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Dependency, Democracy, and Infant Mortality:

A Quantitative, Cross-National Analysis of Less Developed Countries

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ABSTRACT

(Abstract Word Count: 194)

This study presents quantitative, sociological models designed to account for cross-national variation in infant mortality rates. We consider variables linked to four different theoretical perspectives: the economic modernization, the social modernization, the political modernization, and the dependency perspectives. The study is based on a panel regression analysis of a sample of fifty-nine developing countries. Our preliminary analysis based on additive models replicates prior studies to the extent that we find that indicators linked to economic and social modernization have beneficial effects on infant mortality. We also find support for hypotheses derived from the dependency perspective suggesting that multinational corporate penetration fosters higher levels of infant mortality. Subsequent analysis incorporating interaction effects suggest that the level of political democracy conditions the effects of dependency relationships based upon exports, investments from multinational corporations, and international lending institutions. Transnational economic linkages associated with exports, multinational corporations, and international lending institutions adversely affect infant mortality more strongly at lower levels of democracy than at higher levels of democracy; that is intranational, political factors interact with the international, economic forces to affect infant mortality. We conclude with some brief policy recommendations and suggestions for the direction of future research.

KEYWORDS

Full Word Count: 8,542 Words

INTRODUCTION

Over the past two decades, a number of quantitative, cross-national studies have been published examining the factors that influence infant mortality rates (Shen and Williamson 2001; Frey and Field 2000; Boehmer and Williamson 1996; Firebaugh and Beck 1994; Bradshaw et al. 1993; Lena and London 1993; Bradshaw and Huang 1991; Wimberley 1990; Cutright and Adams 1984). Some of this literature (Firebaugh and Beck 1994) finds evidence supporting hypotheses suggested by modernization theory that intranational or internal factors reduce infant mortality. In contrast, other studies (Bradshaw et al. 1993; Caldwell 1993; Bradshaw and Huang 1991) find infant mortality to be a function of international or external forces suggested by dependency and world systems theory. A smaller number of analyses (Frey and Field 2000; Boehmer and Williamson 1996; Lena and London 1993; Wimberley 1990) conclude that predictors linked to both modernization theory and dependency theory are important when attempting to account for cross-national variation in infant mortality. While some of this research has found support for both theoretical perspectives simultaneously, very few studies in this genre have attempted to specify the theoretical articulations between these seemingly divergent development theories of cross-national variation in infant mortality.

We seek to address this gap in the literature by elaborating a contextual model of the characteristics of nations that influence infant mortality throughout the developing world. First, we review four of the most frequently used theoretical frameworks in the development literature—the economic modernization perspective, the social modernization perspective, the political modernization perspective, and the dependency perspective. Second, we review a number of past quantitative, cross-national studies of

infant mortality to identify various economic, political, and social factors that have been useful in prior attempts to account for cross-national variation in infant mortality rates. We then construct quantitative, cross-national models in which we test a number of hypotheses suggested by the relevant development literature and quantitative, cross-national studies of infant mortality. In doing so, we seek to specify the contexts in which seemingly opposing development theories may influence infant mortality in the developing world by considering how international, economic factors suggested by dependency theory interact with intranational, political factors suggested by political modernization theory.

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INFANT MORTALITY IN THEORETICAL PERSPECTIVE

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Economic Modernization Perspective

Arising from neo-classical economic contentions that scarce goods are most efficiently distributed through markets, economic modernization theory emphasizes internal or intranational financial factors in its analysis of development processes (Rostow 1990). Economic modernization theory views development as bridging the gap between developed nations and developing countries through an imitative process. From this perspective, economic growth is viewed as the driving force behind development within countries. Economic development fosters greater levels of industrialization and urbanization. Increases in industrialization and urbanization tend to generate a higher standard of living and greater access to advanced medical technology that should decrease infant mortality (Rostow 1990). Several prior cross-national studies have modeled and found support for the inverse relationship between economic modernization

predictors such as the level of development and infant mortality (Shen and Williamson 2001; Frey and Field 2000; Firebaugh and Beck 1994; Lena and London 1993).

Social Modernization Perspective

Another strand of modernization theory stresses the role education plays as an intranational factor in the development process within a country. Increasing education levels in a developing country results in higher earnings in the wage labor market, which generally translate into increases in economic growth (Bellew et al 1992). Economic expansion, in turn, augments levels of industrialization, which often yields a higher standard of living and greater access to advanced medical technology. As noted previously, increases in standards of living and technological advancements may decrease infant mortality throughout the developing world (Rostow 1990). The results of several prior studies support the hypothesis that education helps to reduce infant mortality in developing nations (Field and Frey 2000; Lena and London 1993).

Decreases in infant mortality may also be connected to the education of women via fertility reductions—see Caldwell (1982) for a complete discussion on how education tends to reduce fertility levels in the developing world. Under conditions of limited resources, reducing the number of children allows the provider to allocate more time and finances to each child. These children will be better fed and clothed, generally better cared for, and, therefore, healthier. In addition, better-educated mothers will be more knowledgeable about health and safety risks as well as nutrition, all of which improve the health of children and reduce infant mortality. Several cross-national studies offer evidence supporting the hypothesized beneficial impact of female educational attainment

on infant mortality (Field and Frey 2000; Boehmer and Williamson 1996; Lena and London 1993).

