ULRIKE BOEHMER and JOHN B. WILLIAMSON

THE IMPACT OF WOMEN'S STATUS ON INFANT MORTALITY RATE: A CROSS-NATIONAL ANALYSIS

(Accepted 15 December, 1995)

ABSTRACT. A number of prior studies have attempted to account for cross-national differences in infant mortality rate using a variety of economic, demographic, and health related variables. These studies have given relatively little attention to the impact of predictors measuring the status of women. The present study, based on a sample of 96 less developed countries circa 1990, tests a series of hypotheses derived from gender stratification theory and industrialism theory. Evidence is presented of an inverse relationship between the status of women and infant mortality rate. The present study shows that it makes a difference whether we use relative or absolute measures of women's status and it shows that in addition to women's educational status, other dimensions of women's status particularly economic status and autonomy are also important predictors of infant mortality rate.

High infant mortality rates are much more prevalent in developing nations than in industrial nations. Prior studies have sought to understand the factors that account for cross-national differences in infant mortality rates among the less developed countries (LDCs) (Heligman et al., 1978; Trussell and Preston, 1982; Martin et al., 1983). Many of the relevant variables can be classified as demographic or socioeconomic. Demographic factors are emphasized in many studies based on survey research data (Cleland and Sathar, 1983; Thapa and Retherford, 1982). Demographic factors such as mother's age and birth intervals generally have more of an impact in nations at the lowest levels of industrialization and economic development. With increasing socioeconomic development, these demographic factors tend to have less impact, particularly when compared to socioeconomic and health factors such as education and access to health facilities (Adlakha and Suchindran, 1985; Gubhaju et al., 1991).

Past studies have often reported mother's (or women's) education to be the single most important predictor of infant mortality rate (Caldwell, 1979; Martin et al., 1983; Bhuiya and Streatfield, 1991).
A number of prior studies have assessed the impact of a variety of health and nutrition variables (Flegg, 1982; DiGiacomo, 1978; Puffer and Serrano, 1973; Jayachandran and Jarvis, 1986). Other studies point to the impact of breast feeding (Adlakha and Suchindran, 1985), fertility (Repetto, 1978), income inequality (Rodgers, 1979), sanitation (Meegama, 1980), and urbanism (Hobcraft et al., 1984). With few exceptions, aspects of women's status other than women's education have been neglected in studies of cross-national variation in infant mortality rate (Florez and Hogan, 1990).

Infant mortality has often been linked to fertility rates; the argument being that a decrease in infant mortality will lead to a reduction in fertility. The demographic transition theory specifies that economic development leads to lower mortality which in the long-run leads to lower fertility (Brazzell and Gillespie, 1981; Heer, 1966; Heer and Smith, 1968). It is also argued that higher fertility rates contribute to high rates of population growth which in turn tend to reduce rates of economic growth in many LDCs. In recent years policy makers and planners have begun to take an interest in the potential impact of women's status on both infant mortality rate and fertility. To date this discussion is found primarily in the popular press; there have been very few empirical studies that have attempted to test the impact of women's status (other than educational status) on infant mortality rate, particularly using national level aggregate data.

The link between women's status and infant mortality rate can be analyzed using a variety of different types of data. Survey research studies of this relationship have a number of advantages when the goal is to assess of the relationship between women's status and demographic behavior at the individual level (Aghajanian, 1992; Florez and Hogan, 1990). But when the goal is to take into consideration structural characteristics of the country as a whole such as the number of parliamentary seats held by women or women's educational status relative to men, the study must be based on national level aggregate data. In this sense our study represents an effort to bring this very relevant, but under utilized source of data to the study of the relationship between women's status and infant mortality rate.

In this paper we present a detailed analysis of the hypothesis that there is an inverse relationship between the status of women and infant mortality rate; that is, all other things being equal, as women's
status increases infant mortality rates will decrease. We argue that nations in which women have higher status will tend to be nations in which women are able to have a greater influence on social policy. Women will tend to favor spending a greater share of family and national resources on basic education, primary health care, and a variety of other social welfare programs that tend to lower infant mortality rates.

As we view women's status as being multidimensional, we use a variety of indicators measuring different aspects of women's status; but we expect them all to be inversely related to infant mortality rate. By introducing several indicators of women's status, we hope to determine which dimensions of women's status are and which are not important as predictors of infant mortality rate. Our focus on the effects of women's status represents an effort to go beyond the large body of prior studies in the industrialization theory tradition that emphasize the role of economic development and industrialization (as well as closely associated bureaucratic and demographic consequences of industrialization). Our analysis seeks to add to the much more modest corpus of studies that point to the relevance of gender stratification theory and the importance of various dimensions of the status of women.

THEORETICAL BACKGROUND

Industrialism Theory

Many studies have emphasized predictors and explanations linked to industrialism theory. This theory specifies that the transition from a lower level of development to a higher level of development will be achieved when a country undergoes a number of structural changes linked to the process of industrialization (Kerr et al., 1960; Wilensky and Lebeaux, 1965). A higher level of economic development leads to an improved standard of living with better nutrition and advanced medical technology. Studies in this tradition commonly use variables such as percent urban, school enrollment (or some other education measure), and GNP per capita (Tolnay and Christenson, 1984; Brazzell and Gillespie, 1981; Van de Walle and Knodel, 1980; Chandler, 1985).
Theorists concerned with the status of women have often been critical of much of the work in this theoretical tradition as it often omits any analysis of male/female differences with respect to either the causes or the consequences of industrialization and economic development (Boserup, 1970; Oppenheimer, 1970; Ward, 1984).

**Gender Stratification Theory**

Theorists in the gender stratification theory tradition attempt to account for differences in privilege and power in society that are linked to inequality based on gender. Stratification based on gender is independent of, but in addition to other systems of inequality such as those based on class, caste, and ethnicity. Gender stratification theorists point out that it is important to distinguish between measures of women’s absolute status (such as female secondary school enrollment rate) and measures of women’s relative status (such as ratio of female to male secondary school enrollment rate). The relative status of women, the status women hold in comparison to men, is at the core of gender stratification theory (Mason, 1986). Although many dimensions of women’s status and autonomy have been proposed in prior studies, it is possible, without doing too great an injustice to the data, to group the various dimensions and indicators into four broad areas: (1) women’s educational status, (2) women’s political status, (3) women’s economic status, and (4) women’s autonomy throughout the life cycle. Each of these four areas are sites of construction and reconstruction of gender inequality in society. In the present study we consider indicators of women’s status linked to each of these spheres.

According to Blumberg (1984), women’s economic power is the strongest predictor of women’s overall status. Prior research has established that the process of economic development has a profound impact on the economic status of women. In the LDCs women generally have less access than men to the new economic resources as they are introduced to society. At the same time women tend to lose their traditional sources of economic subsistence (Ward, 1983). Some studies report that higher levels of female labor force participation increase infant mortality levels (Carvajal and Burgess, 1978). Others suggest that when a nation is starting at a very low level of economic development, during the early stages of development the
status of women tends to decline; however, as level of development increases there is a tendency for the status of women to improve (Boserup, 1970; Oppenheimer, 1970; Ward, 1985).

