2012

Women's status and fertility rates : results from national level data

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WOMEN'S STATUS AND FERTILITY RATES: RESULTS FROM NATIONAL LEVEL DATA

An Abstract of a Thesis

Submitted

in Partial Fulfillment

of the Requirements for the Degree

Master of Arts

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May 2012

ABSTRACT

The rapid increase in human population makes the study of fertility rates an area of imminent concern. Understanding the relationship between women's status and fertility rates is important because providing women with access to adequate health services, educational opportunities, occupational opportunities, and political power will give them greater control over their lives. With increased control over their lives women are more likely to limit the number of children they have to their desired amount as they gain access to the resources to limit child bearing and to find fulfillment in other areas of their lives. This study contributes to the literature on fertility rates by investigating the relationship between women's status and fertility by exploring multiple dimensions of women's status using cross-national data while controlling for variables that have been identified as important in previous research.

Ordinary least squares regression was used to test the relationship between four dimensions of women's status and fertility rates. These dimensions included women's health status, women's political status, women's educational status, and women's occupational status. Though this research failed to demonstrate a significant relationship between women's political status and women's occupational status with fertility rates, and it was unable to test the relationship between women's educational status and fertility rates due to issues with multicollinearity, it did demonstrate that women's health status had an effect on fertility rates that approached statistical significance and contributed significantly to the explanation of the variance in fertility rates. Furthermore, two of the indicators that made up the women's health status index (*births attended by skilled health*

personnel and *mandatory paid maternity leave*) had significant effects of fertility rates once they were considered as single indicators. This research demonstrates that creating policies that enhance women's health status can have a dramatic effect on the number of births per woman. According to this study, nations that have social policies that provide skilled health personnel at 100% of births, mandate a full year of paid maternity leave, and provide contraception to the entire population will have an average of 2.33 less births per woman than nations that do not have any skilled personnel attending births, do not mandate any days of paid maternity leave, and in which there is no contraception available.

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This Study by: Jason Thomas Surratt

Entitled: Women's Status and Fertility Rates: Results from National Level Data

has been approved as meeting the thesis requirement for the

Degree of Master of Arts

3/3/12
Date — Dr. Phyllis Baker, Chair, Thesis Committee

3/3/12
Date — Dr. Xavier Escandell, Thesis Committee Member

3/3/2012
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4/9/12
Date — Dr. Michael J. Licari, Dean, Graduate College

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CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

Introduction

The global population has grown exponentially in the past century. According to Lutz and Qiang (2002):

> At the dawn of the agricultural revolution (8000 years before the present), total population was about 250,000...It took...(until 1800) for global population to reach one billion...it took 130 years (until 1930) to reach two billion. It took only 60 more years (1960) to reach three billion. The fourth billion was reached between 1960 and 1975, the five billion mark was passed in 1987, and the six billion mark was reached in 1999 (1197).

Though most developed countries have undergone a demographic transition in which both mortality and fertility rates have significantly declined, high fertility and mortality rates continue to be a problem in most developing countries (Sanderson and Dubrow 2000:512; Lutz and Qiang 2002:1197-1198). With the continued increase in global population the need to understand the factors that contribute to fertility decline is great.

Previous studies identified several key variables as important predictors of fertility rates including: gross domestic product per capita (Lutz and Qiang 2002; Barber 2010); level of education (Musick et al. 2009; Becker et al. 2010; Bulled and Sosis 2010); urbanization (Barber 2010); population density (Lutz and Qiang 2002); contraceptive prevalence rates (Leridon 1981; Larsen 1997); child/infant mortality rates (Sid Ahmed 2010; Barber 2010; Sanderson and Dubrow 2000) and various measures of women's status (Sanderson and Dubrow 2000; Lutz and Qiang 2002; Dodoo and Tempenis 2002). While some research investigates the link between women's status and fertility rates this body of research relies on limited measures of women's status and/or it is limited to regional analyses (Morgan and Niraula 1995; Sid Ahmed 2010).

The purpose of this project is to empirically analyze the relationship between women's status and fertility rates after controlling for other relevant factors. Understanding the relationship between women's status and fertility rates is important because providing women access to adequate health services, educational opportunities, occupational opportunities, and political power will give them with greater control over their lives. With increased control over their lives women are more likely to limit the number of children they have to their desired amount as they gain access to the resources to limit child bearing and to find fulfillment in other areas of their lives in addition to child bearing/rearing. This study investigates the relationship between women's status and fertility rates by exploring multiple dimensions of women's status using cross-national data.

Literature Review

Fertility Rates

The most comprehensive framework to research the correlates of fertility rates is the demographic transition model. In general, demographic transition refers to the drop that takes place in the fertility and mortality rates as countries undergo industrialization (Thompson 1929; Notestein 1945; Blacker 1947; Caldwell 1976; Kirk 1996:361). According to this model countries go through various stages in which mortality rates first begin to decline and are followed by declining fertility rates. There are a number of demographic transition models proposed by researchers with each one varying in the number of stages and demographic composition of each stage.

Thompson (1929) was the first demographer to write about the concept of the demographic transition though he did not use this term. He argued that the transition is a linear process that occurs in three stages. In the first stage both mortality rates and fertility rates are high and population growth, decline, and stagnation are the results of "positive checks" such as "disease, hunger, [and] war." In the second stage of the transition both fertility and mortality rates begin to decline; however, since mortality rates tend to decline faster the total population begins to increase. In the third and final stage the decrease in birthrates begins to outpace the decrease in mortality leading to a declining population (961-962).

Much like Thompson, Blacker (1947) saw demographic transition as a linear process, though he conceived of the transition as occurring in five stages rather than three. He labeled the stages the high stationary stage, the early expanding stage, the late expanding stage, the low stationary stage, and the diminishing stage in reference to the rate of natural increase associated with each group (88).

In the high stationary stage populations were relatively stable because high mortality rates were offset by high fertility rates; so the rate of natural increase was stationary. In the early expanding stage the rate of natural increase begins to expand as mortality drops and fertility stays the same. In the late expanding stage fertility rates also begin to drop though they are still outpaced by mortality rates that continue to decline. In the low stationary stage both fertility and mortality rates are low and near a point of equilibrium; thus, the rate of natural increase is again relatively stationary. In the fifth and final stage, the declining stage, the rate of natural increase is in decline as mortality rates exceed fertility rates (89-97).

While Thompson and Blacker were among the first to write about the demographic transition, according to Caldwell (1976) "Neither could be said to be the father of demographic transition theory in that neither suggested an explanation for fertility change" (323). While both of them had outlined the paths of the demographic transition they had failed to provide a theoretical explanation for why these changes take place.

Similar to Thompson and Blacker, Notestein (1945) argued that the demographic transition was a linear progression that takes place in evolutionary stages. For Notestein there were three stages which he labeled as "high growth potential," "transitional growth," and "incipient decline." The stages he presented roughly resemble the stages suggested by Thompson. Notestein's high growth potential stage is made up of populations where both fertility and mortality are high and the rate of natural increase very low, the transitional growth stage is made up of populations that are experiencing a decline in mortality while fertility remains high leading to a rise in the rate of natural increase, and the incipient decline stage refers to populations with both low fertility and low mortality.

The novelty of Notestein's work is in his presentation of the mechanisms through which the demographic transition takes place. For this reason, Caldwell (1976) credits

Notestein as the first researcher to offer a comprehensive theoretical explanation for the demographic transition (323). As Notestein writes:

> the whole process of modernization in European and Europe overseas brought rising levels of living, new controls over disease, and reduced mortality. Meanwhile, fertility was much less responsive to the process of modernization...the reasons why fertility failed to declined with mortality are clear enough in general terms. Any society having to face the heavy mortality characteristic of the premodern era must have high fertility to survive. All such societies are therefore ingeniously arranged to obtain the required births. Their religious doctrines, moral codes, laws, education, community customs, marriage habits, and family organizations are all focused toward maintaining high fertility. These change only gradually and in response to the strongest stimulation" (39-40).

Notestein presented not only empirical evidence that a demographic transition was occuring, but also a theoretical basis for understanding why this transition took place.

Several researchers have argued that the demographic transition takes place as "thresholds" are crossed. For example, Campbell and Wood (1988) and Turke (1990) argued that the demographic transition takes place in countries as declining fertility rates fall below 2.6. Additionally, Barber (2010) estimated that this shift occurs as, "infant mortality falls below 33 per thousand and GDP rises above US$20,508." Additionally, he noted that a demographic shift is not predicted to take place until the percentage of women in polygynous unions drops below .01% (14).

Other scholars have been skeptical of this analysis arguing that it is too inflexible to see "thresholds" as predicting transitional change. As Kirk (1996) pointed out, "No two countries have followed identical paths to transition, because there are so many possible combinations of nuptiality, fertility, mortality, and migration at each stage of the transition" (386; See also Dyson and Murphy 1985; Coale and Watkins 1986; Bongaarts and Watkins 1996; Casterline 2001; Bongaarts 2002).

Eventually, as a country's total fertility rate (TFR) continues to drop, it may fall below the replacement level; the fertility level at which a geographic area is able to exactly reproduce its current population. Generally speaking this happens as declining fertility rates reach about 2.1. However, there is variability in the replacement levels of individual countries due to the need for the replacement of those who died without having children and the sex ratio at birth which typically slightly exceeds 1 male birth for every female birth (Bongaarts and Bulatao 1999:516).

Though fertility rates of developed countries tend to be below replacement level, Leridon (1981) found that declining fertility rates in these countries have begun to plateau (101). In Addition, Harbison and Robinson (2002) note that "present trends in fertility strongly suggest that a deliberate equilibration process is...under way." Even this does not signal the end of the road for demographic transition as researchers including Harbison and Robinson, suggest that there may be rebound in fertility due to "growing material affluence and potential technological mastery of environmental challenges" (37).

Recent research has looked at the global demographic convergence of fertility and mortality rates (Wilson 2001; Dorius 2008). According to Dorius (2008) convergence happens when "the variance around the mean is declining proportionately faster than the decline in the mean" (520). In terms of fertility rates this means that the inter-country variance in TFR would be declining faster than the actual global fertility rate. Dorius found that "the overall trend for the last 50 years was one of convergence" due mainly to the simultaneous effects of declining fertility in high fertility countries and the slow-down of declining fertility in countries with low fertility rates (532).

Though the demographic transition model emphasizes industrialization as the primary catalyst in bringing about a decline in fertility, empirical evidence has demonstrated that industrialization is not a necessary precondition in fertility decline. As Kirk (1996) noted "an effective family planning programme may contribute to fertility decline even a very low levels of modernization" (367).

Several key variables are identified as important predictors of fertility rates. These variables include: gross domestic product per capita (Lutz and Qiang 2002; Barber 2010); level of education (Musick et al. 2009; Becker et al. 2010; Bulled and Sosis 2010); urbanization (Barber 2010); population density (Lutz and Qiang 2002); contraceptive prevalence rates (Leridon 1981; Larsen 1997); child/infant mortality rates (Barber 2010; Sid Ahmed 2010); and measures of women's status (Sanderson and Dubrow 2000; Lutz and Qiang 2002; Dodoo and Tempenis 2002). Since previous research has found these variables to be important predictors of fertility rates they will be used as control variables for the present study.

Gross domestic product (GDP) refers to the value of the goods and services produced by a country in a given time period. The negative correlation between GDP and fertility rates is a consistent finding in research on fertility rates (Sanderson and Dubrow 2000; Lutz and Qiang 2002; Adsera 2004; Barber 2010; Bulled and Sosis 2010). For example, Barber (2010) found that countries that are less economically developed have higher fertility rates. He argued that the relationship between fertility and wealth (as measured by GDP PPP) is due to the fact that urbanization is greater in wealthy countries (17). Barber suggested that GDP should be interpreted as "a measure of the extent of participation in the monetary economy" rather than an indicator of wealth. As he explained:

> Considered as a measure of wealth, GDP can be quite misleading. In a subsistence society, both food and housing may be "free" in the sense that they are not recorded in monetary transactions but that does not mean that the population suffers from malnutrition or has inadequate housing from the perspective of maintaining high fertility (11).