Political Modernization Perspective

No examination of the modernization perspective is complete without considerations of certain non-economic dimensions such as political factors (McAdam et al. 2001; Ryan 1991; Bollen 1983). The level of political democracy should influence the level of infant mortality in developing countries. In particular, some scholars suggest that democracies in the developing world are more likely to be responsive to public opinion, social movements, and special interest groups concerned with health related issues like infant mortality, while non-democracies tend to respond to transnational corporate interests not associated with such health outcomes—see the discussion of dependency theory below for elaboration on this point (Fischer 1999; Karliner 1997; Crenshaw and Jenkins 1996; Rich 1994). Because democracies are typically more responsive to the social concerns of civil society, infant mortality should be lower in democratic societies. Conversely, political repressiveness or a lack of democracy can lead to increases in infant mortality, as repressive regimes are less likely to respond to public opinion, social movements, and interest groups concerned with health issues (London and Ross 1995; Leonard 1988). To our knowledge, only one study has found support for the hypothesized, inverse relationship between democracy and infant mortality (Lena and London 1993).

Another aspect of political modernization theory that deserves attention is the state's relationship to the economy (Crenshaw and Jenkins 1996; Bradshaw and Tshandu 1990; Moon and Dixon 1985). Yet, political modernization scholars disagree about the

effect of government spending on infant mortality. Neo-classical economic scholars hypothesize an inverse relationship between state spending and infant mortality. According to neo-classical economic theory, any increase in state size, as measured by either government spending or revenues, is undertaken at the expense of the private sector. State size increases impede economic growth and lower the standard of living in a developing country (Friedman and Friedman 1980). Lower standards of living are often associated with higher infant mortality rates as there is limited access to health care and other basic social services. Some studies have found the hypothesized adverse relationship between indicators of government spending and infant mortality (Shen and Williamson 2001; Lena and London 1993).

While neo-classical economic theorists argue that an increase in the size of government spending is undertaken at the expense of the private sector, many other scholars view government spending as an important corrective to undesirable effects of private market activity (Moon and Dixon 1985). In this view, increased government spending should be associated with lower levels of infant mortality as money is invested in health, education, and other social services. A few studies support the hypothesis that government spending tends to lower infant mortality (Wimberly 1990; Hill and Pebley 1989).

Dependency Perspective

According to dependency theory, the capitalist world system perpetuates a global division of labor that distorts the domestic economy of many developing nations, reduces the rate of economic growth, increases income inequality, and adversely affects well-being for a substantial portion of a population (Gereffi 1989; Wallerstein 1974; Frank

1967). Dependency theorists argue that trade dependence has aggravated the gap between core and peripheral countries because the exchange of raw materials for processed goods is inherently unequal and prices for primary goods have experienced long term decline relative to prices for processed goods (Frank 1967). As a result, the state's ability to raise revenues is weakened and the resulting lack of revenues affects the funding of health and other basic social service programs. Without the availability of such programs, infant mortality is likely to increase. Many prior studies have found the hypothesized, harmful effects of trade dependence on infant mortality (Shen and Williamson 2001; Boehmer and Williamson 1996; Lena and London 1993; Cutright and Adams 1984).

Within the dependency literature, scholars have noted the changing nature of international economic exchanges of core-periphery relations that have taken place in the last three or four decades, as the tendency for multinational corporations to invest in industrial production in the periphery has increased (Ross and Trachte 1990; Bornschier and Chase-Dunn 1985; Frank 1967). They suggest that foreign direct investment promotes underdevelopment in developing countries. Specifically, multinational corporations obstruct education, health, and other social programs, by hampering government policies that are beneficial to much of the population but harmful to the interests of multinational corporations (Ross and Trachte 1990; Bornschier and Chase-Dunn 1985; Evans 1979). In particular, less developed countries are often viewed as "cheap" factors of production for multinational corporations that are headquartered in the core (Karliner 1997; Crenshaw and Jenkins 1996). Peripheral countries—eager to attract foreign investment in efforts to expand local production, employment, and technology—

are often in the position of competing with one another. As a result, peripheral countries offer a variety of economic incentives including wage and tax reductions (London and Ross 1995; Ross and Trachte 1990; Leonard 1988). Consequently, multinational corporate investment erodes tax revenues used to fund basic social service programs, which may lead to an increase in infant mortality. Some quantitative, cross-national studies have found the hypothesized, positive relationship between multinational corporate penetration and increased infant mortality (Shen and Williamson 2000; Lena and London 1993; Wimberley 1990).

Since the 1970s, many developing nations have become caught up in the international debt crisis. Foreign debt expansion and concomitant austerity measures dictated by institutions that lend them capital (i.e., World Bank and International Monetary Fund) have added a new dimension to core-peripheral dependency relations (Harper 2001; Bell 1998; Bradshaw and Huang 1991). Debt and interest payments drain already scarce capital away from investment in the national economy and, as a result, inhibit economic development. This reduces government spending on various health and social service programs, preventing any reductions in infant mortality. Several studies suggest that debt dependency has an adverse effect on infant mortality (Shen and Williamson 2001; Frey and Field 2000; Bradshaw et al. 1993; Bradshaw and Huang 1991).

