldscheider and Hernandez, among others, and propose four specific factors to have particularly influential effects on fertility: one, increases and advances in structural economic development, specifically participation in the nonagricultural labor force, and economic productivity; two, overall improvements in general health conditions, especially reductions in

infant mortality; three, improvements in overall social conditions and livelihood, particularly in educational attainment; and four, both absolute and relative improvements in female status.

There is a modest literature showing one or more of the above social and economic development factors to be influential in accounting for fertility trends in China (Birdsall and Jamison, 1983; Tien, 1984; Poston and Gu, 1987; Gu, 1989; Poston and Jia, 1990; among others), and in Taiwan (Schutjer and Stokes, 1984; Sun, 1984; Easterlin and Crimmons, 1985; Poston, 1988; Jia, 1991; Robey, 1991; Sanchez, 1993; Feeney, 1994; among others). A contribution our analysis will make to this literature is the separation and analysis of the effects on fertility of specific aspects of social and economic development. We turn now to the cross-sectional investigations of fertility in China and in Taiwan.

### **Empirical Investigations**

We have shown above in Figure 1 the very similar declines in fertility in China and Taiwan, from total fertility rates of more than 6 in the 1950s to less than 2 in 1997. In Taiwan, these fertility declines mirrored in important ways changes in economic development, which, Feeney has argued, affected the overall economic costs and social value of children (1994: 518). Sun has written that “urban industrial development had strong effects on fertility in the early stages of the fertility transition” (1984: 49), but not necessarily in the later stages.

In China, the overall trends in fertility since 1950 reflect the effects of both social and economic development as well as the influences of a compulsory family limitation policy (Poston, 1992; Feeney and Wang, 1993). The dramatic drop in the TFR from the late 1950s to early 1960s was caused by the famine experienced in China during and immediately after

Mao's "Great Leap Forward" program; the program and the famine led to serious conditions of subfecundity as well as to disruptions for many couples in their patterns of normal married life (Coale, 1984; Chen, 1984; Poston, 1992). The marked increases in the TFR in the early 1960s occurred in conjunction with the economic recovery in China, and resulted as well from "the restoration of normal married life, from an abnormally large number of marriages, and from the unusually small fraction of married women who were infertile because of nursing a recently born infant" (Coale, 1984: 57). By the mid-1970s, China's TFR had returned to about the same level as Taiwan's.

The TFR time-series data for China and Taiwan indicate that fertility fell in both countries from 6 children per women in 1950 to less than 2 children per woman in 1997. This occurred despite the fact that China instituted in the 1970s a coercive fertility control program and Taiwan did not. Both countries, however, also experienced significant increases in social and economic development, which it has been argued, were responsible in important ways for the fertility declines. It is these factors, and their effects on fertility, that we examine here in a series of cross-sectional analyses.

We undertake cross-sectional investigations of the sub-regions of China and of Taiwan at two points in time. There is considerable heterogeneity among the countries' sub-regions (counties and provinces of China, and counties/cities of Taiwan) in fertility and in social and economic development. It is our position that cross-sectional analyses of the associations between development and fertility among the sub-regions will inform us in important ways about these relationships that would not be possible were we to analyze the associations over time in the two countries considered as wholes. We investigate the development and fertility

relationship first among the counties of China, then among the provinces of China, and finally among the counties and cities of Taiwan.

**The Counties of China.** We conduct two cross-sectional analyses of fertility patterns in the counties of China, one for 1982 and one for 1990, the two years of the most recent censuses.

Our 1982 analysis is concerned with the fertility patterns of the 2,300 counties of China for which fertility and social and economic development data are available. According to the 1982 Census of China, there were 2,378 counties in the country. The fertility and social and economic data we use, however, were not gathered for all the counties; most of the counties with missing data are in the Xizang (Tibet) Autonomous Region.

The dependent variable is the General Fertility Rate, i.e., the number of births in 1981 per 1,000 women in the age group 15-49. Among the 2,300 counties of China for which data are available, the GFR has an average value of 98, varying from a low of 36 in Shihezhi City in Xinjiang to a high of 233 in Butuo County in Sichuan (see Table 1). These GFRs indicate substantial variability in fertility. Shihezhi City's low GFR of 36 parallels the GFR of 37 reported by West Germany in 1986 (United Nations, 1988), the country then with one of the lowest GFRs in the world. Conversely, Butuo County's high GFR of 233 is close to the GFRs reported recently by Rwanda and by Nigeria, two countries with GFRs among the highest in the world. The variation in fertility in 1981 among the counties of China parallels in an important respect the variation in fertility in the mid-1980s among the countries of the world. In addition, as we will see later, there is much greater variability in fertility among the counties of China than among the country's provinces.