We have briefly touched on the link between women’s status and infant mortality rate earlier in the paper. Here an effort will be made to make a more explicit link to gender stratification theory. Caldwell’s (1993) finding that mother’s education is the single most important determinant of child survival has informed our thinking about this link. He suggests three reasons for the link: (1) With increasing education there tend to be changes in family roles giving women greater say with respect to the care of their children. (2) A more educated mother tends to be less fatalistic about her sick child. She tends to be more prone to seek medical treatment and more prone to make use of modern medical facilities. (3) More highly educated mothers are in a better position to demand the attention of health providers and more likely to ask for explanations as to the cause of the problem and what can be done to prevent it. Gender stratification theory would suggest that such behavior would be even more likely in countries in which women have more autonomy, more political influence, and greater control over economic resources.

METHODS

The present study is based on a sample of 96 LDCs.1 We have excluded (except where otherwise specified) those nations that are typically described as the industrial nations or the advanced industrial democracies. We have limited ourselves to those LDCs with a population of over 1 million in 1991 (U.N., 1992; World Bank, 1993). The sample is also limited to those nations for which data are available, with respect to our measure of infant mortality rate and our measure of level of economic development. Had we limited our analysis to those countries for which we had no missing data, the sample would have been too small for multivariate analysis. For this reason we have allowed our sample size to vary from one model to another depending on data availability. This has the advantage of making maximum use of the available data, but it also means that the reader must take into consideration subsample variation when accounting for differences between models. In general when a model is based on
a smaller sample, it tends to be the least developed nations that have been excluded. Our analysis is based on multiple regression models using cross-sectional data circa 1990. We have found no evidence of stronger effects with lagged predictors and for this reason have decided not to lag any of our predictors.

As noted earlier, we have theoretical reasons for wanting to explore the impact of a number of variables that call for national level data. This is particularly important when the goal is to assess the impact of a national level structural characteristic such as the proportion of parliamentary seats occupied by women. While there are many advantages of working with national level data given our theoretical objectives, our choice to work with national level data does have its costs. In view of the risk of the ecological fallacy, it is potentially problematic to make inferences about individual level behavior based on the aggregate data being used. It is also important to keep in mind that the data for our measure of infant mortality rate (as well as a number of our other measures) tends to be of a much lower quality for our sample of LDCs than it tends to be for the advanced industrial countries. Where possible we have assessed the relative merits of data from various sources and selected what we consider to be the highest quality source. In the case of our infant mortality variable we took into consideration a number of articles that have made an effort to critically assess the data available from various sources (Heligman et al., 1978; Murray, 1987) in making our choice, a choice that was influenced by the desire to obtain a sample of sufficient size to carry out the multivariate analyses our theories call for.

Variable Measurement

Our dependent variable, infant mortality rate, is taken from what we consider the best available source (UNICEF, 1993; Tables 1 and 9). These data combine male and female infant mortality rates circa 1991. We have used a square root transformation of our infant mortality variable throughout this analysis to deal with the positive skew in the data.

Our measure of level of economic development (an indicator drawn from the industrialism theory) is the logarithm of purchasing power of currencies estimates of gross domestic product per capita
for 1991 (hereafter LGDP/C). This indicator is preferable to GDP/capita because it is based on an estimate of the goods and services a nation’s GDP will buy when it is spent in the local economy instead of basing a country’s GDP on the exchange rate of its currency to the U.S. dollar. This is a sufficiently important control variable that it is included in all of our regression models. Due to the wide range with respect to LGDP/C an effort will also be made to check for possible interaction between this (moderator) variable and each of the other independent variables.

A major goal of the present study is to present a detailed assessment of the relevance of gender stratification theory. To this end we consider several indicators of women’s status many of which have been considered in prior studies. Rather than presenting our results for one or two of the strongest predictors, we have decided to present results for several relevant indicators. We did, however, exclude indicators when the source was unreliable, when it was more than ten years old, or when it was available for too few countries to be suitable for our analysis. As mentioned earlier, the indicators we consider can be grouped into four categories: (1) measures of women’s educational status, (2) measures of women’s political status, (3) measures of women’s economic status, and (4) measures of women’s autonomy and independence in the family.

We consider both absolute and relative measures of women’s educational status. Our absolute measures are: female illiteracy (ILLITRCY-F), female primary school enrollment (EDUC1-F) and female secondary school enrollment (EDUC2-F). See the Appendix for the sources and details about these and all of the other independent variables described below. Our relative measures of women’s educational status are based on a ratio of female to male enrollment at various educational levels. One measure is the ratio of female/male 1st level (primary school) education (EDUC1-F/M). Another is the logarithm of the ratio of female/male 2nd level (secondary school) education (EDUC2-F/M). Yet another is the logarithm of the ratio of female/male 3rd level (post-secondary school) education (EDUC3-F/M).

We measure women’s political status using two measures. One is an indicator of the number of years women have had the right to vote (SUFFRAGE-F). Our argument is that women will generally have
more political influence in those societies in which they have had
the right to vote longer. The assumption here is that over time the
institutionalization of women’s right to vote translates into greater
political influence for women. Our second indicator is the percent of
seats in the parliament held by women (PARLAM-F). Our argument
is that women will have more political influence in those societies
in which they hold a greater proportion of the seats in the national
parliament.

Women’s absolute economic status is measured using an indicator
of adult women’s economic activity rate (ECONOM-F) and women’s
unpaid economic contribution via working as unpaid family mem-
bers (UNPAID-F). We have used two relative measures of women’s
economic status. One is the ratio of the percent of women economic-
ally active to the percent of men economically active (ECONOM-
F/M). The second is the ratio of the percent of women working as
unpaid family members to the percent of men working as unpaid
family members (UNPAID-F/M).

We attempt to measure the concept of female autonomy usingive quite different indicators. One is a general measure of women’s
autonomy (GENDER-EQU). See the Appendix for a description
of this variable which is based on many factors including level of
women’s legal equality and equality in the family. Nations with
greater gender equality score high on this indicator. Our second
measure is average age at first marriage for women (AGE-
MARRIED). Our argument is that women generally have less
autonomy in those societies in which women marry early. As a
third measure of women’s autonomy we use contraceptive preva-
ience (CONTRACPTN). We view this measure as an indicator of
women’s control over their reproductive behavior. Our argument
is that contraceptive usage tends to be higher in those societies
in which women have more autonomy. Control over reproductive
behavior is a particularly important domain of autonomy for women
and there is unlikely to be much control in societies with low con-
traceptive prevalence. Fertility (FERTILITY) and crude birth rate
(CBRTHRTE) measure lack of control over reproductive behavior.
Societies with low contraceptive prevalence will most likely have
high fertility and high crude birth rates. We decided to include these
variables as indicators of women’s lack of autonomy, since the vari-
able (CONTRCPTN) measures only the contraceptive prevalence among married women. The fertility and crude birth rate variables are not limited to married women.

