

**Bringing Males In:  
A Critical Demographic Plea for Incorporating Males in  
Methodological and Theoretical Analyses of Human Fertility**

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**Introduction**

According to Horton (1999), an important characteristic of “critical demography,” as opposed to “conventional demography,” is the posing of “questions that challenge the prevailing social order” (1999: 365). If there was ever a question that challenges the prevailing social order of demography, of the social sciences, and indeed of all of society, it is, why are males not included in the study of fertility? In discussions in both the scholarly and popular literatures pertaining to human fertility rates, the methods and numbers almost always apply only to females, but are referred to as fertility rates and fertility numbers, not as female fertility rates and female fertility numbers. In the development and testing of fertility theories in the demographic and social science literatures, the explanations are implicitly based on females, but are referred to as fertility theories, not as female fertility theories.

But as everyone knows, biology dictates that females and males must both intimately be involved in the production of children. Fertility is not a process that only involves women. So, why are males ignored in conventional demographic studies of fertility? Why, in Horton's words, has "conventional demography chose(n) to ... implicitly accept the status quo" (1999: 365) and ignore males in methodological and theoretical studies of fertility?

In the next section of this paper, we present a detailed answer to the specific question that conventional demography is incapable of addressing. By not challenging the status quo, conventional demography has not been able to either ask, or answer, the question, why has fertility research concentrated largely if not exclusively on women? We show below that the answer is not because female and male fertility rates are the same. Although common sense suggests they should be, in fact they are not, and we show this below.

But we do more in this paper than merely ask and answer this question of critical demography. We take the issue two steps further. First, we gather detailed data on male and female fertility for Taiwan and its constituent cities and counties, and describe male and female fertility longitudinally in Taiwan, and then cross-sectionally among Taiwan's 23 cities and *hsiens* (counties) for the year of 1995. Our descriptions will show that male and female fertility rates are far from identical. This will be the first of our critical demographic results that will argue for the inclusion of males in fertility studies.

Second, we then model the variation in both the male and the female rates among the sub-regions in 1995 using key variables from each of three different fertility paradigms, all of which are implicitly based on female behavior, namely, wealth flows,

political economy, and human ecology. These results will show that the variables representing these three fertility paradigms have much larger effects on female fertility rates than on male fertility rates. This will be the second of our critical demographic results that will argue for the inclusion of males in fertility theories. We turn now to address, and then answer, the question of why conventional demography has virtually ignored males in fertility analysis.

### **Why Has Conventional Demography Ignored Males in Fertility Research?**

It is not at all an understatement that up until the past few years virtually all conventional demographic research on fertility has been devoted to analyses of women. Until quite recently, meetings of the Population Association of America (PAA) and the International Union for the Scientific Study of Population (IUSSP) have seldom if ever included sessions on the male side of fertility. Indeed it has just been in the past few years that articles and book chapters on male fertility have started to appear in the demographic literature. In 1998 the journal *Demography* published a special issue on the topic of male reproduction. In 2000, a major paper appeared in the journal *Population and Development Review* (Greene and Biddlecom, 2000) that evaluated current research and suggested directions for future research on male reproductive roles. And also in 2000, a monograph was published on *Fertility and the Male Life-Cycle in the Era of Fertility Decline* (Bledsoe, Lerner and Guyer, 2000), based in large part on the papers presented at a 1995 conference of the IUSSP.

We recently used POPLINE to conduct a review of the literature on the topic of fertility. Our POPLINE search reported over 75,000 fertility studies conducted between

1950 and 2000. Of these, only 381 dealt with fertility and reproduction behaviors involving males, two-thirds of which were biological and medical in orientation, focusing on such issues as spermatogenesis (Aitken, Irvine, Clarkson, and Richardson, 1986; Bujan and Mieusset, 1996; Kandeel and Swerdloff, 1988; Waites, 1992), and medical and biological aspects of fertility regulation (Singh and Ratnam, 1991). The other one-third investigated family planning policies (Adamchak and Adebayo, 1987; Waites, 1993) and fertility regulation (Mbizvo and Adamchak, 1992), male attitudes toward fertility and family planning and economic considerations and cultural factors that shape male fertility (Muvandi, 1995). Included in this latter one-third were a few papers using formal demographic methods to compare male and female fertility within the context of Gompertz models (Paget and Timaeus, 1994; Timaeus, 1991), classical stable population theory (Pollak, 1990), and the two-sex population model (Nath and Datta, 1992). Most of the fertility analyses we uncovered in our POPLINE search that included males (often along with females) were published in the last decade.

So, why has conventional demographic research in fertility concentrated largely if not exclusively on women? Seven specific reasons have been proposed to justify excluding males from fertility studies. First, Greene and Biddlecom (2000) have written that the “most important barrier to the inclusion of men in demographic research was normative and reflected the socialization of influential demographers and the research course they set.” Men were regarded principally as breadwinners, and “as typically uninvolved in fertility except to impregnate women and to stand in the way of their contraceptive use” (Greene and Biddlecom, 2000: 83). This is a gendered-related reason and focuses significantly on the social construction of the male gender role. This is not a

biological reason but a sociological one that is grounded in the society's "prevailing social order" (Horton, 1999: 365). The critical demography paradigm would surely question the legitimacy of such a reason that is based on social construction.

Keyfitz (1977) has noted (although not necessarily endorsed) four more reasons. Two of them are: 2) data on parental age at the birth of a child are more frequently collected on registration certificates for the mothers than for the fathers; and 3) when such data are obtained for mothers and fathers, there are a greater number of instances of unreported age data for fathers, and this is especially the situation for births occurring outside marriage.