The four social and economic variables are 1) the per capita Gross Value of Industrial and Agricultural Output (in Yuan) in 1982 (GVIAO); 2) the infant mortality rate in 1981 (IMR); 3) the illiteracy rate (ILLIT), i.e., the percentage of the population aged 12 or over in the county in 1982 who are illiterate or semi-literate; and 4) the percentage of the labor force in 1982 classified as industrial employees (INDUSTRY). These four variables reflect three of the four specific modernization and development factors we identified earlier. GVIAO and INDUSTRY tap the economic development factor, ILLIT represents social development, and IMR the health dimension. We did not have county-level data available to tap women's status.

The variation in these four independent variables is as striking as the variation in fertility. Look especially in Table 1 at the extreme values of infant mortality. We anticipate negative relationships between fertility and both the economic measures (GVIAO and INDUSTRY) measures, and positive relationships between fertility and the illiteracy (ILLIT) and infant mortality (IMR) variables. Each of these four variables is related to each other, although none of the zero-order correlations exceeds +/- 0.6.

The left panel of Table 2 presents the results of a county-level multiple regression equation of these four independent variables with the General Fertility Rate. All four variables have unstandardized regression coefficients (*b*'s) that are signed in the direction predicted by the hypotheses, and all but one (GVIAO) are statistically significant. An inspection of the standardized regression coefficients (*betas*) in the 2nd column (left panel) of Table 2 shows that the infant mortality rate has the greatest effect on fertility, net of the effects of the other independent variables. These variables account for almost 43 percent of the variation in fertility.

The 1990 analysis of fertility focuses on 2,349 counties; we dropped about 100 counties owing to incomplete or absent data on one or more variables. About 80 new counties were created in China between 1982 and 1990 when the government took territory away from various counties already in existence in 1982. However, we are not yet able to link the 1982 set of counties with the 1990 set because we lack the boundary files. Hence we do not estimate county-level equations dealing with fertility change between 1982 and 1990.

As in the 1982 analysis, the dependent variable in 1990 is the General Fertility Rate measured as of the second half of 1989 and the first half of 1990. The GFR has a mean value of 91, and ranges from a low of 35 in Jiading District in Shanghai to a high of 210 in Cuoqin County in Tibet. As in 1982, there is considerable variation in the GFR among the counties of China in 1990.

Two of the independent variables in the 1990 analysis are similar to those used in 1982, namely, the illiteracy rate (ILLIT) and the percentage of the labor force in industrial jobs (INDUSTRY). The numerator and denominator of the illiteracy rate in 1990, however, refer to the population aged 15 and over (as against 12 and over in 1982). The economic productivity variable in 1990 is the gross value of agricultural output (in Yuan) per agricultural population (GVAO); in 1982 this variable covered both agricultural and industrial output, and its denominator was the total county population. This is an imperfect economic measure because it is restricted to agricultural productivity, but it is all that is available.

Unavailable for the 1990 analysis of counties are data on infant mortality or other indicators of health conditions. The only mortality indicator available is the crude death rate (CDR). However, in 1982, among the counties of China there was a correlation of 0.79

between the IMR and the CDR. Therefore, we estimate two regression equations for 1990, one with no mortality independent variable, and a second using the CDR as a rough proxy for the IMR.

The middle panel of Table 2 reports the results of a county-level multiple regression equation for 1990 of the GFR on three social and economic development variables. All three report *b*'s with the expected signs, but the GVAO variable is not significant. The standardized effects on fertility of the ILLIT and INDUSTRY variables are of about the same magnitude. The three variables together account for almost 38 percent of the variation in fertility.

The right panel of Table 2 shows the results of a multiple regression equation for 1990 in which the CDR has been added as a fourth independent variable. It has a significant effect on fertility, but the ILLIT and INDUSTRY variables retain their more substantial impacts. The results of this second 1990 equation are similar to those of the first 1990 equation.

Overall, the results of the 1982 and 1990 models are much more similar than different. The economic productivity predictor, viz., GVIAO and GVAO, is never significant, but the other economic development variable, INDUSTRY, which measures industrial, i.e., non-agricultural, participation in the labor force – to be sure, an expression of the overall state of the economy – is significant and influential. The IMR, a social and health-related variable, is the most important predictor in 1982, whereas the other social variable, ILLIT, along with INDUSTRY, is the most influential in 1990. Adding the CDR in 1990 as a proxy for infant mortality changes in only a minor way the results of an equation estimated without the CDR. The amounts of explained variance are similar in the three equations.