Interpreting the meaning of a correlation between fertility rates and GDP is not a straight forward as it may seem. Rather than concluding that wealthier countries and countries with a more equal distribution of wealth have lower rates of fertility, the correlation means that the more a country participates in an economy based on monetary exchange the lower the fertility rates.

In addition to GDP, Bulled and Sosis (2010) found that there is a negative correlation between fertility and education (283). Bulled and Sosis argued that education works to reduce fertility rates by advancing people's quality of life, making access to resources and opportunities more available, and decreasing the time and energy spent on reproduction (285). Others have made a similar argument (Mamdani 1972; Caldwell 1980; Matemowska 2006; and Gant et al. 2009). It is through these mechanisms that many researchers believe education has an effect of fertility rates.

However, While Musick et al. (2009) found that completed fertility and the predicted level of education are negatively associated in the United States, they found that "education mainly deters...unintended births" (558). Breaking their results down by race they established that:

> The least educated white women are predicted to have .86 times as many intended, 3.02 times as many mistimed, and 6.68 times as many unwanted births as their counterparts who have graduated from college...The least educated black women are predicted to have 1.36 times as many intended, 1.69 times as many mistimed, and 7.33 times as many unwanted births as their counterparts who have graduated from college (558).

The results of this research suggests that while less educated women do not desire more children than their more educated counterparts, on average they have more children because of a lack knowledge regarding contraception and abortion, or an inability to afford contraception and abortion.

Leridon (1981) found that an "Examination of fertility declines in 12 developed countries in recent decades leads to the conclusion that a 'revolutionary change in contraceptive technology and practice' has impacted more heavily on reproductive behavior than have economic, social, and political changes" (93). Leridon pointed out that the increased use of contraception makes child bearing "a voluntary act" that can be postponed until the time when a couple feels that they are ready for children (102). Though the use of contraception is not always successful at preventing unwanted births the idea that the aggregate effect of increased contraceptive use plays a role in the reduction of fertility is theoretically valid. As couples gain more control over the timing of child bearing they are better equipped to limit the number of offspring according to their desire rather than being bound by nature.

However, there are methodological problems associated with using survey research to determine contraceptive prevalence rates because respondents may provide false information due to social desirability bias. Utilizing a triangulation technique which checked survey results with official records Guyavarch (2006) found that many of the respondents that had filled out his survey had in fact under-reported contraception use. He concluded that the under-reporting of contraceptive use "probably occurs in many other surveys but is not usually identified, because independent sources of information are rarely available for comparison" (481). Because of this finding, data regarding contraceptive prevalence rates should be treated with skepticism and considered a conservative estimate.

Lutz and Qiang (2002) noted that "there has been surprisingly little systematic analysis on the question of the relationship between...human fertility...and population density on the other" (1202). According to their longitudinal study, population density is negatively correlated with fertility and "second in importance after female literacy." This finding was statistically significant in almost every year whether they considered all of the countries in their study or a sub-group consisting only of developing countries (1206). Lutz and Qiang attributed the relationship between population density and fertility rates to "psychological factors, such as perceived living space" (1209). In other words, as population density increases there is less personal space for each individual; therefore, people are less likely to choose to have children.

Sid Ahmed (2010) found child mortality rates to be the most influential factor in predicting fertility rates (795). His analysis provides evidence for the "child replacement hypothesis...the existence of [a] positive correlation between fertility and child mortality" (795). According to this hypothesis, countries with high child mortality rates experience high fertility rates because parents seek to increase the odds of having children that live to adulthood by increasing reproduction. According to Sid Ahmed this effect is mitigated by the relative costs/benefits of having children as well as “preferences and norms” regarding the appropriate number of children (783).

By comparing two Nepali villages that differ in the in the level of gender equality Morgan and Niraula’s (1995) research provides evidence for the link between women’s status and fertility. They operationalized women’s status by looking at the restrictions on women’s movement, women’s participation in household decision making, and women’s ability to gain income or to support themselves. They found that the effect of women’s status on fertility was due to the level of son preference and the ability of women to choose to use contraception when they no longer desired more children (551-558). However, this research relies on limited measures of women’s status and is limited in its focus on regional rather than cross-national analysis.

Adsera (2004) found that fertility rates were negatively associated with women’s average years of schooling and the percentage of women enrolled in tertiary education (33), factors usually associated with women’s status. However, Sid Ahmed (2010) found that women’s education levels had varying effects on fertility. For women in urban areas all levels of education had negative effects on fertility, though only secondary and university levels of education were significant. For women in rural areas there were positive effects for primary and intermediate levels of education and negative effects for secondary and university levels, however, the only significant coefficient is for women with a secondary level of education (795-796). Both of these studies are limited in that they are regional analyses that include limited indicators of women's status.

Adsera's (2004) primary findings indicate that female unemployment, another factor associated with women's status, is negatively correlated with fertility in OECD countries. As she wrote: "Confronted with labor market instability, women postpone (or abandon) maternity since and early child bearing strategy may sharply reduce lifetime income and increase employment uncertainty. This finding applies to OECD countries in which women's participation in the labor force is more likely to be necessary to provide for the household. In less developed countries there may be an opposite effect since women's participation in the labor force is more likely to bring them out of their traditional role in the household giving them less time to commit to child rearing and reproductive behaviors (38-39).

Women's Status

An examination of the women's status literature is necessary in order to understand how women's status has been measured in previous research. Women's status is difficult to operationalize because it is a multidimensional concept. For this reason many researchers use indicators that focus on women's status in a variety of contexts such as health status, political status, educational status, and occupational status.

Balk (1994) measured four facets of women's social status based on individual and household level data: the degree to which women are able to go out in public on their own; their own perceptions of what they are allowed to do; their participation in household decision making; and their attitudes regarding women's rights. These indicators are measured indirectly by asking several questions that pertain to each of the various dimensions of women's status. For instance, one of the questions asked: "When you travel outside do you wear a burka?" Another question asked: "When you go outside the village, who usually accompanies you?" (23). Balk used the responses from these questions to create the four indices mentioned above. While Balk assigned equal weight to each of the questions other researchers have used factor analysis to estimate the appropriate weight from the data (Schuler et al. 1997; Steele and Goldstein 2006). This method is used to give extra weight to indicators that have superior discriminatory power.

Steele and Goldstein (2006) considered two dimensions of women's status: "social independence; and decision making power" (139). They measured social independence using seven binary variables that asked women if they are able to "go to any part of [their] village/town/city, go outside the village/town/city, talk to a man [they do] not know, go to the cinema or a cultural show, go shopping, attend a cooperative or a social club, or visit a health center." Similarly, Steele and Goldstein measured women's decision making power by measuring five categorical variables concerning who makes decisions regarding "whether children go to school, visits to relatives or friends, household purchases, use of family planning, and seeking treatment for a sick family member." In addition, Steele and Goldstein took into account a number of "background characteristics" including: "current age, level of education (no school versus some education), religion (Hindu or Muslim), and type of region of residence (urban or rural)" (144).

Meyer (2003) used "two standardized indices of occupational sex segregation" in her analysis of women's labor market status under globalization: nominal segregation and ordinal inequality. Nominal segregation refers to the extent to which men and women differ in occupational distributions without considering occupational ranking. Measures of ordinal inequality, on the other hand, take into account the extent to which women and men are segregated within a hierarchical occupational organization (356-357).

Examples of nominal segregation measures include the index of dissimilarity which "estimates the percentage of either men or women that would have to change occupation in order for the two groups to have an identical occupation distribution" and the size standardized index of dissimilarity which differs from the index of dissimilarity in that "it adjusts for problems with variations in occupational structure across places." Alternatively, measures of ordinal inequality include the index of net differences which estimates the probability "that a man would, on average, be ranked at a higher (or lower) rank category than a woman" (357).

Young (2001) investigated the link between women's status and life expectancy. He used measures of women's status derived from the United Nations Human Development Report 1999. He compiles five indicators of women's status to create a single composite measure. All five of these indicators "measure women's attainment against those of men," and four of these indicators "reflect the percent of women in an important occupational category: administration, professional, government and seats in parliament." The fifth indicator is the "ratio of male to female literacy" (229-232).

Heaton et al. (2005) looked at the relationship between women's status and women's autonomy. Like many who study women's status in general, they viewed women's autonomy as a multidimensional concept which is difficult to operationalize. They created composite measures based on various indicators of autonomy. They used 3 different surveys in their analysis: The 2000 Bolivia Family Interaction and Children's Well-Being Survey; the 1997/1998 Peru Demographic and Health Survey; and the 2000 Nicaragua Demographic and Health Survey. Using factor analysis Heaton et al. identified two components of autonomy in the two different surveys (the Family Interaction and Children's Well-Being Survey and the Demographic and Health Surveys): personal autonomy and decision making autonomy in the Bolivian survey; and family autonomy and public autonomy in the Nicaraguan/Peruvian surveys (291-293).

They pointed out that "[b]ecause of differences in question wording, it was impossible to replicate results in each sample." They measured personal autonomy in the Bolivian survey using women's responses to questions regarding "whether they feel they have control over their lives, are free to do things by themselves, and are free to say what they like." They measured decision making autonomy in the Bolivian survey using women's responses to questions regarding "who has the final say in visiting friends and family, the family budget, lending or borrowing money, the children's education, and child discipline" (293).

They measured family autonomy in the Nicaragua survey using women's responses to questions concerning "who makes decisions regarding children's visits to the doctor, children's education, daily meals, contraceptive use, and children's discipline." They measured public autonomy in the Nicaragua survey using women's responses to questions concerning who makes decisions "regarding visits to friends, spending money, making expensive purchases, and the value of the respondent's opinion." (293).They measured family autonomy in the Peru survey using women's responses to questions concerning "the woman's health care, purchases for daily needs, and food to be cooked each day." They measured public autonomy in the Peru survey using women's responses to questions concerning who makes "decisions regarding large household purchases and visits to family and relatives." (293-294).

Other than autonomy, measures of women's status used in the Heaton et al. study include education, literacy, and employment. Education was measured on a four point scale in which 0 equals no schooling and 4 equals post-secondary education. Literacy was measured on a three point scale in which 1 equals illiterate and 3 equals reads well. Employment was measured differently between the Family Interaction and Children's Well-being survey and the Demographic and Health Surveys. In the Bolivian survey, women who do not work were coded as 0, women who work without wages were coded as 1, women who receive wages but do not have a standard schedule were coded as 2, and women who have regular work schedules were coded as 3. In the Nicaragua/Peru surveys, women who do not work were coded as 0, women who work but do not have control over their income were coded as 1, women who control their income in conjunction with their husbands were coded as 2, and women who control the money they earn were coded as 3 (294-295).

Hossain et al. (2007) also used composite measures of women's status in their investigation of the relationship between women's status and infant/child mortality rates in Bangladesh. Using latent class analysis, they constructed two indicators of women's status from the answers to survey questions which they labeled "women's autonomy in the household" and women's "authority to make decisions in the household." They created the autonomy index from "questions defining whether a woman is permitted to take a sick child to the hospital outside her village alone, to meet unknown male visitors at her home, to go outside for recreation (such as watching a movie) and to travel for family planning." They created the authority index from "indicators of the respondent's decision-making power regarding spending money for medicine when her child is sick, seeing a doctor when she is sick, how long a child should attend school and to whom and at what age a daughter should be married" (357).

Hossain et al. also created a third composite measure which they labeled *purdah.* Purdah refers to "[s]ocial and cultural institutions that compel women to live in isolation and seclusion." Though purdah can be used as an indicator of women's status they used this indicator as a control variable indicating social class in their analysis. They did this because women's ability to adhere to purdah is stratified since it requires women to wear a burkah at all times (raising the expenditure on clothing), to travel in covered vehicles, and to stay inside at all times (restricting their ability to work outside of the home) (357-358).