It is true that if birth registration systems do not collect the same data for both parents, they will certainly favor the mothers; and that missing data will more frequently occur for the fathers. While it is true that demographic surveys have sometimes tended to focus more on women than on men, this situation has improved significantly in recent years. Of the 160 Demographic and Health Surveys conducted as of July 2000, over 50 included men or husbands. Also, birth registration certificates, particularly in the developed world, now typically include data on both parents. Certificates for births occurring outside marriage, however, occasionally still do omit data on fathers. Finally, Coleman (2000: 43) has noted that as of 1995, fifteen countries in the industrialized world have published, at one or more times in recent years, data and/or rates on male fertility in their demographic yearbooks or related publications.

The next two reasons mentioned by Keyfitz are: 4) the fecundity, and hence, the childbearing years of women occur in a more sharply defined and narrower range (15-49) than they do for men (15-79); and 5) "both the spacing and number of children are less

subject to variation among women; a woman can have children only at intervals of 1 or 2 years, whereas a man can have hundreds” (1977: 114). The 4<sup>th</sup> point is true theoretically, and indeed “in polygamous populations a man’s fertility can remain high well into his fifties and sixties; ... (however), in controlled fertility societies, it peaks ... with a mode in the mid-twenties” (Coleman, 2000: 41). This is due in part to low fertility norms in Western societies, as well as to a small average age difference of about two to three years between men and women in first marriages. Regarding the 5<sup>th</sup> point, Guyer (2000) has noted that although biologically a man has the potential for siring dozens more children than a woman, this large difference in number of children ever born only occurs in a few societies and “amongst a tiny minority of the population” (2000: 64).

A 6<sup>th</sup> reason is that female fertility rates are thought to be more fundamental because they are more physiological, that is, they are more bound by biological limitations, and hence are more influenced by the proximate determinants, say, by breastfeeding, than are male rates. Indeed several of the proximate determinants, Coleman (2000: 31) has reminded us, are virtually “man-free.” Owing to this physiological nature of female rates, male rates are certainly less tractable (Coleman, 2000: 31; see also Hajnal, 1948). “Births outside marriage are often only attributed to their mothers, not to the fathers, and false paternity is another, even more intractable obstacle to accuracy” (Coleman, 2000: 31). Greene and Biddlecom (2000: 85) have also noted the argument that “mothers remember events such as miscarriages and deaths in early childhood more clearly than fathers do, and there is no ambiguity as to whether a child is theirs or not.” Actually, until DNA testing is done on whole populations, we will not be able to study the genetics of male fertility. “For humans, fatherhood has been studied as reported by the

participants rather than as measured independently of the social context of meaning” (Guyer, 2000: 63).

We will never get away from the biological fact that births are more tractable to mothers than to fathers. But critical demographers would argue that this fact makes it all the more necessary to include males in fertility studies, if for the only reason that by including males we would then be able to estimate the degree of false paternity in a population, a subject about which we know very little. Moreover, Greene and Biddlecom (2000: 85) have observed that “since demographers do not limit themselves to counting but also attempt to explain and predict fertility behavior, this methodological justification (# 6 above) is patently weak.”

A 7<sup>th</sup> reason proposed to justify the exclusion of men in studies of fertility is the incompatibility of male and female fertility rates. Unless the population is closed and has a stable age distribution, the rates will likely be different. Let us consider in more detail this counter-intuitive statement. After all, one would think the rates should be nearly identical in a closed population because each coupling that produces a birth requires but one male and one female.

Coleman (2000: 49) has reported that in recent decades “male rates have typically been below those of females.” For instance, total fertility rates (TFRs) for the U.S. in 1992, and for France in 1974, were 2.05 for males and 2.11 for females; in Denmark in 1988, they were 1.37 for males and 1.50 for females; in Taiwan in 1993, the TFRs were 1.7 for males and 1.8 for females. The differential rates are due to a host of causes that are well-known to demographers, some of which are that more males are born than females, males have higher age-specific death rates than females, males marry at older ages than

females, males re-marry more quickly than females, and emigration and immigration both are usually sex-selective. These and other factors act together to produce male and female fertility rates that are not the same.

To further illustrate this result, we note that Coleman's above point about male TFRs being lower than those of females is a relatively new occurrence. Previously, the various factors producing differential sex-specific fertility rates interacted in such a way that in many countries the TFRs were higher for males than for females. In France, for instance, before World War I, the "male TFR was slightly higher than that of women. For a decade after the war, the male TFR was strikingly higher, reflecting the relative shortage of men after that conflict and their corresponding higher levels of nuptiality" (Coleman, 2000: 49-50). By the 1960s male fertility rates fell below female fertility rates. "This reflects a pattern common to most industrialized countries, where males have moved into (relative) surplus as populations recover from wartime losses and where ... emigration dominated by males has been greatly reduced and replaced by immigration initially dominated by males" (Coleman, 2000: 50). But since conventional demography has all but ignored male fertility, this important pattern has pretty much gone unrecognized.

The male TFR in the United States is now (in 1998) lower than the female TFR, 2,015.0 versus 2,058.5; however, almost two decades ago in the U.S.(in 1980) the opposite situation was true, that is, the male TFR was higher than the female TFR, 1,967.0 versus 1,839.5 (Ventura et al., 2000: Tables 4 and 20). Smith (1992) has written about this reversal that occurred in the U.S. in the early 1990s, noting that it was due to the fact that "women outnumbered men at all ages over 25, and outnumbered men 3 years older than themselves, the mean age difference between parents, at all ages over 20. In

computing fertility rates, births are thus averaged across smaller numbers of males than females at almost all ages, a pattern that has held [in the U.S.] for most of the 20<sup>th</sup> century” (Smith, 1992: 227; see also Myers, 1941).

