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Military Power and Food Security: A Cross-National Analysis of Less-Developed Countries, 1970–1990

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Addressing the long-standing debate over the social impact of military power and recent discussions of military-induced famine, we conduct a panel analysis of aggregate food supply and child hunger rates in 75–79 less-developed countries (LDCs). Distinguishing between *militarization*, as the growth of military resources, and *militarism*, as the use of military force to handle political conflicts, we show that militarization is both beneficial and detrimental to food security, whereas militarism is consistently detrimental. Arms imports and associated increased military spending plus praetorianism and military repression reduce food security, whereas increased military participation and arms production boost food security. Increased food supply reduces child hunger and is largely confined to the more developed of the LDCs. These military power effects show net economic growth, which "trickles down" to improve food supply and reduce child hunger among the more developed LDCs, reflecting the growth of global economic inequality. Contrary to views that see militarization as a single unified process, use of armed force is not strongly rooted in either praetorianism or militarization.

Food security is the most fundamental of human needs and is central to general discussions of human rights and development policy (Sen, 1981, 1995; Drèze and Sen, 1989; Kutzner, 1991; Brandt, 1986; Drèze, Sen, and Hussain, 1995; FAO, 1996a). Despite the "green revolution" and increased international food trade and improved food security in most less-developed countries (LDCs), almost half of the LDCs experienced a loss in aggregate food supply and over a quarter an increase in child hunger between 1970 and 1990 (Bongaarts, 1996; FAO, 1996a, 1996b; Foster and Leathers, 1999:75–92). In the mid-1990s, an estimated 840 million people lacked sufficient food to meet basic nutritional needs (UNFPA, 1999) and over 200 million children suffered from severe undernutrition (UNICEF, 1998). As proponents of the "entitlement" approach to hunger contend (Sen, 1981; Drèze and Sen, 1989; Drèze et al., 1995), global hunger is not a problem of aggregate food supply but of distribution. Globally there is sufficient food to

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meet all human nutritional needs, but many LDCs and particular groups inside these countries lack secure access to food.

We examine the impact of military power on food security. The long-standing debate over the social impact of military power has largely been framed in terms of the question as to whether military spending improves, undermines, or is irrelevant to economic growth (for recent reviews, see Chan, 1985, 1995). Some contend that, despite a short-term trade-off, military spending boosts long-term growth by creating human capital, work discipline and social integration, technological spin-offs, mild inflation, and market stimulus (e.g. Andreski, 1968; Benoit, 1973, 1978; Janowitz, 1977; Weede, 1983, 1986; Ward, Davis, and Chan, 1993; Ward, Penubarti, Cohen, and Lofdahl, 1995; Cohen, Mintz, Stevenson, and Ward, 1996). In contrast, others argue that military spending crowds out private investment, diverts human capital from productive efforts, and has few spin-offs and multiplier effects (e.g. Kaldor, 1976; Dumas, 1988; Harris, Kelly, and Pranowo, 1988; Kick, Nasser, Davis, and Bean, 1990; Kick, Davis, Kiefer, and Burns, 1997). This debate, however, has largely neglected social welfare outcomes. As Chan (1985:422) argues, "we need to disaggregate the dependent variable in terms of measures that are more directly relevant to the lives of particular groups of people." We focus on food security as the most basic of human needs and as thus central to social welfare. Food security is especially problematic in many of the poorer LDCs, where military power has been most prominent and is central to recent policy discussions of military-induced famine, including the argument that food aid is often diverted by bandit armies and guerrillas, who use it to strengthen their power, thus creating protracted political instability and greater hunger (Cheatham, 1994; Macrae and Zwi, 1994; Prendergast, 1996; Messer, Cohen, and D'Costa, 1998; Uvin, 1998; de Soysa and Gleditsch, 1999).

Research on the social impact of military power has largely focused on military spending, neglecting other aspects of military power and behavior. We distinguish between *militarization*, defined as increased military control over social and economic resources, and *militarism*, treated as the use of military force to handle political conflicts (Ross, 1987; Vantuyll, 1994). Several studies have found that military participation (i.e., the ratio of troops to labor force) is distinct from military spending and improves infant mortality, literacy, and secondary schooling (Dixon and Moon, 1986; Kick and Sharda, 1987; Bullock and Firebaugh, 1990; Kick et al., 1990; Kick et al., 1997). Some have refined the spending argument by claiming that the root problem is international arms races that spur international arms purchases and local arms production at the expense of health, nutrition, and education programs and socially beneficial economic development (McKinlay and Mughan, 1984; Brzoska and Ohlson, 1987; Thomas, 1994). There is also the question of military conduct, especially praetorianism and the use of military force to control internal opponents and challenge international competitors (Huntington, 1968; Janowitz, 1977). Some contend that militarization gives the military more resources and thus encourages praetorianism, political repression, and interstate wars that undermine social welfare (Wolpin, 1981, 1983; Sivard, 1991; Tilly, 1992). This raises the additional question as to whether militarization and militarism are strongly interrelated.

We examine the impact of military power on two measures of food security: food supply and child hunger.[1] By food supply, we mean the aggregate per capita

[1] This parallels Tweeten's (1997) distinction between food availability (the aggregate supply of foodstuffs in a country) and food access (secure possession by individuals, households, and specific groups of the means to acquire food for consumption). We argue, however, that both are actually measures of food access at different levels of aggregation. Thus a country's food availability per capita captures a country's access to the global "bread basket," whereas child hunger as indicated by the prevalence of undernutrition captures individual access to that country's basket. Tweeten also distinguishes utilization, defined as nutrition derived from the metabolization of consumed food, which we do not address.

availability of foodstuffs in a country regardless of where it was produced.[2] It includes both internal food production (both marketed and nonmarketed) as well as food imports and assistance. Given the global food surplus, it captures the access of a country to the global "bread basket." The child hunger rate captures the internal or intracountry distributional component of food security. Since children are the most vulnerable and child hunger is typically associated with the hunger of other vulnerable groups (Kelly, 1992; Foster and Leathers, 1999:47–52), it serves as a proxy for broader hunger problems. In the regression analysis of child hunger rates below, we control first for increased food supply, thus tapping hunger net of increased food supply. We use a lagged panel design, which is less vulnerable to reciprocal causation and specification bias (Finkel, 1995:13–22; Hannan, 1979).

We begin by discussing the meaning of food security and its relevance to the long-standing debate over the social impact of military power and the question of military-induced famine. We then clarify the distinction between militarization (resources) and militarism (conduct), finding only modest relationships between them. Using a lagged panel model to analyze change in food supply and child hunger, we show that arms imports and associated military spending along with praetorianism and internal repression create a military burden but that increased military participation and an arms industry improve food security. In general, factors that improve (or reduce) food supply also improve (or reduce) child hunger rates.

What Is Food Security?

The idea of food security has been pioneered by the United Nations (U.N. General Assembly, 1949; FAO, 1996a, 1996b) and proponents of an "entitlement" approach to food security (Sen, 1981, 1995; Drèze and Sen, 1989; Foster and Leathers, 1999) to underscore the importance of food as the most basic of human needs. Recently the United Nations Development Programme (UNDP) has included food security in its broader concept of "human security" (1994:22–46). In the words of the UNDP (1994:22), "a feeling of insecurity arises more from worries about daily life than the dread of a cataclysmic world event." In place of Cold War concerns about the superpower rivalry and impending nuclear destruction, security discussions should focus on threats to ordinary citizens and their quality of life. Put simply, food security means that

> [a]ll people at all times have both physical and economic access to basic food. This requires not just enough food to go around. It requires that people have ready access to food—that they have an "entitlement" to food, by growing it for themselves, by buying it or by taking advantage of a public food distribution system. (UNDP, 1994:22)[3]

Food security is thus a fundamental aspect of human development in LDCs and is associated with reductions in absolute poverty and improvements in public health (Sen, 1981; Drèze and Sen, 1989) and the physical quality of life (Morris, 1979). Food is the foundation of social welfare and thus should be central to discussions of development policy and theory.

The central distinction between food supply and hunger is more than a simple measurement question. It raises the fundamental question as to whether increase

[2] Past work has misleadingly referred to food supply as "food consumption" or "nutrition" (Bullock and Firebaugh, 1990; Wimberly and Bello, 1992; Firebaugh and Beck, 1994), but in fact it is a measure of aggregate availability and thus distinct from hunger and nutritious consumption.

[3] The above use of "entitlement" should be understood in a normative sense, as distinct from the empirical use in the "entitlement" theory of food security (Sen, 1981).

(or decline) in aggregate food supply "trickles down" to individuals, households, and disadvantaged groups. Does increased food supply automatically improve child hunger? A country's food supply is an aggregate bread basket of food available to a defined population but says nothing directly about how this food is distributed. The prevalence of child hunger in the presence of adequate food supply is a strong indication of serious internal access problems. As Sen (1981) and Drèze and Sen (1989) have shown, famines often occur in the midst of food surplus, selectively affecting those who lack the economic means to acquire sustenance and where the political will in the country to secure the basic needs of the population is lacking. Past cross-national research (e.g., Bullock and Firebaugh, 1990; Wimberley and Bello, 1992; Firebaugh and Beck, 1994) has examined supply but neglected hunger.