In addition to several women’s status indicators we also consider a number of other indicators that have been used with some success in prior studies of cross-national variation in infant mortality rates. Most of the variables in this category are health related. The reader is referred to the Appendix for details about these indicators. Based on prior studies we would hypothesize that nations with the following characteristics will tend to have lower infant mortality rates: greater income equality (INCOME) (Rodgers, 1979; Flegg, 1982; Brazzell and Gillespie, 1981), percent of population living in urban areas (URBAN) (Florez and Hogan, 1990; Tolnay and Christenson, 1984), percent with access to good sanitation (SANITATION) (Gubhaju et al., 1991), percent of the population with access to health services (HEALTH-SER) (Jayachandran and Jarvis, 1986; Flegg, 1982), percent breast fed until 12 to 15 months (BREAST-FED) (Adlakha and Suchindran, 1985; Florez and Hogan, 1990), percent of infants born without low birth weights (LO-BRTH-WT) (Grosse, 1980; Puffer and Serrano, 1973), per capita calorie supply (CALORIES) (DiGiacomo, 1978; Puffer and Serrano, 1973), and percent of births attended by a trained person (BIRTH-ATT) (Jayachandran and Jarvis, 1986). The hypothesis concerning the INCOME variable can be linked to class theory. The other indicators in this set can be linked to a broad version of the industrialism perspective referred to as modernization theory.

RESULTS

We first consider a series of additive models derived from gender stratification theory. For each model in Table I the dependent variable is infant mortality rate and there are two predictors, the control variable LGDP/C and the various indicators of the status of women taken one at a time. We include these women's status variables one at a time for two reasons: (1) it allows us to work with as large a sample as our data permit for each women's status predictor and (2) it allows us to see which of these predictors have significant effects when controlling for LGDP/C alone.
<table>
<thead>
<tr>
<th>Predictors</th>
<th>N</th>
<th>b</th>
<th>t-value</th>
<th>Beta</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGDP/C</td>
<td>96</td>
<td>-2.71a</td>
<td>-16.94</td>
<td>-0.868</td>
<td>0.75</td>
</tr>
<tr>
<td>ILLITRCY-F</td>
<td>67</td>
<td>0.04a</td>
<td>5.01</td>
<td>0.395</td>
<td>0.80</td>
</tr>
<tr>
<td>EDUC1-F/M</td>
<td>80</td>
<td>-0.03b</td>
<td>-2.42</td>
<td>-0.157</td>
<td>0.77</td>
</tr>
<tr>
<td>EDUC2-F/M</td>
<td>67</td>
<td>-1.39a</td>
<td>-3.18</td>
<td>-0.242</td>
<td>0.79</td>
</tr>
<tr>
<td>EDUC3-F/M</td>
<td>69</td>
<td>-0.92a</td>
<td>-3.10</td>
<td>-0.253</td>
<td>0.78</td>
</tr>
<tr>
<td>EDUC1-F</td>
<td>73</td>
<td>-0.02a</td>
<td>-2.72</td>
<td>-0.208</td>
<td>0.78</td>
</tr>
<tr>
<td>EDUC2-F</td>
<td>70</td>
<td>-0.05a</td>
<td>-6.03</td>
<td>-0.516</td>
<td>0.83</td>
</tr>
<tr>
<td>GENDER-EQU</td>
<td>61</td>
<td>-0.62a</td>
<td>-3.65</td>
<td>-0.256</td>
<td>0.74</td>
</tr>
<tr>
<td>AGE-MARRIED</td>
<td>65</td>
<td>-0.27a</td>
<td>-2.70</td>
<td>-0.216</td>
<td>0.76</td>
</tr>
<tr>
<td>CONTRACPTN</td>
<td>74</td>
<td>-0.05a</td>
<td>-5.83</td>
<td>-0.446</td>
<td>0.83</td>
</tr>
<tr>
<td>FERTILITY</td>
<td>81</td>
<td>0.54a</td>
<td>6.13</td>
<td>0.374</td>
<td>0.83</td>
</tr>
<tr>
<td>CBRTHRTE</td>
<td>81</td>
<td>0.10a</td>
<td>6.98</td>
<td>0.449</td>
<td>0.85</td>
</tr>
<tr>
<td>SUFFRAGE-F</td>
<td>56</td>
<td>-0.04b</td>
<td>-2.29</td>
<td>-0.177</td>
<td>0.71</td>
</tr>
<tr>
<td>PARLAM-F</td>
<td>60</td>
<td>-0.06b</td>
<td>-2.33</td>
<td>-0.164</td>
<td>0.72</td>
</tr>
<tr>
<td>ECONOM-F</td>
<td>81</td>
<td>-0.02b</td>
<td>-2.17</td>
<td>-0.132</td>
<td>0.76</td>
</tr>
<tr>
<td>ECONOM-F/M</td>
<td>81</td>
<td>-1.67b</td>
<td>-2.58</td>
<td>-0.148</td>
<td>0.77</td>
</tr>
<tr>
<td>UNPAID-F</td>
<td>51</td>
<td>-0.01</td>
<td>-1.41</td>
<td>-0.103</td>
<td>0.74</td>
</tr>
<tr>
<td>UNPAID-F/M</td>
<td>51</td>
<td>-0.08</td>
<td>-1.50</td>
<td>-0.111</td>
<td>0.74</td>
</tr>
</tbody>
</table>

\[a \text{ } p < 0.01.\]  
[\[b \text{ } p < 0.05.\]  
[\[c \text{ } p < 0.10.\]

From Table I we see that most indicators of women's status have significant effects. The effect of LGDP/C is significant in all models, but results for this variable are presented for only one model, the model in which it is included alone (row 1). All six predictors relating to educational status are significant. Note that the strongest of this set of education related predictors is female secondary school enrollment (EDUC2-F). We also find that all five indicators related to female autonomy (GENDER-EQU, AGE-MARRIED, CONTRACPTN, FERTILITY, AND CBRTHRTE) have significant effects; the indicator of crude birth rate (CBRTHRTE) having the strongest effect. The political status variables show significant effects as well. The coefficient for the percent of parliamentary seats held
by women (PARLAM-F) and the measure of years of women’s suffrage (SUFFRAGE-F) are significant, but the effects are generally weaker than those associated with other dimensions of women’s status. Two of the four indicators of women’s economic status, women’s economic activity rate (ECONOM-F) and the ratio of percent of women economically active to percent of men economically active (ECONOM-F/M) also have significant effects on infant mortality rate.

In Table II we check for possible interaction between each of our indicators of women’s status and LGDP/C. The models in Table II all include three predictors; for each model results are presented for two of these predictors, the women’s status indicator and the interaction term. We have not included the coefficients for the moderator variable LGDP/C by itself. The reason for considering these models is the wide range with respect to GDP per capita for this sample and possibility that the impact of various indicators of women’s status might be quite different for the less affluent as opposed to the more affluent LDCs.

