Maternal mortality, women’s status, and economic dependency in less developed countries: a cross-national analysis

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Abstract

While much has been written about the medical, economic, and social causes of cross-national differences in some mortality related phenomena such as in life expectancy and infant mortality, much less attention has been given to maternal mortality, the focus of the present study. In the studies of maternal mortality that have been done, there has been very little effort to assess the potential relevance of the gender stratification and dependency theory perspectives. Using lagged cross-sectional and path analysis with a sample of 79 less developed countries, this article focuses on the impact of predictors linked to three theoretical perspectives – modernization, economic dependency, and gender stratification. We find that women’s status, as measured by indicators such as level of education relative to men, age at first marriage, and reproductive autonomy, is a strong predictor of maternal mortality. We find that economic dependency, especially multinational corporate investment, has a detrimental effect on maternal mortality that is mediated by its harmful impacts on economic growth and the status of women. We also find support for developmental theory, a variant of modernization theory. © 1999 Elsevier Science Ltd. All rights reserved.

Keywords: Maternal mortality; Women’s status; Economic dependency; Cross-national

Introduction

According to what we consider the most reliable data source currently available (WHO, 1996), globally approximately 585,000 women died from pregnancy-related causes in 1990. Rates of maternal mortality show a greater disparity between rich and poor nations than do any of the other commonly used public health indicators, including infant mortality rate, the indicator which is most often taken as the primary measure of comparative disadvantage (Royston and Armstrong, 1989; WHO, 1996). Women who become pregnant in developing countries face a risk of death due to pregnancy that is 80 to 600 times higher than women in developed countries (United Nations, 1991). In 1990, the average maternal mortality rate in the developed countries was 27 per 100,000 live births, while in countries such as Angola, Bhutan, Chad, Guinea, Nepal, Sierra Leone, and Somalia the rates were at least 1500 per 100,000 live births (WHO, 1996). In most developing countries, between a quarter and a third of the deaths of women in their reproductive years can be attributed to pregnancy-related causes (Royston and Armstrong, 1989). In some rural areas
of Africa and South Asia, of every two women who die, one dies from pregnancy related causes.

Very often, the death of a woman in childbirth is described as a tragic misfortune due to the risky process of childbirth and is accepted as unavoidable. But such a description does not give adequate attention to the many factors that influence the level of risks associated with pregnancy and childbirth. Maternal mortality is a particularly sensitive indicator of inequality and social development as well as health. Due to the importance of maternal mortality as an indicator of social development for developing countries, the reduction of maternal mortality has been established as a goal for the health of women and children by both the World Health Organization and the United Nations; it has also been described as one of the major public health goals at several recent international conferences (WHO, 1996).

Among the major direct causes of high maternal mortality in developing countries are: births not attended by trained personnel, lack of availability or access to backup services for high-risk pregnancies, and malnutrition among pregnant women (United Nations, 1991). Much of the literature on maternal mortality focuses on its medical, social, and cultural causes that vary among countries and geographical regions (e.g., Chen et al., 1974; India, 1981; Fortney et al., 1986; Walker, 1986; Hertz et al., 1994). It is of note that in cross-national quantitative studies on maternal mortality in less developed countries (LDCs), two important perspectives have been largely overlooked.

One is the examination of the impact of women’s status on maternal mortality. Maternal mortality tends to be attributed to causes such as poverty and underdevelopment typically assumed to put both men and women at the same disadvantage with respect to health status. Even though women’s educational status has long been recognized as an important factor affecting fertility, infant mortality, and maternal mortality (Caldwell, 1979, 1993), sex discrimination in general as a contributory factor has not been given much attention (Royston and Armstrong, 1989). With the increased data availability in recent years, some studies have used indicators other than education to study issues related to women’s status and autonomy in LDCs (Marshall et al., 1988; Osirim, 1992; Boehmer and Williamson, 1996). However, very few cross-national quantitative studies have examined maternal mortality with these measures.

The second is the effects of economic dependency and the globalization of the world economy on maternal mortality in LDCs. Economic dependency theory has been applied in a number of cross-national studies dealing with basic human needs provision such as fertility, infant and child mortality and women’s social status (Ward, 1984, 1985; London and Williams, 1990; Wimberly and Bello, 1992; Shen and Williamson, 1997). But very few cross-national quantitative studies have analyzed the effects of economic dependency on maternal mortality in LDCs.

Our study examines the effects of several key external and internal factors on cross-national variation of maternal mortality in LDCs. We call these factors ‘causes behind the direct causes’. We are interested in how women’s status affects maternal mortality in societies with similar economic development level and in how economic dependency impacts maternal mortality directly and indirectly via other key predictors of maternal mortality.

Theoretical and empirical background

We attempt to explain the cross-national variation of maternal mortality using predictors linked to three different theoretical perspectives: modernization theory, gender stratification theory, and economic dependency theory.

The modernization perspective

Modernization theory is closely linked to neoclassical economic theory. Both view economic development as a bridging of the gap between developed and underdeveloped nations through an imitative process. According to demographic transition theory-derived from modernization theory-fertility and mortality go hand in hand. In societies where fertility is high, maternal mortality tends to be high. Economic development leads to higher standards of living and advanced medical technology which in turn contribute to both lower mortality and fertility. Maternal mortality, an indicator of health status of the population, should decrease as the level of economic development increases. This process allegedly requires greater levels of industrialization, education, and urbanization (Inkeles and Smith, 1974; Kelly and Cutright, 1980; Van de Walle and Knodel, 1980). Modernization theorists have also emphasized the importance of capital for the development in LDCs (Rostow, 1971). Capital scarcity is viewed as a major inhibitor to development in LDCs (International Monetary Fund, 1985; Grieco, 1986). They believe that investment from the core industrialized countries and world trade promote development in LDCs by providing external capital, new technology and management experience, which are crucial to the economic and social development of LDCs. Indicators commonly used by researchers working in this tradition include gross national (or domestic) products, economic growth rate, urbanization, education, and health care service.
Modernization theory has been criticized for over emphasizing the effects of economic development and not giving much attention to inequality within societies including class and gender stratification. It also tends to ignore the structural relations among countries at different levels of development and the political dimension of the international economy.