In our view, the fact that male and female fertility rates are not the same makes it all the more important and necessary to analyze male fertility along with female fertility. The factors causing the differentials vary over time in their magnitude and effects on the male and female fertility rates. In some cases they may well be sex-specific, and will not be realized or understood empirically unless both male and female rates are investigated.

We began this paper with the critical demographic question, why has conventional demography ignored males in fertility studies? We entertained seven answers. We noted each in detail and showed that it is either unimportant or of little or no consequence. We discussed in somewhat greater detail the seventh reason, namely, the incompatibility of male and female fertility rates. But we observed that the fact that male and female fertility rates are not the same makes it all the more important and necessary to analyze male fertility along with female fertility.

We turn now to the empirical part of the paper and investigate male and female fertility in Taiwan. We describe the patterns of male and female fertility, first longitudinally in Taiwan between 1983 and 1995, and then cross-sectionally among Taiwan’s cities and *hsiens* in 1995. We then set out three separate fertility paradigms and examine the degree to which key variables from each paradigm influence the male rates and the female rates.

### **Male and Female Fertility in Taiwan : 1. Description, 1983 to 1995**

We now describe patterns of male and female fertility in the whole of Taiwan between 1983 and 1995. We use the total fertility rate, a common summary cross-sectional measure of fertility that represents the number of children 1,000 men or women would have during their childbearing years if they followed the sex-specific and age-specific fertility rates of an area at one point in time. Its calculation for females is well-known, namely, the summing of a schedule of age-specific (5-year) fertility rates (ASFRs), and then the multiplying of the sum by five, the width of the age interval of the ASFRs. For females, seven ASFRs (15-19, 20-24, ... 40-44, 45-49) are used in the calculation. Male TFRs are calculated in the same way but because both male fecundity and fertility extend beyond age 49, nine ASFRs (15-19, 20-24, ... 50-54, 55-59) are employed. In our analyses, births to women under age 15 or over 50 are included in the ASFRs for 15-19 and 45-49, respectively. Births to fathers under age 15 or over 60 are included in the ASFRs for 15-19 and 55-59, respectively.

Births to mothers or fathers of unknown ages have been proportionately distributed among the seven age groups of mothers (or among the nine age groups of fathers), where age is known. Births to fathers with unknown ages include unrecognized, posthumous and abandoned births. This method of distributing the births to parents of unknown ages is subject to some criticism, especially for the births to fathers of unknown ages, because “the age of father distribution for legitimate births is known to differ from that for illegitimate births and the proportion of unknown ages is higher among the latter” (Coleman, 2000: 42-43; see also, United Nations, 1988: 98-101). Unfortunately, the published male and female fertility rate data of Taiwan have already undergone this

redistribution, and there is no way to remove from the rates the births to mothers or fathers of unknown ages.

Figure 1 charts TFRs for Taiwan from 1983 to 1995. Between 1983 and 1987 male TFRs were higher than female TFRs. In 1983, for instance, 1,000 males on average had 160 more births than 1,000 females (the male and female TFRs were 2,330 and 2,170, respectively). The rates converged in 1988 (the male and female TFRs were 1,860 and 1,855) and were identical in 1989 (both TFRs were 1,680). Since 1990 the female TFRs have been higher than the male TFRs, and, moreover, the gap has widened. In 1990 the difference between the sex-specific TFRs was only 30 births (the male and female TFRs were 1,780 and 1,810), whereas by 1995 the gap had increased to 70 births (the male and female TFRs were 1,705 and 1,775). By the 1990s Taiwan had joined most of the developed world by having higher female than male total fertility rates. This important trend has gone largely unnoticed in the demographic literature owing for the tendency of conventional demography to ignore males in fertility studies.

### **Male and Female Fertility in Taiwan :**

#### **2. Description of Sub-regional Patterns in 1995**

We turn now to sub-regional analyses of male and female fertility in Taiwan in 1995. Taiwan, with a population in 1995 of over 21 million persons, is divided into twenty-three cities and *hsiens* (counties).<sup>1</sup> Table 1 presents the male and female total fertility rates for the 23 sub-regions for 1995; summary descriptive data for these TFRs are shown at the bottom of Table 2. Female fertility has a mean TFR value across the 23 sub-regions of 1,839 with a standard deviation of 200. It varies from a high of 2,235 in

Hsinchu *Hsien* to a low of 1,415 in the Taipei Municipality. Male fertility has an average TFR value among the sub-regions of 1,709 with a standard deviation of 133. The highest male TFR is 1,985 in Hsinchu *Hsien* and the lowest is 1,495 in the Taipei Municipality. The average female TFR in the Taiwan sub-regions is higher than the average male TFR by a difference of 130 births per 1,000 persons.

Also there is more variability in the female TFRs than in the male TFRs, as evidenced by their respective coefficients of relative variation (CRV) of 0.11 and 0.08 (CRV is the standard deviation divided by the mean). However, the two Taiwan sub-regions with the highest, and the lowest, TFR values for females and males are the same, namely, the Hsinchu *Hsien* and the Taipei Municipality.