When interpreting the results in Table II our focus is on whether or not the partial regression coefficient for the interaction term (b-inter) is statistically significant. To simplify the interpretation of these coefficients, we centered the independent predictors for all models; as a result, each has a mean at zero. This allows us to interpret the main effects (b-main) as the effect this variable has at the average (mean) level of development for this sample. From the results presented in Table II it is evident that there is significant interaction between LGDP/C and several of these indicators of women’s status. There are significant interaction effects for two indicators of the economic status of women (ECONOM-F, ECONOM-F/M). The economic indicators UNPAID-F and UNPAID-F/M have neither a significant interactive effect nor a significant additive effect in Table I. Other significant interaction effects are the three educational ratio measures EDUC1-F/M, EDUC2-F/M, and EDUC3-F/M. EDUC1-F women’s absolute educational measure at the primary level has an almost significant interaction effect.

Women’s educational status has proven to be a strong predictor in prior studies. We find that most of the absolute educational measures have additive effects and are stronger than the corresponding rela-
TABLE II
Impact of women's status on infant mortality rate. Models checking for interaction with LGDP/C

<table>
<thead>
<tr>
<th>Predictors (centered)</th>
<th>b-inter</th>
<th>t-inter</th>
<th>b-main</th>
<th>t-main</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILLITRCY-F</td>
<td>0.01</td>
<td>1.06</td>
<td>0.04a</td>
<td>5.02</td>
<td>0.81</td>
</tr>
<tr>
<td>EDUC1-F/M</td>
<td>-0.03b</td>
<td>-2.02</td>
<td>-0.04a</td>
<td>-3.18</td>
<td>0.78</td>
</tr>
<tr>
<td>EDUC2-F/M</td>
<td>-1.26a</td>
<td>-2.71</td>
<td>-1.90a</td>
<td>-4.16</td>
<td>0.81</td>
</tr>
<tr>
<td>EDUC3-F/M</td>
<td>-0.65b</td>
<td>-2.27</td>
<td>-1.13a</td>
<td>-3.74</td>
<td>0.79</td>
</tr>
<tr>
<td>EDUC1-F</td>
<td>-0.01c</td>
<td>-1.70</td>
<td>-0.03a</td>
<td>-3.24</td>
<td>0.79</td>
</tr>
<tr>
<td>EDUC2-F</td>
<td>0.002</td>
<td>0.30</td>
<td>-0.05a</td>
<td>-5.64</td>
<td>0.83</td>
</tr>
<tr>
<td>GENDER-EQU</td>
<td>-0.02</td>
<td>-0.09</td>
<td>-0.61a</td>
<td>-3.40</td>
<td>0.74</td>
</tr>
<tr>
<td>AGE-MARRIED</td>
<td>-0.04</td>
<td>-0.37</td>
<td>-0.27a</td>
<td>-2.70</td>
<td>0.76</td>
</tr>
<tr>
<td>CONTRACPTN</td>
<td>0.003</td>
<td>0.35</td>
<td>-0.05a</td>
<td>-5.68</td>
<td>0.83</td>
</tr>
<tr>
<td>FERTILITY</td>
<td>0.008</td>
<td>0.08</td>
<td>0.54a</td>
<td>5.30</td>
<td>0.83</td>
</tr>
<tr>
<td>CBTHRHRTE</td>
<td>0.002</td>
<td>0.11</td>
<td>0.10a</td>
<td>6.32</td>
<td>0.85</td>
</tr>
<tr>
<td>SUFFRAGE-F</td>
<td>-0.02</td>
<td>-0.51</td>
<td>-0.03</td>
<td>-1.55</td>
<td>0.71</td>
</tr>
<tr>
<td>PARLAM-F</td>
<td>-0.01</td>
<td>-0.42</td>
<td>-0.05a</td>
<td>-1.87</td>
<td>0.72</td>
</tr>
<tr>
<td>ECONOM-F</td>
<td>-0.02b</td>
<td>-2.30</td>
<td>-0.02a</td>
<td>-2.71</td>
<td>0.78</td>
</tr>
<tr>
<td>ECONOM-F/M</td>
<td>-1.61b</td>
<td>-2.31</td>
<td>-1.77a</td>
<td>-2.80</td>
<td>0.78</td>
</tr>
<tr>
<td>UNPAID-F</td>
<td>-0.01</td>
<td>-1.30</td>
<td>-0.01</td>
<td>-1.27</td>
<td>0.75</td>
</tr>
<tr>
<td>UNPAID-F/M</td>
<td>-0.07</td>
<td>-0.40</td>
<td>-0.03</td>
<td>-0.28</td>
<td>0.75</td>
</tr>
</tbody>
</table>

a p < 0.01.
b p < 0.05.
c p < 0.10.
d The Ns for the models in this table are identical with the Ns for the corresponding models in Table 1.

tive educational measures. Based on the results presented here, we decided to work with EDUC2-F rather than ILLITRCY-F as our education control in subsequent models. Prior studies have used years of schooling or ILLITRCY-F as if they were interchangeable (Menard, 1987; 1990). Even though both measures are similar in strength, we prefer EDUC2-F over ILLITRCY-F. One reason is that EDUC2-F is probably the most reliable as it is easier to measure, that is, it is easier to get a count of the proportion of school age women in school than it is to actually administer individual reading and writing tests to measure literacy. Another reason we prefer EDUC2-F as a
predictor of infant mortality rate is that it is typically measured at ages 12 to 17 and as a result it taps an age group that is closer to the median age of those giving birth in a given year than is ILLITRCY-F, which attempts to measure literacy among adult women of all ages including older age groups with very low fertility rates.

Having analyzed the additive and interactive effects for all the women's status indicators, we now want to explore what impact, if any, other indicators of women's status have after controlling for the dimension of women's status, female education. That most studies agree is a major predictor of infant mortality rate. Are there other dimensions of women's status that have an independent impact even after we control for female secondary school enrollment or does it turn out that once we control for EDUC2-F none of the other indicators of women's status have significant effects? In Table III we look at several additive models which include three predictors. Each model includes: (1) LGDP/C, (2) EDUC2-F, and (3) one of the indicators of women's status listed in the column down the left side of Table III. The coefficient for the predictor listed in the column at the left end of the table is presented at the right end of the table.