METHODOLOGY

Research Design: Panel Regression

We use panel regression to compare alternative models designed to account cross-national variation in infant mortality rates. In panel regression analysis, the dependent

variable at one point in time is regressed on itself at an earlier point in time (the lagged dependent variable) and the other independent variables of interest at that same earlier point in time. This method estimates the effects of the independent variables on change in the dependent variable between two time points. This is widely regarded as a powerful tool for making causal inferences with non-experimental data (Finkel 1995).

A panel design helps rule out reciprocal effects and reduces the threat of spuriousness due to an apparent effect that can be accounted for by another variable causally prior to both the dependent and independent variable of concern. Further, since there is usually a high correlation between the lagged dependent variable and the dependent variable, panel analyses assign maximum explanatory power to the lagged dependent variable. This produces a conservative test of the effect of the independent variables on change in the dependent variables, making it appropriate to discuss effects that are significant at the $p < .10$ level as well as the more conventional $p < .05$ level (Schafer 1999). Finally, panel regression improves on unconditional change score models, which assume that the lagged endogenous variable has no effect on later values. This assumption is unrealistic with a phenomenon like infant mortality that tends to remain relatively stable over time with small incremental change. A lagged panel model is also superior to fixed effects models or "the method of first difference" insofar as it allows us to examine independent variables that are long-standing structural conditions as well as trends (Finkel 1995).

Our dependent variable is infant mortality in 1997 and the lagged dependent variable is infant mortality in 1980. Data for the independent variables were obtained circa 1975 to 1980. Finding quality data for comparative analysis can be difficult, and it

requires some adjustments to ideal models. While it would be preferable to collect all the data for one year, the range represented should not substantively alter the results (Ehrhardt-Martinez 1998). This design is also referred to as the cross-lagged effects model as shown in the mathematical notations:

$$Y_t = B_0 Y_{t-1} + B_1 + B_2 X_{t-1} + E_t$$

The dependent variable (Y_t) is hypothesized to be determined by the lagged dependent variable (Y_{t-1}), the constant (B_1), the lagged value of the independent variable (X_{t-1}), and an error term (E_t).

Countries Included

The population for this study is defined as all non-core nations according to Bollen's (1983) reclassification of Snyder and Kick's (1979) classification of world system position.[1] As is standard in studies of this sort, countries with any missing information are excluded from the analysis. In the initial set of equations that include all controls, complete data for our models yield a case base of fifty to fifty-nine developing countries. To maximize the use of available data, we allow our sample size to vary from one model to another depending on data availability. Caution should be taken when interpreting differences between models. Various scholars have offered sample size guidelines that concern the appropriate ratio of cases to predictors. Tabachnick and Fidell (2001) suggest standard multiple regression may be conducted with as few as five cases to every one predictor. Polit (1996) argues it is necessary to have ten cases for every predictor. When constructing our models, we maintain a ratio between five and ten cases to every predictor.

Regression Diagnostics

In addition to the basic ordinary least squares analysis, we make extensive use of various regression diagnostics such as Cook's D to test for the presence of influential cases. In cross-national analysis, there is a very real risk that regression results will be highly sensitive to a small number of influential cases (Kennedy 2001; Polit 1996). When our regression diagnostics suggest the presence of highly influential cases, we rerun the analysis deleting those cases. If the basic pattern of results is not dramatically changed, confidence in the validity of the initial equations is enhanced. If the pattern is substantially changed, we call this to the reader's attention and present our results excluding these cases.

In any quantitative, cross-national study of this sort, there is also a potential problem of multicollinearity. Kennedy (2001) suggests a test for multicollinearity in which each independent variable is regressed on all other independent variables—see also Lewis-Beck (1980). It is common not to worry about collinearity unless the R-squares from these equations exceed the R-squares in the original analysis (Kennedy 2001; Rudel 1989; Lewis-Beck 1980). In addition, we examine the variance inflation factor scores produced for each variable in our models. If the values of the variance inflation factor scores do not exceed a value of ten, then multicollinearity should not be a problem (Tabachnick and Fidell 2001).

MEASUREMENT

Dependent Variable

Level of Infant Mortality: We use the infant mortality rate for 1997 as the dependent variable for this analysis. The infant mortality rate is the number of infants who die before reaching the age of one year per one thousand live births. The lagged

dependent variable is the infant mortality rate for 1980. We log both the dependent and lagged dependent variable to reduce the potential problem of heteroskedasticity in our analysis (Kennedy 2001). These data may be obtained from the World Bank (2000).

