Patterns of Male and Female Fertility in the World, 1990-1998

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Introduction

In the field of demography, fertility rates are almost always calculated for females, and hardly ever for males. In both the scholarly and popular literature 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 demographic and social science literatures, the explanations are implicitly based on females, but are referred to as fertility theories, not as female fertility theories (Horton, 1999; Poston and Chang, 2005). Biology dictates that females and males must both intimately be involved in the production of children. Therefore, "critical demography" criticizes "conventional demography" with regard to why are males not included in the study of fertility (Horton, 1999; Poston and Chang, 2005).

Demographers have listed several biological, methodological, and sociological reasons to justify excluding males from fertility studies. The biological reasons, such as the childbearing years of women, occur in a more sharply defined and narrower age range, 15-49, than they do for men aged 15-79. "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" (Keyfitz, 1977: 114). The methodological reasons include data on parental age at the birth of a child. They are more frequently collected on registration certificates for the mothers than for the fathers and there are a greater number of instances of unreported age data for fathers. This is especially the situation for births occurring outside marriage (Keyfitz, 1977; Poston and Chang, 2005). In addition, male and female fertility rates are incompatible (Coleman, 2000: 49; Smith, 1992: 227; see also Myers, 1941). The sociological reasons mentioned include the fact that 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). Female fertility rates are thought to be more fundamental because they are bound by biological limitations, and hence are more influenced by the proximate determinants, such as by breastfeeding, than are male rates (Coleman, 2000; see also Hajnal, 1948).

Yet, some critical demographers note the fact that male and female fertility rates may not be the same makes it all the more important and necessary to analyze male fertility along with female fertility. Given the plea of critical demography of bringing men back in, theoretical and methodological studies of human fertility, questioning whether male and female fertility are the same, and whether conventional fertility theories based on female fertility may also be applied to males, are important. This study will endeavor to address the above questions and evaluate the plea of conventional demographers. Thus, there is significant potential for the research of this article impacting demography and sociology.

Review of Male Fertility Literature

Since conventional demographic research on fertility has been devoted to analyses of women, 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. It is, thus, particularly important to know that what has been published on the topic of male fertility. A *POPLINE* demographic database search showed over 82,500 fertility studies have been conducted between 1950 and 2005; of these, only 406 were about males. A *JSTOR* search found 11,308 articles relating to fertility in sociology and population studies published during 1930 to

2002. Among these, only 126 of them were about male fertility. The *CAMBRIDGE SCIENTIFIC ABSTRACTS: SOCIAL SCIENCES* source was also reviewed. It showed that in the sociology, there were 858 abstracts that addressed fertility, but only 15 of them dealt with male fertility. Some overlaps occurred in the three data sources. This paper has grouped all the male fertility literature into the following categories:

I. Male reproductive health and contraceptive use. Under this topic, the literature was mainly biological and medical in orientation and accounted for two-thirds of all the literature. Biological and genetic factors influencing male fertility and sterility were discussed, including such issues as cadmium (Archibong and Hills, 2000), Chlamydia trachomatis (Gdoura, et al., 2001), hydroxyurea (Archibong et al., 2000), Ramafhan fast (Abbas and Basalamah, 1986), spermatogenesis (Aitken et al., 1986; Bujan and Mieusset, 1996; Kandeel and Swerdloff, 1988; Waites, 1992), and tripterygium hypoglaucum (Qian et al., 1988), Other studies used medical and biological approaches to regulate male fertility. These studies focused on gossypol (Adekunle et al., 1999; Waites et al., 1998; Wang and Yeung, 1985; Yu and Chan, 1998), hormonal methods (Griffin and Farley, 1996; Paulsen et al., 1986; Ringheim, 1995), testosterone (Fogh et al., 1980; Wu et al., 1996), injections (Frich, 1994), and immunological approaches (Talwar and Pal, 1994; Wickings and Nieschlag, 1982). The effects of smoking and temperature on male reproductive health were also addressed (Bujan and Mieusset, 1996; Zavos, 1989).