From the results presented in Table III we see that some of the various indicators of women's status have significant effects even after controlling for women's education. It is of note that the three of the five women's autonomy measures (CBRTHRTE, FERTILITY, AND CONTRCPTN) show strong significant effects ($p < 0.01$). Since the correlation between FERTILITY and CBRTHRTE is very high and CBRTHRTE is a stronger predictor, in subsequent analysis we will focus on CBRTHRTE.\textsuperscript{6} The other two indicators of women's autonomy, (AGE-MARRIED AND GENDER-EQU) have almost significant effects.\textsuperscript{7} The indicators of women's political status and women's economic status are no longer significant when we add a control for women's education.\textsuperscript{8}

To this point our emphasis has been an assessment of the impact of various indicators of women's status. However, as there are a number of predictors other than women's status that prior studies have shown to be important predictors of cross-national differences in infant mortality, we now turn to a discussion of some of the most important of the health, modernization, and inequality measures suggested by these studies; our goal is to integrate some of these variables into
### TABLE III
Impact of women’s status on infant mortality. Models with LGDP/C and EDUC2-F as controls

<table>
<thead>
<tr>
<th>Predictors</th>
<th>N</th>
<th>LGDP/C</th>
<th>EDUC2-F</th>
<th>x^d</th>
<th>R^2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(t)</td>
<td>(t)</td>
<td>(t)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Beta]</td>
<td>[Beta]</td>
<td>[Beta]</td>
<td></td>
</tr>
<tr>
<td>GENDER-EQU</td>
<td>53</td>
<td>-1.37a (-4.11)</td>
<td>-0.04a (-3.70)</td>
<td>-0.36c (-1.99)</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.431]</td>
<td>[-0.431]</td>
<td>[-0.151]</td>
<td></td>
</tr>
<tr>
<td>AGE-MARRIED</td>
<td>58</td>
<td>-1.12a (-3.60)</td>
<td>-0.05a (-5.04)</td>
<td>-0.16c (-1.78)</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.357]</td>
<td>[-0.506]</td>
<td>[-0.129]</td>
<td></td>
</tr>
<tr>
<td>CBIRTHTE</td>
<td>70</td>
<td>-1.24a (-5.17)</td>
<td>-0.03b (-2.59)</td>
<td>0.07a (3.56)</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.411]</td>
<td>[-0.271]</td>
<td>[0.317]</td>
<td></td>
</tr>
<tr>
<td>FERTILITY</td>
<td>70</td>
<td>-1.34a (-5.50)</td>
<td>-0.03a (-3.10)</td>
<td>0.36a (3.07)</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.443]</td>
<td>[-0.319]</td>
<td>[0.244]</td>
<td></td>
</tr>
<tr>
<td>CONTRACPTN</td>
<td>65</td>
<td>-1.06a (-3.90)</td>
<td>-0.03a (-3.09)</td>
<td>-0.03a (-3.76)</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.349]</td>
<td>[-0.310]</td>
<td>[-0.334]</td>
<td></td>
</tr>
<tr>
<td>SUFFRAGE-F</td>
<td>49</td>
<td>-1.22a (-3.65)</td>
<td>-0.05a (-4.26)</td>
<td>0.01 (0.46)</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.409]</td>
<td>[-0.514]</td>
<td>[0.036]</td>
<td></td>
</tr>
<tr>
<td>PARLAM-F</td>
<td>51</td>
<td>-1.38a (-3.65)</td>
<td>-0.04a (-3.58)</td>
<td>-0.02 (-0.68)</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.445]</td>
<td>[-0.467]</td>
<td>[-0.052]</td>
<td></td>
</tr>
<tr>
<td>ECONOM-F</td>
<td>70</td>
<td>-1.51a (-5.37)</td>
<td>-0.05a (-5.66)</td>
<td>-0.01 (-1.50)</td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.501]</td>
<td>[-0.490]</td>
<td>[-0.085]</td>
<td></td>
</tr>
<tr>
<td>ECONOM-F/M</td>
<td>70</td>
<td>-1.51a (-5.38)</td>
<td>-0.05a (-5.42)</td>
<td>-0.97 (-1.52)</td>
<td>0.84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.501]</td>
<td>[-0.478]</td>
<td>[-0.083]</td>
<td></td>
</tr>
</tbody>
</table>

\(a\) \(p < 0.01\).
\(b\) \(p < 0.05\).
\(c\) \(p < 0.10\).
\(d\) This column gives the results for the predictors listed at the left end of the table.

our model. In Table IV we add the most important of these variables one at a time to our basic women's status model. Our basic model includes two predictors: LGDP/C and EDUC2-F.

The coefficients for the variables listed down the left hand side of Table IV are given in the second to last column on the right hand side of the table. See the Appendix for details about the definition and measurement of these variables. From the data presented in the second to last column at the right end of the table we see that the


**TABLE IV**

Impact of nutrition, income inequality, urbanism, and health related variables on infant mortality rate. Models with LGDP/C and EDUC2-F as controls

<table>
<thead>
<tr>
<th>Predictors</th>
<th>N</th>
<th>LGDP/C</th>
<th>EDUC2-F</th>
<th>x&lt;sup&gt;d&lt;/sup&gt;</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>b (t)</td>
<td>b (t)</td>
<td>b (t)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Beta]</td>
<td>[Beta]</td>
<td>[Beta]</td>
<td></td>
</tr>
<tr>
<td>INCOME</td>
<td>38</td>
<td>-1.54&lt;sup&gt;a&lt;/sup&gt; (-3.97)</td>
<td>-0.04&lt;sup&gt;a&lt;/sup&gt; (-3.40)</td>
<td>0.58 (1.33)</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.499]</td>
<td>[-0.428]</td>
<td>[0.110]</td>
<td></td>
</tr>
<tr>
<td>URBAN</td>
<td>70</td>
<td>-1.40&lt;sup&gt;a&lt;/sup&gt; (-5.07)</td>
<td>-0.05&lt;sup&gt;a&lt;/sup&gt; (-5.94)</td>
<td>0.01 (0.67)</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.464]</td>
<td>[-0.533]</td>
<td>[0.050]</td>
<td></td>
</tr>
<tr>
<td>SANITATION</td>
<td>55</td>
<td>-0.83&lt;sup&gt;a&lt;/sup&gt; (-3.06)</td>
<td>-0.04&lt;sup&gt;a&lt;/sup&gt; (-4.09)</td>
<td>-0.03&lt;sup&gt;a&lt;/sup&gt; (-4.48)</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.295]</td>
<td>[-0.381]</td>
<td>[-0.348]</td>
<td></td>
</tr>
<tr>
<td>HEALTH-SER</td>
<td>45</td>
<td>-1.52&lt;sup&gt;a&lt;/sup&gt; (-5.24)</td>
<td>-0.04&lt;sup&gt;a&lt;/sup&gt; (-3.93)</td>
<td>-0.01 (-1.23)</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.526]</td>
<td>[-0.398]</td>
<td>[-0.084]</td>
<td></td>
</tr>
<tr>
<td>BREAST-FED</td>
<td>52</td>
<td>-1.06&lt;sup&gt;a&lt;/sup&gt; (-3.52)</td>
<td>-0.05&lt;sup&gt;a&lt;/sup&gt; (-4.68)</td>
<td>0.02&lt;sup&gt;b&lt;/sup&gt; (2.11)</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.371]</td>
<td>[-0.467]</td>
<td>[0.165]</td>
<td></td>
</tr>
<tr>
<td>LO-BRTH-WT</td>
<td>65</td>
<td>-1.17&lt;sup&gt;a&lt;/sup&gt; (-3.84)</td>
<td>-0.05&lt;sup&gt;a&lt;/sup&gt; (-5.39)</td>
<td>-7.04 (-1.27)</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.390]</td>
<td>[-0.489]</td>
<td>[-0.099]</td>
<td></td>
</tr>
<tr>
<td>BIRTH-ATT</td>
<td>65</td>
<td>-1.29&lt;sup&gt;a&lt;/sup&gt; (-5.15)</td>
<td>-0.04&lt;sup&gt;a&lt;/sup&gt; (-4.57)</td>
<td>-0.01&lt;sup&gt;c&lt;/sup&gt; (-1.93)</td>
<td>0.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.429]</td>
<td>[-0.425]</td>
<td>[-0.145]</td>
<td></td>
</tr>
<tr>
<td>CALORIES</td>
<td>68</td>
<td>-1.28&lt;sup&gt;a&lt;/sup&gt; (-4.14)</td>
<td>-0.05&lt;sup&gt;a&lt;/sup&gt; (-5.47)</td>
<td>-0.0001 (-0.32)</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.418]</td>
<td>[-0.513]</td>
<td>[-0.027]</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> p < 0.01.