Koenen et al. (2006) analyzed the association between women's status and the well-being of children in the United States. They used composite measures of women's status taken from the Institute for Women's Policy Research 2002. The indicators they used include women's political participation, women's employment and earnings, women's social and economic autonomy, and reproductive rights (3001).

The Institute for Women's Policy Research derived the political participation indicator from "women's voter registration, women's voter turnout, women in elected office, and institutional resources available for women in the state." They derived the employment and earnings indicator from "women's median annual earnings "(in 2000 dollars), ratio of women's to men's earnings (in 2000 dollars) women's labor force participation, and representation of women in managerial and professional occupations." They derived the social and economic autonomy indicators from "women's access to health insurance, women's educational attainment, women's business ownership, and women above poverty." Finally, they derived the reproductive rights indicators from "access to abortion service without mandatory parental consent, access to abortion services without a waiting period, public funding for abortions, women living in counties with at least one abortion provider, pro-choice governor or legislature, contraceptive coverage laws, coverage of infertility treatments, same-sex couple adoption, and mandatory sex education for children in public schools" (3001-3004).

Chen et al. (2005) analyzed the link between women's status and depressive symptoms. They used data from the 1991 National Maternal Infant Health Survey (NMIHS). This survey provides four composite measures of women's status which were used by Chen at al. in their analysis: political participation; employment and earnings; economic autonomy; and reproductive rights. The political participation index was derived from voter registration, voter turnout; female elected officials at the state and federal level, and women's institutional resources (the presence of a commission established by legislatures or executive orders for women , as well as legislative caucuses organized by women legislators in either both houses or of the state legislature for women)." The employment and earnings index was comprised of the following indicators: women's median earnings; the ratio of female to male earnings; women's participation in the labor force; and "the proportion of women in professional and managerial occupations." The economic autonomy index was derived from "the percent of women with health insurance, women's educational attainment, women's business ownership, and percent of women above the official poverty level." Finally, the reproductive rights index was derived from the National Abortion and Reproductive Rights Action League Foundation and included composite indicators which include "whether governors or legislatures support a ban or restriction on abortion...whether the state provided public funding for abortion...whether the state mandated coverage for contraception and infertility treatment...whether minors were permitted access to abortion without parental notification...weather a mandatory waiting period was required for women to have abortions...and the percent of women living in counties with at least one abortion provider." (51-52).

Koenig et al. (2003) explored the link between women's status and domestic violence in the rural areas of Bangladesh. Their data were taken from the Family Health Research Project of the Center for Health and Population Research. Women's status indicators include the wife's land holdings, education, "an index of women's autonomy and variable on membership in savings and credit groups" (275). The women's autonomy indicator was created using latent class analysis. Koenig et al. used five indicators in the construction of the women's autonomy variable which cover three facets of women's autonomy: autonomy/mobility, familial decision making power, and control of resources" (275).

Orgill and Heaton (2005) looked at the connection between marital satisfaction and women's status in Bolivia. In addition to "objective measures" which include women's "education, literacy, [and] work status," they investigated the relationship between women's status and marital satisfaction by looking at women's autonomy, "decision making ability, [women's] sense of control over [their] personal life, and importance of [wife's] opinion" (26-27).

All of Orgill and Heaton's indicators are composite measures. Women's autonomy was calculated by combining the responses to two questions "that ask if the wife can do and think for herself and if she believes she is in control of her life." The women's decision making indicator was calculated by combining the responses to five questions concerning "who has the last say with regard to visiting friends or parents, the family budget, borrowing or loaning money, the children's education, and discipline of the children." The sense of control over resources indicator was calculated by combining the responses to three questions concerning "who keeps track of household expenditures, who decides when to purchase items such as food and medicine, and whether the wife can seek medical help without talking to her husband first?" Finally, the importance of wife's opinion indicator was calculated by combining the responses to three questions about whether or not "the wife feels free to say what she thinks, if she thinks it is important to express her opinion and how valued the wife's opinion was compared to that of her husband" (30-32).

Caiazza and Putnam (2005) examined the connection between social capital and women's status in the United States. In carrying out their project Caiazza and Putnam used data from the Institute for Women's Policy Research (IWPR) as indicators of women's status. The IWPR publishes a report entitled *The Status of Women in the States* which uses 30 variables to construct five indices of women's status. These composite measures include: "political participation, employment and earnings, economic autonomy, reproductive rights, and health and well being." They also used these five indices to create a general index of women's status (75).

The women's political participation index is made up of four indicators: women's voter registration rates; women's voter turnout rates; women's representation in elected office; and women's institutional resources. The women's employment and earnings index is comprised of four measures: women's median annual earnings, the ratio of women's to men's annual earnings; women's labor force participation rate; and the percentage of women in professional and managerial positions. The women's economic autonomy index was constructed from four measures: women's health insurance coverage rate; women's educational attainment; proportion of businesses owned by women, and proportion of women living above poverty. The reproductive rights index consists of nine indicators: Whether the state requires parental consent or notification for minors seeking abortion; whether the state mandates a waiting period before abortions, whether the state provides public funding for abortions for women who qualify; the proportion of women in counties with abortion providers; whether the state mandates comprehensive contraceptive coverage by insurance companies; whether the state mandates infertility treatment coverage by insurance companies; if the state government is pro-choice; whether second-parent adoption is legal for gays and lesbians; and whether sex education is mandated for public school students. Finally, the women's health and well-being index is made up of nine indicators: women's mortality rates from heart disease; women's mortality rates from breast cancer; women's mortality rates from lung cancer; women's incidence rates of diabetes; women's incidence rates of AIDS; women's incidence rates of Chlamydia; women's mortality rates from suicide; women's self-reported mental health; and women's self-reported activities limitations due to health (76).

Other researchers used "direct" measures of women's status rather than the indirect measures and proxies being used by the researchers in the literature mentioned above. Direct measurement is being used in two distinct ways. One measures women's status by asking a direct question regarding their status (i.e. level of education, percent of women in the workforce, etc.) as opposed to asking an indirect question that can be used, in conjunction with other indirect questions, to create an index that indicates some aspect of women's status (i.e. when you go out in public do you wear a burka? Or, when you go outside the village, who usually accompanies you?). The second distinct way direct measurement is used is to differentiate between an actual measurement of status (i.e.

percentage of women in parliament) and a proxy for women's status (i.e. contraceptive prevalence rates and births attended by skilled health personnel).

For example, Vieraitis at al. (2007) explored the impact of women's status and inequality of female homicide victimization rates. In their research they used four indicators of women's status: "education, income, employment, and occupational attainment." These indicators are direct measures of women's status rather than proxies. They operationalized women's educational status as "the percentage of women 25 years and older who have completed a bachelors degree." They operationalized women's income status as "the median annual income (in 1999 U.S. dollars)." They operationalized women's employment status as "the percentage of women aged 16 years and older employed in the civilian labor force." Finally, they measure women's occupational status by looking at "the percentage of women aged 16 and older employed in management, professional, and related occupations." All of these indicators were measured in their absolute values as well as values relative to men's status. To calculate the relative values of women's status they divided the absolute values of men's status in terms of education, income, employment, and occupational status by the absolute values of women's status (62).

Additionally, Shen and Williamson (1999) looked at women's level of education compared to men's, births attended by skilled healthcare personnel, contraceptive prevalence rate (CPR), and total fertility rates (TFR) (203). Though many of these indicators are proxies for, rather than direct measures of women's status, they are often used by researchers because they are correlated with measures of women's status.

However, the use of direct measurements of women's status such as women's labor force participation rate, workforce participation rate, and number of seats in parliament occupied by women, which are available in the Human Development Report, are better indicators of the actual relationship between women's status and fertility rates than proxies for women's status such as TFR and CPR.

The previous fertility literature demonstrates that there are a number of important variables that predict fertility rates: GDP; level of education; urbanization; population density; contraceptive prevalence rates; and child/infant mortality rates. Before investigating the link between women's status and fertility rates these variables need to be identified and used as control variables. Additionally, previous work has demonstrated that women's status is an important correlate though investigations into the link between women's status and fertility rates from a cross-national perspective are limited in that they use only a few indicators of women's status.

The literature on women's status demonstrates that there are a number of important facets of women's status that need to be taken into consideration when operationalizing this variable. Women's status is a multidimensional concept and should be investigated from a variety of contexts including: women's health status, women's educational attainment, women's occupational attainment, and women's political participation. Much of the previous literature on women's status takes these variables into account; however, the literature on women's status and fertility rates is limited in this respect focusing only on one or two measures of women's status. Additionally, many scholars investigating women's status have used composite measures derived from multiple indicators of women's status. While this method has been used to investigate the connection between women's status and fertility regionally it has not been used on cross-national research. This study will fill both of these gaps by examining the relationship between women's status and fertility rates using multiple measures of women's status (women's educational status, occupational status, health status, and political representation) using composite measures derived from multiple indicators in a cross-national design.

CHAPTER 2

DATA AND METHODS

Data

This project used cross-national data to investigate the relationships between women's status and fertility rates while controlling for other relevant variables. The sources of the data include the statistical annex of the "Human Development Report 2010" and the "2010 World Population Data Sheet." Most of the data came from the Human Development Report; only one indicator, population density, came from the World Population Data Sheet.

The Human Development Report (HDR) is a cross-national report on the state of human development. The philosophy underlying the HDR is that measures of development should be multidimensional and not rely exclusively on economic measures such as GDP (1). Because of this focus on multiple measures of human development there were a number of indicators pertaining to the topic of this study.

The Population Data Sheet is produced by the Population References Bureau; a private, nonprofit organization that provides information regarding population changes. The Population Data Sheet presents data from 200 countries on many of the same variables found in the HDR. However, the HDR does not include data on population density while the Population Data Sheet does include this information.

In total, the 2010 HDR's statistical annex included information on 194 countries; however, only 166 of these countries were utilized in this analysis. Countries were initially excluded if data were not available for the dependent variable (TFR). Following this, many of the other countries were excluded from the analysis because of missing data on the independent variables to be used in the analysis. Though statistical techniques were utilized to impute missing data these countries were missing so many important indicators that they must be struck from the analysis. Data for *population density,* derived from the Population Data Sheet, were available for all 166 of these countries.

The following definitions for these indicators were taken from the 2010 Human Development Report unless otherwise indicated:

- Female labor force participation rate was defined as the "percentage of the working-age [female] population (ages 15-64) that actively engages in the labor market, by either working or actively looking for work" (224).
- Maternal mortality ratio was defined as the "[n]umber of maternal deaths, expressed per 100,000 live births. Maternal death is defined as the death of a woman while pregnant or within 42 days after terminating pregnancy, regardless of length and site of the pregnancy, due to any cause related to or aggravated by the pregnancy itself or it's care but not due to accidental or incidental causes" (224).
- Women receiving antenatal coverage of at least one visit was not defined in the HDR; however, this data was collected from the 2010 State of the World's Children report which provides the following definition: "Percentage of women 15-49 years old attended at least once during pregnancy by skilled health personnel (doctors, nurses, or midwives) (119).

- Births attended by skilled health personnel was defined as the "percentage of deliveries attended by personnel (including doctors, nurses, and midwives) trained to give the necessary care to women during pregnancy, labor and the postpartum period" (223).
- Number of days of mandatory paid maternity leave was defined as the "[n]umber of days of maternity leave paid by the government, the employer, or the government and the employer" (191).
- Adult female mortality rate was defined as the "[p]robability per 1000 that a 15-year-old [female] will die before reaching age 60" (224).
- The 2010 Human Development Report did not give an official definition for the percentage of females with at least a secondary education; however, based on the information in the statistical annex this indicator is comprised of the percentage of the female population ages 25 and older who have attained a secondary education (156).
- Seats in parliament held by women was defined as the "Percentage of seats held by [women] in a lower or single house or an upper house or senate, where relevant" (224).

The dependent variable for this project was national level total fertility rates. This was defined in the 2010 Human Development Report as the "Number of children that would be born to each woman if she were to live to the end of her child-bearing years and bear children at each age in accordance with prevailing age-specific fertility rates" (223).