Figure 2 is a scatterplot of the male and female TFRs. The sub-regions are identified by abbreviated versions of their names (see Table 1 for the abbreviations). Sub-regions above the line (which connects the male rates) have higher female TFRs than male TFRs, with the opposite for sub-regions below the line. Three sub-regions have male TFRs larger than female TFRs (Taichung City -- TacC [1,775 versus 1,675], Taipei *Hsien* -- TaiH [1,680 versus 1,670], and Taipei Municipality -- TaiM [1,495 versus 1,415]). The Kaohsiung Municipality has identical male and female TFRs of 1,515. The remaining nineteen sub-regions have higher female than male TFRs. The differences for some of the sub-regions are substantial: three have female TFRs that are more than 300 births greater than their corresponding male TFRs: Chiayi *Hsien* (ChiH, 2,035 versus 1,690), Yunlin *Hsien* (YuH, 2,080 versus 1,750), and Taitung *Hsien* (TatH, 1,975 versus 1,655). The descriptive patterns shown in Figures 1-2 and in Tables 1-2 have also gone

unnoticed in the demographic literature because conventional demography has ignored males in fertility studies.

The correlation between the male and female TFRs is 0.77. A regression predicting the values of the male TFR across the 23 Taiwan sub-regions with knowledge only of the female TFR has an adjusted value of  $R^2$  of just over .57, meaning that we could account for just over one-half of the variation in the male TFRs by knowing the values of the female TFRs. In Figure 3 we have plotted the residuals (or errors) from such a predictive equation (vertical axis) by the fitted values of the male TFRs that are predicted by the female TFRs (horizontal axis). Sub-regions below the line have predicted values of male fertility larger than their actual values, and sub-regions above the line have predicted values smaller than their actual values.

Figure 3 informs us that there is much less error predicting male TFRs with female TFRs for those sub-regions with low male TFRs. Knowledge of female fertility does pretty well predicting male fertility for such sub-regions as the Taipei Municipality (TaiM), Chiayi City (ChC), and Tainan City (TnC). But both the positive and negative errors increase dramatically with increasing values of male fertility. For instance, Penghu *Hsien* (PeH) has an actual male TFR of 1,505, but a predicted male TFR of 1,664, or an over-prediction of almost 160 births. At the other extreme, Taoyuan *Hsien* (TaoH) has an actual male TFR of 1,915, but a predicted value of 1,753, for an under-prediction of 159 births. In general we do not do as well relying on the values of female TFRs to give us anything other than a rough and imprecise picture of the values of male TFRs. Moreover, the higher the actual values of the male TFRs, the worse are the errors incurred predicting the male TFRs with values of female TFRs.

This finding that there is more error predicting male TFRs with female TFRs for the sub-regions with low male TFRs than for those with high male TFRs is yet another result that has not received attention in the literature owing to conventional demography's tendency to ignore males in fertility studies.

### **Three Fertility Paradigms and the Prediction of Male and Female Fertility**

We now consider three conceptually distinct fertility paradigms, namely, wealth flows, political economy, and human ecology. We will ascertain the degree to which key variables from each are capable of influencing the male and female fertility rates among the Taiwan sub-regions. We first present brief statements of the paradigms.

**1. Wealth Flows.** John Caldwell's (1982) wealth flows theory stresses the influence of a patriarchal family structure on fertility. Until the patriarchal family structure is replaced by a nuclear family system, fertility levels remain high. "The primary determinant of the timing of the onset of fertility transition is the effect of mass education on the family economy" (Caldwell, 1982: 301). Mass education changes the direction of the "wealth flow" between generations within families. "In the traditional economy of family-based production, children tend to be net producers (rather than consumers) of wealth. Hence, the flow of wealth is 'upward' from children to parent, and high fertility is profitable" (London and Hadden, 1989). A reversal of the flow typically occurs after the transformation from a patriarchal family system with its traditional mode of production, to a nuclear family system with its capitalist mode of production, which is occasioned by mass education. We use the illiteracy rate as an indication of the degree of presence in a sub-region of traditionally based familial systems. The higher the illiteracy rate, the

greater the presence of patriarchal family systems. And we use the percentage of females employed in non-agricultural activities to represent the lack of a presence of traditionally based familial systems.

**2. Political Economy.** The political-economic theory of fertility is mainly derived from neo-Marxian structuralism. The political-economic approach typically examines “capital accumulation and the capitalist division of labor in the context of inter-group power relationships and class conflicts” (London and Hadden, 1989: 23). The major thesis is that changes in complex sets of political, economic, social, and cultural relationships lead to a sharp reduction in fertility. Studies focusing on the political-economic approach tend to emphasize the importance of the historic “penetration of capitalism” to explain current phenomena, such as fertility, especially in Third World countries. Areas with high percentages of males engaged in agriculture should be areas that have not yet experienced this so-called penetration of capitalism.

Some demographers have used this approach to examine the effects of world-system position and international dependency on fertility (London, 1988; Nolan and White, 1983; Ward, 1984) and have found that “non-core status in the world system was associated with fertility levels higher than development levels alone would predict” (Nolan and White 1983: 3). London (1986) used the concept of “a new tertiary elite,” that is, the number of persons engaged in wholesaling, retailing, and financial services, to represent the degree to which change had occurred in the mode of production. Such a measure is meant to indicate the degree to which an area has become integrated into the capitalist mode of production. “It signifies a move away from family production based on primary economic activities (farming and fishing) and toward economic diversification

that characterizes an increasingly monetized economy with a capitalist labor market” (London and Hadden, 1989: 25).

**3. Human Ecology.** Since 1970, ecological research has developed in several areas, one of which focuses on the effect of sustenance differentiation on population change, usually migration (Poston and Frisbie, 1998). London (1987) has argued that this sustenance organization approach provides as powerful an explanation of fertility variation and change, as it does for migration. London and Hadden (1989) have noted that “like migration, fertility behavior may be seen as a means, albeit somewhat slower, by which populations may seek an equilibrium between their size and sustenance organization” (1989: 21). Accordingly, ecological theory would expect that the more differentiated the sustenance structure of a population, the lower its fertility rate. They also argue that the more densely settled the population the more adapted is its ecological organization for survival.