**The Provinces of China.** We now turn to several cross-sectional analyses of fertility patterns in the provinces of China. In 1982 China was divided into 29 major provinces, municipalities, and autonomous regions, and in 1990 and 1995 the number was 30. For the 1982 period, detailed fertility and development data were not available for Tibet. Before the 1990 census was conducted, Hainan Island was separated from Guangdong Province into a separate province. In our provincial-level analyses, we use 28 provinces; we have excluded Tibet and treat Hainan as a part of Guangdong.

We first conduct an analysis of the effects in 1982 on fertility of the social and economic development factors; we then regress fertility in 1989 on the social and economic development variables in 1982. We then conduct a similar analysis for 1990 by looking first at the effects in 1990 of the development variables on fertility, and looking next at the effects of them on fertility in 1995.

The fertility variable for 1982 and 1990 is the total fertility rate (TFR) measured in 1981 and 1989, respectively, and for 1995, the crude birth rate (CBR) measured in 1995. We use the CBR for 1995 because TFR data are not available for that year. However, among the 28 provinces, the TFR and CBR in 1981 and in 1989 are correlated with each other at 0.93 and 0.91, respectively, so we hold that the variation in the CBR in 1995 is very similar to the variation in the TFR in 1995.

In 1981 and 1989 the TFR has mean values of 2.7 and 2.3, respectively, and the 1995 CBR has a mean value of 15.4 (see Table 3). Shanghai has the lowest fertility values for all three time periods, with TFRs of 1.3, and 1.4 for 1981 and 1989, and a CBR of 5.8 for 1995. Guizhou, Xinjiang and Qinghai have the highest fertility values, with 1981 TFR, 1989

TFR and 1995 CBR values of 4.4, 3.1, and 22.0, respectively. There is considerable variability in fertility among the provinces for the three years, but it is not as great as it is among the counties.

We use four social and economic development variables as our predictors of fertility: per capita provincial income (INCOME); illiteracy rate (ILLITERACY); ratio of female-to-male life expectation at birth (M-F-LIFE), and infant mortality rate (IMR).

The INCOME variable is an indicator of structural economic development in the province; it refers to newly created value in Yuan of labor engaged in production activities in agriculture, industry, construction, transportation, social services, and commerce (China Population Information and Research Center, 1996: 110); it has mean values in 1982 and 1990 of 547 Yuan and 1471 Yuan, respectively. In both years Shanghai has the highest values and Guizhou the lowest.

The ILLIT variable represents social development; it refers to the percentage of the population 12 years of age and older (in 1982), or 15 years of age and older (in 1990), who are illiterate or semi-literate. Beijing has the lowest percentages in 1982 and in 1990, and Yunnan has the highest value in 1982 and Qinghai in 1990 (see Table 3).

The third independent variable, F-M-LIFE, is the ratio of female to male life expectation at birth; this is a relative measure of women's status and is one used fairly extensively in international research (Sivard, 1995). The higher the value of the ratio, the higher the women's status. This measure has mean scores of 1.04 and 1.05 in 1982 and 1990. The infant mortality rate, IMR, is the fourth independent variable and is used here to represent

overall health conditions. In 1981 IMR ranges from a low of 15 in Beijing to a high of 108 in Xinjiang; the range in 1989-90 is 9 in Beijing to 66 in Qinghai.

The four panels of Table 4 report the results of regressions pertaining to one, a dependent variable and independent variables all measured in circa-1982; two, independent variables in 1982 and a dependent variable in 1989; three, a dependent variable and independent variables all measured in circa-1990; and four, independent variables in 1990 and a dependent variable in 1995.

Our hypotheses expect negative associations with fertility for the INCOME and F-M-LIFE variables, and positive relationships for the ILLIT and IMR variables. The results of all four equations are the same: INCOME and IMR are signed in the hypothesized directions and are significant. The coefficients of the ILLIT variable are signed in the hypothesized direction but are not significant. The coefficients of the F-M-LIFE variable are either not signed in the expected negative direction and/or are not significant. In two of the equations, the INCOME variable reports the highest *betas*, while the IMR variable has the highest *betas* in the other two equations.

Among the provinces of China in 1982 and in 1990, our measures of structural economic development (INCOME) and health conditions (IMR) consistently have strong and significant effects on fertility, irrespective of whether fertility is measured at the same time as the two development variables or lagged five or more years later.