Previous research has identified several key variables as important predictors of fertility rates, therefore these variables were utilized as controls in the following analysis. The following definitions of these control variables were taken from the 2010 Human Development Report unless otherwise indicated:

- Gross domestic product per capita was the "Gross Domestic Product (GDP) in US dollar terms, divided by midyear population (224).
- Labor force participation rate was defined as the "Percentage of the working-age population (ages 15-64) that actively engages in the labor market, either by working or actively looking for work" (224).
- Mean years of schooling was defined as the "Average number of years of education received by people ages 25 and older in their lifetime based on educational attainment levels of the population converted into years of schooling based on theoretical durations of each level of education attended" (224).
- The 2010 Human Development Report did not give an official definition for the percentage of the population that is urban; however, based on the information in the statistical annex this indicator represents the percentage of the total population that dwells in urban areas. Furthermore, the notes in the statistical annex indicated that this variable should be used with caution when making cross-national associations "because data are based on national definitions of what constitutes a city or metropolitan area" (187).

- Contraceptive prevalence rates (CPR) was defined as "the percentage of women of reproductive age (ages 15-49) who are using, or whose partners are using, any form of contraception, whether modern or traditional" (223).
- Under-five mortality rate was defined as the "Probability per 1,000 that a newborn baby will die before reaching age five, if subject to current age-specific mortality rates" (224).

Methods

An Excel file containing the data were downloaded from the Human Development Report web page. The data was transferred onto an SPSS file for analysis. Variables that were not relevant statistical controls, and in which there was a lot of missing data, were removed. Many variables that were not relevant to the final analysis, but were not missing a large amount of data, were retained for the purpose of predicting values for missing data.

Lichtenstein and Andorra were removed from the file because they were missing a significant amount of data including the *Total Fertility Rate* (*TFR*); the dependent variable of this study. After removing these two observations there were eleven variables without missing data. These variables included: the human development index (HDI); life expectancy at birth; expected years of schooling; gross national income (GNI) per capita; GNI rank minus HDI Rank; non-income HDI value; adolescent fertility rate; total population; median age; dependency ratio; and sex ratio at birth.

Additionally, there were five indicators that were missing data on only one case; Hong Kong. Though the sample size is already small, Hong Kong was removed because it has a significant amount of missing data, including multiple indicators that will be used in the main analysis. In addition to the fact that much of the missing data from Hong Kong includes important control variables, taking Hong Kong out also increased the efficiency in predicting missing data due to the additional five variables that were no longer missing data. These variables included: infants lacking immunization against DTP; infants lacking immunization against measles; infant mortality per 1000 births; adult male mortality per 1000 live births; and public expenditure on health as a percentage of GDP. This left a total of sixteen variables (excluding the dependent variable; TFR) that did not have any missing data.

In total there were eleven variables that had missing data: female labor force participation rate (1.8%); ratio of female to male employment (36.1%); ratio of female to male vulnerable employment (39.1%); maternal mortality ratio (1.8%); women receiving antenatal coverage (31.3%); births attended by skilled health personnel (6%); number of days of paid maternity leave (26.5%); percentage of seats in parliament help by women (3%); percentage of females with at least a secondary education (14.5%); contraceptive prevalence rate (25.9%); and GDP per capita (4.8%). Conventionally, indicators that are missing more than 25% of the data are discarded rather than having the missing data imputed; however, since a few of the above variables have only crossed this threshold by a small margin a few of them were retained as part of the analysis. The variables that were retained were *number of days of paid maternity leave* and *contraceptive prevalence rates. Ratio of female to male employment, ratio of female to male vulnerable employment,* and *women receiving antenatal coverage* were discarded.

The sixteen variables that were not missing data or being used as a part of the analysis were used to calculate predicted values that were used as proxies for missing data in the variables being analyzed. This was done by running regression analyses in which the variables with missing data were treated as dependent variables and the sixteen variables that were not being used in direct analysis which were not missing data were treated as independent variables. R^2 statistics for each model are as follows: female labor force participation rate (.299); maternal mortality ratio (.855); births attended by skilled health personnel (.796); number of days of paid maternity leave (.371); percentage of female population with at least a secondary education (.875); percentage of seats in parliament help by women (.211); contraceptive prevalence rate (.753); and GDP per capita (.762). The coefficients were then used to calculate a predicted value for the missing data using the following equation:

$\hat{Y} = \beta_1 + \beta_2$ (*Human Development Index*) + β_3 (*Life expectancy at birth*) + β_4 (*Expected years of schooling*) + β_5 (*Gross National Income (GNI) per capita*) + β_6 (*GNI per capita rank minus HDI rank*) + β_7 (*Non-income HDI value*) + β_8 (*Adolescent fertility rate*) + β_9 (*Total population*) + β_{10} (*Median age*) + β_{11} (*Dependency ratio*) + β_{12} (*Sex ratio at birth*) + β_{13} (*Infants lacking immunization against DTP*) + β_{14} (*Infants lacking immunization against measles*) + β_{15} (*Infant mortality per 1000 live births*) + β_{16} (*Adult male mortality rate per 1000 live births*) + β_{17} (*Public expenditure on health as a percentage of GDP*).

Predicted values for the missing responses in the remaining variables were created in SPSS using the *compute variable* function. This was carried out by entering the equation from above into the *numeric expression* window utilizing the beta coefficients that were derived from the previous regressions. The new (predicted) variables were compared to the original variables by eye to establish face validity. Finally, data from these new variables were used to fill in the missing data in the original variables.

Researchers utilize indicators that focus on women's status in a variety of contexts. For instance, Shen and Williamson (1999) look at women's level of education compared to men's, births attended by skilled healthcare personnel, contraceptive prevalence rate (CPR), and total fertility rates (TFR) (203). Though many of these indicators are not direct measures of women's status they are often used as proxies because these researchers believe they are correlates of women's status.

However, the use of several common indicators as proxies for women's status would pose methodological problems for this project. First, total fertility rate cannot be used as an indicator of women's status because it is the dependent variable. Second, contraceptive prevalence rates (CPR) are already being used as a key control because previous research has linked CPR to fertility rates. However, the use of direct measurements of women's status such as women's labor force participation rate and number of seats in parliament occupied by women, which are available in the Human Development Report, will give a better indication of the actual relationship between women's status and fertility rates than proxies for women's status such as TFR and CPR.

The indicator used for *women's health status* is composite measures derived from maternal mortality ratio, the percentage of births attended by skilled health personnel, the number of days of mandatory paid maternity leave, and adult female mortality rate. Factor analysis was used to analyze the mutual variation between these indicators in order to determine whether or not they shared an underlying structure that justified creating a composite measure.

The factor analysis revealed a single underlying component with the following factor loadings: maternal mortality ratio (.932); births attended by skilled health personnel (-.887); mandatory paid maternity leave (-.409); and female mortality rate (.89). The new variable was computed using the *compute variable* function. In the *numeric expression* window each of the variables were added together and dived by N = 4.

The other three measures of women's status, women's occupational status, women's educational status, and women's political status, were measured using single indicators. Women's occupational status was measured using the female labor force participation rate. Women's educational status was measured by the percentage of the female population with at least a secondary education. Women's political status was measured by the percentage of seats in parliament held by females. Though it would have improved the data if there were multiple indicators of women's status in these areas with which composite measures could be created these are either the only indicators available in the 2010 HDR's statistical annex or the only indicators with enough available data.

Hypothesis 1: Women's educational attainment is negatively related to total fertility rates at the national level after controlling for other relevant variables.

Hypothesis 2: Women's occupational attainment is negatively related to total fertility rates at the national level after controlling for other relevant variables.

Hypothesis 3: Women's health status is negatively related to total fertility rates at the national level after controlling for other relevant variables.

Hypothesis 4: Women's political participation is negatively related to total fertility rates at the national level after controlling for other relevant variables.

CHAPTER 3

FINDINGS

Scatter plots were created for each of the indicators of women's status as well as each of the indicators that made up the women's health status index. (see Figures 1-8 on pages 38-45). In addition to visually representing the relationship between each of these indicators and fertility rates these figures helped to identify how various countries are clustered together in trends. These charts revealed that many countries are consistently clustered together indicating that the women in these countries share either high, medium, or low levels of status between countries. Furthermore, countries tend to be clustered together with other countries that share a similar political/economic arrangement.

For instance, European countries, especially countries with highly developed infrastructure that provide welfare services to their citizens, clustered together in areas that indicate low levels of fertility (Figures 1-8), high levels of women's health status (Figures 1-5), high levels of women's political status (Figure 6), high levels of women's educational status (Figure 7), and high levels of women's occupational status (Figure 8). Similarly, African countries, especially those without a developed infrastructure that do not provide welfare services to their citizens, tended to cluster together in areas that indicate high levels of fertility (Figures 1-8), low levels of women's health status (Figures 1-5), low levels of women's political status (Figure 6), and low levels of women's educational status (Figure 7).

At the same time, much like their European counterparts, many of the African countries clustered together in areas of high occupational status for women (Figure 8).

This is because women's occupational status is measured using *female labor market participation* which does not take into account the type of work (service sector versus professional sector) or the prestige associated with the type of work women are doing.

A correlation matrix was constructed to identify variables that might have a problem with multicollinearity (see Table 1 on page 46). The results indicate that there were strong correlations between variables and many of them were significant at the .001 level. Because of the high correlations between variables, tolerance and VIF diagnostic tests were performed on the independent variables in the model (see Table 2 on page 47).

The OLS regression revealed only three statistically significant variables in the first model: *mean years of schooling* (-.085), *contraceptive prevalence rates* (-.008), and *under 5 mortality rates* (.014). In the second model, which added the women's status variables, only two of these relationships remained significant: *contraceptive prevalence rates* (-.009) and *under 5 mortality rates* (.009). Additionally, *women's health status* had a statistically significant effect (-.002). Furthermore, the R^2 change (.014) was statistically significant indicating that *women's health status* significantly contributed to explaining the variance in fertility rates.

Looking at the collinearity statistics, and going by conventional "rules of thumb" which state that tolerance levels of less than .2 or .1 and VIF levels of greater than 5 or 10 indicate multicollinearity, the second model seems to be fairly robust to the effects of multicollinearity for most of the variables. The only variable to cross the conservative thresholds for tolerance and VIF levels was *mean years of schooling*. However, three