The gender stratification perspective

Gender stratification theorists attempt to explain gender linked differences in privilege and power in society. Gender stratification is different, but related to other dimensions of inequality such as those based on social class and ethnicity. Gender stratification theory can be used to argue that societies in which women have higher status and more autonomy will generally be societies in which maternal mortality is lower. This perspective has long been neglected by modernization theory. According to modernization theory, a nation’s industrialization and modernization will enhance women’s status in general by providing more labor participation opportunities, and increase women’s access to, and control over, any resources including health services, and maternal mortality rate should decrease automatically in step with the decline of general mortality. However, this assumption has been challenged by the finding that a large number of women in developing countries are victims of development because the products they were selling or the services they were performing are replaced by new alternatives. Commonly they are then relegated to jobs in the backward sectors of the economy (Boserup, 1970; Abraham and Abraham, 1988).

Some studies conclude that the global division of labor actually circumscribes work opportunities for women in the Third World. The type of employment available to them often marginalizes women in low-paying, tertiary and informal economy (Marshall et al., 1988; Osirim, 1992; Fernandez-Kelly and Sassen, 1993; Ward and Pyle, 1995). Evidence from even the Newly Industrialized Countries (NICs) shows that sustained economic growth and industrialization in that region over the past few decades has not resulted in a significant reduction of gender wage differentials. To the contrary, in some cases the gap has widened (Seguino, 1997).

Many studies have examined the intricately entwined relationship between women’s status and health based on the understanding that any serious attempt to improve the health of women must first deal with those ways in which a woman’s health is harmed by social customs and cultural traditions (Lyons, 1985). In societies where the status of women is low, women have too many children, start childbearing too early, end childbearing too late and the children are too close together (Royston and Armstrong, 1989). A recent cross-national study found that women’s status (measured by education, health and reproductive autonomy) has a beneficial effect on child mortality decline (Shen and Williamson, 1997). With poor socioeconomic conditions, women are vulnerable to the health risks caused by childbearing, yielding high mortality.

Decreases in fertility reduce the risk of dying from pregnancy-related causes. With greater access to education, employment and contraception, women choose to have fewer children (United Nations, 1995). Thus, fertility decreases with the increase of women’s status. With increasing status, women have more say with respect to the number of children they have, greater access to health care, and better nutrition during pregnancy. In turn, these factors impact maternal mortality.

Malnutrition among pregnant women is recognized as a major cause of maternal mortality in LDCs, as measured by the incidence of anemia (United Nations, 1991), though in developed countries it is no longer a major problem. Anemia increases women’s susceptibility to illness, pregnancy complications and maternal deaths. In many developing societies, where girls and women are considered inferior to boys and men, they are often given smaller amount of food, as well as less protein-rich and iron-rich food than boys and men.

The age of the pregnant women is another important determinant of maternal mortality (Royston and Armstrong, 1989). In societies where women have high social status, women typically start childbearing much later than in societies where women’s status is low. Teenage marriage – a reflection of the low status of women – is a crucial factor in maternal mortality because of the number of years of childbearing ahead for the woman and because of the risks associated with giving birth before becoming physically fully developed. In developing regions 40% of women give birth before reaching age 20 and adolescent girls have a 20–200% higher risk of dying from pregnancy-related causes than adult women – the younger the girl the higher the risk (United Nations, 1995). Moreover, early child-bearing continues to impede advances for women’s education and economic status, continuing the cycle of disadvantaged mothers passing on their vulnerability to their daughters, and their daughters to theirs.

Sex discrimination acts on the health of women in many ways. In many underdeveloped societies, there is a general lack of provision for women’s special needs in the design of health services. Many maternal deaths are avoidable if trained personnel attend births. In developed countries attended delivery is almost universal. However, in developing countries on average only
55% of births take place with a trained attendant (United Nations, 1995). Women seldom receive maternal health care and family planning services, and families often give lower priority to the health care of women than men. When health services are cut back, as they sometimes are under economic austerity programs, the health needs of women are often given a low priority (United Nations, 1991).

Many maternal deaths occur because women are having more pregnancies than they want (Royston and Armstrong, 1989). There are presently at least 300 million couples in the Third World who do not want any more children but who are not using an effective means of limiting family size (UNICEF, 1990). If women who do not want to become pregnant were empowered to exercise that choice, the rate of population growth in the developing world would fall by approximately 30% and there would be a steep reduction of maternal mortality. If women were able to avoid unwanted pregnancy, at least a quarter of the maternal deaths would be avoided; each year some 150,000 fewer women would die of pregnancy related causes (Royston and Armstrong, 1989).

A number of studies (Mauldin and Berelson, 1978; Knode and Van de Walle, 1979; Freedman, 1982; Tolnary and Christensen, 1984; Shen and Williamson, 1997) have confirmed the significant role of family planning programs in recent fertility declines, which, in turn, may be contributing to the decline in maternal and child mortality. Although modern family planning methods make it far easier to limit fertility, the acceptance and availability of family planning methods are nevertheless uneven. In many patriarchal societies men do not allow women to practice family planning. In this sense, the prevalence of contraception can be used as a measure of women’s status.

The dependency perspective

Contrary to modernization theory which has developed out of liberal thought and the positivist tradition, dependency theory has developed out of Marxist thought and the historist tradition (Billet, 1993). According to dependency theorists, capitalist world system perpetuates a global division of labor which distorts the domestic economies of many LDCs, reduces the rate of economic growth, increases income inequality, and adversely affects well-being for a substantial fraction of the population (Bornschier et al., 1978; Wimberly and Bello, 1992).

Dependency theorists argue that free trade, looked upon so favorably by those in the modernization theory tradition, does not help to equalize incomes either within or between nations. Rather, it aggravates the gap between rich and poor nations while at the same time contributing to inequality with respect to income and physical well-being within nations because of the unequal exchange between the core and periphery countries of raw materials for processed goods (Bunker, 1984; Michaely, 1984), the long-term decline of prices for primary goods in relation to prices for processed goods, and the unbalanced economy created by specialization in the export of raw materials (UNICEF, 1989). Therefore, the state’s ability to raise revenues is weakened and the resulting lack of revenues affects the funding of many health and social services programs.

Some prior studies in this tradition have reported harmful effects of trade dependence on fertility and mortality (and mortality related quality of life measures) (Hout, 1980; Cutright and Adams, 1984; London and Williams, 1990; Miller, 1992; Ragin and Bradshaw, 1992). Miller found that trade dependency impeded the decline of maternal mortality in LDCs.