II. Conceptualization, measurement, and methodological problems related to male fertility. Topics covered in this category include issues of the definition and measurement of male fertility (Wishik, et al., 1972), the incomplete reporting of male fertility in censuses and surveys (Rendall et al., 1999), and the inaccuracy of male fertility data (Byrne, 1997; Coughlin, 1998). Some literature hence emphasized the importance of improving male fertility data (Federal Interagency Forum on

Child and Family Statistics, 1998; Hertrich, 1997). Modeling male fertility was also briefly covered (Paget and Timaeus, 1994; Nath and Datta, 1992).

III. Social, economic, behavioral, attitudinal, cultural and religious determinants of male fertility. Here are some of the studies in this category. Harter's (1968) study of male fertility in New Orleans showed that social class and motivation were the best predictors of male fertility. Bean and his collaborator (1987) showed that religion has an effect on sterilization patterns. Adamchak (1994) measured the impact of husband's and wife's education and occupation on family size in Zimbabwe, and suggested that the gender interaction rather than simply women's status helped to explain male fertility. Muvandi (1995) further found that family planning knowledge and use, perceptions of the role of women, communication patterns between spouses, and the motivations for marriage determined male fertility in Kenya. Pantelides (2001) examined reproduction-related knowledge, attitudes and behavior of young urban men in four Latin American cities and showed that male fertility patterns varied from society to society and from culture to culture which means that male fertility is also a historically and culturally based issue. The relationship between polygamy and male fertility was also examined (Lee and Wang, 2000).

IV. Family planning and reproductive rights. The issues in this category cover family planning information sources and media exposure among men (Adamchak and Mbizvo 1991) and family planning knowledge, attitudes, and practices among men (Mbizvo and Adamchak, 1991; Petro-Nustas, 1999), men's acceptance and involvement in family planning program (Mbizvo and Adamchak, 1992; Omondi-Odhiambo, 1997; Palan, 1984; Turner, 1991), the impact of family planning program on men (Pitotrow et al., 1991), and family planning decision-making in families (Chandra, 1980). Some other scholars emphasized the importance of reproductive rights in contraceptive use and family planning decision making (Bruce, 1994; Saha and Chatterjee, 1998).

V. Male fertility trends and patterns. Longitudinal studies analyzed patterns of male fertility during the demographic transition (Low, 1994), and the declining pattern of male fertility since the 1950s (Bostofte et al., 1983; Miret-Gimundi, 2000). Cross-sectionally, Brenes and Sandoval (1981) examined men's sexual behavior and marital fertility in Costa Rica by using survey data. Morris (1993) analyzed male fertility in 12 Latin America countries regarding male premarital intercourse, contraceptive usage and fertility rates. Leslie and collaborators (1994) compared the fertility of both nomadic and settled males in Turkana and Kenya. They revealed the similar fertility for nomadic and settled men at younger ages but different pattern in older ages.

VI. Paternity, maternity, and negotiation of the processes of child rearing. In studies in this category male fertility was examined by life-course approaches. Topics on this issue focused on the impact of family background on the ages of male entry into marriage and parenthood (Michael and Tuma, 1985); the relationship between the amount of assets held by fathers and whether the fathers live with their children (Pirog-Good and Amerson, 1997); the importance of fathers' involvement regarding children's well-being (Smock and Manning, 1997); fertility and the male life cycle in the era of fertility decline (Bledsoe et al., 2000); and the living arrangement and marital experience of men in the U.S. (Marsiglio, 1987).

VII. Comparisons of male and female fertility and the importance of studying male fertility. Dinkel and Milenovic (1993) examined age-specific and cohort fertility rates for males and females and suggested that prior to 1930 male fertility was higher, but the gap narrowed over time among males aged over 40 years. Ventura et al (2000) found that the male TFR in the United States in 1998 was lower than the female TFR; however, almost two decades ago in the U.S. (in 1980) the opposite situation was true (Ventura et al., 2000: Tables 4 and 20). Poston and Chang (2005) found male and female fertilities were not the same in Taiwan. Some other literature compared the pregnancy rates among females and their partners, and indicated similar pregnancy patterns for both sexes (Darroch et al., 1994; Mott and Mott, 1985).