Table 1 charts the trends in food supply and child hunger rates between 1970/1975 and 1990 for all LDCs that had a population of 1 million or more in 1970. To capture food supply, we use the five-year means for per capita daily caloric and protein supply for 1968–1972 and 1988–1992 to eliminate annual volatility. These are derived from the food balance sheets of the Food and Agriculture Organization (FAO, 1972, 1974, 1992, 1994), which include estimates of marketed and nonmarketed food from all domestic and international sources (including self-production and aid). This is the most reliable food security indicator available, based on field reports cross-checked by satellite imagery, and has broader temporal and country coverage than any other available cross-national indicator (Quinn and Kennedy, 1994; Foster and Leathers, 1999:66–73). To capture hunger, we use the percentage of children under five years of age whose body weight is below two standard deviations from the median weight-for-age of the country's population. Children are typically the most vulnerable population in LDCs, and child hunger is associated with hunger for other vulnerable groups (Kelly, 1992). This weight-for-age method, also known as the "Gomez system" (Foster and Leathers, 1999:62–63), taps only those who are severely undernourished. These data are compiled by the United Nations Sub-Committee on Nutrition and are supplemented by household and community surveys conducted by Macro International's Demographic Health Survey Project. Field studies show this is the most reliable gauge of preschool children who are at risk for primary undernutrition (i.e., insufficient calories) and secondary undernutrition (i.e., diarrheal infection that depletes nutrients). It normalizes for the physical characteristics of the country's population and is broadly available for LDCs beginning in 1975 from country surveys conducted by the World Health Organization (UNDP, 1994; FAO, 1996b). Because it is unavailable on an annual basis, we focus on the change from 1975 to 1990, the longest time period currently available.

The overall trend in the data examined is toward improved LDC food security. Between 1970 and 1990, mean daily caloric supply per capita in LDCs increased by 7.63% and, for protein supply, by 5.71%. Child hunger rates dropped by almost 20%, from 28.9 to 23.4% of all children. Progress, however, has been regionally uneven. Improvements were greatest in North Africa and the Middle East, with caloric supply rising by 27.4% and protein by 12.5%, were moderate in Asia/Oceania (12.0 and 10.2%), with slight improvement in Latin America (5.8 and 2.2%), and a drop in sub-Saharan Africa (−.16 and −2.4%). The fight against child hunger showed greater progress, with a mean 41.2% decline in North Africa and the Middle East, a 26.9% decline in Latin America, a 17.4% decline in Asia/Oceania, and a 13.6% decline in sub-Saharan Africa.[4] Despite improvement, over a third of all children remain hungry in Asia/Oceania, near

[4] Experts disagree as to whether the greater incidence of underweight children in Asia/Oceania is due to water-borne disease in a monsoonal climate (UNDP, 1994:27) or constitutes a genuine access problem (FAO, 1996b:79), but our lagged panel design controls for serial correlation of errors and thus minimizes this issue.

TABLE 1. Trends in LDC Aggregate Food Supply and Child Hunger, 1970–1990

	Means (Standard Deviations) for Caloric Supply per Capita		*Means (Standard Deviations) for Protein Grams per Capita*		*Means (Standard Deviations) for Prevalence of Child Hunger*	
	Circa 1970	*Circa 1990*	*Circa 1970*	*Circa 1990*	*Circa 1975*	*Circa 1990*
All Less-Developed Countries ($N = 88$)	2227.47 (299.12)	2397.43 (416.82)	57.62 (12.97)	60.91 (14.47)	28.88 (15.34)	23.42 (13.81)
Caloric Availability Models ($N = 79$)	2243.01 (309.14)	2412.30 (428.87)				
Protein Availability Models ($N = 79$)			57.85 (12.91)	61.18 (14.77)		
Percentage of Undernourished Children Models ($N = 75$)					28.57 (15.58)	23.19 (14.11)
Asia and Oceania	2208.76 (310.01)	2452.09 (406.73)	54.88 (11.72)	60.95 (14.36)	46.07 (16.63)	38.27 (14.12)
Latin America	2364.75 (345.77)	2501.20 (310.96)	61.84 (14.55)	63.22 (11.83)	15.71 (7.19)	11.48 (6.74)
North Africa and the Middle East	2357.65 (290.45)	3004.76 (316.66)	64.13 (12.12)	81.18 (9.96)	18.20 (4.76)	10.70 (2.83)
Sub-Saharan Africa	2135.16 (253.05)	2110.28 (260.78)	54.45 (10.50)	52.54 (4.31)	32.11 (10.48)	27.97 (8.97)

Countries with Substantial Decreases in Food Security

Caloric Supply ($n = 25$):	Afghanistan, Angola, Argentina, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Chile, Guinea, Haiti, Kenya, Madagascar, Malawi, Mozambique, Paraguay, Peru, Rwanda, Senegal, Sierra Leone, Sri Lanka, Togo, Sudan, Uruguay, Zambia
Protein Supply ($n = 27$):	Afghanistan, Angola, Argentina, Burundi, Cameroon, Central African Republic, Chad, Ethiopia, Ghana, Jamaica, Kenya, Liberia, Madagascar, Malawi, Mongolia, Mozambique, Namibia, Nicaragua, Paraguay, Peru, Rwanda, Somalia, Uganda, Uruguay, Zaire, Zambia, Zimbabwe
Prevalence of Child Hunger ($n = 12$):	Afghanistan, Angola, Burundi, Madagascar, Malawi, Mozambique, Nigeria, Senegal, Sierra Leone, Uruguay, Zaire, Zambia

30% in sub-Saharan Africa and a little over 10% in the other regions. Overall, improvement in child hunger was greater in the more developed regions, paralleling studies indicating an increase in international economic inequality (Peacock, Hoover, and Killian, 1988; Homer-Dixon, 1995; Korzeniewicz and Moran, 1997).

At the bottom of Table 1, we identify all LDCs with significant negative changes in food security over the period studied. For food supply, we list all that lost 100 or more mean daily calories per capita and three or more grams of daily protein per capita and, for child hunger, all with an increase of 1% or more. Sub-Saharan Africa and Asia/Oceania experienced the greatest losses in food security, with 20 and 17 out of 35 countries in sub-Saharan Africa suffering a decline in caloric and protein supply, respectively, and, in Asia/Oceania, 6 out of 22 countries. In general, levels of child hunger improved everywhere except in 10 countries in sub-Saharan Africa, civil war–torn Afghanistan, and Uruguay.

Dimensions of Military Power

The debate over the social impact of military power has been confused by the failure to distinguish clearly between different aspects of military power. Some have treated militarization (or, alternatively, militarism, which is often used synonymously) as a single unified process, assuming that an increase in military resources leads to or is mutually reinforced by praetorianism and the use of military force (Wolpin, 1981, 1983; Sivard, 1991; Bucholz, 1999; Mayer, 1999). Thus the Stockholm International Peace Research Institute (1982:393) defines "militarization" broadly in terms of "a steady growth in the military potential of states. Such growth is usually accompanied by an increasing role for military institutions both in national affairs, including the economic, social and political spheres, and in international affairs."[5] The extent to which different military resources are integrated and encourage the use of military force is an empirical question, however. Below we show that some aspects of military resources are moderately correlated with one another but that most aspects are distinct and that military resources are not strongly correlated with use of military force. This undermines the idea of a single unidimensional process called "militarization" or "militarism" and points to the need to evaluate the impact of distinct dimensions of military power.

In discussing military power, we draw on Ross's (1987) distinction between *militarization*, defined in terms of military resources, and *militarism*, treated in terms of praetorianism and the use of military force to regulate political conflict. Each in turn has multiple aspects that may potentially have a distinctive impact on social welfare. We use this distinction to organize the discussion of the social impact of military power.

Past research on military power has focused almost entirely on military spending, typically treated in terms of a governmental budget trade-off. The classic statement was that of Benoit (1973, 1978), who argued that military spending might appear wasteful and create a short-term trade-off in terms of government spending on health and education, but, in the long run, it creates human capital, economic infrastructure, better work discipline, technology spin-offs, national security, and market stimulation, thus contributing to economic growth. Subsequent studies, however, have found highly mixed effects, including reductions in social and health spending, the crowding of private capital markets, minimal technology and infrastructure spin-offs, weak multiplier effects, and significant opportunity costs in terms of foregone alternative investments (Chan,

[5] Others (e.g. Vagts, 1959; Bucholz, 1999; Mayer, 1999) have used "militarism" as equivalent to "militarization," contributing to this confusion.

1985, 1995; Ward and Davis, 1992; Payne, Sahu, and Ward, 1994). Critical questions are, first, whether any economic growth created by military spending "trickles down" to social welfare and, second, whether military spending should be treated as a narrower budget trade-off or as a broader societal burden.