According to the more recent dependency theory literature, the dependence of LDCs on multinational corporate (MNC) investment has increased significantly and indicators of this aspect of dependency better reflect the consequences of dependence than do indicators of classical dependence such as commodity concentration. This is due to the changing nature of international economic relationship between the core and periphery nations since the mid-1960s (Bornschier and Chase-Dunn, 1985). By comparing the total amount of economic activity of the Multinational corporations (MNCs) to the gross national product (GNP) of OECD (Organization for Economic Cooperation and Development) members, Billet (1993) suggests that the resource base of numerous MNCs is as great as that of some of the most advanced industrial countries in the world.

Dependency theorists and some of their empirical studies have offered following explanations for the harmful effects of MNCs investment on LDCs: (1) MNCs repatriate most of their profits and displace local businesses, slowing economic growth in the host country. (2) Foreign investment promotes income inequality (Sullivan, 1983; Crenshaw and Ameen, 1993). It generally generates some higher paying jobs, but the economic benefits are concentrated on a small fraction of the local population. (3) MNC investment often impedes public health measures by obstructing government policies that are beneficial to much of the population, but harmful to MNC interests (Wimberly, 1990). Some empirical studies identify the detrimental effects of foreign investment on mortality in LDCs (London and Williams, 1988; Wimberly, 1990; Lena and London, 1993).

Bank loans are another form of capital available to LDCs. Since 1970’s, many developing countries have experienced a great increase in foreign debt. Contrary to modernization theorists, dependency theorists...
regard foreign debt as another form of economic dependency, because the LDCs must follow the dictates of those countries and institutions that loan them capital (e.g., the World Bank and the International Monetary Fund – IMF). The adverse effects of debt are typically linked to the following factors: (1) Debt and interest payments drain already scarce capital and as a result inhibit economic development. (2) The resulting capital drain reduces government spending on social, educational, and health programs, slowing any decline in mortality. (3) This capital drain and the concomitant austerity measures reduce state strength and flexibility making it difficult to take action when faced with social or economic crises. Some empirical studies suggest that debt incurred from foreign aid programs has a harmful net effect on mortality (Sell and Kunitz, 1987; Bradshaw and Huang, 1991; Bradshaw et al., 1993).

Because fertility is closely related with maternal mortality the link between fertility and economic dependency is of particular interest. Based on the experience of Latin American countries, Hout (1980) challenged the assumption of demographic transition theory and found that trade dependence blocks the fertility-reducing effect of development. Moon (1991) also found that higher fertility levels are common in nations with a large foreign trade sector and with substantial multinational corporate penetration. Nolan and White (1984) suggest that the core countries may benefit from a continuing supply of cheap labor and, accordingly, core-periphery interactions may counteract developmental forces conducive to fertility decline. Some studies found that the concentration of women in the ‘bloated tertiary’ or low-wage service sector – a by-product of MNC penetration (Evans and Timberlake, 1980; Osirim, 1992) contributes to high fertility (Ward, 1984). Also, in a distorted economy with a large poor population, dependency fosters a situation in which children make an integral contribution to the household economy. So long as wealth flows from child to adult, there is little motivation to limit fertility (Hout, 1980; Caldwell, 1990).

Although a number of studies have investigated the impact of economic dependency on basic human needs and some studies have even linked dependency to women’s status (Ward, 1984, 1985, 1990; Marshall et al., 1988; Clark, 1991; Miller, 1992; Osirim, 1992; Seguino, 1997; Shen and Williamson, 1997), few studies have examined the impact of dependency on maternal mortality. And no prior cross-national studies have examined the indirect effect of the economic dependency of LDCs on maternal mortality as mediated by various dimensions of women’s status.

**Methods**

**Research design**

Although many countries have experienced reductions in maternal mortality rates in recent decades, for many of the poorest nations, particularly those in sub-Saharan Africa, there is little evidence of decline (United Nations, 1995). According to estimates by the United Nations, the situation has not improved in most of sub-Saharan Africa and has worsened in some parts of Africa. For many LDCs there is little if any reliable maternal mortality data for the 1960s and 1970s. Due to these reasons, our analysis is not based on a panel regression design. Instead, we use a design that combines lagged cross-sectional and cross-sectional analysis.

Our dependent variable measured at a recent point in time (1990) is regressed on independent variables some of which are measured at an earlier point in time (1960s or 1970s). By utilizing dependent variable lagging, we can evaluate the temporal effects of certain independent variables. This least squares procedure captures the effect of initial levels of the independent variables on subsequent levels of the dependent variable because we have theoretical reasons to believe that this lagging procedure reflects the processual nature of the relationship examined. According to dependency theorists, economic dependency variables, particularly foreign investment, usually need a long time to have a measurable impact on LDCs, especially on health outcomes. Therefore, we give foreign investment data (1967) the longest time lag, followed by trade dependency and debt increase. For other predictors such as fertility rate, contraceptive prevalence, and age of first marriage there is no reason to hypothesize a long time lag and we use much more recent data.

First, we use ordinary least square (OLS) regression analysis to examine the direct effects of both internal (modernization, gender stratification) and external (dependency) variables on maternal mortality with economic development level (GDP per capita) controlled. Because some previous studies have found that economic dependency has indirect effects on health and social welfare outputs through intervening variables such as economic growth rate, we next test the effects of the three dimensions of economic dependency on all of our internal predictors of maternal mortality. Finally, to obtain a more precise assessment of both direct and indirect effects, especially for dependency variables, path analysis was conducted to provide a comprehensive estimate of the combined direct and indirect effects of economic dependency on maternal mortality in LDCs.
Sample and significance testing

Because the focus of the study is on LDCs, countries classified as industrial market economies by the World Bank are excluded as are countries with populations below one million in 1991 (World Bank, 1993). Also excluded are former and current socialist countries due to the absence of data for several key predictors (such as GDP per capita (1970), economic growth rate (1965–1990), and foreign investment (1967)). As those who conduct studies based on cross-national aggregate data are aware, it is generally not feasible to work with a random sample of countries (Bollen et al., 1993). In this study as is commonly the case, the countries excluded for lack of reliable data tend to be among the poorest nations in the world leaving us with a sample that is biased toward the more affluent LDCs. We were able to obtain data on maternal mortality in 1990 (our dependent variable) and real GDP per capita in 1970 (a key control variable) for 79 LDCs.

Following the conventional rules to keep the ratio of cases to predictors close to the suggested lower limit of 10:1 (London, 1988), in constructing models we have to limit the number of predictors in any one regression equation to between four and six and allow our sample size to vary from one model to another depending on data availability. For most models in this study, the sample size varies between 50 and 60 countries. The resulting variation in the sample should be taken into consideration when interpreting differences between models. Considering the importance of GDP level in determining maternal mortality in LDCs, we control this variable throughout the study.