VIII. Fertility preferences and motivations of men. Mason and Taj's (1987) study suggested that men typically prefer sons more strongly than women, and there was some tendency for women to express the desire to cease childbearing more frequently than men do in developing countries. Literature also showed that in Africa, men's dominances and patrilineal traditions support men's reproductive motivation affecting their wives' reproductive behavior (Dodoo, 1998; Isiugo-Abanihe, 1994). Bankole's (1995) study found that men's dominance in Africa is important only in the initial stages of a couple's reproductive lives. This tendency is offset by the stronger influence of the wife's desire in the later stages.

In general, most of the male fertility (often along with females) analyses were published in the last decade. And most of them had biological or medical orientations. Although social, religious, attitudinal and behavioral determinants have been emphasized on male fertility (see above). Yet, no male fertility theories have been presented and the comparison results regarding male and female fertility varied. Thus, it is important to further examine if the fertility theories that are based on females can be applied to males. This paper next turns to examine male and female fertility empirically.

Male and Female Fertility in 43 Countries and Places, 1990-1998

In this analysis, the total fertility rate (TFR) is used to examine both male and female fertility levels. The calculation of TFR 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 this 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.

Demographic Yearbook 2001 which is published by the United Nation is the major data set in this study. This data source provides fertility information for 229 countries and places throughout the world between 1980 and 1999. Most countries and places merely have female fertility rates available, only 43 countries contain both male and female fertility rates. Both legitimate and illegitimate births are included. For those countries and places that have more than one year TFR available, the most recent year was chosen. Table 1 shows the names of the 43 countries and places, along with their corresponding male and female TFRs during 1990 to 1998 and the specific years for doing the analyses. Summary descriptive data for these TFRs are shown at the bottom of Table 2. Female fertility has a mean TFR value across the 43 countries and places of 1,967 with a standard deviation of 725. It varies from a high of 3,913 in Mexico to a low of 871.5 Hong Kong. Male fertility has an average TFR value among the 43 countries and places of 2,016 with a standard deviation of 886. The highest male TFR is 4,705 in Mexico and the lowest is 867.5 in Hong Kong, too. The average female TFR in the 43 countries and places is only slightly higher than the average male TFR by a difference of 49 births per 1,000 persons.

But, there is more variability in the male TFRs than in the female TFRs, as evidenced by their respective coefficients of relative variation (CRV) of 0.43 and 0.37 (CRV is the standard deviation divided by the mean). However, the two countries and places with the highest, and the lowest, TFR values for females and males are the same, namely, Mexico and Hong Kong. This means that on the whole, the male and female fertility rates are quite close, but there are a lot of variations among different countries and places.

Figure 1 is a scatterplot of the male and female TFRs. The countries and places are identified by abbreviated versions of their names (see Table 1 for the abbreviations). Countries and places above the line, which connects the male rates, have higher female TFRs than male TFRs, with the opposite for countries and places below the line. There are two main observations according to this figure. First, the male and female fertility in most of the countries and places are very close, especially for the countries and places that have lower TFRs below 2,000 because most of the countries and places almost fall on the line which connects the male fertility rates. Also, most of those countries and places have higher female than male fertility rates. This indicates that among the 43 countries and places, most countries and places tend to have closer male and female fertility rates, particularly for those that have lower fertility rates. The second observation is that right after the male TFRs go up to 2,000 and over, the difference between male and female TFRs increases. For most of the countries and places that have different male and female fertilities, male fertility rates are higher than female fertility rates. This suggests that male and female fertility differences mainly occur in higher fertility (TFRs 2,000 and over) countries and places, and those places usually have higher male than female fertility rates. But on the whole, male and female fertility rates are quite close, except for Bahamas (male 2,277 versus female 1,954), Greenland (male 1,980 versus female 2,600), El Salvador (male 3,692 versus female 2,938), and Mexico (male 4,705 versus female 3,914). They have male and female fertility differences of 323, 620, 754 and 791, respectively. There are no extreme outliers in the scatterplot, which also indicates similar male and female fertilities in general.

The correlation between the male and female TFRs is 0.96, which is also statistically significant. A regression predicting the values of the male TFR across the 43 countries and places during 1990 to 1998 with knowledge only of the female TFR has an adjusted value of R^2 of .91, meaning that we could account for more than 90% of the variation in the male TFRs by knowing the values of the female TFRs. This again indicates the similarity between male and female fertility.