On the other hand the women's status variable and the illiteracy variable have either no effect on fertility in any of the equations, or an effect in the wrong direction. It may be that

these two latter indicators of development should have been measured differently. We return later to a fuller discussion of these matters.

**The Cities and Counties of Taiwan.** We report now on several cross-sectional investigations of the effects in 1980 and 1990 of social and economic development on fertility among the cities and counties of Taiwan.

In 1980 there were 21 cities and counties (*hsiens*) in Taiwan; five were cities or municipalities (hereafter referred to as cities), namely, Kaohsiung Municipality, Keelung City, Taichung City, Tainan City, and Taipei Municipality; and sixteen were counties, namely, Changhwa, Chiayi, Hualien, Hsinchu, Ilan, Kaohsiung, Miaoli, Nantou, Penghu, Pingtung, Taichung, Tainan, Taipei, Taitung, Taoyuan, and Yunlin. Four of the counties have the same names as four of the cities and are contiguous to their same-named cities.

In 1990, there were 23 cities and counties in Taiwan. Chiayi County split into Chiayi County and Chiayi City; and Hsinchu County split into Hsinchu City and Hsinchu County. However, in our 1990 analyses we have returned Chiayi County and Hsinchu County to their 1980 geographies, and will thus use the same 21 cities and counties as in 1980.

Our analysis strategy differs slightly from the analyses completed above for the counties and provinces of China. For at least two reasons we will not rely solely on multiple regression analysis to investigate the effects of social and economic development on fertility among the cities and counties of Taiwan. One, we have only 21 areal units available for analysis, and, two, many of the social and economic development indicators are correlated with one another, usually at levels of  $\pm 0.6$  or higher. Thus, we first examine zero-order correlations between fertility and various indicators of social and economic development to

gain a general and overall view of the bi-variate associations. This is followed by a series of multiple regressions.

We first examine the zero-order effects on fertility in 1980 and 1990 of the social and economic development factors measured in 1980. Then we undertake a similar analysis of the effects of the development variables measured in 1990 on fertility measured in 1990 and then in 1995.

We use the total fertility rate for all three time periods of 1980, 1990, and 1995. The TFR has mean values for these years of 2.5, 1.8, and 1.8, respectively (see Table 5). Taipei City has the lowest values for all three years, and three counties have the highest values. However, there is nowhere near as much variation in fertility among the cities and counties of Taiwan as we saw earlier among the provinces of China. Miaoli County in 1990 and Yunlin County in 1995 have the highest TFRs of all the cities and counties in Taiwan, and these are replacement-level fertility values of 2.1. For all practical purposes the fertility transition was completed in Taiwan more than twenty years ago (Freedman, Chang, and Sun, 1994; Weinstein, Sun, Chang, and Freedman, 1990), and fertility is quite low everywhere on the island.

In the analyses of fertility patterns among the Taiwan cities and counties, we use four social and economic development variables as predictors: the divorce rate, i.e., number of divorces per 1,000 current marriages (DIVORCE); the percentage of the labor force in professional occupations (PROF); the percentage of females who are illiterate (F-ILLIT); and the crude death rate (CDR).

We use the PROF variable as an indicator of structural economic development. Yunlin County has the lowest values in 1980 and 1990, and Taipei City the highest values. The kinds of economic productivity data we used in the above analyses of the Chinese sub-regions were not available to us for Taiwan.

The DIV variable is a measure of secularization, and we use it here to represent social development. Among the cities and counties of Taiwan, the mean number of divorces per 1,000 current marriages increased from 3.7 in 1980 to 9.2 in 1990. The third independent variable, F-ILLIT, is the percentage of females who are illiterate. This is an absolute measure of female status. The higher the value, the lower the women's status. F-ILLIT has mean scores of 29.3 and 12.9 in 1980 and 1990; Taipei City has the lowest scores, and Yunlin County the highest. The fourth independent variable is the crude death rate (CDR). As in the above analysis of the counties of China, we use the CDR here as a proxy for the infant mortality rate to represent overall health conditions. In 1980 the CDR ranged from a low of 4.3 in Tainan City to a high of 9.5 in Hualien; in 1990 it ranged from 4.7 in Taipei County to a high of 11.5 in Taitung County (see Table 5).

Table 6 presents zero-order correlation coefficients between these four independent variables and the total fertility rate. Our hypotheses expect negative associations with fertility for the PROF and DIV variables, and positive relationships for the F-ILLIT and CDR variables. In all cases these expectations are upheld.