Independent Variables

Level of Economic Development: As is standard in such analyses, it is incumbent for the researcher to take into account a nation's level of economic development in order to make sure that any effects discovered are independent of nation's level of wealth. In this regard, we employ a measure of gross national product per capita for 1980. This variable is logged to correct for its highly skewed distribution. These data may be obtained from the World Bank (2000). Bangladesh and Sierra Leone are two of the countries with the lowest levels of economic development in our sample. Costa Rica and Mexico are two countries with medium levels of economic development in our sample. Hungary and Israel are two of the countries with the highest levels of economic development in our sample. All other things being held equal, economic modernization theory suggests that the level of economic development should have a beneficial impact on infant mortality.

Level of Educational Attainment: To assess the importance of education on infant mortality, we include the level of gross secondary school enrollment in a developing country for 1980. These data may be obtained from the World Bank (2000). Central African Republic and Haiti are among two of the countries with the lowest levels of educational attainment in our sample. Bolivia and Brazil are two countries that have medium levels of education attainment in our sample. Jordan and South Korea are two of the countries with the highest levels of educational attainment in our sample. Social

modernization theory suggests a beneficial relationship between the level of educational attainment and infant mortality rates.

Level of Female Educational Attainment: As an alternative indicator of educational attainment, we use the level of female gross secondary school enrollment for 1980. We log this variable to correct for its highly skewed distribution. These data may be obtained from the World Bank (2000). This use of alternative model specifications or the building in of dimensions of variation into an analysis is a useful tactic in conducting cross-national research (London and Ross 1995). The sequential use of cognate but distinct indicators of one or more independent variables can shed considerable light on the complexity and dynamics of the issue under examination. If our various indicators of education exhibit similar effects on infant mortality, then our confidence in the generality of the beneficial impact of education on infant mortality suggested by the economic modernization perspective is enhanced. Bangladesh and Pakistan are two of the countries with the lowest levels of female educational attainment in our sample. El Salvador and Chile are two countries that have medium levels of female educational attainment in our sample. Hungary and Poland are two countries with the highest levels of female educational attainment in our sample. Social modernization theory predicts female education may reduce infant mortality rates in the developing world.

Level of Political Democracy: Bollen's (1983) index of political democracy for 1980 is used to test the degree to which freely elected and open regimes respond to popular demands for solving development problems such as infant mortality. Varying between zero and one hundred, this measure is a composite index based upon six indicators: (1) freedom of the press, (2) government sanctions, (3) tolerance of political

opposition groups, (4) fairness of elections, (5) methods of selecting executives, and (6) methods of selecting legislators. These data may be obtained from Bollen (1983). Nigeria and Pakistan are among two of the least democratic countries in our sample. Ecuador and South Korea are among two of countries with moderately democratic regimes. Costa Rica and Greece are among two of the most democratic countries in our sample. Political modernization theorists would expect an inverse relationship between this variable and infant mortality.

Level of Expenditures on Public Health: We operationalize state involvement in the economy as public health expenditures as a percentage of gross national product for 1978. These data may be obtained from Taylor and Jodice (1983). Public health expenditures include all current expenditures by all levels of government for the provision of medical services. Bangladesh and Nigeria are two countries with the lowest levels of public health expenditures in our sample. Jordan and Singapore are two countries with moderate levels of expenditures on health in our sample. Hungary and Poland are two countries with the highest levels of public health expenditures in our sample. The political modernization perspective predicts state expenditures to have either an adverse or beneficial impact on infant mortality.

Level of Commodity Concentration: Commodity concentration is the value of a nation's most important export commodity measured as a percentage of its total exports. This measure may be obtained from Taylor and Jodice (1983). This is a widely used indicator of export or classical dependency theory (Ehrhardt-Martinez 1998; London and Williams 1990). This variable is measured for 1975 and indicates the degree to which peripheral nations rely on a single commodity and are vulnerable to market fluctuations

for their export earnings. Portugal and Turkey are two countries with the lowest levels of commodity concentration in our sample. Jamaica and Morocco are two countries with moderate levels of commodity concentration in our sample. Nigeria and Trinidad are two countries with the highest levels of commodity concentration in our sample. According to dependency theory, commodity concentration should increase infant mortality.

Level of Multinational Corporate Penetration: This variable is the end of year stocks of a developed country's foreign direct investments in a given host country. This measure may be obtained from Muller (1988). This measure, frequently employed in previous quantitative cross-national studies, is available for 1975 (Schafer 1999). The variable is logged to correct for its skewed distribution. Bangladesh and Egypt are two countries that have the lowest levels of multinational corporate penetration in our sample. Chile and Mexico are two countries that have moderate levels of multinational corporate penetration. Indonesia and Malaysia are two countries that have the highest levels of multinational corporate penetration. According to dependency arguments, foreign investment should increase infant mortality.

Level of International Monetary Fund Conditionality: This index is the sum of four variables which include (1) the number of debt renegotiations between a country and an international financial body (i.e., private bank or multilateral lender), (2) the number of debt restructurings experienced by an indebted nation, (3) the number of times a country utilized IMF Extended Fund Facility, and (4) the total IMF loans received by a country as a percentage of its allocated quota (Schafer 1999). The variable is measured for the period of 1975. We constructed this index as described by Walton and Ragin (1990). In doing so, the preceding four components of the index are converted to z-

scores and summed. Greece and Portugal are two countries with the lowest levels of International Monetary Fund Conditionality in our sample. Central African Republic and Ghana are two countries with moderate levels of International Monetary Fund conditionality in our sample. Brazil and the Philippines are two countries with the highest levels of International Monetary Fund Conditionality in our sample. Dependency theorists claim that the policies of international lending institutions may increase infant mortality.