Figure 3 plotted the residuals from such a predictive equation by the fitted values of the male TFRs that are predicted by the female TFRs. 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 in general, knowledge of female fertility does well predicting male fertility for almost three fourths of the countries and places; it also does well for such countries and places such as Lithuania (LT), Cuba (CU), and Australia (AU). In addition, there is much less error predicting male TFRs with female TFRs for those sub-regions with low predicted male TFRs (below 2,000). With the increase of the predicted male TFRs above 2,000, the errors also increase accordingly. For instance, Bahrain (BH) has an actual male TFR of 1,954, but a predicted male TFR of 2,969, or an over-prediction of 1010 births. At the other extremes, Greenland (GL) has an actual male TFR of 1,981, but a predicted value of 2,756, for an over-prediction of 775 births; El Salvador (ES) has an actual male TFR of 3,693, but a predicted value of 3,149, for an under-prediction of 544 births. With the predicted value of male TFRs increase to 3,500 and larger, the positive errors become smaller again. But if we ignore the three outliers, female TFRs can predict male TFRs well in most of the other countries and places.

In general, the values of female TFRs can well predict the value of males for three fourths of the countries and places. There were some outliers such as El Salvador (ES), Greedland (GL), and Bahrain (BH). But on the whole, there were not many errors occurring when using female TFRs to predict male TFRs. With the increase of the actual values of the male TFRs, the errors begin to increase, too. However, this only occurs to a few countries. This finding shows that there is more error predicting male TFRs with female TFRs for the countries and places with low male TFRs than for those with high male TFRs, which is similar to Poston's finding in Taiwan fertility in 1995

(Poston and Chang, 2002). Nevertheless, in this analysis, the female fertility rates did much better when predicting male fertility rates.

Three Fertility Paradigms and the Prediction of Male and Female Fertility

The paper now considers three conceptually distinct fertility paradigms, namely, wealth flow, human ecology, urbanization and industrialization. The paper will ascertain the degree to which key variables from each paradigm are capable of influencing the male and female fertility rates among the 43 countries and places.

Wealth Flows

John Caldwell's (1982) wealth flows theory is an important theory (Mason, 1997). His perspective 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 parents, 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. This paper uses the illiteracy rate as an indication of the degree of presence in a sub-region of traditionally based familial systems where the higher the illiteracy rate, the greater the presence of patriarchal family systems. It also uses the female employment rate to represent the lack of a presence of traditionally based familial systems.

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 a powerful 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 equilibrium between their size and sustenance organization” (1989: 21). Ecological theory expects 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. The independent variables chosen to represent the ecological paradigm are the GNI PPP Per Capita, which is an indicator of the sustenance maintenance in a certain country or place, and population density; population density is the number of people per square mile. The data for both of the independent variables are from the Population Reference Bureau 2004 World Population Data Sheet. The relationship between the degree of sustenance maintenance and fertility should be negative, that is, among the countries or places, the higher the sustenance maintenance, the lower the fertility rate and the higher the population density, the lower the fertility rate.

Urbanization and Industrialization

This approach comes from classic demographic transition theory that was first developed by Thompson (1930: Chapter 8) and Notestein (1953). It 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. Urbanization and industrialization also create a new way of life in which rearing more than a few children is expensive enough to discourage most parents from having large families (Mason, 1997). The independent variables selected to represent the urbanization and industrialization paradigm are the infant mortality rate, percent of urban population, life expectancy at birth and the average age at first marriage for all women. The relationships between the independent variables and fertility rate are expected to be negative. The data for the average age at first marriage for all women are from the Population Reference Bureau the World's Youth 2000 Data Sheet. And, the data for the rest of the independent variables are from the Population Reference Bureau 2004 World Population Data Sheet.

Table 2 presents zero-order correlations between the ten independent variables and the 1990-1998 male and female total fertility rates. Surprisingly, not as the "critical demography" expected, all of the ten independent variables work in the same way on both male and female fertilities, i.e. the coefficient values are quite similar and they have the same significant level of p=0.05. Among the ten independent variables, except for population density and percent of urban population, all of the other nine variables work similarly on both male and female fertilities as the theories expected. The zero-order correlation results, therefore, showed that the wealth flow and urbanization and industrialization paradigms work well on both male and female fertilities; only part of the key variables explored from the ecological paradigm works on both male and female fertilities.