Given that none of our samples are simple random samples our use of tests of significance and t-statistics are presented for heuristic purposes. Bollen et al. (1993) assert that statistical significance tests can be justified with samples such as ours in terms of a hypothetical ‘superpopulation’ where the observed sample is treated as one possible sample that could be drawn from that hypothetical population. Messner (1989) also argued that such tests could still be used as a criterion for identifying nontrivial relationships. We use the significance levels based on t-statistics to indicate the relative strength of a variable in accounting for the cross-national variation of maternal mortality.

We use the ratio of the regression coefficient to its standard error as a measure of the level of significance. Following previous studies (Bradhaw and Tshandu, 1990; London and Williams, 1990; Lena and London, 1993) coefficients are considered significant if the coefficient is at least 1.5 times the size of its standard error. According to Pedhazur (1982), in analysis of this type, where the units of analysis are large aggregates and where the number of cases is relatively small, this measure is the most reliable guide to interpreting the ‘significance level’ of coefficients. As shown in analysis results section, several checks were performed to ensure data quality.

Variable measurement

Perhaps the biggest challenge for cross-national quantitative studies based on data from LDCs is obtaining reliability data. In this study, the reliability of our dependent variable, maternal mortality, and of the independent variables measuring women’s status are of concern. Maternal mortality rate is defined as the annual number of deaths of women from pregnancy-related causes per 100,000 live births. However, in practice, the definition used is not as consistent between countries as one might hope, particularly as regard to the inclusion of abortion-related deaths. If the definition of maternal mortality is to include all deaths due to pregnancy and childbirth, it must include deaths taking place before childbirth (e.g., due to abortion, ectopic pregnancy), those taking place during childbirth, as well as deaths taking place some time after the actual event of childbirth. In addition, not all maternal deaths are directly due to conditions resulting solely from pregnancy (Royston and Armstrong, 1989; WHO, 1996).

According to World Health Organization (WHO, 1993), the vital registration of cause of deaths data exists only in 78 countries or areas, covering only approximately 35% of the world’s population. Most official maternal mortality rates are underestimates (Royston and Armstrong, 1989; WHO, 1996). This study focuses on maternal mortality rates for developing countries, nations whose data are much less reliable than in the developed countries. We use the most reliable source that exists for a broad range of LDCs, a recent publication of the WHO (1996). As indicated by the data source, because measuring maternal mortality is difficult and complex, reliable esti-
mates are not generally available. In this publication, WHO and UNICEF have developed new estimates using data that has been adjusted to account for the common problems of under-reporting and misclassification of maternal deaths (for a detailed discussion of the methods of calculation and estimates, see WHO, 1996). The results of this study must be viewed with caution given the limitations of the data currently available.

All the data for measuring women’s status are from publications of World Bank and United Nations. The data sources point out that it is hard to get reliable data especially for contraceptive prevalence, births attended by trained persons, and average age of first marriage. We intended to collect data circa 1990 for these variables. However, as the data sources indicate, for some countries the data are from 1980s and in a few cases even the 1970s. In addition, the variable definitions are not always exactly the same from country to country. For example, the data for contraceptive prevalence is usually calculated as the proportion of married women between 15 and 44 using contraception. Obviously, many people are excluded. Also, some contraceptive methods are included for certain countries, but not for others.

As a remedy for skewed distributions for some of our variables, we have, where called for, used logarithmic or square root transformations of these variables. See Appendix A for a listing of all variables, sources, and transformations used.

In our assessment of modernization and neoclassical economic theory we consider four indicators: (1) real GDP per capita in 1970 (an estimate of gross domestic product per capita, adjusted for purchasing power parity so that it is more comparable internationally than GDP per capita); (2) economic growth (average annual economic growth rate between 1965 and 1990); (3) population per doctor circa 1990; and (4) calories per capita (1989).

Population per doctor is included due to the obvious link between the availability of general health service personnel and maternal mortality although this measure does not reflect gender differences in access to health care due to inequality between men and women. We use average calories per capita as an indicator of a nation’s average nutrition level. Again, this measure does not reflect gender differences in the allocation of food.

It is hard to operationalize the concept of the ‘status of women’ because it is a multidimensional construct that involves a complex set of inter-related factors. Considering the relevance to our dependent variable – maternal mortality – and data availability, we include five indicators linked to this theoretical perspective: (1) the ratio of female over male secondary school enrollment (1989); (2) births attended by trained personnel (or health attendants) (1990); (3) contraceptive prevalence (1990); (4) average age of first marriage (1990); and (5) total fertility (1990).

The first indicator measures the relative educational status of women in a society. The relative status of women compared to men is at the core of gender stratification theory (Mason, 1986). Households and governments almost always invest less in women and girls than in men and boys (United Nations, 1991). For example, roughly 60% of rural Indian boys and girls enter primary school, but after five years, only 16% of the girls are still enrolled, compared with 35% of the boys (Tan and Haines, 1984).

When we control for level of economic development, the prevalence of trained attendants at birth can be viewed as a measure of the status of women as it reflects a decision to allocate resources to foster the well-being of women in connection with childbirth. Average age of first marriage and contraceptive prevalence can both be viewed as measures of women’s status related to autonomy in marriage and reproductive behavior. Total fertility is frequently used as an outcome measure of modernization level. In this study, we use it as an indicator of women’s status because fertility is influenced by a number of social, economic, cultural, and religious factors, many of which are linked to or affected by the status of women (Boehmer and Williamson, 1996).

To evaluate the utility of dependency theory, we consider three dimensions of economic dependency: (1) foreign investment (MNC penetration in 1967); (2) foreign debt increase (the increase in the ratio of debt service to exports between 1970 and 1990), an indicator of debt dependency, and (3) commodity concentration of exports in 1973, an indicator of trade dependency. We keep our measures of economic dependency as close as possible to the early 1970s. However, due to the long time lag required to test the effect of foreign investment, we use the earliest available data for MNC penetration (1967). A number of prior studies use the same measure and same data source for foreign investment (Bornschier and Chase-Dunn, 1985; Boswell and Dixon, 1990). For commodity concentration, we used 1973 data as it is the closest to 1970 available. We also believe trade dependence may need shorter time lag to demonstrate its effect on health than MNC investment. In terms of debt increase, we chose the difference between 1990 and 1970 because the dramatic increase of foreign debt among LDCs began since early 1970s (World Bank, 1988; UNICEF, 1989).