Several studies have shown that two aspects of military spending should be distinguished: purchases of arms and equipment and personnel (or military participation). Drawing on Andreski (1968), military participation has been shown to improve food supply, decrease infant mortality, and increase literacy and physical quality of life (PQLI) as well as spurring economic growth (Weede, 1983, 1992; Dixon and Moon, 1986; Davis, Kick, and Kiefer, 1989; Kick et al., 1990; Bullock and Firebaugh, 1990; Looney, 1990; Kick et al., 1997). Weede (1992), however, found that it did not affect income inequality, and Bowman (1996) observed that it reduced democratization in Latin America between 1973 and 1986. In analyses controlling for both military participation and spending, military spending normed over gross national product (GNP) has either a negative effect on PQLI (Dixon and Moon, 1987) or an insignificant effect on the above social welfare indicators (Bullock and Firebaugh, 1990; Looney, 1990), whereas military participation is socially beneficial. This suggests the need to distinguish between military spending on personnel that improves social welfare and spending on weapons and supplies that may be detrimental to it.

A related discussion has focused on international arms imports. Several contend that arms imports create a budget trade-off in terms of reduced education, nutrition, and health spending, thus reducing social welfare (Senghaas, 1977; McKinlay and Mughan, 1984; Thomas, 1994). Others point to destabilizing consequences of arms imports, arguing that they set off regional arms races that lead to international war and increase the violence of internal conflicts (Brzoska and Ohlson, 1987; Pearson, 1994). Lappé, Collins, and Rosset (1998:138), for example, argue that Cold War regional arms races destabilized Somalia, precipitating a civil war that created widespread famine. Wolpin (1981, 1983) contends that arms imports promote other socially harmful economic policies, such as encouragement of foreign investment and the export of cash crops, fosters internal repression, and cements international alliances with foreign powers (including foreign investors and banks) that create distorted growth and reduce social welfare (Wolpin, 1981, 1983). Several studies have found that arms imports reduce economic growth and political rights as well as increasing infant mortality (Kick et al., 1990; Kick et al., 1997).

A fourth aspect of militarization is arms production, which was central to nineteenth-century state-led industrialization (Gerschenkron, 1962; Kennedy, 1974). Arms production should create human capital and technology spin-offs, stimulate market demand, and strengthen the international power of the state. Arms production should also be associated with arms exports, which increased nearly fourfold in the 1970s and 1980s and shifted from mainly security to more commercial purposes (Brzoska, 1989; Krause, 1992; Pearson, 1994). Exporting countries are likely to be producers of more sophisticated and higher-value arms, which should have greater economic benefits and strengthen the state internationally, thus allowing it to further improve food security. Although a few studies have found that arms production boosts economic growth (Kick and Sharda, 1986; Looney, 1989) and increases income inequality (Looney, 1989), arms exporting has not been examined, and neither has been used to explain social welfare outcomes.

Following our above discussion, militarism centers on the behavior or conduct of the military. A classic argument focuses on the benefits and risks of praetorianism, that is, military rule and coups. Whereas a few have argued that military rulers are agents of modernization with managerial and technical skills and a modern social vision (Johnson, 1962; Trimberger, 1978), most contend that mil-

itary leaders lack the political skills to sustain legitimacy and are prone to use violence to resolve political disputes and that such violence spurs generalized political instability (Huntington, 1968; Janowitz, 1977; Tilly, 1992). Military rulers who have acquired power through violent means are likely to use force to control opponents, including resorting to genocide and politicide to eliminate internal political enemies (Gurr, 1989; Harff and Gurr, 1993) and using military force against international rivals, thus leading to wars and foreign military interventions. Several studies have shown that democracies are unlikely to go to war against other democracies (Russett, 1993; Mousseau, 1998), but the war propensity of military regimes is unclear. Ethnic minorities should be especially vulnerable to military repression and thus to food insecurity, as the recent "food wars" in Ethiopia, Afghanistan, Sierra Leone, Myanmar (Burma) and the Congo testify. Military rule may also indirectly reduce food security by diverting government spending from social programs toward weapons purchases and reinforcing the power of metropolitan elites and foreign investors at the expense of the rural population and the poor (Wolpin, 1981, 1983; Bates, 1981; Berg-Schlosser, 1984).

A recent twist on these arguments is the idea of "military famine" (Cheatham, 1994; Macrae and Zwi, 1994; Uvin, 1998). Responding to underlying subsistence crises, bandit armies and guerrilla groups use broadly distributed humanitarian food aid to consolidate their territorial control, thus perpetuating the chaos and collapsed states that have contributed to widespread hunger (Prendergast, 1996; de Soysa and Gleditsch, 1999). Messer et al. (1998) show that military repression and internal war have been a major source of food scarcity in several LDCs, pointing to the need for peace-building as a basis for restoring food security.

These arguments, especially those about military force, have received little cross-national analysis. Jackman (1976) found no significant difference in economic growth between military and civilian regimes, and Dixon and Moon (1986) uncovered no impact of the duration of military rule on PQLI. Kick et al. (1990), however, found that the longer the duration of military rule in a country, the lower its economic growth and the higher its rate of infant mortality. We extend this to food security as well as to addressing the link between praetorianism and the use of military force both internally and internationally.

Insofar as some of these aspects of military power are distinct, it is possible that some (e.g., military participation) improve social welfare whereas others (e.g., military spending) reduce it. Most studies have focused on only one or two dimensions of military power (typically spending and military participation), and there has been little attention to the relationship between militarization (resources) and militarism (conduct). We first examine the relationship among the various aspects of military power and then evaluate how these affect food security.

Method and Measurement

Our primary focus is change in food security between 1970 and 1990.[6] As noted earlier, this was a period of generally improving food security, with a significant number of LDCs, however, losing food security. It also witnessed significant increases in military power, making this an opportune time to evaluate the impact of military power on food security. We use ordinary least-squares regression in a lagged panel design (i.e., controlling for the lagged endogenous term for 1970/1975). This is a conservative design, which is preferable to a static or cross-sectional design because it reduces the risk of bias associated with reciprocal causality and serial correlation of errors, thus strengthening confidence in

[6] Updated measures for child hunger after 1990 are not available, but supplementary analysis of food supply change to 1996 produced results identical to those for the caloric models, indicating that Cold War patterns have persisted into the 1990s.

our results (Hannan, 1979). It is also superior to predicting a change score, which is more vulnerable to heteroskedasticity and specification bias (Bohrnstedt, 1968; Hannan, 1979; Finkel, 1995:13–22).[7] Some of the military power variables discussed below are best considered as change scores (e.g., *increased* military spending), whereas others are underlying static features (e.g., military rule). Residual plots and the Breusch-Pagan test (Breusch and Pagan, 1979; Judge, Griffiths, Hill, Lütkepohl, and Lee, 1985; McClendon, 1994:179–184) indicate no heteroskedasticity in any of our models. We also introduce controls for economic growth (1970–1990), the initial development level, and the interaction of growth with the initial development level to evaluate whether there is a trickle down from growth that mediates any military power effects. To test for specification bias, we introduced regional dummies in full models, which indicated no problems.[8] Exhaustive tests of final models for influential cases using standard methods (Bollen and Jackman, 1985) revealed no problems.[9]

We examine LDCs with a population of 1 million or more in 1970 and a standing military by 1990. We include two countries (Mongolia, Lesotho) that did not have a standing military in 1970 but did by 1990 as well as one country (Costa Rica) that had no military spending in 1970 but did by 1990. Because of missing values, the food supply analysis is based on 79 cases and the child hunger on 75.[10] Table 2 summarizes the measurement of all our independent variables, which we discuss below.

Capturing Food Security

To capture change in food supply, we use the five-year means for daily caloric and protein supply for 1968–1972 and 1988–1992 as outlined above and, to capture change in child hunger, the weight-to-height measures of undernutrition for 1975 and 1990 discussed earlier. These data have broad coverage and high reliability, tapping distinct aspects of food security.

Assessing change also has a substantive advantage in analyzing food supply. Discussions often treat food supply as if it were an absolute, but anthropometric

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[7] We test equations using a cross-sectional (simple panel) design predicting levels of caloric and protein supply in 1990 and the level of child hunger in 1990 using both static and change scores for military spending and participation. The results were identical with stronger *t*-tests, as expected with such an approach, thus underscoring the point that a lagged panel design is a more conservative method for evaluating hypotheses in that it reduces the chance for inflated *t*-values.

[8] In the food supply equations, two different dummy variables—one for sub-Saharan Africa, the other for North Africa and the Middle East—were significant, with the former being negative and washing out the effects of arms imports and military spending, whereas the latter was positive and washed out the effects of development level. They did not alter any other effect, indicating that these factors are associated with the underlying nature of respective regions. This should not be surprising, given that North Africa and the Middle East contain the highest levels of economic development, whereas Africa exhibits the largest regional changes during the period under study in the spending burden and arms imports. Dummy variables for Latin America and Asia were not significant in the supply models and had no effects on the final equations. None of the regional dummy variables were significant in the child hunger models.

[9] India is an outlier, but removing it indicates that it is not influential in the caloric supply models. Similarly, Afghanistan is an outlier in the child hunger models but not influential.