Due to the multicollinearity problem among the independent variables, separate regression models for each of the three paradigms were utilized in this analysis. For the wealth flow paradigm, all four independent variables were first included into a single model. The high correlation between the female illiteracy rate and the male illiteracy rate (.97) and the highly correlation between the female employment rate in 1980 and in 2000 (.91), along with the high VIF values (larger than 2.9) for each independent variable indicated that separate regression models are needed (see Table 3). According to the results, the combination of male illiteracy rate and female employment rate (1980) slightly better explained the male fertility change, which has adjusted R square value .49. It means that theses two independent variables can explain almost half of the male fertility variation during 1990 to 1998. The same analysis was conducted on female fertility (see Table 4). Based on the results, the combination of male illiteracy rate and female employment rate (1980) also did a slightly better job explaining female fertility change, which has adjusted R square value .48. It means that theses two independent variables can explain almost half of the female fertility variation during 1990 to 1998.

As to the human ecology paradigm, the VIF value is close to 1, which indicated that there were no high correlations between the two independent variables. The results showed that with only GIP PPP Per Capita in the model, it has a stronger ability to explain the male fertility change. But all of the three models did not do well regarding the low R square values of lower than .20. The female fertility analysis demonstrated that compared to the models for male fertility, all the models work a little bit better on male fertility rates than on female fertility rates (see Table 4). Due to the low R square values, more independent variables may need to be explored for this paradigm.

In terms of the urbanization and industrialization paradigm, the results suggested that for both male and female fertilities, all of the four models did a slightly better job on male fertility than on female fertility. However, the four models show similar pattern of explanation ability for both male and female fertility (see Table 3 and 4). That is the combination of percent urban population, infant mortality rate and life expectancy at birth, and the combination of percent urban, infant mortality rate and women's age at first birth can well predict both male and female fertility.

These independent variables representing the three fertility paradigms performed quite similar explaining levels of both male and female fertility. 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; this has been approved by this analysis. The paper discusses this point, and its implications, along with other points in the conclusion.

Conclusion

This paper began with a literature review and showed most of the studies on male fertility were biological and medical based. It then followed the plea of critical demographers and conducted an empirical analysis to examine male and female fertility. The zero-order correlations showed that male and female fertility rates in 43 countries and places during 1990 to 1998 are highly correlated with each other. When female fertility rates were used to predict male fertility rates, the errors were small for most of the countries. Countries and places that have larger difference between male and female fertility were also the ones that have higher fertility rates. Regression analyses showed the independent variables worked on male and female TFRs in almost the same way.

This exercise indicated that at the country level, it is hard to challenge the status quo of conventional demography. The findings also suggested that countries and places with lower fertility levels tend to have similar male and female fertility rates. If this is true, then with the declining pattern of fertility in the world, particularly with the emergence of the lowest-low fertility in some countries, (for example, based on the United Nation 2004 international data base, South Korea has total fertility rate of 1.2, Taiwan of 1.2, and Hong Kong below 1.0), male and female fertilities may be even closer in future.

In the future, in order to better examine the demographic plea of bringing men back in fertility studies, studies in other levels and time periods are needed. Also, it is important to explore the social and cultural reasons that caused the differences in male and female fertility in some have fertility countries as well.

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Table 1
Male and Female Total Fertility Rates: 43 Countries and Places, 1990-1998