The first two panels of Table 6 report correlations where the independent variables have been measured in 1980 and the total fertility rate measured in 1980 (panel 1) and in 1990 (panel 2). The last two panels show the results for the independent variables measured

in 1990 and the total fertility rate measured in 1990 (panel 3) and in 1995 (panel 4). In all four panels, the PROF variable, our indicator of structural economic development, has the highest relationship with fertility, ranging from -0.62 to -0.80. And in the first three panels of the table, the CDR, used here to represent overall health conditions, shows the lowest correlations with fertility. In these same three panels, the social development variable (DIV) and the female status variable (F-ILLIT) have the second and third highest correlations, respectively, with fertility. Only in the last panel of the table (independent variables in 1990 and fertility in 1995) is the order of the magnitude of the relationships with fertility of these three predictors reversed. For the most part, the development variables show rather strong correlations with fertility in all four panels. But recall our earlier observation that the social and economic development independent variables are correlated with one another. The F-ILLIT variable in particular is highly correlated with the other predictors, so we will not use it in the multiple regressions. The remaining three independent variables are correlated with one another; some are as high as 0.6. But they are not as high as those involving the F-ILLIT predictor.

Table 7 reports the results of four regressions; the first regression is for a dependent variable and three independent variables all measured in 1980; the second is for the independent variables in 1980 and the dependent variable in 1990; the third is for a dependent variable and independent variables all measured in 1990; and the fourth is for independent variables in 1990 and the dependent variable in 1995.

Our hypotheses expect negative associations with fertility for the PROF and DIV variables, and a positive relationship with fertility and the CDR. The results indicate that in the first two regressions only the PROF variable is both signed in the hypothesized direction and

statistically significant. None of the three social and economic predictors is significant in the third regression. And in the fourth regression only the CDR variable, representing overall health conditions, is signed in the hypothesized direction and is significant.

The results of our analyses in Tables 6 and 7 indicate that despite the fact that by 1995 fertility in all the cities and counties of Taiwan were at or below replacement levels, there were still sizable zero-order relationships between the development measures and fertility. The results of the multiple regressions show that in three of the four equations, one of the development variables is statistically associated with fertility in the direction expected. The fact that some of the social and economic predictors do not have statistically significant relationships with fertility is due in large part to the high collinearity among the predictors.

We turn now to a discussion of our results about the relationship between social and economic development and fertility among the sub-regions of Mainland China and Taiwan.

## **DISCUSSION**

With respect to levels of social and economic development, China lags considerably behind Taiwan. This is the case irrespective of the reference date. In 1990, for instance, the infant mortality rate was 37 in China and 17 in Taiwan (population Reference Bureau, 1990). Per capita GNP in China in the late 1980s was just over \$300, and more than ten times higher (\$3,750) in Taiwan (Encyclopaedia Britannica, 1989: 574, 709). Yet the levels of fertility for China and Taiwan were nearly the same in 1990 and were almost identical in the late 1990s (Figure 1). One of the major differences about the fertility reductions in China and Taiwan is

that the decline in China was due in part to a forceful and very powerful intervention in family planning by the Chinese government. Family planning programs were also influential in Taiwan, but participation in them was voluntary.

We hold that were it not for China's far-reaching fertility control policies, it is not likely that its fertility rate would have dropped as rapidly and as precipitously in recent decades. Were it not for these policies, China's fertility rate would not be as low today as Taiwan's. Nevertheless, despite these vastly different levels of social and economic development in China and Taiwan, their effects on fertility have been very similar.

The results of the analyses in this paper provide general support for the relevance of social and economic development as an explanation of fertility. Although the results are not uniform regarding the influence of a single social or economic development variable, they do support the general hypothesis that among the provinces and counties of China and Taiwan, the higher the levels of social and economic development, the lower the fertility rates.

Our tests of the development-fertility association could be significantly improved were we able to employ the same indicators of development in all cases. Since this was not possible we need to exercise caution in generalizing about the effects of certain kinds of development factors being more influential than others. Nevertheless, our results do indicate that labor-force measures of economic development appear to have more of an effect on fertility than indicators of economic productivity. In a similar vein, health-based indicators as tapped by the infant mortality rate and crude death rate do not seem to be as influential as educational-based social indicators. To the extent that social and economic factors and contexts tend to influence reproductive motivation and fertility by specifying the reward structures related with

childbearing, as suggested by Blake (1973), Hernandez (1984) and others, the more influential ones may well be those more closely tied in with such mechanisms. Aggregate measures of economic productivity and health conditions could be argued as less proximate than the more socially-based indicators, and hence less effective predictors of fertility.