<sup>b</sup> p < 0.05.

<sup>c</sup> p < 0.10.

<sup>d</sup> This column gives the results for the predictors listed at the left end of the table.

Variable attendant present at birth (BIRTH-ATT) has an effect that is almost significant. For this set of models the two new predictors with the strongest effects are SANITATION (access to sanitation) and BREAST-FED.<sup>9</sup>

Our next step is to integrate the findings of Table IV with those of Table III. Due to the constraints of sample size which are compounded by missing data problems in connection with several of these indicators, it is not appropriate to include all of the predictors of potential interest in one final model. In Table V we present a set of final models each of which includes three key control variables
<table>
<thead>
<tr>
<th>Predictors</th>
<th>N</th>
<th>LGDP/C</th>
<th>EDUC2-F</th>
<th>CBRTHRTE</th>
<th>x*d</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>b</td>
<td>(t)</td>
<td>b</td>
<td>(t)</td>
<td>b</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Beta]</td>
<td></td>
<td>[Beta]</td>
<td></td>
<td>[Beta]</td>
</tr>
<tr>
<td>GENDER-EQU</td>
<td>53</td>
<td>-1.22</td>
<td>(-3.84)</td>
<td>-0.02</td>
<td>(-1.59)</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.384]</td>
<td></td>
<td>[-0.214]</td>
<td></td>
<td>[0.327]</td>
</tr>
<tr>
<td>AGE-MARRIED</td>
<td>58</td>
<td>-0.88</td>
<td>(-2.96)</td>
<td>-0.03</td>
<td>(-2.26)</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.282]</td>
<td></td>
<td>[-0.270]</td>
<td></td>
<td>[0.345]</td>
</tr>
<tr>
<td>CONTRACPTN</td>
<td>65</td>
<td>-1.06</td>
<td>(-3.92)</td>
<td>-0.03</td>
<td>(-2.35)</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.349]</td>
<td></td>
<td>[-0.254]</td>
<td></td>
<td>[0.161]</td>
</tr>
<tr>
<td>SANITATION</td>
<td>55</td>
<td>-0.80</td>
<td>(-3.14)</td>
<td>-0.02</td>
<td>(-2.05)</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.284]</td>
<td></td>
<td>[-0.216]</td>
<td></td>
<td>[0.246]</td>
</tr>
<tr>
<td>BREAST-FED</td>
<td>65</td>
<td>-1.13</td>
<td>(-4.00)</td>
<td>-0.02</td>
<td>(-2.26)</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.376]</td>
<td></td>
<td>[-0.248]</td>
<td></td>
<td>[0.334]</td>
</tr>
<tr>
<td>BIRTH-ATT</td>
<td>65</td>
<td>-1.23</td>
<td>(-5.07)</td>
<td>-0.03</td>
<td>(-2.39)</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[-0.410]</td>
<td></td>
<td>[-0.268]</td>
<td></td>
<td>[0.228]</td>
</tr>
</tbody>
</table>

*a p < 0.01.

*b p < 0.05.

*c p < 0.10.

d This column gives the results for the predictors listed at the left end of the table.
(LGDP/C, EDUC2-F, and CBRTHRTE) to which we add the predictors listed in the left column of the table one at a time. For this genre of research a common rule of thumb is to include no more than one predictor for each ten cases in the sample.

The predictors in the left column of Table V consist of the women’s status indicators GENDER-EQU, AGE-MARRIED, and CONTRACPTN which had significant or almost significant effects in Table III and the non women’s status indicators, SANITATION, BREAST-FED, and BIRTH-ATT which showed significant or almost significant effects in Table IV.

The results presented in Table V show that of the women’s status indicators two (AGE-MARRIED and CONTRACPTN) show an effect even after controls are made for LGDP/C, EDUC2-F, and CBRTHRTE. Of the non women’s status predictors (other than LGDP/C) only the health related variable SANITATION remains significant.\textsuperscript{10}

DISCUSSION

We have found evidence of an inverse relationship between the status of women and infant mortality rate. Our findings support the argument that women’s status is a multidimensional concept that includes more than educational status. Very few prior studies of infant mortality take this complexity into account, far more often the impact of women’s status has been reduced to one dimension, educational status. While discussing and interpreting our findings further, we will address the differences we found among the various dimension of women’s status. In our basic additive models (Table I) most measures of women’s status show inverse effects on infant mortality rate. This is true for indicators of women’s absolute educational status (ILLITRCY-F, EDUC2-F). It is true for indicators of women’s autonomy (AGE-MARRIED, GENDER-EQU, CONTRACPTN, FERTILITY, CBRTHRTE) and also true for indicators of women’s political status (SUFFRAGE-F and PARLAM-F). For some of our women’s status indicators (ECONOM-F and ECONOM-F/M) as well as the relative educational measurements (EDUC1-F/M, EDUC2-F/M, and EDUC3-F/M) we did find evidence (Table II) of interaction with level of development (LGDP/C).
Our findings confirm the results of prior studies that women’s educational status is an important predictor for the LDCs, but they also qualify and extend prior studies as evidence is presented that women’s relative educational status makes more of a difference (has a stronger impact) for the more developed of the LDCs. By introducing many different educational measures and checking for interaction between education and level of development, we were able to refine our understanding of the effect of education on infant mortality rate. We were able to show that while the effect of women’s absolute educational status is additive, relative educational measures generally suggest interaction with level of development. In Table II, the effects of EDUC1-F/M, EDUC2-F/M, and EDUC3-F/M all tend to be greater at higher levels of economic development. The effects of these relative measures of education are consistently inverse, but the strength of the impact increases with level of development.\footnote{11}

Of the original set of women’s status indicators the two measures of unpaid family work, UNPAID-F and UNPAID-F/M, did not do well in Tables I and II. We had expected that this sphere of women’s work would produce strong inverse effects on infant mortality. Our reason for expecting a strong impact for these unpaid family work variables is that this form of economic activity enables women to attend to their infants and children while working which other forms of women’s economic participation might prohibit. However, we do need to qualify these conclusions somewhat in light of our analysis of influential cases. When Hungary, a nation with a particularly large Cook’s D coefficient (and thus an influential case) is removed from the sample, the coefficient for UNPAID-F/M presented in Table I does have an almost significant effect ($p < 0.10$).\footnote{12}

In Tables I and II we presented evidence that all dimensions of women’s status impact infant mortality rate even after controlling for level of economic development. As we move through the paper and add additional controls, we find that the case for some of these indicators becomes weaker. But four measures (EDUC2-F, CBRTHRTE, CONTRACPTN, and AGE MARRIED) remain important even after a variety of controls have been introduced.