RESULTS

Table 1 presents the results for our panel regression analysis estimating the effects of both intranational and international variables on infant mortality in 1997.[2] Equations 1.1, 1.3, and 1.5 include the lagged dependent variable, the level of economic development, the level of educational attainment, the level of political democracy, the level of public expenditures on health, and one of the measures of dependency. As an alternative indicator of educational attainment, we substitute the level of female gross secondary education for the level of gross secondary education in equations 1.2, 1.4, and 1.6. Equations 1.1 and 1.2 include the level of commodity concentration, equations 1.3 and 1.4 include the level of multinational corporate penetration, and equations 1.5 and 1.6 include the level of International Monetary Fund conditionality. In doing so, we follow the common rule of thumb of maintaining a ratio between five and ten cases to every predictor in order to increase the stability of our findings, thus enhancing confidence in the robustness of our results.

[Table 1 goes about here.]

Consider first the significant internal variables suggested by the economic and social modernization perspectives. In all equations in Table 1, the level of economic development maintains an inverse relationship with the infant mortality rate. This lends support to economic modernization arguments that improvements in the standard of living and advancements in medical technology accompanied by increases in the level of economic development tend to lower infant mortality. In equations 1.1, 1.3, and 1.5, the level of educational attainment maintains an inverse relationship with the dependent variable. This consistent finding supports social modernization arguments that countries with high levels of education have low levels of infant mortality. Additionally, the level of female secondary education has a beneficial impact on infant mortality, as the coefficients for this variable are negative and significant in equations 1.2 and 1.4. This finding lends additional support to arguments put forth by the social modernization perspective that increases in not only education generally but also female education specifically help to reduce infant mortality.

To this point, we have only considered the significant effects of intranational variables. However, the level of multinational corporate penetration has a significant, inverse effect on infant mortality in equations 1.3 and 1.4.[3] These findings suggest support for dependency arguments that foreign direct investment leads to adverse development outcomes in non-core nations such as increased infant mortality.

Surprisingly, the level of political democracy does not have a significant effect in any of the equations in Table 1. This unexpected result calls for further comment. Because previous cross-national research (Lena and London 1993) suggests the importance of including a measure of political democracy when estimating models of

development processes, the failure of this measure to predict any significant variation in infant mortality is unexpected.

So far, we have only considered the additive relationship political democracy has on infant mortality. Some development theory suggests that dependency relations may interact with the political conditions within a developing country (Evans 1979). As such, further research pertaining to the inclusion of political democracy and its relationship to the dependency measures is warranted.

Peter Evans (1979) describes the existence of a "triple alliance" in Brazil of multinational capital, local capital, and the state. He argues that multinational investors are attracted to states that promote "good business climates." This sort of regime repressiveness produces the political stability that investors prize. Moreover, developing countries with such investment climates can more easily receive loans from international financial bodies since such institutions' lending policies are often contingent upon the participation of multinationals in generating capital for repayment of the borrowed funds (Karliner 1997).

Much case study and cross-national evidence (cf. London and Ross 1995; Ross and Trachte 1990) suggest that such an "alliance" among transnational economic actors, state officials, and economic elites plays a key role in shaping a wide range of development policies in the poorer countries of the world. Of most relevance are those cases in which repressive or non-democratic regimes pursue policies that serve the interests of transnational actors (e.g., good business climate, austerity programs, imposed political stability, and so on).

When regimes provide regulatory concessions, financial incentives, and tax holidays or when they outlaw strikes, protests, and unions—all policies that serve the interests of transnationals—many relevant consequences ensue (Korten 1995; Gadgil and Guha 1992; Hurst 1990). For example, tax revenues decline (Hurst 1990) and less state money is available for social and health programs. This inability to provide adequate basic needs to local populations may well be reflected in higher levels of infant mortality (Lena and London 1993; London and Williams 1990). In addition, repressive regimes often provide transnationals with exemptions to occupational safety and environmental laws (London and Ross 1995). Such concessions may increase the exposure of employees to toxic working conditions, increasing the prevalence of reproductive problems and causing some infant deaths (Clapp 2001). These concessions may also lead to higher levels of pollution and improper disposal of hazardous wastes, both of which have a disproportionate impact on pregnant women and infants. Finally, imposed political stability (e.g., outlawing protests) is an obviously non-democratic policy that minimizes both the prevalence and power of grassroots activism. When civil society is powerless to organize in pursuit of the public interest, basic needs will go unattended, and higher levels of mortality may well be one of the outcomes (McAdam et al. 2001; McAdam 1998; Tarrow 1998; Gamson 1992; Ryan 1991). In sum, the alliance of transnational actors and repressive regimes reduces funding, diminishes protections, and produces powerlessness—all factors that translate readily into higher levels of infant mortality than would otherwise be the case.