If the logic of modernization and neoclassical economic theory is correct, we would expect to find a positive relationship between the three indicators of dependency and maternal mortality. Those countries best able to attract foreign capital should experience
greater economic growth and, concomitantly, lower maternal mortality. On the other hand, if dependency theorists are correct, those countries should have lower economic growth and higher maternal mortality.

**Results**

Researchers doing cross-national research based on aggregate data are routinely confronted with a number of methodological issues such as data being available for a limited number of countries, data reliability problems, outliers, influential cases, multicollinearity, and unstable results in the presence of additional control variables. We have adopted a number of strategies designed to deal with many of these methodological concerns.

A small number of influential outliers can have a substantial impact and their presence may be a signal either that there are problems with the data for the outlier countries or that an important predictor has been omitted; that is, that the model is misspecified (Bollen and Jackman, 1985). We check for and where appropriate remove influential outliers so as to insure the robustness of our findings.

Table 1 presents the Pearson zero order correlations among all the variables considered in this study. It is of note that some of these correlations are very high, signaling potential multicollinearity problems. The correlations in column 1 reveal that all of what we refer to as the internal predictors have strong correlations with maternal mortality. These predictors are also often highly correlated with each other, a finding that is consistent with our previous statement that many predictors of maternal mortality are intricately interwoven. Table 1 also shows that the signs of the correlation of MNC investment and debt increase with maternal mortality and other internal variables are not always consistent. MNC investment is negatively correlated with maternal mortality while debt increase is positively correlated with maternal mortality. Our explanation is that MNCs are likely to invest in the more affluent LDCs where GDP level is relatively high. In contrast, loans are not concentrated in the

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<tr>
<th>Table 1</th>
<th>Pearson correlation matrix for variables in the studya</th>
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<td>1</td>
<td>Maternal mortality 1990</td>
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<tr>
<td>2</td>
<td>Real GDP per capita 1970</td>
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<td>3</td>
<td>Economic growth 1965–1990</td>
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<td>Population per doctor circa 1990</td>
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<td>5</td>
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<td>6</td>
<td>Total fertility 1990</td>
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<td>7</td>
<td>Contraceptive prevalence 1990</td>
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<td>8</td>
<td>Health attendants 1990</td>
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<td>10</td>
<td>Age at first marriage 1990</td>
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<td>11</td>
<td>Foreign investment 1967</td>
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<td>12</td>
<td>Foreign debt increase 1970–1990</td>
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<td>13</td>
<td>Commodity concentration 1973</td>
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a The number is the correlation coefficient; the number in parentheses is the number of countries.
more affluent LDCs. The correlation between GDP per capita and MNC investment is 0.63 while the correlation between GDP per capita and debt increase is 0.16.

Table 2 presents standardized OLS estimates for both external and internal predictors of maternal mortality. As shown below, we take certain measures to deal with the potential problems mentioned earlier. To deal with multicollinearity, especially the high correlations among the five predictors linked to gender stratification theory, we allow only one of these variables to be included in any one equation. In addition to checking out influential outliers, we also requested histograms for studentized residuals, normal probability plots, and scatterplots to ensure linearity and to check for heteroscedasticity.

Eq. (2.1) gives the external predictors, that is, the economic dependency variables, the maximum opportunity to account for the cross-national variation in maternal mortality. As shown, when GDP is controlled, all three dependency indicators have positive (detrimental) effects on maternal mortality, although the effect for the most important measure of economic dependency – foreign investment – is not significant.

From Eqs. (2.2)–(2.7), we turn our attention to the effects of what we refer to as the internal predictors of maternal mortality. With GDP per capita as a control variable, we examine the effects of the following internal variables: three indicators linked to the modernization and neoclassical economic perspective (economic growth rate (1965–1990), population per doctor (1990), calories per capita (1989)) and five indicators linked to the gender stratification perspective (contraceptive prevalence (1990), health attendants at birth (1990), female/male ratio in secondary school enrollment (1989), average age of first marriage (1990), and total fertility (1990)).

We examine the effects of these internal predictors in a hierarchical fashion. In Eq. (2.2), we let all three predictors linked to modernization theory compete with each other, and then with the significant ones in the model, one predictor linked to gender stratification theory is added for each equation.

As shown in Eq. (2.2), when GDP per capita is controlled, both economic growth and population per doctor have significant effects on maternal mortality in the direction we had expected. For calories per capita – an indicator of nutrition level – the effect is not significant. The relatively weak effect may be due in part to inability of this indicator to capture gender discrimination in the allocation of food. Based on the particularly poor showing for calories per capita, we decided to drop this variable from our subsequent analysis.

From Eqs. (2.3)–(2.7), each predictor linked to gender stratification theory is added one at a time with the presence of the control variable – GDP per capita and the other two variables linked to modernization theory – economic growth and population per doctor. All five indicators linked to gender stratification theory have significant effects on maternal mortality. At the same time GDP per capita and economic growth rate demonstrate significant effects on maternal mortality.

### Table 2

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Eq.</th>
<th>(2.1)</th>
<th>(2.2)</th>
<th>(2.3)</th>
<th>(2.4)</th>
<th>(2.5)</th>
<th>(2.6)</th>
<th>(2.7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GDP per capita 1970</td>
<td>-0.83**</td>
<td>-0.53**</td>
<td>-0.43**</td>
<td>-0.53**</td>
<td>-0.28**</td>
<td>-0.41**</td>
<td>-0.54**</td>
<td></td>
</tr>
<tr>
<td>Foreign investment 1967</td>
<td>0.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debt increase 1970–1990</td>
<td>0.14*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commodity concentration 1973</td>
<td>0.17**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic growth 1965–1990</td>
<td>-0.30**</td>
<td>-0.20**</td>
<td>-0.24**</td>
<td>-0.20**</td>
<td>-0.25**</td>
<td>-0.26**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population per doctor 1990</td>
<td>0.30**</td>
<td>0.25**</td>
<td>0.07</td>
<td>0.28**</td>
<td>0.34**</td>
<td>0.24**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calories per capita 1989</td>
<td>-0.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total fertility 1990</td>
<td>0.29**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contraceptive prevalence 1990</td>
<td>-0.35**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health attendants 1990</td>
<td></td>
<td>-0.28**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F/M sec. sch. enroll. 1989</td>
<td></td>
<td>-0.19**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age of 1st marriage 1990</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.16**</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.70</td>
<td>0.81</td>
<td>0.84</td>
<td>0.85</td>
<td>0.86</td>
<td>0.83</td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>58</td>
<td>67a</td>
<td>58b</td>
<td>60</td>
<td>63</td>
<td>54a</td>
<td>55</td>
<td></td>
</tr>
</tbody>
</table>

* For this equation, Congo is removed because it is an influential outlier.

b For this equation, Malawi is removed because it is an influential outlier.