[10] A total of 82 countries were included in one or both analyses. The caloric and protein analyses include seven countries for which there are no child hunger data (Benin, Burkina Faso, Côte d'Ivoire, Israel, North Korea, South Korea, and Singapore) and the child hunger analysis includes three countries not included in the caloric and protein analysis (China, Ghana, Papua New Guinea). The other countries included are Afghanistan, Algeria, Angola, Argentina, Bangladesh, Bolivia, Brazil, Burma, Cambodia, Cameroon, Central African Republic, Chad, Chile, Colombia, Congo, Costa Rica, Cuba, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Guatemala, Haiti, Honduras, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Kenya, Laos, Lebanon, Lesotho, Liberia, Libya, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mexico, Morocco, Mozambique, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Panama, Paraguay, Peru, Philippines, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Somalia, Sri Lanka, Sudan, Syria, Tanzania, Thailand, Togo, Tunisia, Uganda, Uruguay, Venezuela, Zaire (Democratic Republic of Congo), Zambia, and Zimbabwe.

TABLE 2. Measurement

Variable	*Definition and Source*
Dependent Variables	
Food Supply	Five-year average for daily caloric supply per capita and daily protein supply per capita, 1988–1992 (FAO, 1994, 1992, 1972)
Child Hunger	Prevalence of child nutritional well-being as indicated by the percentage of children under age 5 who are of healthy weight, 1990 (UNDP, 1994)
Independent Variables	
Level of Economic Development	Level of economic development based on real (1980 U.S. dollars) gross domestic product per capita, 1970, 1975 (Summers and Heston, 1991)
Economic Growth	Average annual percentage change in real (1980 U.S. dollars) gross domestic product per capita, 1970(75)–1990 (Summers and Heston, 1991)
Military Participation	First-difference change in armed forces personnel per thousand in the population aged 16–65, 1970(75)–1990 (U.S. Arms Control and Disarmament Agency, 1975, 1985, 1994)
Military Spending: Budget	First-difference change in military expenditure as a percentage of central government expenditure 1970(75)–1990 (U.S. Arms Control and Disarmament Agency, 1979, 1997)
Military Spending: Societal (GNP)	First-difference change in military expenditures over GNP, 1970(75)–1990 (U.S. Arms Control and Disarmament Agency, 1975, 1985, 1994; World Bank, 1994)
Military Rule	Intensity of military rule based on number of years in which military or mixed regimes held power divided by total number of years from 1970 to 1985 (Gurr, 1989)
Military Repression	Dummy variable for the presence of military repression coded yes = 1, no = 0, 1980s (Kidron and Smith, 1983, 1991)
Military Instability	Likelihood of military coups and military loyalty, coded utterly unreliable = 4, unreliable = 3, barely reliable = 2, not wholly reliable = 1, reliable = 0, 1980s (Kidron and Smith, 1983; Morrison et al., 1989)
Arms Producer	Dummy variable for arms producers coded yes = 1, no = 0, 1970–1985 (Brzoska, 1989; Kidron and Smith, 1983)
Arms Exporter	Dummy variable for arms exporter states coded yes = 1, no = 0, 1970–1985 (Brzoska, 1989; Kidron and Smith, 1983)
Arms Imports	Average annual percentage change in the value of arms transfers per real GNP, 1970–1985 (Brzoska and Ohlson, 1987)
Presence of Interstate War	Dummy variable for the presence of interstate war, yes = 1, no = 0, 1970–1990 (Kidron and Smith, 1983, 1991; Singer and Small, 1993)
Presence of Civil War	Dummy variable for the presence of civil war, yes = 1, no = 0, 1970–1990 (Kidron and Smith, 1983, 1991; Singer and Small, 1993)
Presence of Genocide or Politicide	Dummy variable for the presence of genocide or politicide, coded yes = 1, no = 0 (Fein, 1993; Harff and Gurr, 1989)
Ethnic Political Discrimination	Intensity of ethnic political discrimination based on summed proportion of minorities experiencing political discrimination in the form of neglect, social ostracism, and political exclusion or repression, with high values meaning higher discrimination against larger minority populations, 1970–1985 (Gurr, 1993)

research shows that there is no simple caloric/protein level at which food shortage leads to malnutrition. As noted above, this is partially a question of distribution, but it is also a question of human adaptability. Human caloric/protein and nutrient requirements are based on an accustomed activity level, climate, culture, population age structure, sex composition, and body size (Foster, 1992:77–83; FAO, 1996b:128–142). Although there is a physiological minimum for the basic health of any specific population, this variable is based on accustomed levels and is thus in part culturally relative. Hence the most important issue for a cross-national aggregate analysis is *change* in caloric/protein supply. A drop of 300 daily calories in a country that has traditionally consumed 3,100 calories per capita has greater malnutrition impact than a decline of 100 daily calories in a country that has traditionally consumed 1,900 per capita. For example, North Korea, which had 2,867 daily calories per capita in 1990, is five years later experiencing famine with a drop of only 507 daily calories per capita despite the fact that average daily caloric supply is considerably higher than that of almost all of the countries in sub-Saharan Africa (FAO, 1998).

In analyzing child hunger rates, we also control for the effects of change in food supply over the same period (1975–1990). This allows us to test the argument that hunger is deeply embedded in social structure and largely independent of changes in aggregate food supply (Drèze and Sen, 1989). It also provides a conservative test of arguments about the impact of military power on hunger.

Capturing Military Power

The discussion of military power focuses on both changes and the level of various aspects. Change can be gauged in different ways: the first-difference change scores ($Y_{t2} - Y_{t1}$); the percentage change $[(Y_{t2} - Y_{t1})/Y_{t1}] \times 100$; and the annual average rate of change $\{[(Y_{t2} - Y_{t1})/Y_{t1}]/\text{number of years}\} \times 100$. The first is relevant when we are speaking of a general structural trend, the second when addressing the extent of change relative to a starting point value, and the last when tapping the simple linear rate of change. In the following discussion, we discuss the theoretical reasons for the particular change metric used.

Most attention by academics and scholars (e.g., Chan, 1985; Bullock and Firebaugh, 1990; Benoit, 1973, 1978) has focused on military spending. We use two measures: the change in military expenditures in constant U.S. dollars normed against central government expenditures (U. S. Arms Control and Disarmament Agency, 1979, 1997) and the change in military expenditures normed against real GNP (U.S. Arms Control and Disarmament Agency, 1975, 1985, 1994; Summers and Heston, 1991).[11] Benoit (1973, 1978) used the first to evaluate the impact of a budget trade-off between military and nonmilitary expenditure. If increased military spending is forcing the government to reduce social spending and thus creating hunger, this measure should be negative. If, however, it is stimulating economic growth and reducing insecurity, it should be positive. Between 1970 and 1990, the mean military spending in LDCs increased from 15.32% of central government budget to 17.22%, with the Sudan, Argentina, Saudi Arabia, Syria, and Panama exhibiting the greatest levels of growth. The second taps the possible societal benefit or burden that military spending might impose by affecting human and physical capital, technological spin-offs, and inflation. Military spending relative to the whole economy increased from 11.35%

[11] We compared these Arms Control and Development Agency (ACDA) arms transfer and military spending estimates with those of the Stockholm International Peace Research Institute (SIPRI) (1982, 1994) but found no significant differences. ACDA and SIPRI estimates are correlated between .88 and .97, and SIPRI estimates produced the same results in the regression equations though with fewer cases. Hence despite questions about the pro-Western bias of ACDA, we found no evidence that this affected our results (for a fuller discussion, see Happe and Wakeman-Linn, 1994). ACDA has fuller country coverage, so we use it.

to 13.50% of GNP between 1970 and 1990. On this measure Iraq had the largest growth, with Saudi Arabia, Ethiopia, Afghanistan, and Angola as the other top military spenders. We use a first-difference change for both, since the question is whether there is a trend toward greater or less spending.

Military participation is based on the number of troops in the armed forces divided by a country's labor force. We use troop estimates of the U.S. Arms Control and Disarmament Agency (1975, 1985, 1994). To gauge labor force, we use the population between ages 16 and 65. This is superior to norming by total population because it taps the economically productive sector of the population. Because larger militaries are likely to recruit from a broader cross-section of the population and to be more socially embedded in different regions and subgroups, military participation should create social integration and cohesiveness across regional and ethnic differences in LDCs (see Andreski, 1968; Bullock and Firebaugh, 1990).[12] Between 1970 and 1990, mean military participation in LDCs grew from 11.35 troops per thousand population to 13.5. Iraq experienced the greatest increase on this term as well, with Syria, Mongolia, North Korea, and Libya the other leading militarizing states. Participation is correlated with spending in that personnel costs constitute on average 50% of total military budgets in LDCs (Harris et al., 1988). In the regression analysis, we controlled simultaneously for both spending and military participation, allowing us to disentangle the distinct effects of personnel and nonpersonnel spending. To further check this, we also used two-staged least squares to see if increased spending has the same effect on the residuals left after controlling for military participation, and vice versa. This produced the same results as the additive regression equations. Ideally we would use budget figures broken down into personnel costs, investment in equipment, and arms purchases, but detailed military budget data are not available for sufficient countries to be analyzed cross-nationally.