Figure 1. Total Fertility Rates by Women's Health Status

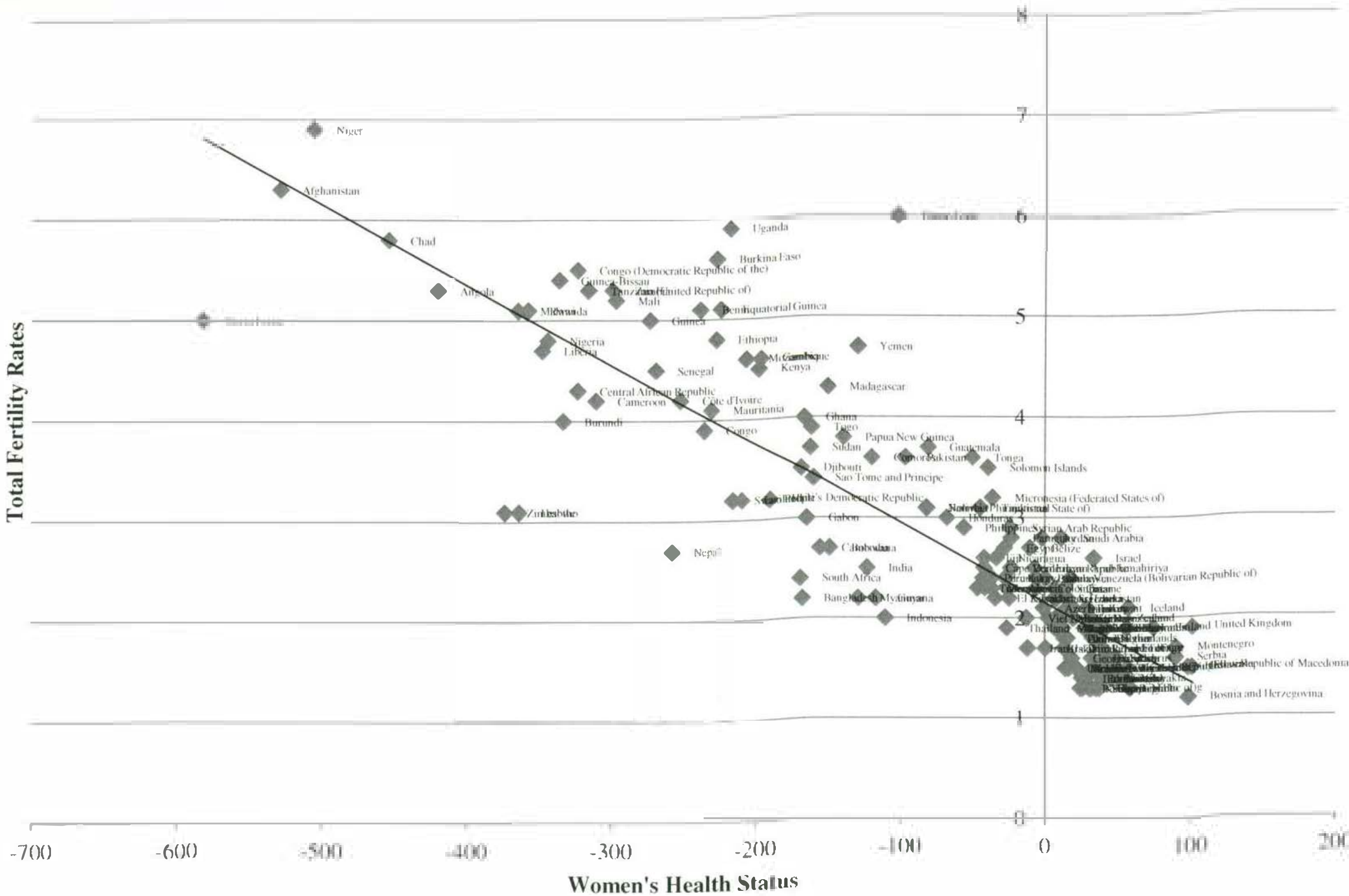

Figure 2. Total Fertility Rates by Maternal Mortality Ratio

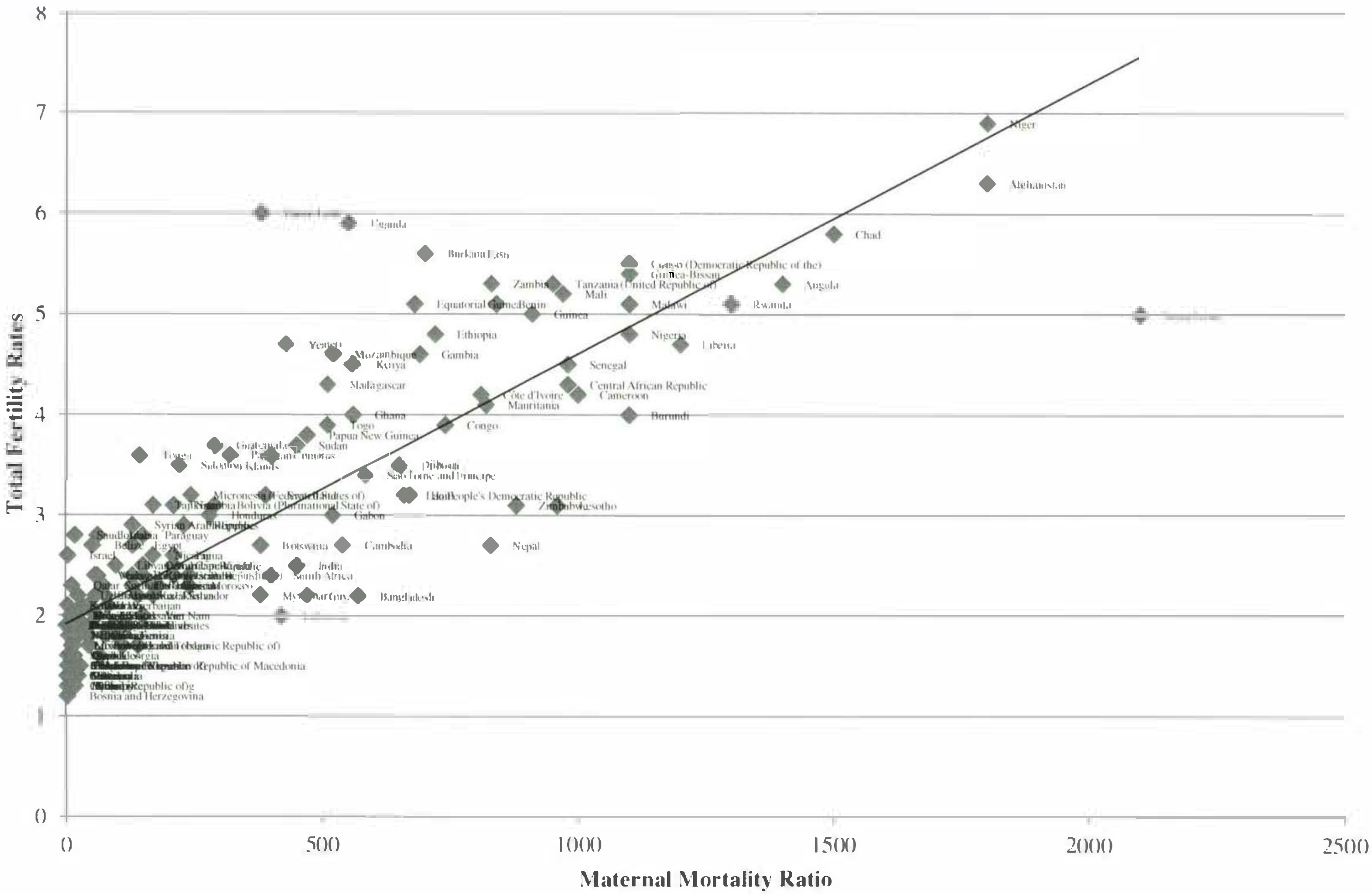

Figure 3. Total Fertility Rates by Births Attended by Skilled Health Personnel

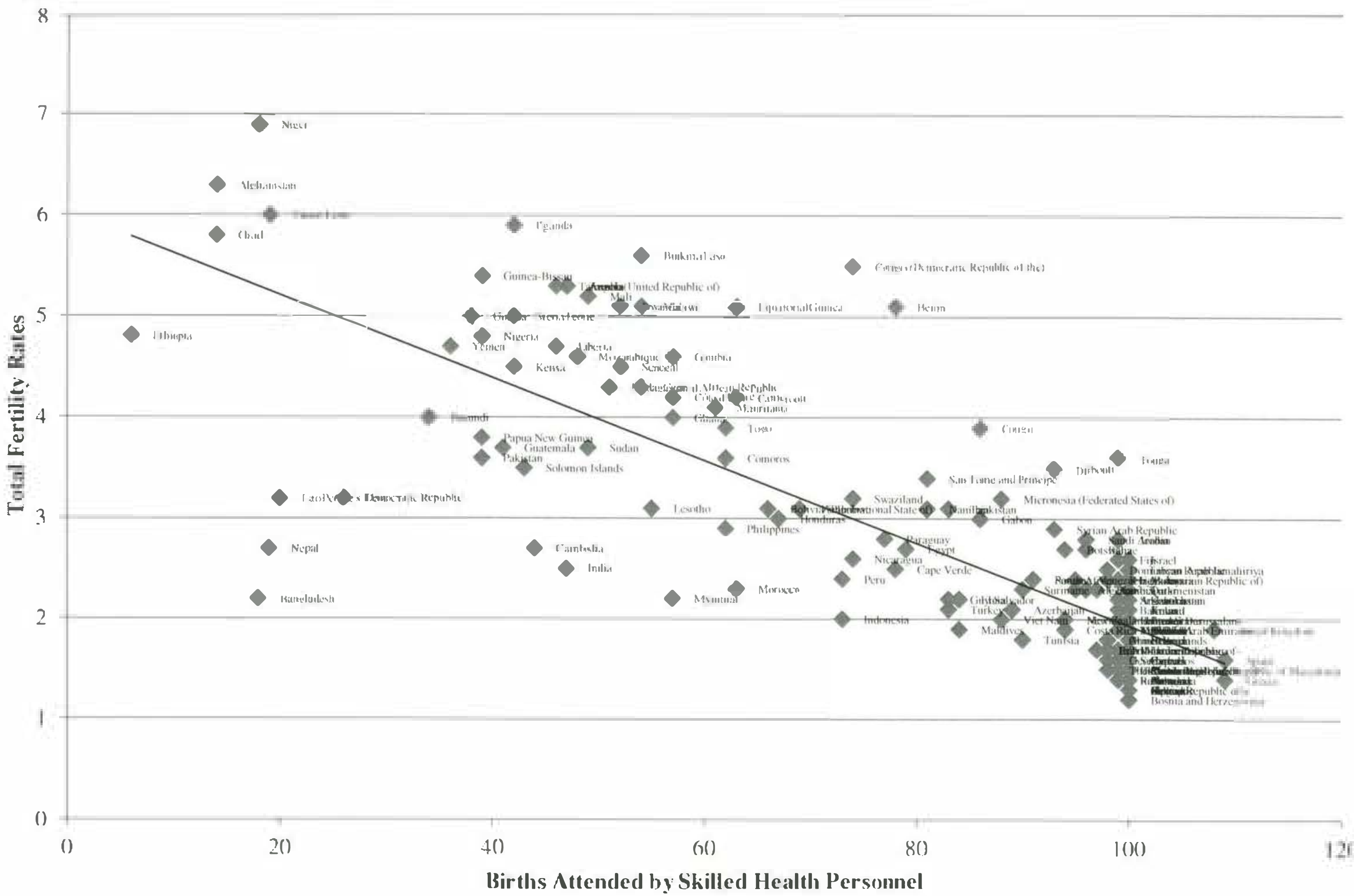

Figure 4. Total Fertility Rate by Female Mortality Rate