	Country	Abbreviation	M_TFR	F_TFR	Selected Year	Available Years	# of Available Years
1	Australia	AU	1835.5	1855	1994	90,92,94	3
2	Bahamas	BS	2277	1954	1992	92	1
3	Bahrain	BH	1953.5	2783	1997	90,91,93,95,97	5
4	Bosnia and Herzegovina	BA	1624	1744.5	1991	91	1
5	Bulgaria	BG	1064.5	1093	1997	93,94,95,97	4
6	Canada	CA	1458	1551.5	1997	90,92,93,94,95,97	6
7	Chile	CL	2163.5	2146.5	1998	90,91,95-98	6
8	China_Hong Kong SAR	HK	867.5	871.5	1998	90-98	9
9	China-Macao SAR	MO	1311.5	1037	1998	93-98	6
10	Croatia	HR	1605.5	1683	1997	95,96,97	3
11	Cuba	CU	1409.5	1439.5	1996	90,95,96	3
12	Cyprus	CY	1839.5	1918.5	1998	90-98	9
13	Denmark	DK	1672	1759	1996	91-96	7
14	Egypt	EG	4205.5	3742.5	1995	90,91,92,95	4
15	El Salvador	ES	3692.5	2937.5	1998	98	1
16	Estonia	EE	1184	1240	1997	93-97	5
17	Greenland	GL	1980.5	2600.5	1997	97	1
18	Hungary	HU	1318.5	1335	1998	90-92,94-98	8
19	Iceland	IS	2015.5	2040	1997	90-93,95-97	7
20	Israel	IL	3154	2933	1997	93-97	5
21	Italy	IT	1202	1191.5	1995	95	1
22	Kyrgyzstan	KG	3023.5	2827	1998	96-98	3
23	Latvia	LV	1055.5	1111	1997	95-97	3
24	Lithuania	LT	1434.5	1492	1998	95-98	4
25	Mauritius	MU	2027	2036.5	1997	91,93,94,95,96,97	6
26	Mexico	MX	4705	3913.5	1990	90	1
27	Norway	NO	1855.5	1923	1991	90,91	2
28	Panama	PA	3173	2910.5	1997	90-97	8
29	Philippines	PH	3708	3259	1991	90,91	2
30	Poland	PL	1490.5	1507	1997	90-97	8
31	Portugal	PT	1507	1465	1997	91-93,95-97	7
32	Puerto Rico	PR	2071	1913	1998	92,94,96,97,98	5
33	Romania	RO	1349	1332	1998	90-92,94-98	8
34	Singapore	SG	1645	1706.5	1997	91-97	8
35	Slovenia	SI	1061	1233.5	1998	93-96,98	5
36	Spain	ES	1191.5	1186	1997	92-97	6
37	The Former Yougoslav Re	FYROM	1896	1926.5	1997	92,97	2
38	Trinidad and Tobago	TT	1809	1718	1997	93,94,95,97	4
39	Tunisia	TN	3111	2614	1995	94,95	2
40	United States	US	1914.5	2032.5	1997	91,93,95-97	5
41	Uruguay	UY	2332	2464.5	1996	96	1
42	Venezuela	VE	2654	2248	1998	90,96,98	3
43	Yugoslavia	YU	1843	1896	1995	95	1