Of the indicators of women’s autonomy that we consider, crude birth rate has the strongest effect. It continues to have a significant impact on infant mortality rate when controls have been added for
female secondary education (Table III). As we show in Table V, crude birth rate maintains its strength even when several other women's status and non women's status predictors are added. Only when we used contraceptive prevalence as a control did crude birth rate lose its significant effect. The effect of crude birth rate held up even after several key health related variables were introduced including several not mentioned in Tables IV and V. However, in light of the extensive literature dealing with demographic transition theory, it is necessary to keep in mind that there is undoubtedly some effect of infant mortality on crude birth rate that is not captured in our models. While we view crude birth rate as a measure of women's status that is relevant as a predictor when attempting to account for cross-national variation in infant mortality rates, we realize that many of our readers will elect not to do so. They will prefer to view crude birth rate as a demographic dependent variable that is strongly affected by a nation's infant mortality rate. Our goal is not to resolve this debate, but rather to add to the case for considering crude birth rate as a predictor of infant mortality rate.

The political dimension of women's status is according to our analysis the dimension which displays the least impact on infant mortality. As shown in Table III, after we control for women's educational status, indicators of women's political status are no longer significant. Our interpretation of this finding is that the other aspects of women's status that we consider have more immediate and direct effects on physical quality of life for women and infant mortality. It may also be the case that our indicators are not good measures of the political influence of women in developing nations. It may be that independent of the percentage of women in the parliament or of the number of years women have had the right to vote, women in developing nations tend to have very little political influence. It may also be the case that those women who do have political influence tend to support policies that benefit economic elites, rather than poor women and their infants.

To this point we have limited our analysis and discussion to consideration of a sample of developing nations. In so doing, we have followed the now conventional practice of analyzing data for industrial nations and developing nations separately due to presumed differences in causal mechanisms for these two categories of coun-
tries. While our sample of industrial nations is too small to analyze separately, as a check on the robustness of our findings we did attempt to replicate our results using a larger sample that included the industrial nations as well.\textsuperscript{14} When we add 19 industrial countries to our sample, using the same variables and controls as in Tables III, IV, and V, our results and conclusions remain basically unchanged.

We started with a series of hypotheses derived from gender stratification theory and a similar set derived from industrialism theory. Our analysis shows that what starts off as very strong support for gender stratification theory becomes weaker as the analysis progresses and additional controls are added. But even when we get to the end and have added as many controls as it is reasonable to consider given the limits of our sample size, we find that several indicators derived from gender stratification theory continue to show significant effects. While we do not propose that gender stratification should replace industrialism theory in efforts to account for cross-national variation in infant mortality rates, we do believe we have made the case that gender stratification theory does deserve a place at the table in future efforts to account for cross-national differences in infant mortality rates.

We were able to clarify which dimension of women's status has the strongest impact on infant mortality rate. This will be of interest not only to those interested in accounting for cross-national differences in infant mortality rate, but also to those interested in the impact of women's status on cross-national differences in physical quality of life more generally. We say this because infant mortality rate is one of the best single indicators of the more general concept physical quality of life.

We have four suggestions for those who might be interested in building on the analysis presented in this study. It may prove interesting to attempt to replicate some of our most important findings using survey research data. This would be useful for making inferences about the impact of women's status on infant mortality patterns at lower levels of aggregation such as the family. A second suggestion would be to extent our cross-sectional analysis using statistical techniques that allow you to pool cross-sectional data. This would have the advantage of increasing the degrees of freedom (sample size) making it possible to increase the number of statistical controls in
a given model. However, the data demands of this type of analysis will make it difficult if not impossible to consider a number of the predictors we have considered here. A third suggestion would be to introduce longitudinal analysis using panel regression techniques. A fourth suggestion would be to further explore the various ways in which indicators of women's status mediate the effects of a number of the variables central to modernization theory using causal modeling.

NOTES

1 The following are the 96 countries in our sample of LDCs: Algeria, Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Benin, Bhutan, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Chile, China, Colombia, Congo, Costa Rica, Cote d'Ivoire, Czechoslovakia, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia, Georgia, Ghana, Greece, Guatemala, Haiti, Honduras, Hungary, India, Indonesia, Iran (Islamic Republic), Jamaica, Jordan, Kazakhstan, Kenya, Korea South (Rep.), Kyrgyzstan, Lao PDR (Laos), Latvia, Lesotho, Lithuania, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mauritius, Mexico, Moldova, Morocco, Mozambique, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Sri Lanka, Syria, Tajikistan, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, Uruguay, Uzbekistan, Venezuela, Zambia, Zimbabwe.

2 There is some debate among scholars who conduct cross-national aggregate analysis in this genre as to how much emphasis to give to tests of statistical significance. Some argue that it does not make sense as the assumption of a simple random sample is clearly violated (Morrison and Henkel, 1970). Others argue that it makes sense to use the standard test of significance with such samples as a heuristic device (Bollen, 1983). We do not believe there has been a definitive resolution to this debate, but for the purposes of this paper we will follow what has become the conventional practice and present tests of significance.

3 This finding is basically a replication of what many prior studies have reported (Caldwell, 1986; Tolnay and Christenson, 1984). However, it is of note that this predictor is stronger than female illiteracy rate.

4 If it is not significant, as in the case of SUFFRAGE-F, then the appropriate model is the additive model presented in Table I. It does not make sense to interpret the results in Table II as showing that this variable has neither a significant additive effect nor a significant interaction effect.

5 The exception is EDUC1-F which reaches an almost significant interaction effect in Table II.

6 The correlation between FERTILITY and CBTHRTE is 0.96; the correlation between FERTILITY and CONTRCPTN is -0.86; and the correlation between CBTHRTE and CONTRCPTN is -0.90.
There is some debate in the literature as to whether a coefficient that is significant at the 0.10 level should be considered statistically significant. Given the small sample sizes and the special nature of the samples being used, it is not uncommon to use the 0.10 level. Some use the 0.10 level (or the equivalent in t-values) (Ragin and Bradshaw, 1992; Flegg, 1982) others prefer not to (Rogers and Wofford, 1989; Yang and Pendleton, 1980). In the present study we will refer to a coefficient that is significant at the 0.10 level as being almost significant. The reader may want to classify these coefficients as marginally significant.