Arms production is coded as a dummy variable for significant arms production capacity in the 1970s and 1980s (1 = yes; 0 = no) derived from Brzoska (1989) and Kidron and Smith (1983, 1991). Although crude, our assumption is that the simple presence of such capability is the critical issue. The value added from arms production over gross domestic product (GDP) would be better but is unavailable for enough LDCs to be usefully analyzed. A second measure is arms exporting, treated as a dummy variable (1 = yes; 0 = no, derived from Brzoska, 1989; Kidron and Smith, 1983). Most LDC arms producers are also involved in arms exporting, especially those capable of producing more sophisticated weapons. This should further boost or detract from their food security. Assuming that exporting has a greater market value than simple production, this may be more relevant. Although precise estimates of arms export value are not available, the mere presence of arms export capacity should capture its effects on a country's food security.

Many argue that arms imports constitute a social drain. Because the issue is the rate of increase in this potential burden, we use the average annual rate of change between 1970 and 1985 in the total value of international weapons purchased in constant U.S. dollars normed over real GNP (Brzoska and Ohlson, 1987). An arms import burden may also be associated with increased military spending.

We also examine the political role of the military in terms of praetorianism. We use two measures: (1) the intensity of military rule, based on the proportion of years between 1970 and 1985 in which a military or a mixed military-civilian

[12] Military participation ratio (MPR) and a measure of ethnic homogeneity, which we derive from Sullivan (1991), are only mildly correlated at $r = .16$, which is not statistically significant. In fact case-by-case evidence reveals several examples of states' high MPR and low ethnic homogeneity levels relative to other LDCs, indicating a potential cohesiveness function, including Angola, Jordan, Laos, Malaysia, and Mauritania, among others.

regime held power (based on Polity II [Gurr, 1989]);[13] and (2) military instability, based on the loyalty of militaries and the propensity for coups and threatened political interventions. Kidron and Smith (1983) use multiple sources (e.g., press reports, the International Institute for Strategic Studies) to construct this scale. We supplement it with the frequency of coups and coup attempts in sub-Saharan Africa (Morrison, Mitchell, Paden, and Stevenson, 1989). A related measure is military repression, based on assigning the military chief responsibility for internal security and reports of military involvement in torture, imprisonment, and human rights violations from Amnesty International, press reports and the like (Kidron and Smith, 1983, 1991). If the military is responsible for internal policing, it is more likely to repress the political enemies of the regime.

The "military famine" thesis traces food insecurity to armed conflicts. Internal wars and interstate wars should disrupt food production and markets and hinder distribution and may also interact with military regimes, regional arms races, and related military spending growth. Thus there may be direct effects of armed conflicts as well as effects linked with these other aspects of military power. We gauge both of these with a dummy variable (1 = presence; 0 = no presence), based on wars reported by the Correlates of War project (Singer and Small, 1993), cross-checked with Kidron and Smith, 1983, 1991, and Project Ploughshares, 1994. Simple presence or absence of these measures are useful in that the effects of war on food security linger beyond the specific official duration of the conflict, including deaths directly and indirectly related to it (Messer et al., 1998). To test the argument that it is not the form of war but rather the incidence of armed warfare per se, we also use a general war indicator that sums the two.

Internal political enemies are often ethnic minorities subjected to political discrimination. We therefore also tap the intensity of ethnic political discrimination by the percentage of country population represented by minority groups subjected to the most intense political discrimination (Gurr, 1993) and a dummy variable representing the presence of genocide or politicide in a country between 1970 and 1990 (Harff and Gurr, 1989; Fein, 1993). Wars make the military functionally important and thus strengthen military power. Thus we test the interaction between military rule and armed conflicts.

In general, broad militarization measures should have more impact on economic growth and thus aggregate food supply, whereas militarism, especially that tied to the repression of internal enemies, should affect internal food access and thus child hunger.

Control Variables

We also examine the trickle down from economic growth. Neoclassical economics and modernization theory argue that economic growth benefits disadvantaged populations and thus should improve food supply and reduce hunger. These benefits may also be more linked to the more developed of the LDCs. Thus we test for both the average annual percentage of economic growth and the interaction between growth and the level of economic development. Economic growth rate is measured as the average annual percentage growth in real U.S. dollars of real gross domestic product (RGDP) per capita between 1970 and 1990 (Summers and Heston, 1991). Economic growth may also be tied up with military spending and participation. We therefore test this by comparing equations including and excluding economic growth to see if spending mediates or is behind any growth benefits. We also control for the starting-point (1970) level of

[13] We also used the simple presence of a military regime during this period, testing the idea that simply having a military regime would have detrimental effects. It was never significant.

economic development (or RGDP per capita) to reduce possible specification bias and control for any "floor" effect of starting at a lower level of development (i.e., indicating that LDCs have more room for improvement). If RGDP is positive, this indicates that more-developed countries were more economically and socially integrated and thus better able to improve food security, which is compatible with modernization arguments. We begin by examining the dimensionality of military power to see if there is strong overlap among the various military power measures, then turn to the analysis of food security.

Results

Table 3 shows the correlation matrix and the descriptive statistics for the military power measures. The change in military spending and military participation are strongly related, suggesting that they might comprise an underlying resource dimension. However, we are also interested in distinguishing among different types of spending. We thus control for both simultaneously in the regression analysis and compare this against simpler equations to see if spending on personnel can be distinguished from that on weapons and equipment. As noted earlier, we confirm this using a two-staged least-squares procedure. Arms producers are also correlated with arms exporters, confirming our earlier discussion of the overlap. However, none of the other resource measures, including military spending and arms imports, are strongly correlated. This indicates that these military resource aspects are quite distinct, except for military spending and participation.

Several of the militarism measures are moderately correlated: (1) military repression with internal war, (2) military rule with general war and geno-/politicide, and (3) internal and general war with geno-/politicide. The link between military rule and general war and geno-/politicide supports the idea that military regimes contribute to armed conflicts. Military instability, however, is unrelated to any other measures, except negatively to arms production and exporting. Significantly, there are only two positive correlations between the militarization measures and any militarism measure. Arms exporters are more likely to experience interstate wars, possibly because export activities embroil them in regional conflicts. Neither military spending nor participation are strongly related to any of the militarism measures, undermining the contention that military power constitutes a single unified process. In fact, arms producers/exporters are significantly less likely to experience military instability. Thus, it appears that overall these are distinct aspects of military power, with some overlap between spending and participation and among the various armed conflict and repression measures.

We next turn to the analysis of food supply (Table 4). We present results for caloric supply because it is more central to overall food security than protein supply. (We did analyze protein supply as well, but the results were virtually identical, so we simply discuss the few discrepancies.) Economic growth, the starting-point development level, and growth in the more developed of the LDCs (i.e., the interactive combination of these) contribute to improved food supply (equation 1 in the table). The more developed of the LDCs experience greater improvement in food supply, indicating increasing global inequality in the food supply of LDCs over time. Economic growth also improves food supply and, in addition, economic growth has a greater benefit in these more developed countries among the LDCs.[14] Protein supply was identical, except that economic growth per se was not significant, whereas the interaction of growth with the starting-point development level was. This supports the modernization argument

[14] These results are not due to multicollinearity. We tested each of these measures separately in all possible combinations, producing identical findings.

TABLE 3. Pearson Correlations, Means, and Standard Deviations for Military Power Measures

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*
(1) Military Participation Ratio	1.0													
(2) Military Spending: Budget	.42*	1.0												
(3) Military Spending: GNP	.53*	.52*	1.0											
(4) Arms Imports	.08	.13	.07	1.0										
(5) Arms Producers	−.14	−.01	−.15	−.28*	1.0									
(6) Arms Exporters	.10	.03	−.07	−.18	.45*	1.0								
(7) Military Rule	.16	−.07	.11	−.12	.07	−.01	1.0							
(8) Military Instability	.04	−.02	.09	.06	−.40*	−.34*	.13	1.0						
(9) Military Repression	−.12	.20	.02	.20	.04	.04	.06	.06	1.0					
(10) Internal War	−.00	.07	.12	.26*	−.20	−.01	.03	.16	.39*	1.0				
(11) Interstate War	.13	.15	.01	.11	−.07	.33*	.07	−.02	.30*	.27*	1.0			
(12) General War	.06	.13	.03	.16	−.10	.26*	.20	−.02	.37*	.56*	.42*	1.0		
(13) Ethnic Discrimination	.01	−.18	−.08	−.01	−.02	.11	.04	.05	−.09	.07	−.01	.08	1.0	
(14) Geno-/Politicide	.07	.10	.00	−.13	.09	.17	.33*	.02	.21*	.48*	.10	.44*	.13	1.0
Mean	3.06	2.43	.01	30.66	.47	.30	4.11	1.36	.53	.34	.42	.51	.14	.29
Standard Deviation	17.75	13.06	.07	84.08	.50	.46	5.52	1.07	.50	.48	.50	.50	.20	.46

*significant at $p = .05$ or higher, two-tailed.