Sustenance differentiation refers specifically to the extent to which a population is differentiated in its sustenance activities, and consists of two elements: (1) the number of activities and (2) the degree of uniformity in the distribution of the population across the activities. A high degree of sustenance differentiation exists when there is a relatively large number of activities characterizing the population and when population members are distributed evenly across these activities (see Gibbs and Poston, 1975). This key ecological concept is a major component of what scholars since Durkheim ([1893]1933) have referred to as the division of labor.

**Applications of the Fertility Paradigms.** We have set forth three conceptually distinct theoretical explanations of fertility. We now examine the extent to which key

variables from these paradigms (two variables from each paradigm) are able to differentially influence the patterns of male and female fertility among the sub-regions of Taiwan in 1995. Since we use key variables from each of the three theoretical approaches, as with previous empirical examinations of competing fertility theories (cf., London and Hadden, 1989), our examination will only be an approximate test of three very complex theories. We echo the statement of London and Hadden that, “in reality, we are testing the relative validity of key concepts drawn from each of the theories, not the theories themselves” (London and Hadden, 1989: 20).

The independent variables we have chosen to represent the ecological paradigm are the index of sustenance differentiation and population density. Using population data from nine industrial categories, we have calculated for each Taiwan city and *hsien* in 1990 a sustenance differentiation index, using the M1 measure, which, according to Gibbs and Poston (1975), reflects both structural and distributive differentiation in sustenance activities. The relationship between the degree of sustenance differentiation and fertility should be negative, that is, among the Taiwan sub-regions, the higher the sustenance differentiation in 1990, the lower the fertility rate in 1995. Population density is calculated as the population of the Taiwan sub-area per square kilometer in 1990; the higher the density in 1990, the lower the fertility rate in 1995.

The independent variables selected to represent the political economy paradigm are the proportion of the labor force engaged in wholesaling, retailing, and financial services, which has been referred to elsewhere as the tertiary elite; and the percentage of males employed in agriculture. The tertiary elite measure is calculated for each Taiwan city and *hsien* for 1990 as the proportion of its labor force engaged in wholesaling,

retailing, and financial services. The relationship between the degree of presence of tertiary elite and fertility should be negative. Among the Taiwan sub-regions, the greater the tertiary elite in 1990, the lower the fertility rate in 1995. The percentage of males in agriculture is also calculated for each Taiwan sub-region in 1990; we expect a positive association between males in agriculture and fertility.

The independent variables selected to represent the wealth flows paradigm are the illiteracy rate, measured as the percentage of the population in the Taiwan sub-region in 1990 aged 6 and over that is illiterate; and the percentage of females in the sub-region employed in non-agricultural activities in 1990. The greater the illiteracy rate, the greater presumably is the presence of patriarchal systems, and hence the higher the fertility rate. The greater the percentage of females in nonagricultural activities, the less the presence of patriarchal systems, and thus the lower the fertility rate.

The data for the six independent variables are taken from the 1990 Taiwan census. The dependent variables, male and female total fertility rates, are calculated with data from Taiwan's *1995 Demographic Fact Book*. In 1990, Taiwan was divided into 21 cities and *hsiens* (counties). After 1990, the Hsinchu and Chiayi *hsiens* were each sub-divided into two separate *hsiens* and cities, resulting in 23 cities and *hsiens*. We have broken out the 1990 data for the Hsinchu and Chiayi *hsiens* into *hsiens* and cities, so that we are able to use 23 sub-regions in the correlation analysis that follows.

Table 2 presents zero-order correlations between the six independent variables and the 1995 male and female total fertility rates. We were not able to estimate a single regression model, or three separate models, one for each paradigm, owing to the high multicollinearity among the six independent variables.

We hypothesize negative associations with the two fertility rates for the sustenance differentiation, population density, tertiary elite, and females in non-agriculture variables, and positive associations for the males in agriculture and illiteracy variables. The correlations in the top two rows of the table indicate that in all cases these expectations are upheld.

However, in all instances, the correlations of the six independent variables are higher with female fertility than with male fertility. Indeed for four of the predictors, namely, sustenance differentiation, males in agriculture, the illiteracy rate, and females in non-agriculture, the zero-order correlations with male fertility are .28 or less, and are not statistically significant (one-tailed tests). Only the population density and the tertiary elite variables are significantly associated with male fertility. Neither of the two wealth flows variables has an effect on male fertility among the sub-regions of Taiwan.

These six independent variables representing the three fertility paradigms, however, perform quite well explaining levels of female fertility. The two ecological predictors of sustenance differentiation and population density have correlations with female fertility of  $-.55$  and  $-.80$ , the two political economy predictors of tertiary elite and males in agriculture have correlations of  $-.82$  and  $.74$ , and the two wealth flows predictors of illiteracy and females in non-agriculture have correlations of  $.60$  and  $-.56$ .

It is no surprise that variables from these three fertility paradigms all do well in predicting variation in female fertility rates among Taiwan's sub-regions. What is surprising is that the same variables from the three paradigms perform so miserably in predicting variation in male fertility among the same Taiwan subregions. Conventional demography has developed these three theories as fertility theories. Presumably they

should be able to account for variation in female fertility as well as in male fertility. Our analysis shows this not to be the case. These three paradigms only work well in predicting female fertility. We discuss this point, and its implications, along with other points in the conclusion.

### **Conclusion**

We began this paper with the critical demographic question, why has conventional demography ignored males in fertility studies. We entertained seven answers. We noted each in detail and showed that it is either unimportant or of little or no consequence.