* At least 1.5 times its standard error.

** At least 2 times its standard error.
Similarly, population per doctor also has significant effect with one exception in Eq. (2.4). We believe that it is at least partly due to its high correlation with contraceptive prevalence ($r = -0.73$).

In summary: The data in Table 2 offer support for modernization theory, but with some qualification. The results for calories per capita and economic growth rate do support the theory. Taken together these results suggest strong support for a more narrowly specified variant of modernization theory called developmental theory. The results in this table also offer strong support for gender stratification theory and some support for dependency theory.

To better understand the nature of the impact of dependency on maternal mortality, we want to check to see if our dependency predictors have important indirect effects, that is, do they have strong effects on some of our internal variables which in turn have strong direct effects on maternal mortality? In Table 3 we focus on the effects that economic dependency predictors have on each of seven potential intervening variables, internal variables which we know from Table 2 have significant effects on maternal mortality. The intervening variables considered are: economic growth, population per doctor, total fertility, contraceptive prevalence, health attendants, female/male secondary school enrollment, and age of first marriage.

In Eq. (3.1) we consider the effects of the three indicators of economic dependency on economic growth between 1965 and 1990 controlling for GDP per capita. Consistent with many previous studies, all three of these dependency indicators show negative effects on economic growth although the effect of foreign investment is not quite significant. Not presented here, we tested the effect of foreign investment separately with GDP per capita as a control variable and found that it does have a significant detrimental effect on economic growth in that model.

Eq. (3.2) tests the effects of the three dependency variables on population per doctor in 1990. With substantial time lag, the investment dependency indicator – foreign investment – and the trade dependency indicator – commodity concentration – both demonstrate significant detrimental effects. Eq. (3.3) reveals that all three dependency indicators have positive (detrimental) effects on fertility although only the effect of debt increase is significant. Eq. (3.4) tests the effect of economic dependency on contraceptive prevalence, a variable closely related with total fertility and an indicator of women’s autonomy with respect to reproductive behavior. Foreign investment shows a significant detrimental effect on contraceptive prevalence. Eq. (3.5) suggests that debt increase has significant negative effect on health attendants at birth, supporting the argument that debt reduces the resources allocated to health services in LDCs. Eq. (3.6) examines the effect of dependency on female/male secondary school enrollment – a measure of women’s relative educational status. Again, foreign investment has a significant harmful effect. Some previous studies (Stokes and Anderson, 1990) have found that MNC investment in LDCs has negative effect on secondary school enrollment. Not presented here, we also tested the effect of foreign investment on women’s absolute educational status – female secondary school enrollment – with GDP per capita as a control and found that it had a significant detrimental effect in that model as well. Our results suggest that the presence of MNC investment increases the inequality between women and men with respect to school enrollment, a finding that lends support to the dependency perspective. The results of Eq. (3.7) test the effects of dependency on yet another women’s status indicator – average age of first marriage – and the results show no significant effects although the effect of foreign investment is nearly significant.

In sum, Table 3 shows that economic dependency has no beneficial effects on either economic growth or social development in LDCs, contradicting hypotheses derived from modernization and neoclassical economic perspective. But the findings do offer at least some support for dependency theory: (1) all three economic dependency dimensions impede economic growth; (2) the most important indicator of economic dependency – foreign investment – has detrimental effects on some of the internal predictors including women’s relative educational status, autonomy in reproductive behavior, and general health care availability; (3) debt increase has harmful effects on fertility decline and prevalence of health attendants at birth; and (4) our indicator of classical economic dependency – commodity concentration – has a detrimental effect on our health care variable – population per doctor.

The findings with respect to the detrimental effects of economic dependency, especially for foreign investment, are consistent with some previous studies and supports the dependency theory argument that women generally have lower status in dependent countries (Ward, 1984, 1990; Marshall et al., 1988; Clark, 1991). These findings also contradict the modernization and neoclassical economic argument that foreign (MNC) investment increases the status of women through providing job opportunities. Our data suggest that a high level of economic dependency hinders economic growth and impedes women’s access to education, health services, and birth control. Considering the significant effects of all the seven internal variables on maternal mortality (see Table 2), the evidence in Table 3 suggests that economic dependency has indirect detri-
Table 3
Standardized OLS estimates of the effect of economic dependency variables on internal predictors of maternal mortality

<table>
<thead>
<tr>
<th></th>
<th>Eq. (3.1), economic growth&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Eq. (3.2), population per doctor&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Eq. (3.3), total fertility&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Eq. (3.4), contracep. prevalence&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Eq. (3.5), health attendants&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Eq. (3.6), F/M sec. sch. enroll&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Eq. (3.7), age of 1st marriage&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GDP/per capita 1970&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.21</td>
<td>-0.88**</td>
<td>-0.75**</td>
<td>0.84**</td>
<td>0.59**</td>
<td>0.86**</td>
<td>0.66**</td>
</tr>
<tr>
<td>Foreign investment 1967&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-0.23</td>
<td>0.19*</td>
<td>0.11</td>
<td>-0.24*</td>
<td>0.06</td>
<td>-0.36*</td>
<td>-0.15</td>
</tr>
<tr>
<td>Debt increase 1970–1990&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-0.25**</td>
<td>0.05</td>
<td>0.19**</td>
<td>-0.12</td>
<td>-0.24*</td>
<td>0.03</td>
<td>-0.06</td>
</tr>
<tr>
<td>Commodity concentration 1973&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-0.35**</td>
<td>0.15*</td>
<td>0.09</td>
<td>-0.07</td>
<td>-0.01</td>
<td>0.02</td>
<td>0.06</td>
</tr>
<tr>
<td>Adj. R&lt;sup&gt;2&lt;/sup&gt;</td>
<td>0.33</td>
<td>0.68</td>
<td>0.57</td>
<td>0.58</td>
<td>0.44</td>
<td>0.43</td>
<td>0.29</td>
</tr>
<tr>
<td>N</td>
<td>55&lt;sup&gt;c&lt;/sup&gt;</td>
<td>57&lt;sup&gt;d&lt;/sup&gt;</td>
<td>57&lt;sup&gt;e&lt;/sup&gt;</td>
<td>50&lt;sup&gt;f&lt;/sup&gt;</td>
<td>54</td>
<td>44&lt;sup&gt;f&lt;/sup&gt;</td>
<td>47&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Dependent variable.
<sup>b</sup> Independent variable.
<sup>c</sup> For this equation, Nicaragua is removed because it is an influential outlier.
<sup>d</sup> For this equation, Senegal is removed because it is an influential outlier.
<sup>e</sup> For this equation, Indonesia is removed because it is an influential outlier.
<sup>f</sup> For this equation, Chad is removed because it is an influential outlier.
<sup>g</sup> For this equation, Zambia is removed because it is an influential outlier.
<sup>**</sup> At least 1.5 times its standard error.
<sup>***</sup> At least 2 times its standard error.
mental effects on maternal mortality mediated by these internal variables.