TABLE 4. Lagged Panel Analysis (OLS) of Military Power on Caloric Supply, 1970–1990

Variable	*Eq. 1* *b* *(t-value)*	*Eq. 2* *b* *(t-value)*	*Eq. 3* *b* *(t-value)*	*Eq. 4* *b* *(t-value)*	*Eq. 5* *b* *(t-value)*	*Eq. 6* *b* *(t-value)*	*Eq. 7* *b* *(t-value)*
Caloric Supply, circa 1970	.54****	.49****	.48****	.41***	.40***	.58****	.56****
	(3.73)	(3.41)	(3.44)	(3.10)	(3.15)	(5.29)	(4.99)
Development Level, 1970	.14***	.14***	.13***	.10**	.09**	.09**	
	(3.20)	(3.23)	(3.08)	(2.49)	(2.28)	(2.37)	
Economic Growth	1.21**	1.26**	1.14**	.74	.72	1.18**	
	(2.26)	(2.43)	(2.23)	(1.51)	(1.46)	(2.37)	
Development Level × Economic Growth	.02**	.02**	.01**	.01	.01		
	(2.17)	(2.26)	(2.16)	(1.51)	(1.33)		
Change in Military Participation		6.40***	6.38***	5.20**	4.94**	6.53***	7.21***
		(2.74)	(2.81)	(2.41)	(2.36)	(3.12)	(3.31)
Change in Military Spending/GNP		−1333.93**	−1131.48*	−963.03*	−840.40	−764.15	−583.62
		(−2.20)	(−1.90)	(−1.72)	(−1.55)	(−1.40)	(−1.08)
Average Annual Percentage Change in Arms Imports/GNP			−.95**	−.83**	−.73*	−.89**	−1.04***
			(−2.34)	(−2.19)	(−1.94)	(−2.24)	(−2.81)
Arms Exporters				269.63***	240.77***		257.20***
				(3.27)	(2.99)		(3.11)
Military Repression					−110.36*	51.07	
					(−1.71)	(.56)	

Military Instability					−46.97*	−60.64**	−58.76**
					(−1.86)	(−2.20)	(−2.44)
Arms Exporter						299.73***	
						(3.14)	
Arms Exporter × Repression						−351.64***	
						(−2.69)	
Intensity of Military Rule							7.40
							(1.08)
Presence of General War							168.16*
							(1.89)
War × Military Rule							−35.09***
							(−2.81)
Constant	1061.88	1181.10	1241.53	1349.50	1495.11	1032.85	1134.24
F-value	16.70	13.46	13.034	14.290	13.11	12.64	14.81
(*F*-prob.)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)
Adjusted R^2	.45	.49	.52	.58	.61	.60	.61
Number of cases	79	79	79	79	79	79	79

*significant at $p = .10$, two-tailed.
**significant at $p = .05$, two-tailed.
***significant at $p = .01$, two-tailed.
****significant at $p = .001$ or higher, two-tailed.

that more developed LDCs have the social infrastructure to reap more social benefits from economic growth. This "growth dividend" to food supply should not, however, be construed automatically as a trickle-down effect, which is more clearly relevant to the distributional component of child hunger we examine below. What it does suggest is an increase in global food inequality, with the more developed among the LDCs benefiting more in terms of aggregate food supply. Such findings support claims (Peacock et al., 1988; Homer-Dixon, 1995; Korzeniewicz and Moran, 1997) of a widening gap in social welfare among LDCs, with the poorer countries falling further behind in terms of human capital and technology.

Next we show that increased military spending relative to GNP constitutes a social burden by reducing caloric supply whereas military participation improves it (equation 2).[15] Introducing these variables separately produces identical findings and did not significantly change the strength of the *t*-statistics, indicating no multicollinearity problems. This allows us to distinguish between military spending directed at personnel, which helps food supply, versus weapons and equipment, which is detrimental to it. The spending burden normed against central government expenditures was never significant, indicating that the burden is not a budget trade-off problem. We also tested the budget trade-off idea by using education and health spending normed over central government spending, but these measures were never significant. Although the number of countries with available budgetary data is limited ($N = 49$ for education and $N = 34$ for health) and therefore problematic, we were unable to find evidence of a budget trade-off. Thus, the military spending problem is that of a burden on the total economy and not just government constraints. Increased purchases of weapons and other equipment crowds out investment and diverts resources from beneficial economic development. Economic growth is weakly correlated negatively with both increased military spending and military participation ($r = -.12$ and $-.11$, respectively), and removing it and the growth/level of development interaction and level of development terms does not significantly alter these militarization effects. Thus the impact of military participation is not due to boosting growth.

To confirm the opposing spending burden and military participation effects, we also used a two-staged least-squares approach. Regressing the societal spending burden on the residuals from predicting caloric supply with MPR was negative and significant ($b = -934.6933$, $t = -1.858$), whereas regressing MPR on the residuals from predicting caloric supply with the societal spending burden was positive and significant ($b = 4.136$, $t = 2.101$). Thus, increased spending on arms and equipment is negative net of controls for increased personnel spending, and increased personnel spending is positive and significant net of increased spending. Results of the analysis of protein supply differ only in that the spending burden is negative but not significant.

We next turn to problem of arms importing, which reduces caloric supply (equation 3). This supports the critics of the international arms bazaar who contend that international arms purchases come at the expense of social needs. This weakens the effect of military spending, suggesting that part of the spending burden problem is tied up with arms imports. Again, this appears to be a product of diverting economic resources from more beneficial societal endeavors rather than a governmental budget trade-off. Removing the controls for

[15] Because there is a possibility that the MPR effects occur only among the more developed or economically prosperous of the LDCs, we test for its interaction with both the economic growth– and economic development–level terms. It is not significant in either basic or combined equations, indicating that the MPR effect is not a condition of either richer or poorer LDCs or of those experiencing more rapid economic growth. Furthermore, because it does not alter other components of the equation, such as economic growth or the growth–development level interaction, we can be confident that it is not tied up with these items.

military spending and the economic growth/development–level terms did not alter this effect. The results of the protein supply analysis were identical.

Arms production and exporting both improve caloric supply, with exporting exerting the stronger influence. These two terms are multicollinear. Thus we show the stronger of the two, which is exporting (equation 4). In this equation, economic growth and the development level/growth interaction lose significance, indicating that arms exporters were major beneficiaries of economic growth and thus central to the growth dividend in terms of food supply. The increased spending burden also loses significance, suggesting that arms exporting offsets this burden. Substituting arms production for exporting in this equation reveals the same result but, if both are used simultaneously, only arms exporting is significant (not shown but available from the authors). This suggests that arms production is beneficial but that the more advantaged exporting countries are the best off. All but 4 of the 27 arms exporters in the analysis are also producers, but there are an additional 20 producers that do not export, producing arms solely for internal use. Since exporters are likely to produce more advanced weapons, we suspect this is due to the international trade benefits of arms exporting. Analysis of protein supply again produced identical results.

We next turn to the problem of praetorianism, finding that repressive and unstable militaries reduce food supply (equation 5). Military rule does not show significance in either this or simpler models, so we show only the significant instability terms. All other terms remain significant, but the *t*-test for the spending burden drops from -1.951 to -1.694, indicating that the effects of repressive and coup-prone militaries are partially tied up with the spending burden. Military participation is unaffected. Thus, it appears that unstable militaries are more likely to boost their spending but not on personnel. The *t*-tests for development level and the interaction with economic growth similarly drop. We also entered these factors separately, producing identical results. Results of the analysis of protein supply followed the same pattern except that the spending burden was not significant.

These findings indicate that the institutionalization of the military is critical to food supply. A military with low morale and a propensity to seize governmental power and to repress political opponents constitutes a significant threat to basic needs. We also tested interactions combining military rule with repression and military instability, but neither were significant. The weak correlations between military rule and the other armed-conflict measures militate against critics who claim military regimes are responsible for repression and internal violence. Praetorian rule per se does not appear to be that critical to this aspect of food security or to internal instability. The effects in the analysis of protein supply were identical.

Equation 6 shows that arms producers whose militaries were simultaneously involved in domestic repression suffered reduced food supply. The base term for arms production remains significant, but military repression loses significance, indicating that the repression problem is tied up with states that produce their own arms. These "low-tech" arms producers are producing weapons that are then used to repress domestic opponents and thereby reduce caloric supply. Examining the cases exhibiting both arms production and domestic repression reveals that food-troubled states such as Ethiopia, Sri Lanka, and the Sudan score highly on this value but are also joined by more food-secure states like Israel, Singapore, and Syria. This effect does not show up for arms exporting, reinforcing the argument that the key question is arms production for internal repressive use. Because the interaction between economic growth and starting-point development level remains insignificant and does not alter these findings, we do not show it in this equation. These repressive arms producers seem to also be the more developed of the LDCs, where economic growth was beneficial. Findings of the analysis of protein supply were again identical.