Our less than perfect operationalizations need also be mentioned. In several tests we used the illiteracy rate as an indicator of social development. And in another test we used the ratio of female to male life expectation as a relative measure of female status. Illiteracy may no longer tap issues of social development as well as it did previously given the dramatic increases in China since the late 1960s in educational attainment, particularly among women (Freedman, Xiao, Li, and Lavelly, 1988; Lavelly, Xiao, Li, and Freedman, 1990). And there have been such improvements in female and male life expectation in China in past decades (Banister, 1987) that at the provincial-level at least there is only modest variability in this ratio in both 1982 and 1990.

Moreover, the fact that the ratio of female to male life expectation was not related with fertility in the provinces of China does not necessarily mean that improvements in women's status are not associated with fertility decline. As one reviewer of this paper pointed out, in some countries with high ratios of female to male life expectancy, women's social status is relatively low. The lack of an association with fertility is likely due to our less than perfect indicator of women's status.

In a similar vein, our failure to show any association between the divorce rate, an indicator of secularization, and fertility among the counties of Taiwan does not necessarily mean that secularizing trends in Taiwan are unrelated to fertility change. The same reviewer

noted that in some countries more developed than either China or Taiwan the divorce rates are very low. The lack of an association in our analysis hence may well be due in part, again, to an imperfect indicator of social development.

These issues and problems notwithstanding, our results indicate clearly and persuasively the strong influences of social and economic development factors on fertility. Among the sub-regions of China and Taiwan, cross-sectional examinations show consistent and pervasive negative associations between levels of social and economic development and fertility. Indeed the similarities of the experiences in the two countries are often more apparent than the dissimilarities.

Overall, the similar kinds of associations between development and fertility are sustained irrespective of whether fertility is measured at the same time as development or lagged five or ten years later. These results are hard to ignore. Development does indeed have an important influence on fertility, at least with regard to the measures and cross-sectional tests for China and Taiwan reported in this paper. We conclude that a social and economic development-based theory of fertility decline, as represented in the broader theory of demographic transition, continues to have considerable relevance and application as a general perspective for understanding variation in fertility among the sub-regions of China and Taiwan.

#### **NOTE**

<sup>1</sup> For ease of reference, we refer in this paper to the People's Republic of China as China or Mainland China, and to the Republic of China as Taiwan. For the same reason, we refer to these two areas as countries. We are aware that this is a contentious political issue. Our

reference to China and Taiwan as countries does not necessarily represent any political position or viewpoint on our part about their political identification.

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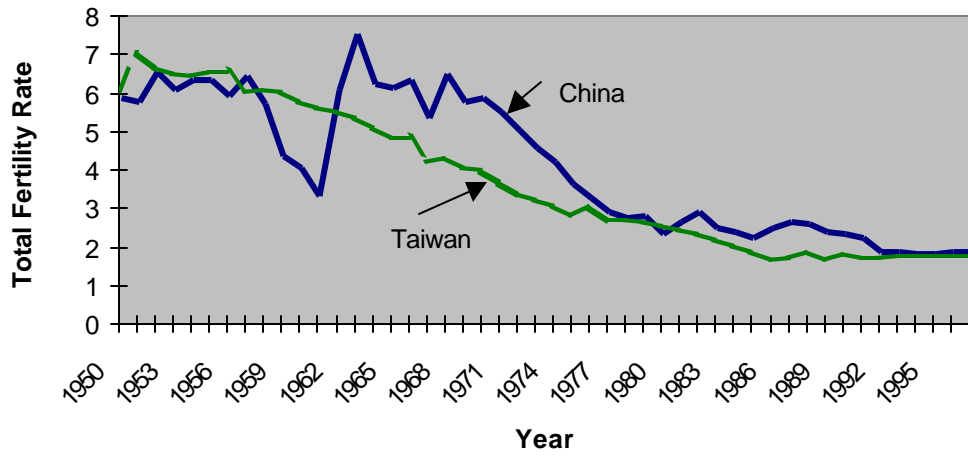
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**Figure 1.**  
**Total Fertility Rates: China and Taiwan, 1950-1997**



**Table 1**  
**Descriptive Statistics for Fertility Rates and Social and Development Variables:**  
**2,300 Counties of China, 1982,**  
**and 2,349 Counties of China, 1990**