As mentioned earlier, throughout this study we kept checking influential outliers. In our OLS analyses, as indicated in Tables 2 and 3, for some equations, one country is removed from the model in order to get stable and robust results. The removal of these cases does not change any of our conclusions.

So far we have examined the possible direct effects of external and various internal variables on maternal mortality (presented in Table 2) and the indirect effects of dependency on maternal mortality through internal intervening variables (presented in Table 3). At this point, we want to know whether the results from the two tables hold up when maternal mortality is regressed on both dependency variables and the key internal predictors simultaneously. As the last step, we perform six path analyses (using LISREL) to estimate direct and indirect effects of both internal and external variables simultaneously. The path diagram is shown in Fig. 1.

As shown in the diagram, there are four exogenous variables: GDP per capita – a modernization (or developmental) variable ($X_1$), and three economic dependency variables ($X_2$–$X_4$). Due to the significant effect of economic growth on maternal mortality (shown in Table 2) and the impact of dependency on it (shown in Table 3, Eq. (3.1)), we use economic growth as the first intervening variable ($Y_1$). The second intervening variable ($Y_2$) varies from model to model. They are the dependent variables in Eq. (3.2)–(3.7) of Table 3. These six variables are assumed to have direct effects on maternal mortality ($Y_3$) theoretically and empirically. The path model examines the direct effect of each of these variables when the three external and three key internal variables are included in the same model. Thus for each model we include six variables. At the same time, our path models test both direct and indirect effects of economic growth, GDP per capita and the three dependency variables on maternal mortality.

We obtained maximum likelihood estimates of: (1) the squared multiple correlations for each structural equation, (2) the residual effects, (3) the direct and indirect effects of all exogenous variables ($X_1$–$X_4$) on endogenous variables ($Y_1$–$Y_3$), (4) the direct effect of the two intervening variables ($Y_1$ and $Y_2$) on $Y_3$, and (5) the indirect effects of $Y_1$ on $Y_3$ via $Y_2$. Due to the similarity of the six models, we will not discuss each model individually. Instead, we summarize the results of the six path models in Table 4. The upper section of Table 4 presents the direct effect of each exogenous and endogenous variable on maternal mortality for six different path models; the lower section presents the indirect effect of each exogenous variable and of the

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3 For example, in Table 2, when Congo is included in Eq. (2.2), when Malawi is included in Eq. (2.3), and when Congo is included in Eq. (2.6), the $R^2$ drops from 0.81 to 0.79, 0.84 to 0.82 and 0.83 to 0.80, respectively. However, the coefficients fluctuated a little and the significance levels of all the independent variable remain the same.
first intervening variable-economic growth rate – on maternal mortality for the same six path models. The number of countries and $R^2$ for each model are at the bottom of the table.

We may summarize the results presented in the upper section of the table as follows: (1) The two major indicators linked to modernization and neoclassic economic theory – GDP per capita and economic growth – both have significant and beneficial direct effects on maternal mortality. However, population per doctor has no significant direct effect on maternal mortality when the three external variables and two internal predictors are included in the model. (2) Consistent with the data in Table 2, all the five variables linked to gender stratification theory have significant direct effects on maternal mortality (see Eqs. (4.2)–(4.6)). Based on this evidence we can conclude that total fertility, contraceptive prevalence, health attendants, female relative educational status, and age of first marriage are all important predictors of maternal mortality in LDCs. Again, gender stratification theory receives solid support. (3) Economic dependency has weak direct effects on maternal mortality: only 2 coefficients out of 18 presented in Eqs. (4.1)–(4.6) are statistically significant. A conservative conclusion is that economic dependency does not have a substantial direct effect on maternal mortality in LDCs.

As shown in Fig. 1, the six internal variables represented by $Y_2$ do not have indirect links to the dependent variable in these models, therefore the $Y_2$ variables are omitted from the lower section. By using path analysis we can analyze the indirect effects of the three dependency variables on maternal mortality when three important internal predictors of maternal mortality are included in the model. We have four major conclusions based on the results presented in the lower section of Table 4. (1) All indirect effects of the three dependency indicators on maternal mortality are detrimental. (2) Although foreign investment does not have a direct effect on maternal mortality, it does have a harmful indirect effect via other intervening variables. In 5 out of 6 models, its effect is significant. (3) Debt increase shows significant harmful effects in 2 out of the 6 models and commodity concentration shows significant harmful effects in 3 out of the 6 models. (4) Two indicators linked to modernization and neoclassical economic perspective-GDP and economic growth—demonstrate beneficial indirect effects although in 3 of
the models the effect of economic growth is not statistically significant.

Our path analysis models reconfirm the importance of women’s status as part of any effort to account for cross-national variation of maternal mortality rates in LDCs. It reveals the detrimental indirect effects of economic dependency (particularly foreign investment) on maternal mortality mediated by internal variables.

**Discussion and conclusions**

As a particularly sensitive indicator of inequality, maternal mortality reflects the status of women, their access to health care, and the adequacy of health care system in responding to women’s special needs. Maternal mortality has many causes. This study considers several predictors tapping factors behind the direct causes, especially those reflecting aspects of women’s status relevant to maternal health. It also gives considerable attention to several indicators we refer to as external variables, that is, measures of the economic dependency of LDCs.

We find consistent support for gender stratification theory. All five indicators of women’s status have significant effects on maternal mortality even after controlling for GDP per capita and economic growth. This provides evidence that in societies with similar levels of economic development, if women’s status is higher, maternal mortality tends to be lower. Women’s level of education relative to men, the presence of health attendants at birth delivery, contraceptive prevalence, age of first marriage, and total fertility are all important predictors of maternal mortality. This study suggests that success in lowering maternal mortality in LDCs may depend, at least in part, on efforts to increase the status of women including policies aimed at increasing women’s education, access to health services, and reproductive autonomy. These findings extend the findings of Shen and Williamson (1997) by suggesting that the positive impact that increasing the status of women would have on child mortality would not be limited to children. Based on this study there are now grounds to conclude that there would also be a positive impact on the health status and physical quality of life among women during their child bearing years.