Finally, we examine the interactive effects of general war, which combines the presence of civil and interstate wars, and the intensity of military rule. Military rule per se is not significant and war is beneficial but, when these are combined, food supply is lowered (equation 7). International war often mobilizes the population socially and politically and may thus improve food supply but the interaction is negative, suggesting that military regimes are less able to mobilize these sentiments. Notable cases such as in Afghanistan, Cambodia, Chad, and Peru fit this pattern of detrimental military rule combined with interstate war. In simpler equations, neither military rule nor war are significant, indicating that this is a special effect of the combination.

Overall, these results support both sides of the traditional debate over military power. There is a negative spending burden on the economy stemming from arms imports and related military spending. Unstable and repressive militaries and military regimes engaged in interstate wars do impose costs on food supply. At the same time, military participation, arms production, and arms exporting do boost food supply, as do arms producers involved in repressing internal enemies. These effects operate largely independently of positive benefits from economic growth and the level of development, adding roughly 15% to the explained variance in these equations. In a highly conservative lagged panel design, this is a respectable increment. The impact on protein supply was identical, except that military spending did not reduce protein supply, and there is no benefit from economic growth.

We next turn to analyzing child hunger rates. We begin by controlling for the change in caloric supply over the same period. This strengthens our confidence that we are tapping the hunger problem and allows us to evaluate the entitlement theory thesis (Sen, 1981; Drèze and Sen, 1989) that hunger is not due to food scarcity per se but to the internal distribution of food. Table 5 examines the change in healthy-weight children, beginning first with the lagged control for 1970 and the 1970–1990 first-difference change in caloric supply (equation 1). We score this so that positive signs indicate an improvement in child hunger rates (i.e., a reduction in hunger). LDCs with increased food supply did experience greater progress in child hunger. This militates against a simple version of the entitlement thesis that food supply is irrelevant to levels of hunger. However, equation 2 shows that this benefit is largely due to economic growth. In this equation, caloric change loses significance and only the starting-point development level and the interaction of growth with development level are significant. We also introduced growth and development level separately but they were never significant and did not influence the effects of change in food supply. Thus, a trickle down from economic growth to disadvantaged groups exists but is limited to the more developed of the LDCs. At the same time, growth in the poorer countries, such as Ethiopia and India, does not trickle down. This suggests that these poorer countries have strongly entrenched social inequalities and barriers that prevent economic growth and increased food supply from reducing child hunger. Controls for the change in protein in place of food supply produced identical effects. Because food supply is never significant in the remaining equations and its inclusion does not alter any of the other effects discussed below, we drop it from the rest of the equations.

Paralleling our findings for food supply, increased military spending relative to GNP contributes to hunger, whereas military participation reduces it (equation 3).[16] As with the food supply models, there is no support for the budget

[16] We once again test the interactions of military participation with development level and economic growth, finding these to be insignificant as in the food supply equations. Furthermore, unlike the interaction between economic growth and development level, the term is in the negative direction, indicating that if significant, the benefits of military participation on child hunger rates would more likely occur in poor countries with less economic growth.

TABLE 5. Lagged Panel Analysis (OLS) of Military Power on Child Hunger, 1975–1990

Variable	*Eq. 1* *b* *(t-value)*	*Eq. 2* *b* *(t-value)*	*Eq. 3* *b* *(t-value)*	*Eq. 4* *b* *(t-value)*	*Eq. 5* *b* *(t-value)*	*Eq. 6* *b* *(t-value)*
Percentage of Children of Healthy Weight, 1975	.78****	.72****	.69****	.67****	.67****	.67****
	(15.87)	(13.49)	(13.11)	(12.85)	(8.14)	(8.09)
Change in Caloric Supply, 1970–1990	.005	.003				
	(2.42)	(1.49)				
Development Level, 1975		.003***	.004****	.003***	.003****	.004****
		(2.82)	(3.55)	(3.13)	(3.46)	(3.57)
Economic Growth, 1975–1990		.02	.03	.05	.03	.02
		(.68)	(.98)	(1.46)	(1.02)	(.64)
Development × Economic Growth		.001**	.001**	.001*	.001**	.001**
		(2.24)	(2.30)	(1.92)	(2.19)	(2.35)
Change in Military Participation			.15**	.17**	.17***	.19***
			(2.22)	(2.52)	(2.75)	(3.09)
Change in Military Spending/GNP			−38.34**	−35.84**	−36.17**	−39.50***
			(−2.28)	(−2.18)	(−2.33)	(−2.62)
Presence of Internal War				−3.54**	−1.32	
				(−2.14)	(−.76)	
Presence of Geno-/Politicide					−4.76***	−6.02****
					(−2.95)	(−4.15)
Military Instability						1.04
						(1.55)
Intensity of Ethnic Political Discrimination						11.81
						(1.63)
Military Instability × Ethnic Discrimination						−9.45***
						(−2.68)
Constant	20.01	23.17	24.74	27.46	28.84	27.72
F-value	133.12	59.54	52.27	47.81	47.71	41.65
(*F*-prob.)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)	(.0001)
Adjusted R^2	.78	.80	.81	.82	.83	.85
Number of cases	75	75	75	75	75	75

*significant at $p = .10$, two-tailed.
**significant at $p = .05$, two-tailed.
***significant at $p = .01$, two-tailed.
****significant at $p = .001$ or higher, two-tailed.

trade-off thesis, indicating that the problem with military spending has to do with diverting economic resources from beneficial development at the societal level. There is also a trickle down from economic growth, but this is confined to the more developed countries, as before.[17] Adding the change in food supply (both caloric and protein) does not alter these results and they remain insignificant, indicating that any benefits from increased food supply are wrapped up with the trickle down from economic growth that is confined to the more developed among the LDCs.

Next we turn to the question of militarism. In equation 4, internal wars create hunger and, in equation 5, geno-/politicides wash out this internal war effect, indicating that the major problem is severe internal repression. The military spending burden and the benefits of military participation persist with strengthened *t*-tests, indicating that these are separate. Equation 6 looks at a potential root cause of geno-/politicides—ethnic political discrimination—and combines it with unreliable militaries. This interaction reduces child hunger and increases the *t*-tests for geno-/politicides and internal wars, indicating that these are distinct sources of hunger problems. Thus, countries such as Afghanistan, the Democratic Republic of Congo, and Sierra Leone that exhibit this combination of intense ethnic discrimination and military instability are particularly prone to child hunger problems. Together, these support the military famine thesis that food distribution problems are due to severe internal repression, internal war, and underlying ethnic discrimination in countries with unstable militaries.

This analysis does not, however, support arguments that militarism constitutes an integrated complex rooted in military rule or resources. The militarization effects are quite distinct from the militarism effects. We also tested for military rule and all theoretically meaningful interactions of military rule with repression and the increase in military resources, but none of these was significant in either simple or more complex equations. As we pointed out above in the discussion of military power, military rule is only modestly correlated with general war and geno-/politicide. Armed conflicts do contribute to increased child hunger, but military regimes do not appear to be the controlling agents behind these conflicts.

Overall, these results show that militarization is both positive and negative with regard to child hunger, whereas militarism is again negative. Increased military spending is a societal burden in that it increases hunger by diverting economic resources from more beneficial endeavors. At the same time, increased military participation reduces hunger. These results parallel those for food supply, with the major difference being the greater relevance of internal repression directed at ethnic minorities primarily in the form of geno-/politicide and the combination of unstable militaries with the presence of ethnic discrimination.

We also find a modest trickle down from economic growth and increased food supply. This benefit, however, is largely confined among the more developed of the LDCs. Thus economic growth does help those at greatest risk where there is greater social infrastructure and social integration. For the poorer countries, however, growth itself is not a panacea. Thus the Drèze and Sen (1989) argument about famine in the midst of adequate supply needs to be qualified as being most relevant to the poorer LDCs. Increased food supply does reduce hunger, but only because it is linked to the successful economic growth occurring among the more developed of the LDCs. This supports arguments about growing international inequality leading to hunger and famine in the poorest countries.

[17] To confirm that the spending burden and military participation are indeed separate effects, we again used two-staged least squares. We residualize change in healthy-weight children against military participation and then regress the spending burden on the residual. We also check the change in healthy-weight children against the spending burden and regress military participation on its residual. Once again an increased spending burden was negative and significant ($b = -20.565$, $t = -1.702$), whereas military participation was positive ($b = .081$, $t = 1.668$).

Conclusions

Three problems have limited past research on the social impact of military power. First, the focus has largely been on economic growth, which does have some beneficial effects on food security, but this is largely confined to the more developed among the LDCs. Many of the poorer LDCs have experienced negative growth, and what growth has occurred has had little impact on food security in these countries. As de Soysa and Gleditsch (1999) argue, the population in many of the poorer LDCs is confronting a subsistence crisis, which has given rise to banditry, support for guerrilla movements, ethnic war, and state collapse. In this context, militarized conflicts have further undercut the food security of the population. Thus analyses need to be extended to the more central question of whether military power is improving or undermining social welfare and such fundamentals as food security. We have focused on food security because it is arguably the most fundamental of human needs and is thus central to understanding the well-being of the least advantaged groups and the poorest LDCs.