We turned next to a consideration of male and female fertility in Taiwan. We first demonstrated the incompatibility of male and female fertility using longitudinal male and female TFR data for Taiwan for the years of 1983 to 1995. In the earlier years (between 1983 and 1987) male TFRs in Taiwan were higher than female TFRs. The rates crossed over in 1988 and 1989, and since 1990 the female TFRs have been larger than the male TFRs, and the gap between them was the largest in 1995. We then examined male and female TFRs among Taiwan's sub-regions as of 1995. In most of the Taiwan sub-regions, the female TFRs were greater in value than the male TFRs. These noteworthy societal fertility trends have gone unreported in the demographic literature because of the practice among conventional demographers to ignore males in fertility studies.

We next set out six independent variables, each representing one of three fertility paradigms, namely, human ecology, political economy, and wealth flows. Using zero-order correlation coefficients, we demonstrated the greater utility of these variables in

being able to account for, and to predict, the values of the female TFRs as against the values of the male TFRs.

Were one to describe the patterns of fertility in Taiwan over time between 1983 and 1995, or among Taiwan's sub-regions in 1995, using TFRs based on females, the conclusions would not at all be identical to those from an analysis using male TFRs. For one thing, the levels of fertility over time and among the sub-regions would for the most part be lower for male fertility than for female fertility. Moreover, those time-periods and sub-regions with the higher and lower values of female fertility would not all be the same as those with the higher and lower values of male fertility. Only by invoking the paradigm of critical demography and questioning the social order do the above points become known.

Also, were one to model the variability in fertility among Taiwan's sub-regions within the framework of the three fertility theories just mentioned using female TFRs, the results would not be the same as in an investigation using male TFRs. Key variables from these theories are all highly and significantly related with female fertility but not with male fertility. Moreover, the efficiency of the six independent variables is much greater when predicting the female TFRs for most of the sub-regions than when predicting the male TFRs. In some cases the independent variables hardly do better in predicting male fertility than does the mean of the male TFRs. Had we followed the conventional demographic practice of focusing only on female fertility, the above conclusion would not have been known.

We have challenged the status quo of conventional demography. We have shown empirically that analyses of fertility patterns in Taiwan have very different results

depending on whether fertility rates based on females or rates based on males are used. We need now to undertake similar longitudinal and cross-sectional analyses in other countries and determine if there are similar kinds of differences between results based on male fertility rates and female fertility rates. There is very little to date of this type of comparative analysis in the literature.

This exercise in critical demography permits us to conclude that demographers and sociologists should give more attention to males in their analyses of fertility variation and change than has heretofore been the case. It would no longer appear to be acceptable or appropriate to estimate fertility models that are based solely on women and on female fertility rates. Goldscheider and Kaufman (1996) have written that “it is increasingly necessary to take men’s roles and commitments into account in considering the factors leading to decisions about bearing and rearing children” (1996: 95). And Greene and Biddlecom (2000) have argued that “the inclusion of men both as individuals and as couples will enable demographers to transcend some of the current assumptions about marriage and fertility and to interpret more effectively the changes taking place throughout the world in reproductive behavior and family formation” (2000: 106). We support both of these very relevant observations as well as their aggregate-level counterpart. Fertility estimation, be it at the micro or macro level, must perforce take into account both sides of fertility. These conclusions and recommendations, however, would not have emerged without the invocation of the paradigm of critical demography.

### Endnote

1. Two of Taiwan's sub-regions are municipalities: Taipei with a population of about 2.7 million, and Kaohsiung with a population of almost 1.5 million. Five of Taiwan's 23 sub-regions are cities: Taichung City (835 thousand), Tainan City (705 thousand), Keelung City (365 thousand), Hsinchu City (340 thousand), and Chiayi City (265 thousand). The remaining sixteen sub-regions are counties; some are in the hinterlands (Ilan *Hsien*, Taoyuan *Hsien*, Miaoli *Hsien*, Changhwa *Hsien*, Nantou *Hsien*, Yunlin *Hsien*, Pingtung *Hsien*, Taitung *Hsien*, Hualien *Hsien*, and Penghu *Hsien*) and others are in the urban fringe areas of the above mentioned cities and municipalities (Taipei *Hsien*, Hsinchu *Hsien*, Taichung *Hsien*, Chiayi *Hsien*, Tainan *Hsien*, and Kaohsiung *Hsien*). The *hsiens* range in size from over 3.3 million (Taipei *Hsien*) to under 100 thousand (Penghu *Hsien*). Typically, the *hsiens* located in the urban fringe areas of the cities and municipalities are much larger in population than those in the hinterland.

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Table 1  
Male and Female Total Fertility Rates:  
23 Cities and *Hsiens* of Taiwan, 1995