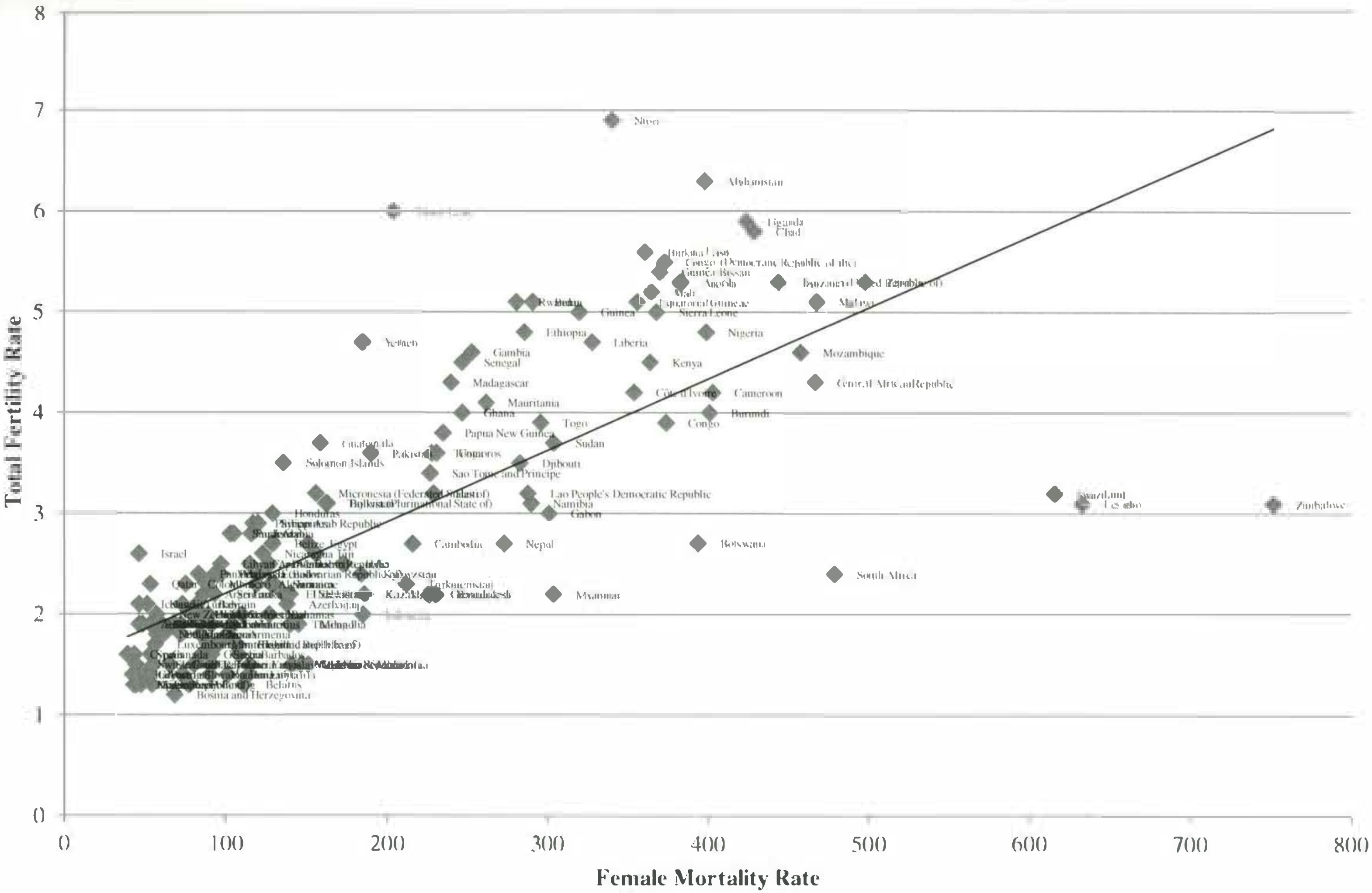

Figure 5. Total Fertility Rates by Mandatory Days of Paid Maternity Leave

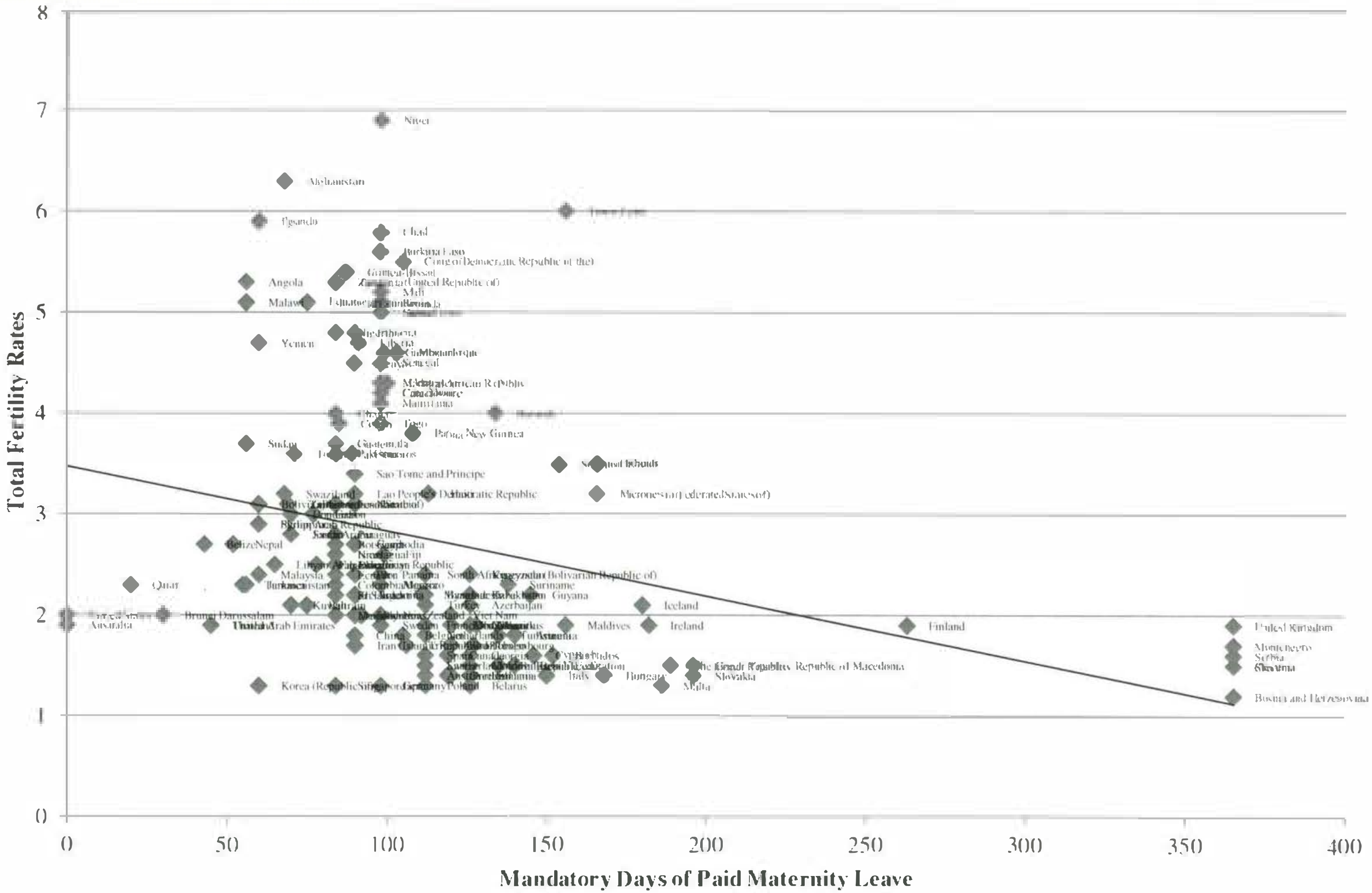

Figure 6. Total Fertility Rates by Percentage of Seats in Parliament Occupied by Women

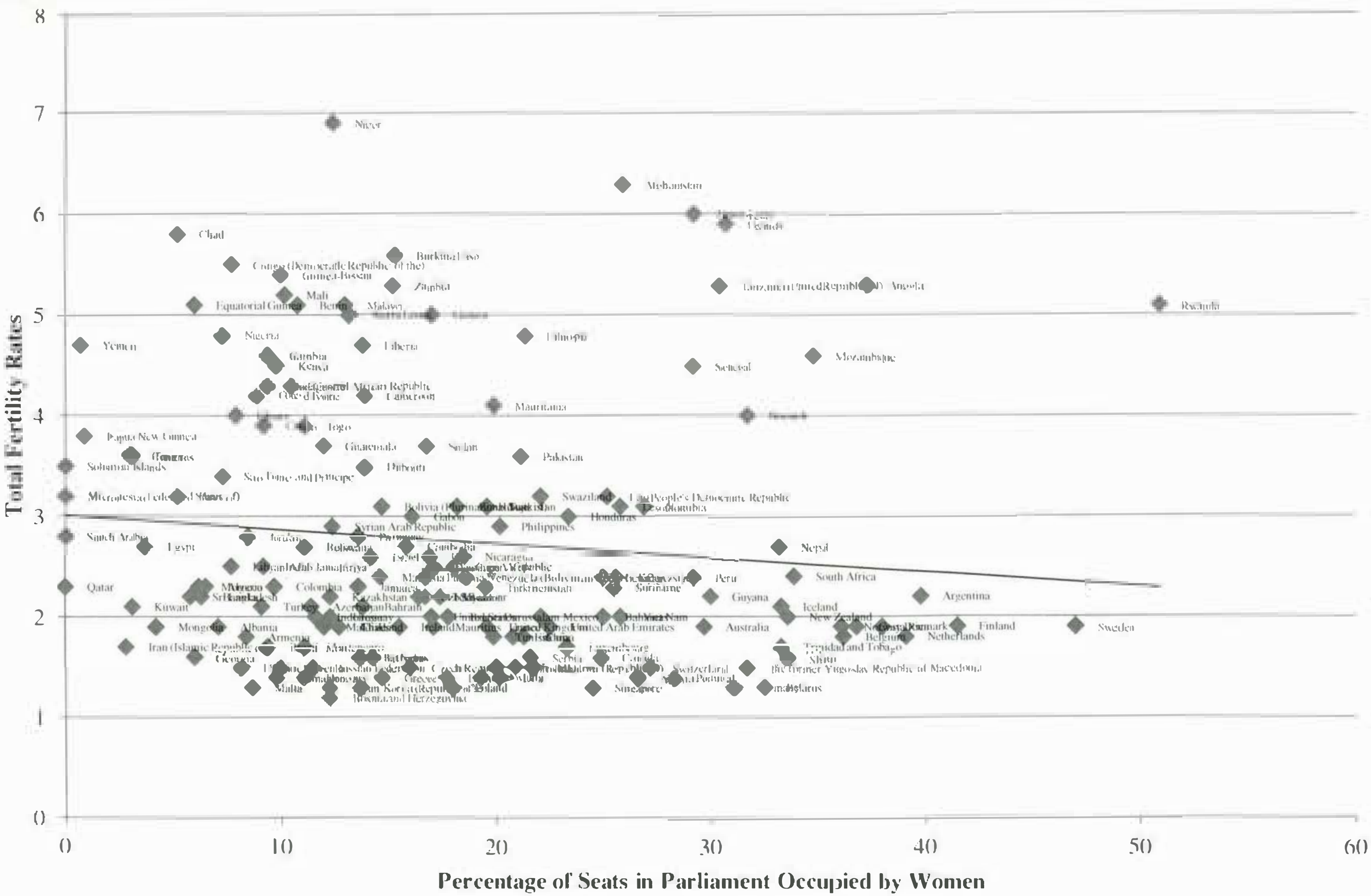

Figure 7. Total Fertility Rates by Percentage of Women with at Least a Secondary Education