Second, there has been an overreliance on static cross-sectional models. Several aspects of militarization are best considered as structural features of countries but others, such as the spending burden or military participation, are best considered as processes. Treating these as change scores also strengthens our ability to make causal inferences about the processes at work (Finkel, 1995). We use a lagged panel design because it is less vulnerable to heteroskedasticity and specification bias. However, we obtained similar results from a simple cross-sectional design, indicating that the errors in these data and equations are not that great. This supports the results of past cross-sectional analyses.

Third, there has also been an overreliance on military spending power and the assumption that militarization (or militarism) constitutes a single unified process. As we have seen, military power is made up of a variety of distinct factors. Military spending and arms imports do undermine food security, but increased military participation and arms production/exporting are beneficial. The use of military force against internal enemies, especially ethnic minorities, creates hunger. Moreover, there are few strong relationships between military resources, praetorian rule, and the use of military force. Thus, instead of assuming that military power is a single unified factor that is detrimental (or beneficial), it would seem better to specify different aspects of military power. In this, we build on the earlier work (Weede, 1983, 1986; Kick and Sharda, 1986; Dixon and Moon, 1986; Bullock and Firebaugh, 1990; Kick et al., 1990; Kick et al., 1997) showing that military spending is detrimental but military participation socially beneficial. We expand this by analyzing arms imports, arms production and exporting, military instability, and the use of military force against domestic and external political enemies. Although spending and military participation are central to any assessment of military power, any comprehensive assessment needs to include these other aspects. Moreover, it needs to recognize that military resources and regimes are not the major architects of armed conflicts. Although we have not examined the specifics of these conflicts in terms of how they emerged or the actors involved, it is clear that more is involved than the simple growth of military resources and praetorianism.

A key finding has been support for the idea that military force contributes to food scarcity and hunger. Thus critics of unconditional humanitarian disaster assistance (Macrae and Zwi, 1994; Prendergast, 1996; Uvin, 1998) are supported insofar as internal wars, state repression, ethnic discrimination and geno-/politicides disrupt food supply and create hunger. We have not examined the impact of food assistance or the policies that regulate access. Hence we cannot evaluate the full argument about military famines or the extent to which food aid has been diverted to create protracted internal wars and collapsed states. But our

evidence does show quite clearly that armed conflict, especially repression targeted at minority groups and political enemies of the state, creates hunger.

Both sides in the traditional debate over military power receive support. Growing military spending and arms imports are detrimental. At the same time, growing military participation creates human capital and social integration and improves food security. The question is what activities are purchased with military spending. If it is arms and weaponry, spending undermines food security. If it is boosting troop strength, providing more training, then it is beneficial. In general, the military power factors that improve food supply also reduce hunger. Armed conflict and repression do have greater impact on hunger, but there is considerable consistency between the two food security outcomes.

This analysis undermines several popular theories. The spending burden thesis is often advanced as a government budget trade-off, with political elites deciding to invest in either "guns" or "butter." At least for food security, this does not appear to be the case. Instead, the spending burden is centered on increases in military spending relative to the total economy. In other words, the spending burden is a long-term investment of human, technological, and economic resources. At the same time, spending tied to increased military personnel works to boost food security, indicating that the burden is centered in arms purchases and material supplies.

The question of military rule is more complex. Both modernization (Huntington, 1968; Janowitz, 1977) and more critical perspectives (Cardoso and Faletto, 1979; Wolpin, 1983) have argued that praetorian rule encourages repression and internal instability and reduces social well-being. The proponents of the military famine thesis (Cheatham, 1994; Macrae and Zwi, 1994; Prendergast, 1996; Messer et al., 1998) likewise argue that military rule is central to recent famines and the use of food as weapon in numerous armed conflicts. We did not find support for the direct harm of military regimes. At most, military rule during wartime reduces food supply, but it does not seem to have the broad negative impact often ascribed to it. At the same time, military rule is tied to general wars and geno-/politicides. In this sense, it may indirectly facilitate reductions in food security. Further research is needed to assess different types of military regimes that may differ in their social welfare impact. Such research, especially at the case level, can contribute to a more thorough understanding of the relationship between military rule and food security than we are able to establish here. For example, some argue that large-scale war makes ruling elites more dependent on their troops and thus forces them to engage in political bargaining and concessions (Downing, 1992; Tilly, 1992). At least in terms of food security, this "war benefit" appears to hold only for civilian regimes. Military rulers seem less vulnerable to this pressure, which may explain the disadvantage of war-bound military regimes.

More significant are military instability and internal repression, which create both food scarcity and hunger. This supports the various analysts who contend that military coups and the political repression of internal enemies are disruptive of social development. Praetorian rule per se does not appear to be primarily responsible for these problems but the social harm from coups and repression are quite evident.

The military famine perspective (Cheatham, 1994; Macrae and Zwi, 1994; Prendergast, 1996; Messer et al., 1998; de Soysa and Gleditsch, 1999) provides a provocative insight about the origins of contemporary hunger and famine. War, repression, and geno-/politicide along with arms buildups and military instability create great food security problems, especially when considering the distributional component of child hunger. In this regard, claims that civil unrest has exacerbating food security consequences that outlive the duration of actual conflict itself is supported. Thus, one should not be surprised that countries such as Afghanistan, Angola, Cambodia, Chad, Ethiopia, Mozambique, Somalia, Sri Lanka,

and the Sudan, which have experienced protracted civil wars and state collapses, are among the countries experiencing the worst food security problems. Many of these countries confront a subsistence crisis in which normal mechanisms for security of adequate nutrition have been disrupted by war, geno-/politicide, and military repression. Peace-building is thus a precondition for restoring viable economies, much less creating economic growth.

Our results also speak to general development theory and theories of famine. Neoclassical economics and modernization theory argue that economic growth trickles down to improve social welfare. We found that economic growth among the more developed of the LDCs does improve both food supply and reduce hunger. Moreover, we found that improved food supply does reduce hunger, thus putting into doubt a strong version of the entitlement thesis that famine is unaffected by food supply (Sen, 1981; Drèze and Sen, 1989). At the same time, this beneficial economic growth and the related improvement in food supply are largely confined to the more developed among the LDCs. Growth and its benefits have largely bypassed the poorer LDCs, leaving them without access to aggregate food supply and displaying persistent hunger. This points to growing global inequality and the emergence of a "Fourth World." Future research should examine what factors might benefit this Fourth World by focused case comparison and policy assessment.

Food security should be at the center of ongoing discussions about social welfare in LDCs. Although distinct from the PQLI (Morris, 1979) and the Human Development Index (UNDP, 1990), which have received far more attention, food security is among the most fundamental of human needs and, as such, should be viewed as a basic human right (Committee on World Food Security, 1996; Kutzner, 1991; Brandt, 1986). Without adequate food, populations are at risk of debilitating disease and are severely hindered in maintaining elementary economic activity. As Sen (1981, 1995) and others (Drèze and Sen, 1989; Drèze et al., 1995) have argued, people do not suddenly perish in famines. Rather, persistent food insecurity gradually erodes their physical well-being, leaving them vulnerable to disease and unable to lead active lives. In the abstract, the food problem is not simply a supply problem. There is sufficient global supply to meet all human needs. Instead the problem is one of distribution, both at the aggregate country level and internal to specific countries. Discussions of food security should thus focus on distribution as well as supply and treat food as a critical index of social welfare.

In addition, the problems of distribution and supply of food are important for their continued links to the potential for future conflicts. Food security has been the source of social unrest in the past (Walton and Ragin, 1990; Walton and Seddon, 1994) and coupled with environmental scarcity has the potential for creating a subsistence crisis that may be explosive in the future (Homer-Dixon, 1995, 1999; Homer-Dixon and Blitt, 1998; Lappé et al., 1998). In this regard, not only does conflict exacerbate food security in the form of increased hunger, this could result in further conflict that reinforces and intensifies food security problems, thus creating a circular pattern that could prove difficult to reverse (Messer et al., 1998). Thus, because poverty and associated food insecurity are most likely to befall rural populations in LDCs, strengthening the agricultural sector is beneficial not only for the marketing spin-offs discussed by Bongaarts (1996) but equally importantly for the peace and prosperity outcomes presented by de Soysa and Gleditsch (1999), who contrast the relative development success of India with the many failures in sub-Saharan Africa. Trickle down from growth must therefore spread to outlying sectors in the poorer of the LDCs for agricultural policies aimed at improving distribution to be successful.

Finally, although militarization is rarely discussed as a tool of development policy, it does have important implications. The mobilization of personnel and their training in the military may create greater social integration and mobility—as

well as creating human capital and social discipline—and thus contribute to social welfare. Arms production also boosts food supply. At the same time, there are major social costs imposed by arms purchases and growing spending burdens. Thus policymakers need to be wary of the claim that military spending will stimulate development and ask what types of military spending are involved. They should also adopt measures to institutionalize the military by promoting professionalization and barring military involvement in domestic policing and political control.

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