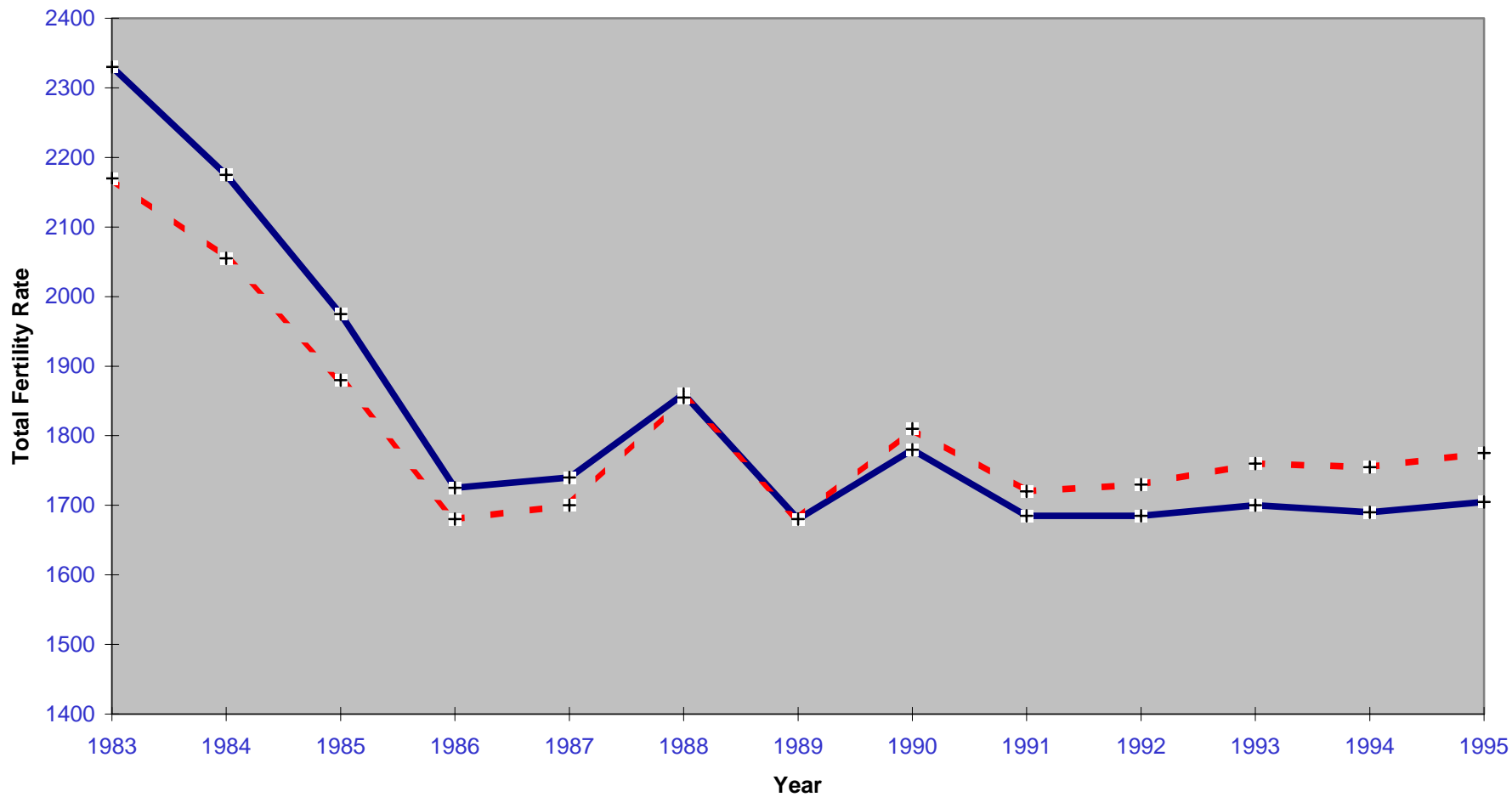
	<u>Sub-region</u>	<u>Abbr.</u>	<u>Male</u>	<u>Female</u>
1.	Keelung City	KeC	1610	1710
2.	Hsinchu City	HsC	1835	1880
3.	Taichung City	TacC	1775	1675
4.	Chiayi City	ChC	1605	1640
5.	Tainan City	TnC	1545	1550
6.	Taipei <i>Hsien</i>	TaiH	1680	1670
7.	Ilan <i>Hsien</i>	IlH	1810	1940
8.	Taoyuan <i>Hsien</i>	TaoH	1915	1925
9.	Hsinchu <i>Hsien</i>	HsH	1985	2235
10.	Miaoli <i>Hsien</i>	MiH	1795	2035
11.	Taichung <i>Hsien</i>	TacH	1860	1905
12.	Changhwa <i>Hsien</i>	ChaH	1805	1950
13.	Nantou <i>Hsien</i>	NaH	1775	1985
14.	Yunlin <i>Hsien</i>	YuH	1750	2080
15.	Chiayi <i>Hsien</i>	ChiH	1690	2035
16.	Tainan <i>Hsien</i>	TnH	1605	1785
17.	Kaohsiung <i>Hsien</i>	KaoH	1640	1785
18.	Pingtung <i>Hsien</i>	PinH	1710	1895
19.	Taitung <i>Hsien</i>	TatH	1655	1975
20.	Hualien <i>Hsien</i>	HuaH	1755	1960
21.	Penghu <i>Hsien</i>	PeH	1505	1750
22.	Taipei Municipality	TaiM	1495	1415
23.	Kaohsiung Municipality	KaoM	1515	1515

**Table 2**  
**Zero-order Correlations and Descriptive Data for Male and Female Fertility Rates in 1995,**  
**and Six Independent Variables in 1990:**  
**23 Cities and Hsiens of Taiwan**

<b>Variables</b>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Male TFR	---	.77*	-.22	-.52*	-.58*	.28	.15	-.04
(2) Female TFR		---	-.55*	-.80*	-.82*	.74*	.60*	-.56*
(3) Sustenance Differentiation			---	.40*	.71*	-.73*	-.63*	.77*
(4) Population Density				---	.79*	-.72*	-.66*	.59*
(5) Tertiary Elite					---	-.83*	-.70*	.71*
(6) Males in Agriculture						---	.85*	-.94*
(7) Illiteracy Rate							---	-.80*
(8) Females in Non-agriculture								---
Mean	1709.35	1838.91	0.75	2004.75	40.46	27.70	8.32	74.80
Standard Deviation	132.95	199.89	0.05	2786.70	12.74	16.10	2.84	18.83
Minimum Value	1495.00	1415.00	0.60	70.86	23.90	2.10	3.11	35.50
Maximum Value	1985.00	2235.00	0.82	10157.24	69.10	57.40	13.67	99.00