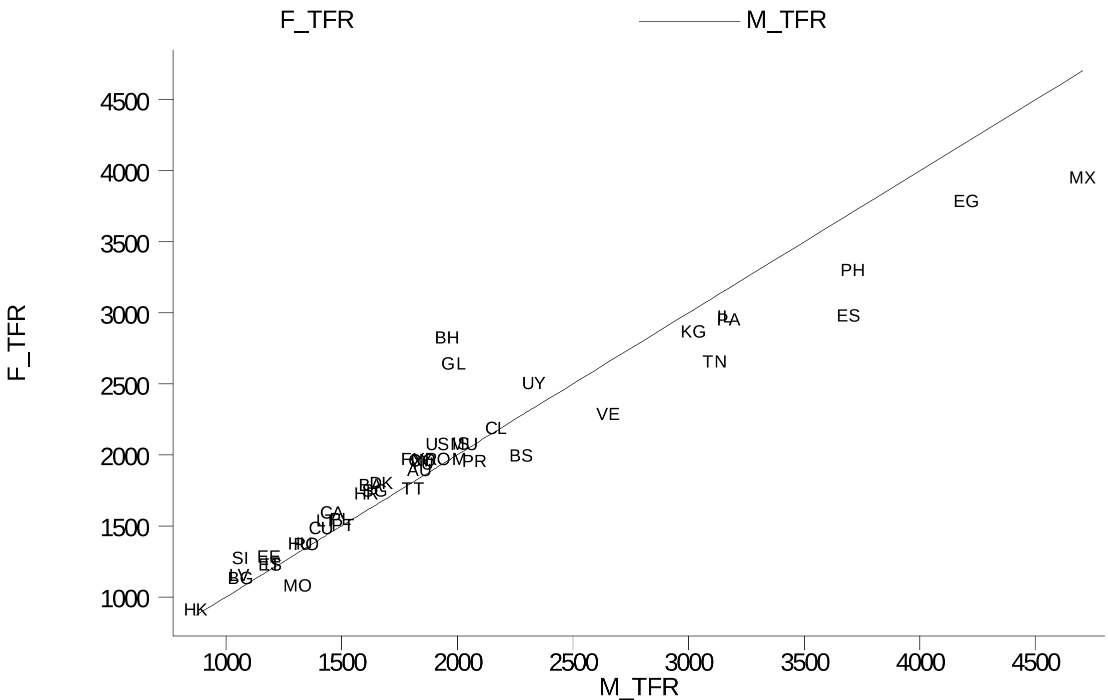

Figure 1: Female and Male TFRs, 1990-1998, 43 Countries and Places

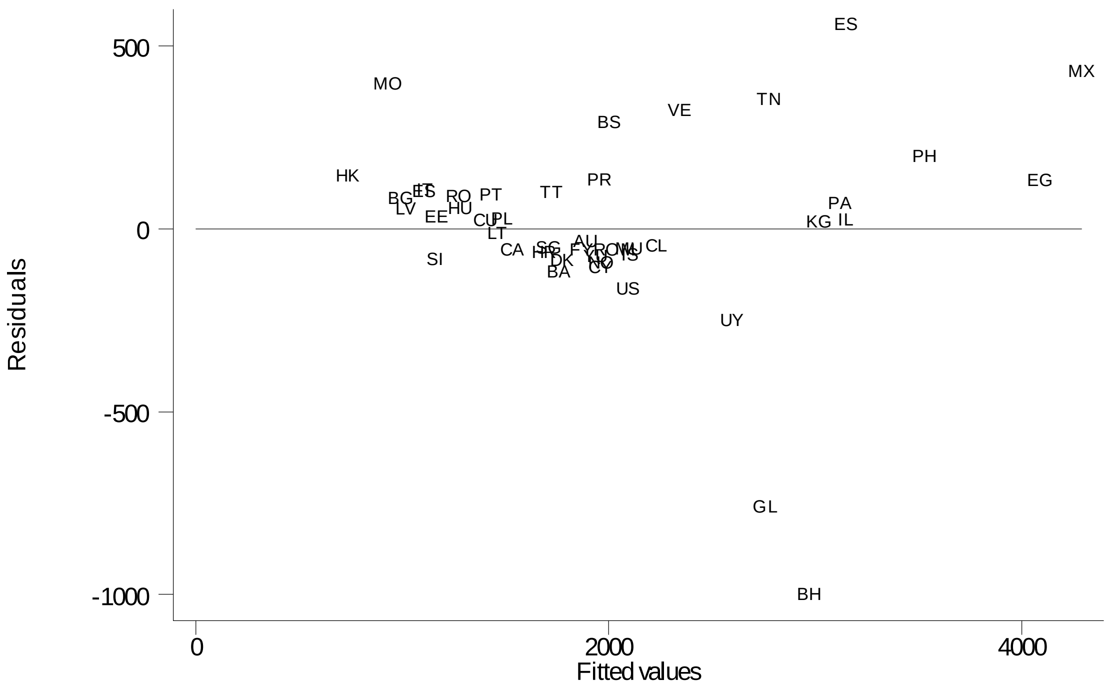

Figure 2: Residual vs. Predicted Values: 43 Countries and Places

Table 2
Zero-order Correlations and Descriptive Data for Male and Female Fertility Rates in 1990-98, And Ten Independent Variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Male TFR	---	.96*	.59*	.66*	-.50*	-.50*	-.44*	.23	-.22	.76*	-.34*	-.50*
(2) Female TFR		---	.58*	.65*	-.55*	-.53*	-.39*	.16	-.20	.70*	-.36*	-.44*
(3) Female Illiteracy Rate (15+)			---	.97*	-.51*	-.61*	-.27	.02	-.29	.62*	-.36*	-.21
(4) Male Illiteracy Rate (15+)				---	-.54*	-.61*	-.39*	.02	-.32	.71*	-.46*	-.37*
(5) Females Employment Rate (1980)					---	.91*	.15	-.24	-.15	-.22*	-.08	.12
(6) Females Employment Rate (2000)						---	.39*	-.29	.06	-.35*	.14	.26
(7) GNI PPP Per Capita (2002)							---	-.17	.55*	-.72*	.84*	.83*
(8) Population Density (Pop/sq. mile)								---	-.17	.13	-.06	-.20*
(9) % of Urban Population									---	-.54*	.55*	.48*
(10) Infant Mortality Rate										---	-.69*	-.69*
(11) Life expectancy at Birth											---	.76*
(12) Women's Average Age at First Marriage												---
Mean												
Standard Deviation	2016.1	1966.7	8.93	5.24	49.43	57.7	15436	226.17	71.78	11.45	74.76	23.35
Minimum Value	886.3	725.2	12.45	7.28	16.43	12.07	9852.7	226.19	17.40	9.55	3.86	2.28
Maximum Value	867.5	871.5	0	0	17	34	1560	0	35	2.2	65	19
Number of Observations	4705	3913.5	56	33	19	77	36690	837	100	42	81	28
	43	43	29	29	37	37	36	35	41	41	41	37

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

Table 3 Regression Analyses for Male and the Three Fertility Paradigms

Variables	Wealth Flow				Human Ecology			Urbanization & Industrialization			