<u>Variable</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Minimum Value</u>	<u>Maximum Value</u>
General Fertility Rate, 1981	98.5	32.8	36.2 Shihezi (Xinjiang)	232.6 Butuo (Sichuan)
General Fertility Rate, 1989-90	91.1	27.4	35.0 Jiading (Shanghai)	210.0 Cuoqin (Tibet)
Gross Value of Industrial & Agricultural Product, pc, 1982	654.6	793.2	70.0 Haiyuan (Ningxia)	11020.0 Beijing City
Gross Value of Agricultural Product, pc, 1990	973.6	1140.8	222.1 Erguna-zuoqi (Inner Mongolia)	46770 Manzhouli City (Inner Mongolia)
Infant Mortality Rate, 1981	39.1	29.1	6.0 Langfang City (Hebei)	319.0 Da-Qaidam (Qinghai)
Crude Death Rate, 1989-90	6.6	1.4	4.0 Dongying (Shandong)	16.4 Jiali (Tibet)
Percentage Illiterate & Semi- Literate, Population 12+, 1982	34.2	13.8	2.7 Lianjiang (Guangdong)	85.0 Dongxiang (Gansu)
Percentage Illiterate & Semi- Literate, Population 15+, 1990	26.8	15.3	5.2 Changsha City (Hunan)	94.2 Nierong (Tibet)
Percentage Labor Force in Industrial Occupations, 1982	13.2	14.5	0.1 Jishishan (Gansu)	76.7 Beijing City
Percentage Labor Force in Industrial Occupations, 1990	12.3	12.1	0.4 Weixian (Hebei)	81.1 Jiujiang (Jiangxi)

**Table 2**  
**Multiple Regression Analyses:**  
**General Fertility Rate on Social and Economic Development Variables:**  
**Counties of the People's Republic of China, 1982 and 1990**

<u>Variable</u>	<u>1982</u>		<u>1990, Model 1</u>		<u>1990, Model 2</u>	
	<u>Regression Coefficients</u>		<u>Regression Coefficients</u>		<u>Regression Coefficients</u>	
	<u>Unstandardized</u>	<u>Standardized</u>	<u>Unstandardized</u>	<u>Standardized</u>	<u>Unstandardized</u>	<u>Standardized</u>
Gross Output	-0.001	-0.035	-0.000	-0.006	-0.000	-0.001
Infant Mortality	0.453*	0.401				
Illiteracy	0.483*	0.204	0.669*	0.373	0.547*	0.305
Industry	-0.436*	-0.192	0.797*	-0.353	-0.751*	-0.333
Crude Death Rate					2.665*	0.141
Constant	71.040		83.196		68.271	
R <sup>2</sup> (adj.)	0.429		0.378		0.392	

\* P < .05

**Table 3**  
**Descriptive Statistics for Fertility Rates and Social and Development Variables:**  
**28 Provinces of China, 1982, 1990, and 1995**

<u>Variable</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Minimum Value</u>	<u>Maximum Value</u>
Total Fertility Rate, 1981	2.7	0.8	1.3, Shanghai	4.4, Guizhou
Total Fertility Rate, 1989-90	2.3	0.5	1.4, Shanghai	3.1, Xinjiang
Crude Birth Rate, 1995	15.4	4.1	5.8, Shanghai	22.0, Qinghai
National Income, pc, 1982	546.8	465.2	235.0, Guizhou	2518.0, Shanghai
National Income, pc, 1990	1470.9	919.2	654.0, Guizhou	4822.0, Shanghai
Percentage Illiterate & Semi- Literate, Population 12+, 1982	31.6	10.3	15.0, Beijing	49.3, Yunnan
Percentage Illiterate & Semi- Literate, Population 15+, 1990	22.6	8.6	10.9, Beijing	40.0, Qinghai
Ratio, F/M Life Expectation at Birth, 1982	1.04	0.02	1.01, Guizhou	1.07, Guangdong
Ratio, F/M Life Expectation at Birth, 1990	1.05	0.01	1.03, Gansu	1.07, Guangdong
Infant Mortality Rate, 1981	37.3	22.5	14.9, Beijing	108.1, Xinjiang
Infant Mortality Rate, 1989-90	28.7	16.7	8.8, Beijing	66.3, Qinghai

**Table 4**  
**Multiple Regression Analyses:**  
**Total Fertility Rate/Crude Birth Rate on Social and Economic Development Variables:**  
**Twenty-eight Provinces of the People's Republic of China,**  
**1982 and 1990**