\*  $p < .05$ , (one-tailed)

**Figure 1. Male and Female Total Fertility Rates:  
Taiwan, 1983-1995**



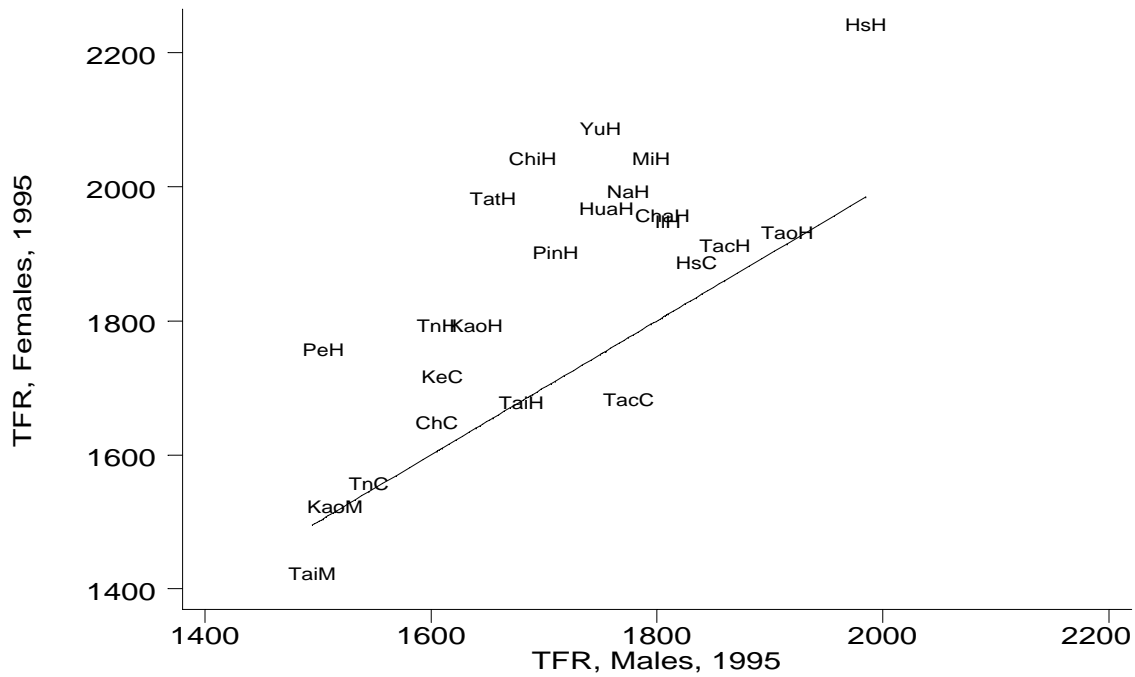


Figure 2: Female and Male TFRs, 1995, Taiwan Subareas

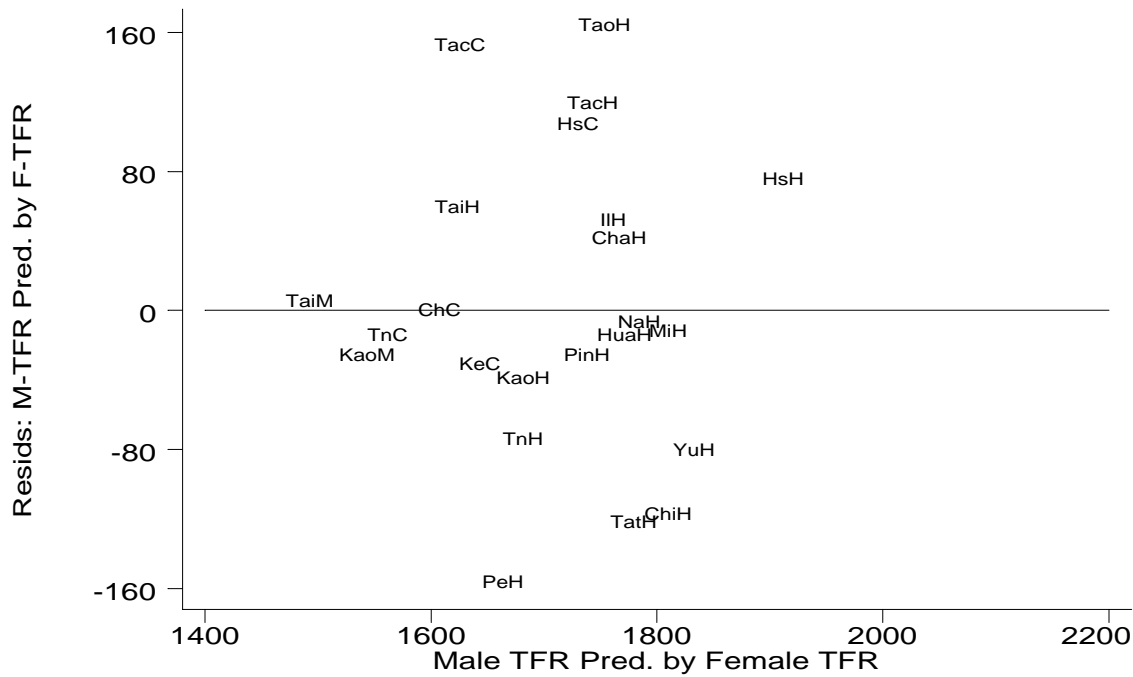


Figure 3: Residuals vs. Predicted Values: Taiwan Regions