In addition to the models shown in Table III, we checked the relative women’s educational measures (EDUC1-F/M, EDUC2-F/M, and EDUC3-F/M) to determine whether they had significant effects once women’s absolute educational status was controlled (EDUC2-F). Not too surprisingly, neither the main effects nor the interactive effects of women’s relative educational status had significant effects when we controlled for EDUC2-F. Further, we ran a similar set of models for the two women’s economic status predictors (ECONOM-F and ECONOMF/M) that showed significant interaction with LGDP/C in Table II. In these models, none showed significant interaction with LGDP/C in models that also controlled for EDUC2-F.

A series of models were constructed (not shown here) in which we checked for possible interaction between each of these predictors and LGDP/C. In most cases the interaction terms are not significant. However, in the model for the BREAST-FED predictor the interaction term was almost significant ($p < 0.10$) and in that model the sign of the BREAST-FED predictor shifts from being positive to negative, an outcome that is more consistent with the general finding that longer breast feeding lowers infant mortality rates.

As we indicated in footnote 9, BREAST-FED had an almost significant interactive effect. For this reason, we tested a model that adds a term for the interaction between BREAST-FED and LGDP/C to the model presented in Table V. The interaction term was not significant.

Due to interaction, the effect (unstandardized partial regression coefficient) of EDUC1-F/M is −0.016 at one standard deviation below the mean on our indicator of level of development (LGDP/C) and it increases to −0.062 at one standard deviation above the mean. For EDUC2-F/M the corresponding coefficients are −0.824 and −1.902, and for EDUC3-F/M they are −0.545 and −1.721.

After removing Hungary, the $R^2$ increases to 0.75, the $b$-coefficient becomes −0.28 ($p < 0.10$), the Beta becomes −0.127 and the t-value becomes −1.72. We checked for interactive effects as well, but there were none.

In addition to the health related measures presented in Table IV we also considered a variety of other predictors: the prevalence of anemia in pregnant women, population per physician, population per nurse, ratio health expenditures by the central government to the GDP, percent of household consumption spend on medical care, and percent of the population with access to safe water. Once we made the controls found in Table IV, none of these predictors had significant effects.

In Tables III and IV all non significant predictors stayed non significant. Among the significant indicators, AGE-MARRIED, GENDER-EQU (Table III) and SANITATION, BIRTH-ATT (Table IV) increased either from $p < 0.10$ to $p < 0.05$ or from $p < 0.05$ to $p < 0.01$. In Table V, BIRTH-ATT becomes almost significant ($p < 0.10$).
APPENDIX

This appendix contains a list of variable abbreviations, definitions, and sources.

AGE-MARRIED: This variable measures women's average age at first marriage, circa 1990. SOURCE: (United Nations, 1991)

BIRTH-ATT: This variable measures the percentage of births that have been attended by a trained person, circa 1990. SOURCE: (United Nations, 1991)

BREAST-FED: This variable measures the percentage of children who are still breast fed during 12 to 15 months of age in the years 1986 to 1991. SOURCE: (UNICEF, 1993)

CALORIES: This variable measures daily calorie supply per capita in 1989. SOURCE: (World Bank, 1992)

CBRTHRTE: This variable measures the crude birth rate per 1,000 population in 1990. SOURCE: (World Bank, 1992)

CONTRACPTN: This variable measures the percentage of married women aged 15 to 49 currently using contraception. SOURCE: (UNICEF, 1993)

ECONOM-F: This variable measures the estimated economic activity rate in percent of economically active women aged 15 years and over in 1990. Economically active is defined to comprise all employed and unemployed persons, including those seeking work for the first time. It covers employers operating unincorporated enterprises, persons working on their own account, employees, unpaid family workers, members of producers co-operatives and members of the armed forces. SOURCE: (United Nations, 1991)

ECONOM-F/M: This variable is a constructed ratio of the estimated economic activity rate in percent of economically active women aged 15 years and over in 1990 to the estimated economic activity rate in percent of economically active men aged 15 years and over in 1990. SOURCE: (United Nations, 1991)
EDUC1-F: This variable measures female primary school enrollment as a percentage of the female primary school age group in 1989. SOURCE: (World Bank, 1992)

EDUC2-F: This variable measures female secondary school enrollment as a percentage of the female secondary school age group in 1989. SOURCE: (World Bank, 1992)

EDUC1-F/M: This variable measures the ratio of female to male enrollment in the first level of education in 1985/1987. SOURCE: (United Nations, 1991)

EDUC2-F/M: This variable measures the logarithm of the ratio of female to male enrollment in the second level of education in 1985/87. SOURCE: (United Nations, 1991)

EDUC3-F/M: This variable measures the logarithm of the ratio of female to male enrollment in the third level of education in 1985/87. SOURCE: (United Nations, 1991)

FERTILITY: This variable measures the total number of births per woman in 1990. SOURCE: (United Nations, 1991)

GENDER-EQU: This variable is a global measure of gender equality. It is based on a rating that has been done of each country on the basis of several gender related aspects of inequality for the period between 1986 and 1988. Among the dimensions included are: political and legal equality, equality in marriage and the family, discrimination against women, and economic equality. SOURCE: (Population Crisis Committee, 1988)

HEALTH-SER: This variable is a measure of the percent of the population that has access to health service for the years 1987 to 1990. SOURCE: (United Nations Development Programme (UNDP), 1993)

ILLITRCY-F: This variable measures the percent of the female population over the age of 15 that was illiterate in 1990. SOURCE: (World Bank, 1993)
INCOME: This variable measures the square root of the percentage of the national income received by the top quintile. It is a measure of income inequality. SOURCE: (Moaddel, 1994)

LGDP/C: This variable measures the logarithm of purchasing power of currencies estimates of GDP rather than exchange rates of GDP per capita. SOURCE: (World Bank, 1993)

LO-BRTH-WT: This variable measures the inverse of percentage of infants with low birth weight, whereby low birth weight equals less than 2,500 grams. SOURCE: (UNICEF, 1993)

PARLAM-F: This variable measures women’s political participation as the percentage of parliamentary seats that were occupied by women in 1987. SOURCE: (United Nations, 1991)

SANITATION: This variable is an estimate of the percentage of the population with access to sanitary means of excreta and waste disposal, including outdoor latrines and composting for the years from 1988 to 1990. SOURCE: (United Nations Development Programme (UNDP), 1993)

SUFFRAGE-F: This variable measures the years women have obtained the right to vote in each country as of 1995. SOURCE: (United Nations, 1991)

UNPAID-F: This variable measures the percentage of women whose labor status is to work as an unpaid family worker. SOURCE: (United Nations, 1991)

UNPAID-F/M: This variable is the inverse of a constructed ratio of the percentage of women who work as unpaid family members to the percentage of men who work as unpaid family worker. SOURCE: (United Nations, 1991)

URBAN: This variable measures the percent of each country’s population living in urban areas in 1991. SOURCE: (World Bank, 1993)
REFERENCES

Carvajal, M. and P. Burgess: 1978, Socioeconomic Determinants of Fetal and Child Death in Latin America (Community and Family Study Center, University of Chicago, Chicago).


Department of Sociology
Boston College
Chestnut Hill, MA 02167
U.S.A.