Variable	<u>1982</u>		<u>1982</u>		<u>1990</u>		<u>1990</u>	
	DV: Total Fertility Rate, 1981		DV: Total Fertility Rate, 1989		DV: Total Fertility Rate, 1989		DV: Crude Birth Rate, 1995	
	Regression Coefficients		Regression Coefficients		Regression Coefficients		Regression Coefficients	
	<u>Unstandardized</u>	<u>Standardized</u>	<u>Unstandardized</u>	<u>Standardized</u>	<u>Unstandardized</u>	<u>Standardized</u>	<u>Unstandardized</u>	<u>Standardized</u>
Income	-0.001*	-0.316	-0.001*	-0.517	-0.001*	-0.541	-0.002*	-0.418
Illiteracy	0.015	0.183	0.001	0.126	0.001	0.016	0.110	0.231
F/M Life Expec.	13.012	0.253	9.956*	0.346	6.035	0.172	-14.400	-0.047
Infant Mortality	0.024*	0.630	0.011*	0.509	0.012*	0.436	0.100*	0.407
Constant	-11.853		-8.327		-3.982		27.859	
R <sup>2</sup> (adj.)	0.622		0.620		0.573		0.785	

\* P < .05

**Table 5**  
**Descriptive Statistics for Fertility Rates and Social and Development Variables:**  
**21 Cities and Counties of Taiwan, 1980, 1990, and 1995**

<u>Variable</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Minimum Value</u>	<u>Maximum Value</u>
Total Fertility Rate, 1980	2.5	0.3	1.9, Taipei City	2.9, Changhwa Cty
Total Fertility Rate, 1990	1.8	0.2	1.5, Taipei City	2.1, Miaoli Cty
Total Fertility Rate, 1995	1.8	0.2	1.4, Taipei City	2.1, Yunlin Cty
Divorce Rate, 1980	3.7	1.5	1.6, Penghu Cty 5.0, Changwa & Yunlin Counties	6.4, Taipei City
Divorce Rate, 1990	9.2	3.0		15.0, Hualien Cty
Percentage in Professional Occupations, 1980	6.0	1.8	3.4, Yunlin Cty	10.8, Taipei City
Percentage in Professional Occupations, 1990	8.0	2.5	4.6, Yunlin Cty	14.0, Taipei City
Percentage Females Illiterate, 1980	29.3	10.0	11.6, Taipei City	50.0, Yunlin Cty
Percentage Females Illiterate, 1990	12.9	4.4	4.7, Taipei City	21.6, Yunlin Cty
Crude Death Rate, 1980	6.1	1.3	4.3, Tainan City	9.5, Hualien Cty
Crude Death Rate, 1990	6.9	1.8	4.7, Taipei Cty	11.5, Taitung Cty

**Table 6**  
**Zero-Order Correlations Between the Total Fertility Rate and**  
**Four Social and Economic Development Variables:**  
**Twenty-one Cities and Counties of Taiwan, 1980 & 1990**

Z-E-R-O O-R-D-E-R C-O-R-R-E-L-A-T-I-O-N C-O-E-F-F-I-C-I-E-N-T-S  
1980 1980 1990 1990  
TFR, 1980 TFR, 1990 TFR, 1990 TFR, 1995

Professionals	-0.796	-0.708	-0.621	-0.725
Divorce Rate	-0.631	-0.600	-0.555	-0.387
Female Illiteracy	0.566	0.465	0.456	0.588
Crude Death Rate	0.249	0.258	0.283	0.602

**Table 7**  
**Multiple Regression Analyses:**  
**Total Fertility Rate on Social and Economic Development Variables:**  
**Twenty-one Cities and Counties of Taiwan,**  
**1980 and 1990**

Variable	<u>1980</u>		<u>1980</u>		<u>1990</u>		<u>1995</u>	
	DV: Total Fertility Rate, 1980		DV: Total Fertility Rate, 1990		DV: Total Fertility Rate, 1990		DV: Total Fertility Rate, 1995	
	Regression Coefficients		Regression Coefficients		Regression Coefficients		Regression Coefficients	
	<u>Unstandardized</u>	<u>Standardized</u>	<u>Unstandardized</u>	<u>Standardized</u>	<u>Unstandardized</u>	<u>Standardized</u>	<u>Unstandardized</u>	<u>Standardized</u>
Professionals	-128.11*	-0.92	-63.54*	-0.75	-0.87	-0.01	-3.07	-0.04
Divorce Rate	5.94	0.03	-1.86	-0.02	-34.38	-0.65	-33.72	-0.54
Crude Death Rate	-40.24	-0.20	-13.26	-0.11	38.18	0.43	74.58*	0.71
Constant	3484.10		2294.80		1887.14		1650.57	
R <sup>2</sup> (adj.)	0.60		0.43		0.40		0.61	

\* P < .05