The results presented in Table 2 can be used to test a number of hypotheses linked to the above line of analysis. Table 2 has the same pattern of variable organization as

Table 1. However, here we show the results testing for the interactive effects of the various dependency measures with the level of political democracy. We check for interaction between each measure of dependency and level of democracy by adding each one at a time to our basic models. In order for high levels of dependency to correspond with low levels of democracy, we multiply the level of political democracy by negative one. High scores are now indicative of a low level of democracy. We then construct the interaction term by centering the moderator variable, the level of democracy, around its mean and multiplying the centered version of the moderator variable by a given measure of dependency. To facilitate interpretation, we provide estimates of the effect of each type of dependency relationship at low (one standard deviation below the mean), at medium (the mean), and at high (one standard deviation above the mean) levels of democracy. By centering the level of political democracy (the moderator variable), the effect of dependency on infant mortality at the mean level of democracy is equal to the unstandardized regression coefficient for a given dependency measure presented in each equation of Table 2.

[Table 2 goes about here.]

In equation 2.1, we find that commodity concentration has a stronger detrimental effect on infant mortality in less democratic regimes than more democratic regimes. In equation 2.1, the coefficient indicating the effect of commodity concentration at low levels of democracy is .548, the coefficient indicating the effect of commodity concentration at medium levels of democracy is .355, and the coefficient indicating the effect of commodity concentration at high levels of democracy is .162. In equation 2.2, commodity concentration again has a stronger adverse effect on infant mortality at lower

levels of democracy than at higher levels of democracy. This pattern is very similar for equations 2.3 and 2.4, which examine the effect of the interaction between multinational corporate penetration and political democracy. In these equations, the detrimental effect of multinational corporate penetration again increases in strength when moving from medium levels of democracy to low levels of democracy. For instance, in equation 2.3, the coefficient indicating the effect of multinational corporate penetration at medium levels of democracy is .011 and the coefficient indicating the effect of multinational corporate penetration at high levels of democracy is .042. This pattern is discernable in equation 2.4 as well. Multinational corporate penetration has an adverse effect on infant mortality that increases in strength when moving from medium to low levels of democracy. In equations 2.5 and 2.6, the interaction between International Monetary Fund conditionality and political democracy has a detrimental, significant effect on infant mortality, which increases in strength as we move from higher to lower levels of democracy. Clearly, the harmful effects of all types of transnational economic linkages on infant mortality, as suggested by some dependency theory, are greater at lower levels of democracy than at higher levels of democracy.

It is important to note that the major findings from Table 1 remain stable and consistent across these new model specifications. First, the level of economic development tends to decrease infant mortality, as the coefficients for this variable are negative and significant in all equations of Table 2. Second, the level of gross secondary school enrollment continues to maintain an inverse relationship with infant mortality, as the coefficients for this variable are negative and significant in equations 2.3 and 2.5. The level of female secondary school enrollment, also suggested by social modernization

theory, maintains an inverse relationship with infant mortality in equation 2.4. The continued significance of key variables enhances our confidence in our initial findings presented in Table 1.

DISCUSSION AND CONCLUSION

Various economic, political, and social factors found to predict infant mortality in past cross-national studies continue to do so in our study as well. First, our results confirm economic and social modernization hypotheses that high levels of development as well as education help to decrease infant mortality in the developing world. Second, we find support for the dependency perspective. Specifically, dependency relationships based upon multinational corporations lead to higher levels of infant mortality.

Although previous research (Shen and Williamson 2001; Frey and Field 2000; Boehmer and Williamson 1996; Firebaugh and Beck 1994; Bradshaw et al. 1993; Caldwell 1993; Lena and London 1993; Bradshaw and Huang 1991; Wimberley 1990; Cutright and Adams 1984) has provided invaluable insights into developing an understanding of infant mortality, these studies have not adequately specified the contexts in which intranational, political factors interact with international, economic factors that influence infant mortality in the developing world. We begin to fill this gap in the literature by conducting the first study of infant mortality to include interaction terms between the level of democracy and transnational economic linkages associated with exports, multinational corporations, and international lending institutions. In doing so, our results suggest that dependency relationships based upon exports, multinational corporations, and international lending institutions adversely affect infant mortality more strongly at lower levels of democracy than at higher levels of democracy, all other things

being held equal. Clearly, variables measuring international-external, economic factors and intranational-internal, political factors point to a highly interdependent process influencing infant mortality.

Therefore, the ultimate theoretical contribution of this paper pertains to the emergence of both international or external and intranational or internal factors in an analysis of infant mortality. In other words, international and intranational dynamics are so interpenetrating in the modern world system that any analysis that does not consider the effects of both sets of factors is seriously deficient and offers at best a partial explanation (London and Williams 1990). There must be willingness by social scientists to self-consciously rid themselves of the sort of "theoretical blinders" that lead to the categorical analysis of either intranational or international factors, of either modernization or dependency theories. This is the case because these ostensibly antithetical approaches are related to each other in a specifiable and meaningful manner (London 1987).