Our finding that economic dependency has negative indirect effects on maternal mortality is consistent with those from some previous studies (Ward, 1984; Marshall et al., 1988; Osirim, 1992; Shen and Williamson, 1997) that women often experience a status decrease in dependent countries and it contradicts the modernization theory argument that MNC investment improve women’s status by providing new employment opportunities. High levels of economic dependency impede women’s access to education, health services, and contraceptive prevalence for several reasons. When the budget for education and/or health is reduced and inequality increases due to factors linked to foreign investment or debt repayment, the first victims are often women and children. In addition, a number of empirical studies have found that foreign investment dependency stimulates the unbalanced growth of tertiary (service) and informal (typically low-wage) labor markets (Marshall et al., 1988; Clark, 1991; Osirim, 1992). As Ward (1984) points out, such economic outcomes are compatible with child bearing roles and are viewed by some as promoting high fertility. Therefore, through a social process economic dependency tends to reduce the status of women in general and discourage contraceptive use. The findings from our study support the classic dependency theorists’ view that economic dependency hinders the rate of economic growth and has a number of other adverse consequences linked to its impact on the economy (Bornschier et al., 1978; Frank, 1979; Timberlake and Williams, 1987; Boswell and Dixon, 1990; Moaddel, 1994).

Our results with respect to modernization theory are mixed. When we combine direct and indirect effects for all of the predictors, we find that GNP per capita is the single most important predictor considered and economic growth rate is also a consistently strong predictor. However, the evidence for calories per capita, population per doctor and the dependency theory variables (which, it will be recalled, are linked to a set of modernization theory hypotheses as well) do not support modernization theory. Our data seem to support developmental theory, a narrow variant of modernization, but not a more general formulation of the modernization perspective.

We conclude with a brief discussion of data needs, suggestions for future research, and policy implications. Although recent years have seen an increase in research on women and development, the depth and breadth of research on the physical quality of life and health status of women in LDCs has a long way to go. Given the recent increase in the amount and quality of data relevant to both the status of women and various health and quality of life outcomes, it would see to be a good time to give these issues more attention.

However, despite recent improvements with respect to data availability, more needs to be done. For many aspects of women’s status (e.g. political influence) more research in needed to come up with reliable and valid indicators. For others (including several used in the present study) we need data for more time points to allow for certain types of longitudinal analysis (United Nations, 1995). Of note is the need for more indicators of the status of women relative to men along the lines of the relative educational status...
measure used in the present study. One such example is the need for more and better measures of women's economic status relative to that of men (Chafetz, 1989).

More and better quality cross-national data on maternal mortality are needed. We need data for more countries and for more points in time. It would then be possible to use multivariate models that control for more predictors at one time. In the present study our options for multivariate analysis have been limited by the size of our sample.

Studies of regional variation in maternal mortality rates are needed. For example, according to WHO (1996), South Asian countries have about four times higher maternal mortality rate than do the countries of East Asia. The countries in Eastern and Western Africa have higher maternal mortality than other regions of the world. Differences in the level of economic development can not fully account for this regional variation.

This study has a number of important implications for policy makers in LDCs. It lends support to those calling for an end to discrimination against women and for changes in policies that perpetuate the low social status of women.

It also constitutes a challenge to policy makers in countries with high maternal mortality. It points to the need for a change of priorities and values in these countries. The death of a woman in childbirth signifies far more than the tragic loss of a single life; it can threaten the survival of the whole family, especially the newborn baby and other young children (Royston and Armstrong, 1989). Maternal mortality is an important predictor of child mortality in LDCs (Shen and Williamson, 1997).

If maternal mortality rates are to be reduced, action must be taken to alter the social, economic, and health status of women. Despite the vital role played by women in the family and the society, their needs are often neglected. The gap between the rate of death during childbirth for women who have access to appropriate health care as opposed to those who do not is one of the most telling health indicators and such gaps do exist in countries at all levels of development (United Nations, 1995).

In societies where women's status is low, child deliveries are often considered a woman's concern and neither transportation to a hospital or clinic, nor the money to pay for such services is provided. In some countries, even if hospitals and clinics provide specialist care and emergency operative and blood transfusion facilities, they cannot ensure the delivery of such benefits to all women (United Nations, 1995). Much progress could be made to reduce maternal mortality even in countries with relatively low GDPs if as the government and society more generally were to recognize the importance of maternal health to the family and to the future health of the nation and give greater attention to women's needs. These include long-term needs such as education, and more immediate needs such as having access to trained birth attendants and emergency health care.

Our study can be read as a challenge to policy makers representing the rich nations of the world to be a bit more generous with their resources. A decade ago, the World Bank calculated that an additional US$ 2 per head health care for women would reduce maternal mortality by about 50% within a decade (Royston and Armstrong, 1989). However, for some underdeveloped countries, even this small sum was and still is far out of reach. In the global division of labor, poor countries face a shortage of capital, a long term decrease of price of primary goods for export, an unequal exchange rate, and heavy debts to pay back. At the same time they are facing concomitant austerity measures dictated by the developed countries and/or IMF and World Bank. For many countries, the annual repayments of interest and capital amount to more than the total of all new aid and loans being received each year (UNICEF, 1989). It is likely that even a modest increase in aid could substantially improve maternal mortality rates if it were spent on improving the access of poor women to health services.

Appendix A

The following is a list of variables used in this study (in alphabetical order). We provide a description transformations where relevant and a reference to the appropriate source. Where we have used more than one name to refer to the same variable, the alternative is listed in parentheses.

Births attended by trained personnel 1990 (or health attendants); percentage of births that have been attended by a trained person circa 1990 (United Nations, 1991).
Calories per capita (1989); daily calorie supply per capita in 1989 (World Bank, 1992).
Commodity concentration (1973); square root of the coefficient of commodity export concentration in 1973 (Michaely, 1984).
Contraceptive prevalence (1990); the percent of women age 15 to 49 using contraception in 1990 (United Nations, 1995).
Female/male secondary school enrollment (1989) (or
References


Hout, M., 1980. Trade dependence and fertility in Hispanic