	Model1	Model2	Model 3	Model 4	Model 1	Model2	Model 3	Model1	Model2	Model 3	Model 4
(1)Female Illiteracy Rate (15+)	34.07	31.99	---	---							
(2) Male Illiteracy Rate (15+)	---	---	72.75	72.08							
(3) Females Employment Rate (1980)	-22.02	---	-17.48	---							
(4) Females Employment Rate (2000)	---	-30.31	---	-23.44							
(5) GNI PPP Per Capita (2002)					-0.4	-.04	---				
(6) Population Density (Pop/sq. mile)					.76	---	.98				
(7) % of Urban Population								15.03	-2.99	9.62	---
(8) Infant Mortality Rate								87.41	---	101.67	77.51
(9) Life expectancy at Birth								---	-71.85	70.52	---
(10)Women's Average Age at First Marriage								-3.01	---	---	21.22
Intercept	2821.5	3473.6	2533.5	3006.3	2475.9	2709.1	1866.6	26.5	7609.3	5103.7	625.4
Adjusted R^2	.43	.41	.49	.47	.13	.17	.03	.61	.07	.65	.57
(df)	2	2	2	2	2	2	2	3	2	3	2

Table 4 Regression Analyses for Female and the Three Fertility Paradigms

Variables	Wealth Flow				Human Ecology			Urbanization & Industrialization			
	Model1	Model2	Model 3	Model 4	Model 1	Model 2	Model 3	Model1	Model2	Model 3	Model 4
(1)Female Illiteracy Rate (15+)	24.02	21.19	---	---							
(2) Male Illiteracy Rate (15+)	---	---	50.39	48.47							
(3) Females Employment Rate (1980)	-22.42	---	-19.43	---							
(4) Females Employment Rate (2000)	---	-32.17	---	-27.33							
(5) GNI PPP Per Capita (2002)					-.02	-.03	---				
(6) Population Density (Pop/sq. mile)					.45	---	.53				
(7) % of Urban Population								12.07	.02	71.77	---
(8) Infant Mortality Rate								68.99	---	8.93	61.04
(9) Life expectancy at Birth								---	-69.92	30.59	---
(10)Women's Average Age at First Marriage								16.08	---	---	35.55
Intercept	2833.8	3575.6	2645.6	3246.4	2278.3	2450	1892.6	-56.40	7194.9.	-1780	424.66
Adjusted R^2	.44	.41	.48	.46	.07	.13	-.004	.53	09	.51	.49
(df)	2	2	2	2	2	2	2	3	2	3	2