There are also important policy implications that go beyond the theoretical implications discussed above. Our results indicate that policies aimed at increasing the level of democracy in the poorer countries of the world should help to reduce the negative consequences associated with transnational economic linkages such as increased infant mortality. Such policies may include those that encourage rather than stifle the evolution of social movements taking the form of non-governmental organizations as well as grassroots movements. Specifically, governments in the developing world should support the adoption of legal frameworks that legitimize non-governmental organizations, labor unions, and grassroots groups. These institutions may: (1) provide funding to

health and social service programs (Schafer 1999; Ndegwa 1996), (2) stimulate grassroots community support to pressure public officials to provide adequate expenditures on health and social services (Schafer 1999; Ndegwa 1996), (3) facilitate state-society partnerships for the provision of greater health and social services (Schafer 1999; Barkan et al. 1991), and (5) propagate worldwide standards pertaining to the importance of meeting every person's basic human needs (Schafer 1999; Boli and Thomas 1997).

We conclude with a few suggestions for readers who might be interested in building upon the research presented here. More multivariate studies are needed in which models are run that involve more than the five or so predictors we have been able to include at one time in our models. Although panel regression is a powerful tool for this genre of research, we need more longitudinal data both for our dependent and independent variables to understand the effects of these determinants on infant mortality. This would make it possible to pool cross-sectional data so as to increase the number of degrees of freedom making it possible to include more control variables in one model. We need data for more countries and for more time points making it possible to do more by way of regional comparisons. We could then replicate our findings across both time and space.

ENDNOTES

1. The following countries are included in the analysis presented in equations 1.1 and 2.1: Algeria, Argentina, Bangladesh, Benin, Brazil, Bulgaria, Burundi, Cameroon, Central African Republic, Chile, Columbia, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Ghana, Greece, Guatemala, Haiti, Honduras, Hungary, India, Israel, Ivory Coast, Jamaica, Jordan, Kenya, Malawi, Malaysia, Mali, Mauritius, Mexico, Morocco, Nicaragua, Niger, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Romania, Senegal, Sierra Leone, Singapore, South Korea, Sri Lanka, Syria, Thailand, Togo, Trinidad, Tunisia, Turkey, Uruguay, Venezuela, and Zambia. In equations 1.2 and 2.2, Dominican Republic, Paraguay, and Venezuela are dropped from the analysis because of missing data while Gabon is added to the analysis because it is no longer missing data. In equations 1.3 and 2.3, Bulgaria, Hungary, Israel, Jordan, Mauritius, Panama, Poland, and Romania are removed from the analysis while Lesotho and Nepal are added to the analysis because they are no longer missing data. In equations 1.4 and 2.4, Dominican Republic, Nepal, Paraguay, and Venezuela are dropped from the analysis because of missing data while Gabon is added to the analysis because it is no longer missing data. In equations 1.5 and 2.5, Bulgaria, Mexico, and Romania are dropped from the analysis because of missing data while Lesotho, Nepal, and Zimbabwe are added to the analysis they are no longer missing data. In equations 1.6 and 2.6, Dominican Republic, Nepal, Paraguay, and Venezuela are dropped from the analysis because of missing data while Gabon is added to the analysis because it is no longer missing data.

2. As a check for multicollinearity, we began by examining a bivariate correlation matrix among all of the variables included in the analysis (not presented but available from the authors upon request). All of the bivariate correlations were low to moderate. Second, the Lewis-Beck (1980) test for multicollinearity is applied for all equations in Tables 1 and 2. Results of this test (not presented but available upon request from the authors) showed no R-squares exceeding the original R-squares. Third, none of the variance inflation factor scores (not presented but available from the authors upon request) exceeded a value of ten. Given the results of all of these regression diagnostic procedures, multicollinearity did not appear to be a problem in this analysis (Kennedy 2001; Rudel 1989; Lewis-Beck 1980).

3. We tested to see if there was statistically significant cross-national variation in infant mortality between the semi-peripheral and peripheral countries in our sample. In order to test this hypothesis, we employed a dummy coding procedure in which we coded peripheral countries one and semi-peripheral countries zero. The grouping of the countries was based on Bollen's (1983) reclassification of Snyder and Kick's (1979) classification of world system position. Results of this test were not significant. We also tested to see if there was statistically significant cross-national variation in infant mortality between countries in different region of the world. We employed a dummy coding procedure in which we classified countries as being in one of five regions of the world. These regions include: (1) Latin and South America, (2) Central Europe, (3) Asia, (4) North Africa and Mid-East, and (5) Sub-Saharan African. We found that only

countries in Sub-Saharan Africa have significantly, higher rates of infant mortality than our reference category of Latin and South America. After controlling for region of the world, all of our other results remain stable and consistent. For sake of space, we do not present these results, but they are available from the authors upon request.