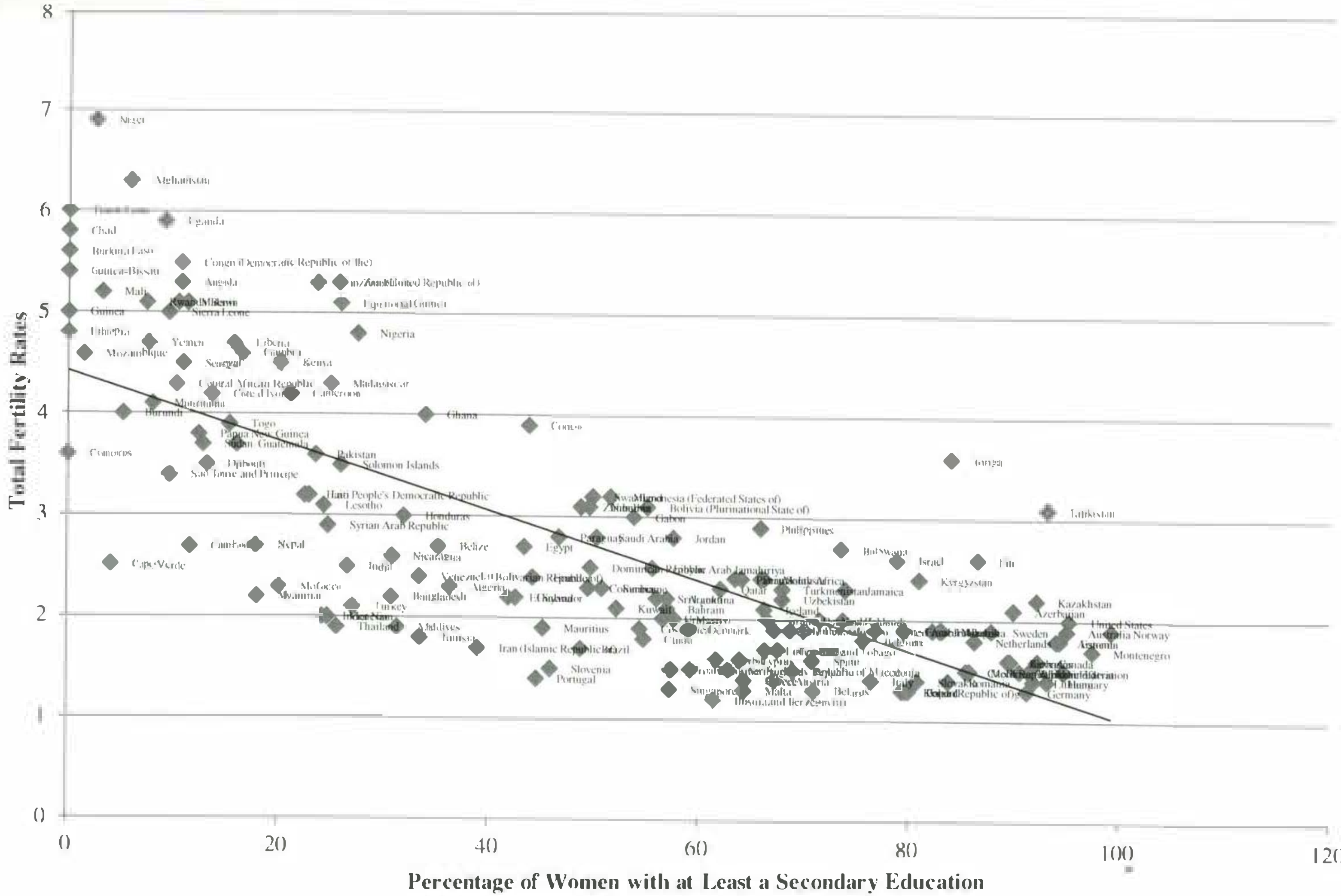

Figure 8. Total Fertility Rate by Female Labor Force Participation

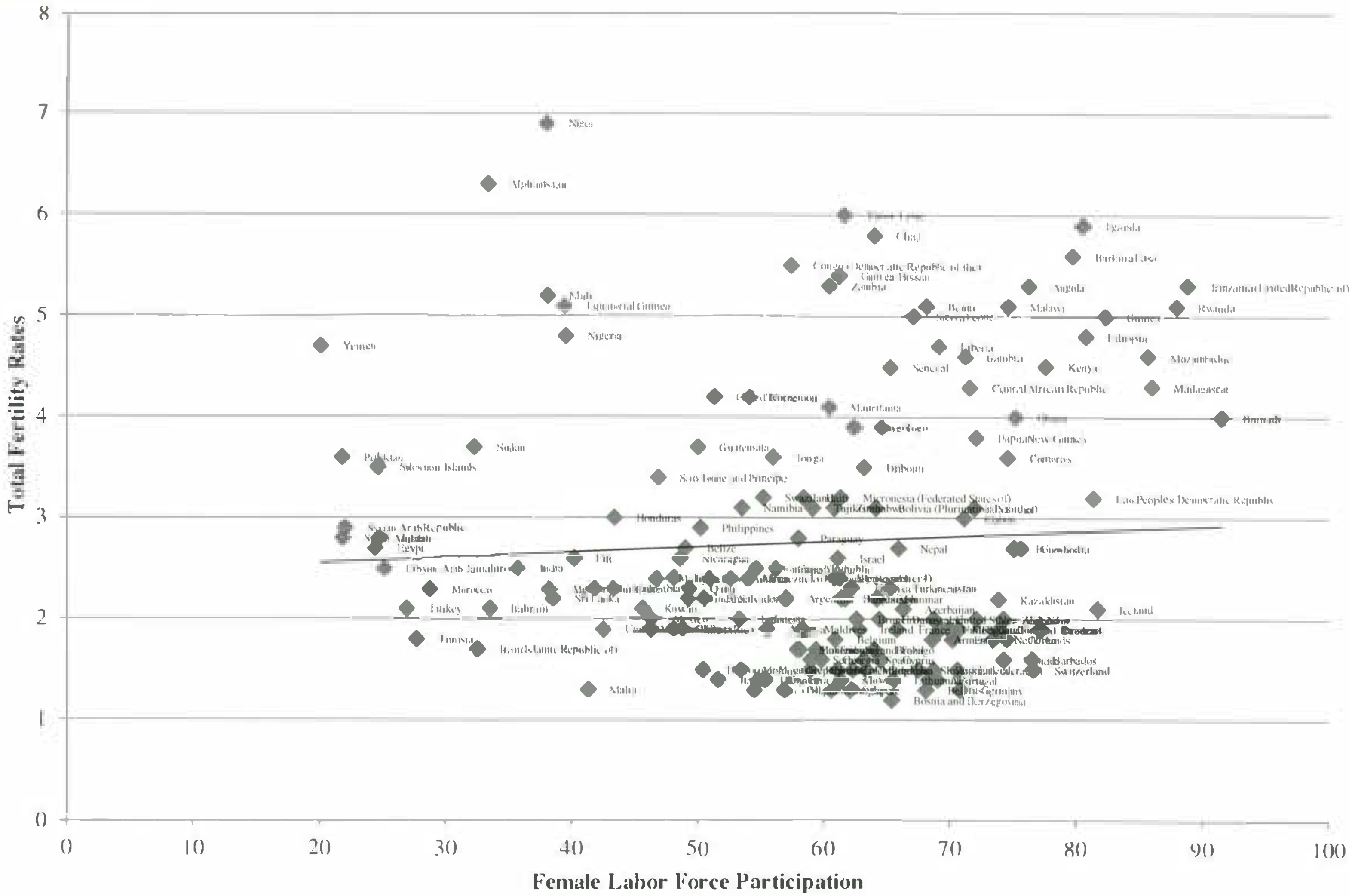

Table 1. Correlation Matrix

	Total Fertility Rate	GDP per Capita	Mean Years of Education	Percent Urban	Population per Square Kilometer	Contraceptive Prevalence Rate	Under 5 Mortality Rate	Women's Health Status	Seats in Parliament Held by Women	Female Population with at Least a Secondary Education	Female Labor Force Participation Rate
Total Fertility Rate	1	-.419***	-.779***	-.592***	-.144	-.78***	.897***	-.874**	-.11	-.764***	.06
GDP per Capita	-.419***	1	.505***	.594***	.109	.382***	-.446***	.444**	.265***	.479***	.123
Mean Years of Education	-.779***	.505***	1	.597***	.045	.695***	-.767***	.753**	1.89*	.945***	.073
Percent Urban	-.592***	-.594***	-.597***	1	.153*	.539***	-.591***	.598**	.136	.566***	-.1
Population per Square Kilometer	-.144	.109	.045	.153*	1	.082	-.115	.1	.023	.031	-.025
Contraceptive Prevalence Rate	-.78***	.382***	.695***	.539***	.082***	1	-.794***	.719**	.119	.667***	-.078
Under 5 Mortality Rate	.897***	-.446***	-.767***	-.591***	-.115	-.794***	1	-.927**	-.102	-.74***	.108
Women's Health Status	-.874**	.444**	.753**	.598**	.1	.719**	-.927**	1	.052	.726**	.126
Seats in Parliament Held by Women	-.11	.265***	.189*	.136	.023	.119	-.102	.052	1	.137	.395
Female Population with at Least a Secondary Education	-.764***	.479***	.945***	.566***	.031	.667***	-.74***	.726**	.137	1	.063
Female Labor Force Participation Rate	.06	.123	.073	-.1	-.025	-.078	.108	.126	.395***	.063	1

Source: U.N. Human Development Indicators 2010 except for *Population per Square Kilometer* from 2010 World Population Data Sheet.
* p = < .05, ** p = < .01, *** p = < .001

Table 2. Results from Initial OLS Regression

Variables	Model I	Model 2	Model 2 Tolerance	Model 2 VIF
GDP per Capita	2.970E-6 (.252)	3.459E-6 (.184)	.573	1.746
Mean Years of Schooling	-.085*** (.000)	-.003 .994	.089	11.261
Percent Urban	-.003 (.239)	-.003 (.334)	.465	2.152
Population per Square Kilometer	.000 (.134)	.000 (.095)	.962	1.04
Contraceptive Prevalence Rate	-.008* (.016)	-.009* (.004)	.342	2.924
Under 5 Mortality Rate	.014*** (.000)	.009*** (.000)	.103	9.668
Women's Health Status		-.002** (.002)	.128	7.798
Seats in Parliament Held by Women		-.001 (.76)	.763	1.31
Female Population with at Least a Secondary Education		-.007 (.09)	.104	9.646
Female Labor Force Participation Rate		-.002 (.478)	.754	1.327
R^2	.837*** (.000)	.849* (.014)		

Source: U.N. Human Development Indicators 2010 except for *Population per Square Kilometer* from 2010 World Population Data Sheet. * p = < .05, ** p = < .01, *** p = < .001

other variables crossed the liberal tolerance and VIF thresholds, these include: *under 5 mortality rate, women's health status,* and *female population with at least a secondary education.* In order to correct for this the variable *female population with at least a secondary education* was removed from the model since it was likely to be correlated with all of the other variables.

In the first model of the second regression (see Table 3) the variables *mean years of schooling* (-.085), *contraceptive prevalence rates* (-.008), and *under 5 mortality rates* (.014) were all significantly correlated with fertility rates. This time all three of these variables remained significant in the second model: B = -.069; B = -.009; and B = .009 respectively. Again, *women's health status* (-.002) was the only women's status variable that was significantly related to fertility rates. Again, the R^2 change (.022) was significant indicating that *women's health status* significantly contributed to explaining the variance in fertility rates.

Table 3. Results from OLS Regression without
Female Population with at Least a Secondary Education

Variables	Model 1	Model 2	Model 2 Tolerance	Model 2 VIF
GDP per Capita	2.970E-6 (.252)	3.349E-6 (.201)	.573	1.745
Mean Years of Schooling	-.085*** (.000)	-.069** .005	.319	3.131
Percent Urban	-.003 (.239)	-.002 (.35)	.465	2.152
Population per Square Kilometer	.000 (.134)	.000 (.112)	.964	1.038
Contraceptive Prevalence Rate	-.008* (.016)	-.009** (.004)	.342	2.924
Under 5 Mortality Rate	.014*** (.000)	.009*** (.000)	.104	9.653
Women's Health Status		-.002** (.002)	.128	7.798
Seats in Parliament Held by Women		.000 (.942)	.778	1.286
Female Labor Force Participation Rate		-.002 (.43)	.756	1.324
R^2	.837*** (.000)	.846* (.022)		

Source: U.N. Human Development Indicators 2010 except for *Population per Square Kilometer* from 2010 World Population Data Sheet. * p =< .05, ** p =< .01, *** p =< .001

Moreover, in this regression none of the collinearity statistics indicated multicollinearity according to the liberal standards of less than .1 for tolerance and greater than 10 for VIF. However, *under 5 mortality rates* and *women's health status* both crossed the conservative thresholds of less than .2 for tolerance and greater than 5 for VIF. In this regression, however, *mean years of schooling* did not cross either threshold in the first or second models.

In carrying out the analysis the *natural log of GDP per capita* was tested against the real *GDP per capita* because previous research has consistently found a non-linear relationship between *real GDP* and *total fertility rates* (for instance Barber 2009). Using the natural logarithm to induce linearity in nonlinear relationships reduces the standard error of the estimate making the model more efficient at making predictions.

Using the natural log of *GPD per capita* did not render the coefficient significant; however, the R^2 change from the regression with the real *GDP per capita* to the regression with *log GDP per capita* was .009 (.837 to .846) in the first model and .007 (.846 to .853) in the second model indicating that log transformed GDP per capita made a more efficient prediction of the dependent variable *total fertility rates*. Furthermore, replacing GDP per capita with the logarithm of GDP per capita did slightly change the significance levels of many of the coefficients but it did not render any significant coefficients insignificant, nor did it make any of the insignificant coefficients significant (see Table 4 on page 40).

Table 4. Results from OLS Regression with
Log Transformed GDP per Capita

Variables	Model 1	Model 2	Model 2 Tolerance	Model 2 VIF
ln GDP per Capita	-.043 (.395)	-.033 (.515)	.236	4.236
Mean Years of Schooling	-.076** (.002)	-.065* .011	.283	3.583
Percent Urban	-.001 (.804)	.000 (.906)	.388	2.576
Population per Square Kilometer	.000 (.14)	.000 (.119)	.963	1.038
Contraceptive Prevalence Rate	-.008* (.013)	-.009** (.004)	.343	2.918
Under 5 Mortality Rate	.014*** (.000)	.01*** (.000)	.103	8.711
Women's Health Status		-.002** (.008)	.126	7.967
Seats in Parliament Held by Women		.001 (.798)	.779	1.283
Female Labor Force Participation Rate		-.002 (.573)	.767	1.304
R^2	.846*** (.000)	.853 (.057)		

Source: U.N. Human Development Indicators 2010 except for *Population per Square Kilometer* from 2010 World Population Data Sheet. * p = < .05, ** p = < .01, *** p = < .001

However, there were theoretical reasons to believe that the data suffered from heteroscedasticity since the dataset was small (N=166), the variation in many of the indicators may have been greater at one point of the slope than they were at other points, and some of the data were imputed since they were missing. Therefore, the Goldfeld-Quandt diagnostic test was utilized to test the model for heteroscedasticity. This was accomplished by sorting all of the observations by the dependent variable (*Total Fertility Rate*), eliminating the middle fifth (34) of the observations (observations 67-100), running separate regression models which include all of the variables for the lower and upper groups of observations, and running an F-test to determine if the difference between the sums of squared errors is significantly different from zero. The F-critical was determined using the following formula to derive the degrees of freedom in order to calculate the critical value:

$$\frac{N-D}{2} - K = \frac{166-34}{2} - 9 = 57$$

In this equation N = the number of observations, D = the number of observations in the middle fifth of the sample, and K = the number of parameters

With 57 degrees of freedom in the numerator and the denominator the F-critical value is 1.55 at the .05 level and 1.87 at the .01 level. The F-obtained of 9.26 exceeds the F-critical values indicating that there is a statistically significant difference between the sum of squared errors at each end of the model; the model is heteroscedastic (see Table 5).

Though this test reveals that the model as a whole is heteroscedastic it does not isolate which variable or variables are causing the problem. Therefore, the Goldfeld-

Quandt test was performed on all of the independent variables. The exact same procedure was used as before except that the data was ordered according to the magnitude of the variable in question rather than the dependent variable. The Goldfeld-Quandt diagnostics reveal that all of the independent variables, with the exception of *population per square kilometer*, *percentage of females in parliament*, and *percentage of females in the labor market*, were heteroscedastic (see Table 5).

Table 5. Results from Goldfeld-Quandt
Tests for Heteroscedasticity

Variable	ESS1 – ESS2	F-obtained
TFR	2.353 – 20.577	8.75 **
ln GDP per Capita	4.879 – 24.377	5**
Mean Years of Educ.	7.27 – 20.895	2.87**
% Urban	4.856 – 25.179	5.19**
Population per Square Kilometer	11.974 – 15.261	1.27
CPR	5.017 – 23.357	4.66**
Under 5 Mortality Ratio	4.817 – 21.605	4.49**
Women's Health Status	3.381 – 24.092	7.13**
Percentage of Females in Parliament	12.034 – 15.99	1.33
Percentage of Females in the Labor Market	10.164 – 14.487	1.36

Source: U.N. Human Development Indicators 2010 * p = .05, ** p = .01

Since the model suffered from systemic heteroscedasticity, method 2 for Weighted Least Squares was used as a correction technique. Method 2 weighted least squares requires the variables to be weighted by the dependent variable rather than a problematic dependent variable. To accomplish this in SPSS the observations were ordered according to the dependent variable (total fertility rate) and divided into 13 groups of 12 observations and one remaining group of 10 observations. Regressions were run on each of the 14 groups in order to obtain the mean squared error for each group. The mean squared errors were matched with each observation and entered into a variable column named "WEIGHT." Using the *compute variable* function, the dependent variable and each of the independent variables were divided by "WEIGHT" in order to obtain weighted variables.

A Weighted Least Squares regression was performed by running the weighted variables in an Ordinary Least Squares regression. As with the original OLS regression, two models were created to compare control variables previous literature indicated as important found to be important as well as the indicators of women's status that are of interest in this project.

A Goldfeld-Quandt test was performed on the weighted variables to test the results of the correction technique. This was done according to the same method as the first Goldfeld-Quandt test except that it used the weighted variables. The F-obtained from this test was 411.47 which is far greater that the F-critical values of 1.55 (at the .05 level), 1.87 (at the .01 level), and the F-obtained in the OLS models indicating that the difference between ESS 1 and ESS 2 is significantly different from zero; the model was heteroscedastic. Though the OLS models were inefficient in their predictions they were more efficient that the WLS model.

The only women's status indicator for which the OLS regression found significant relationship with fertility rates was *women's health status*. Therefore, in order to test which indicators of the women's status index were most important another regression was run that replaced *women's health status* with the indicators upon which it was constructed (see Table 6). Since none of the other women's status variables had proven to be significant they were omitted from this analysis.

Table 6. Results from OLS Regression with
Women's Health Status Indicators

Variables	Model 1	Model 2	Model 2 Tolerance	Model 2 VIF
ln GDP per Capita	-.043 (.395)	-.017 (.727)	.238	4.204
Mean Years of Schooling	-.076** (.002)	-.042 .096	.288	3.478
Percent Urban	-.001 (.804)	-.000 (.972)	.386	2.588
Population per Square Kilometer	.000 (.14)	.000 (.071)	.964	1.308
Contraceptive Prevalence Rate	-.008* (.013)	-.01** (.002)	.349	2.869
Under 5 Mortality Rate	.014*** (.000)	.011*** (.000)	.112	8.938
Maternal Mortality Ratio		.000 (.477)	.139	7.17
Births Attended by Skilled Health Personnel		-.008* (.019)		
Mandatory Paid Maternity Leave		-.002** (.002)		
Female Mortality Rate		..000 (.761)	.784	1.275
R^2	.846*** (.000)	.865*** (.000)		

Source: U.N. Human Development Indicators 2010 except for *Population per Square Kilometer* from 2010 World Population Data Sheet. * p = < .05, ** p = < .01, *** p = < .001

In the first model there were three significant effects: *mean years of schooling* (.002), *contraceptive prevalence rates* (.013), and *under five mortality rates* (.000). *Mean years of schooling* and *contraceptive prevalence rates* were both negatively associated with *fertility rates* (-.076 and -.008 respectively) indicating that higher levels of education and contraceptive prevalence were related to lower levels of fertility. *Under five mortality rates,* on the other hand, was positively associated with *fertility rates* indicating that higher levels of mortality among children under the age of five was related to higher levels of fertility. In the second model, however, *mean years of schooling* ceases to have a significant effect on *fertility rates. Contraceptive prevalence rates* and *under five mortality rates* continue to have a negative association with *fertility rates* though the coefficients change (from -.008 to -.01 and from .014 to .011 respectively) as does the significance level for *contraceptive prevalence rates* (from .013 to .002). Additionally, two of the women's health status indicators had significant effects on *fertility rates: births attended by skilled health personnel* and *mandatory paid maternity leave* (-.008, sig. = .019, and -.002, sig. = .002 respectively). Both of these indicators were negatively associated with *fertility rates* indicating that the increased presence of skilled health personnel at birth and an increase in mandatory paid maternity leave are associated with lower levels of fertility. Further justifying this claim, the R^2 change of .019 (.846 to .865) was significant (.000) demonstrating that these indicators help to explain the variation in fertility rates after controlling for variables that have been determined to be relevant in previous research.

CHAPTER 4

LIMITATIONS AND CONCLUSION

Limitations

The major limitation with this analysis was the sample size. With a sample size limited to 166 cases the data analysis was beset by issues with multicollinearity, failure to carry out a weighted least squares regression that would increase the efficiency of the predictions, and possibly low significance levels on variables that would have had a significant effect with a larger sample size. Although the number of countries in the world and the lack of data for some of these countries both contribute to this limitation, future research in this area could make use of longitudinal data that would increase the sample size and thereby increase the efficiency of the predictions. Additionally, the cross-sectional design of this project limited the ability to demonstrate causality because time-order could not be established for certain using data that were gathered at the same time. This is another issue that would be resolved by using a longitudinal design since longitudinal data includes variables that were collected at different time periods.

Another major limitation with this project was that the relationship between *female population with at least a secondary education* and *total fertility rates* could not be analyzed because of the inefficiency due to the multicollinearity between *female population with at least a secondary education* and *mean years of schooling*. This was a major limitation for two reasons: first, because *female population with at least a secondary education* was an indicator of women's status, the analysis of which was the express purpose of the project; second, because the strong correlation between this variable and *total fertility rates* indicates that it may have made an important contribution to explaining the variation in fertility. If so this model is biased due to a specification error having omitted a relevant variable. Again, a longitudinal design may be able to take care of this problem by increasing the sample size and therefore the efficiency of the model.

Finally, this project was limited by the measurement of women's occupational status. This variable was measured using *female labor force participation*. This measure is limited by the fact that it does not take into account the type of work that women are doing or the prestige attached to this sort of work. It puts women who are doing work in the service sector of the economy on the same level as women who are doing work in the professional sector of the economy. Future research in this area should take into account the type of work that women are doing to control for this important factor.

Conclusion

The rapid increase in human population makes the study of fertility rates an area of imminent concern. Understanding the relationship between women's status and fertility rates is important because providing women with access to adequate health services, educational opportunities, occupational opportunities, and political power will give them with greater control over their lives. With increased control over their lives women are more likely to limit the number of children they have to their desired amount as they gain access to the resources to limit child bearing and to find fulfillment in other areas of their lives in addition to child bearing/rearing. This study has added to the literature on fertility rates by investigating the relationship between women's status and fertility by exploring multiple dimensions of women's status using cross-national data while controlling for variables that have been identified as important correlates in the previous literature.

Though this research failed to demonstrate a significant relationship between women's political status and women's occupational status with fertility rates, and it was unable to test the relationship between women's educational status and fertility rates, it did demonstrate that women's health status had a statistically significant effect on fertility rates and contributed significantly to the explanation of the variance in fertility rates. Furthermore, two of the indicators that made up the women's health status index (*births attended by skilled health personnel* and *mandatory paid maternity leave*) had significant effects of fertility rates when they were considered as single indicators (p = -.008 and -.002 respectively).

These findings indicate that fertility rates can be reduced at the national level by creating policies to enhance women's health status. Specifically, these data indicate that there would be a reduction of .8 births per woman in countries in which 100% of the births were attended by skilled health personnel compared to countries in which there were no skilled health personnel attending births. These data also indicate that there would be a reduction of .002 births per woman at the national level with each additional day of maternity leave mandated by the state. This translates into a reduction of .2 births per women for countries that mandate 100 days of paid maternity leave and a reduction of .73 births for countries that mandate a full year (365 days) of paid maternity leave compared to countries without any days of paid maternity leave mandated by the state.

There was also a statistically significant negative relationship between the prevalence of contraception and the number of births per woman. This is an interesting finding both on its own and because the variable, *contraceptive prevalence rates*, has been used as a proxy for women's health status in previous research (Shen and Williamson 1999). This relationship (p = -.008) indicates that for every percentage increase in the prevalence of contraception there is a decrease of .008 births per woman at the national level. This translates into a decrease of .8 births per woman at the national level for countries in which the prevalence of contraception in 100% compared to countries in which there is no access to contraception.

This research demonstrates that women's status is an important indicator of fertility rates. In particular, creating policies that enhance women's health status can have a dramatic effect on the number of births per woman. According to this study, nations that have social policies that provide skilled health personnel at 100% of births, mandate a full year of paid maternity leave, and provide contraception to the entire population will have an average of 2.33 less births per woman than nations that do not have any skilled personnel attending births, do not mandate any days of paid maternity leave, and in which there is no contraception available.

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