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Table 1

Ordinary Least Square Estimates of Infant Mortality from 1975 to 1997
Controlling for All Independent Variables

	Equation 1.1 Infant Mortality 1997	Equation 1.2 Infant Mortality 1997	Equation 1.3 Infant Mortality 1997	Equation 1.4 Infant Mortality 1997	Equation 1.7 Infant Mortality	Equation 1.6 Infant Mortality 1997
Intranational Determinants						
Lagged Dependent Variable, 1980	.821** .731 (7.858)	.843** .749 (8.124)	.875** .732 (8.512)	.928** .771 (9.287)	.814** .704 (8.057)	.924** .795 (9.099)
Level of Economic Development, 1980	-30.525** -.161 (2.381)	-22.011* -.116 (1.770)	-29.753** -.148 (2.186)	-26.275** -.134 (2.037)	-28.760** -.148 (2.247)	-23.919* -.120 (1.795)
Level of Educational Attainment, 1980	-.003* -.099 (1.501)		-.005** -.150 (2.219)		-.005** -.165 (2.416)	
Level of Female Educational Attainment, 1980		-.259* -.111 (1.500)		-.280* -.114 (1.742)		-.210 -.087 (1.259)
Level of Political Democracy, 1980	-.001 -.061 (1.292)	-.001 -.065 (1.347)	.001 .007 (.137)	-.001 -.006 (.107)	-.001 -.022 (.484)	-.001 -.018 (.357)
Level of Public Health Expenditures, 1978	.032 .048 (.955)	.022 .033 (.624)	-.039 -.045 (.971)	-.054 -.062 (1.248)	.028 .041 (.883)	.022 .03 (.633)
International Determinants						
Level of Commodity Concentration, 1975	.082 .030 (.649)	.115 .040 (.863)				
Level of Multinational Corporate Penetration, 1975			.072** .111 (2.443)	.096** .144 (3.096)		
Level of International Monetary Fund Conditionality, 1975					.011 .044 (1.050)	.009 .034 (.794)
Adjusted R-Squared	.893	.892	.909	.904	.906	.894
Number of Cases	59	57	53	50	59	56

Note: The first number reported is the unstandardized regression coefficient, the second number is the standardized regression coefficient, and the third number in parentheses is the t-value.

**p<.05
*p<.10

Table 2

Ordinary Least Squares Estimates of Infant Mortality from 1975 to 1997
Controlling for the Interaction Effects Between Various Dependency Measures and Political Democracy

	Equation 2.1a Infant Mortality 1997	Equation 2.2a Infant Mortality 1997	Equation 2.3b Infant Mortality 1997	Equation 2.4 Infant Mortality 1997	Equation 2.5c Infant Mortality 1997	Equation 2.6c Infant Mortality 1997
Intranational Determinants						
Lagged Dependent Variable, 1980	.822** .734 (8.545)	.840** .748 (9.069)	.873** .738 (9.600)	.909** .755 (8.793)	.728** .633 (7.214)	.861** .745 (8.408)
Level of Economic Development, 1980	-23.071** -.123 (2.000)	-20.053* -.107 (1.757)	-36.425** -.170 (2.801)	-30.009** -.150 (2.190)	-38.053** -.200 (2.972)	-32.200** -0.169 (2.422)
Level of Educational Attainment, 1980	-.002 -.062 (.907)		-.004** -.136 (2.218)		-.005** -.170 (2.597)	
Level of Female Educational Attainment, 1980		-.122 -.052 (.737)		-.229* -.093 (1.575)		-.175 .072 (1.074)
Level of Political Democracy, 1980	.001 .020 (.305)	.001 .017 (.250)	-.002* -.112 (1.782)	-.001 -.068 (.950)	.001 .050 (1.130)	.001 .044 (.890)
Level of Public Health Expenditures, 1978	.010 .015 (.329)	.003 .005 (.102)	-.071* -.081 (1.866)	-.046 -.053 (1.017)	.019 .029 (.638)	.016 .023 (.453)
International Determinants						
Level of Commodity Concentration 1975	.355** .122 (2.702)	.363** .119 (2.748)				
Level of Multinational Corporate Penetration, 1975			.011** .155 (2.837)	.011** .151 (2.552)		
Level of International Monetary Fund Conditionality, 1975					.023** .090 (2.093)	.020* .076 (1.633)
Corresponding Dependency Measure x Political Democracy, circa 1975-1980	.006* .116 (1.753)	.006* .110 (1.608)	.001* .120 (1.653)	.001* .148 (1.875)	.001* .080 (1.840)	.001* .079 (1.633)
Calculated Interaction Effects						
Corresponding Dependency Measure at Low Levels of Democracy	.548	.555	.042	.043	.055	.052
Corresponding Dependency Measure at High Levels of Democracy	.162	.171	-.020	-.021	-.009	-.012
Adjusted R-Squared	.917	.917	.929	.897	.914	.900
Number of Cases	57	55	51	50	58	55

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Note: The first number reported is the unstandardized regression coefficient, the second number is the standardized regression coefficient, and the third number in parentheses is the t-value.

As discussed in the text, the effect of each dependency measure at medium levels of democracy is equal to the unstandardized regression coefficient for the dependency measure included in each equation.

**p<.05
*p<.10

a. Algeria and Chile are removed from the analysis because they are influential cases.
b. Argentina and Zambia are removed from the analysis because they are influential cases.
c. Chile is removed from the analysis because it is an influential case.