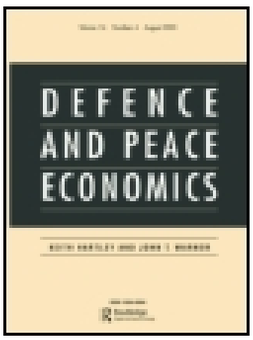

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MILITARY EXPENDITURES AND INEQUALITY: EMPIRICAL EVIDENCE FROM GLOBAL DATA

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A substantial body of literature has uncovered a robust relationship between institutions including unionization and political democracy and economic inequality. This paper examines the effect of military spending on inequality, controlling for the size of the armed forces, GDP growth, per capita income, and other possible determinants. Using a panel regression with country level observations from 1987–1997, we obtained consistent estimates that there is a positive effect of military expenditure on pay inequality. This relationship is robust across variable definitions and model specifications. Given the close relationship between pay and income, this result suggests that a country's increases in military spending could increase income inequality.

Keywords: Military spending; Inequality

JEL CODES: H56, D30

INTRODUCTION

A substantial body of literature has uncovered relationships between inequality and economic and political institutions. Gradstein *et al*. (2001) showed that democratization can reduce inequality. More generally, affluence has been correlated with the presence of democratic institutions[1] by Lipset *et al*. (1993) and Diamond (1992). Rodrik (1999) strongly suggested that democratic institutions are associated with higher wages; institutions do matter to distributive outcomes. Dinardo *et al*. (1996) have shown that de-unionization is an important factor in explaining the rise in wage inequality from 1979 to 1988. Differences in labor market institutions, mainly the relative decentralization of the wage-setting mechanism, provide a widely accepted explanation of wage inequality in the US as compared with other OECD countries (Blau & Kahn, 1996).

Although much work has been done on the relationship between military spending and economic growth, we are not aware of any research that addresses inequality and military spending. A watershed study by Knight *et al*. (1996) extended a standard growth model and

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[1] The term 'institution' has different meanings. For example, in economics and sociology it often denotes the incorporation of values or norms into conventional patterns of social behavior that are sanctioned and enforced by formal and informal authority. It may also be used in broader sense to denote a complex social, political and economic system that incorporates values and discharges services to the community (Esman, 1964). This commonly accepted use of the term institution is a point of departure in our inquiry into using the military expenditure and size of the armed forces variables as institutional parameters.

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obtained consistent panel data estimates of the growth- retarding effects of military spending via its adverse impact on capital formation and resource allocation. This paper emulates Knight *et al*.'s purpose and approach. However, we treat economic growth as a control variable rather than a dependent variable, and emphasize instead the relationship between military spending and inequality.

The purpose of this paper is to examine two important questions. First, to what extent does military spending affect inequality? Second, what are the factors that tend to influence or determine levels of military expenditure? Our approach to this issue is fairly novel, and our hypotheses are generally *ad hoc* rather than derived explicitly from an economic model. Our study is confined to period 1987–1997, a time frame spanning the end of the Cold War. It would be useful to build a data set covering a longer time period that would permit a clear differentiation between the Cold War and after. But this must remain a project for future research.

The mechanism that relates defense spending to inequality is straightforward.[2] Labor in defense and defense-related industries is relatively well-paid; as military spending rises, the industry rents paid to this inelastically supplied part of the workforce will rise and the inter-industry dispersion in wages will increase. Conversely, as defense and defense-related workers enjoy higher wages to begin with, a reduction in defense spending should lower their relative wages and reduce the inequality measures. The assumption that defense and defense-related industry workers enjoy high wages can be justified with efficiency wage theory or equality through the theory of industry specific labor rents. Therefore, we note that the inequality and the military expenditure variables are both endogenous. The causation between them may run both ways – from military expenditure to inequality and from inequality to military expenditure. Consequently, Ordinary Least Squares (OLS) estimates of the effect of military expenditure on inequality are likely to understate the magnitude of the effect. Our objective, therefore, is to obtain estimates of the effect of military expenditure on inequality that are unaffected by a simultaneity bias.

The paper is organized as follows. The next section describes the data on inequality and the key variables such as military spending, armed forces and other control variables: GDP growth, per capita real income, and size of imports. The third section presents empirical methodology for the model specification. The fourth section presents panel regression estimates of the effects of military spending on inequality, using a two-stage least squares regression. The fifth section presents a sensitivity analysis to examine the robustness of the effect of military spending inequality. The sixth section discusses findings and draws some conclusions.

INEQUALITY, MILITARY ACTIVITY AND OTHER KEY VARIABLES

This section describes the key variables: (1) inequality measures and trends; (2) indicators of military activities; and (3) economic and conflict variables.

Inequality Measures

As Galbraith and Conceição (2001) have shown, the partition of pay data based on the International Standard Industrial classification (ISIC) is a useful way to compute between-group Theil's T statistics and to construct from them long and dense measures of industrial

[2] I would like to thank John Warner for the explanation relating military spending to inequality without appealing to a 'guns or butter' argument.

pay inequality. Theil's T statistic is part of the family of generalized entropy inequality measures and enjoys the attractive property that it can be decomposed exactly into within-groups and between-groups' components. The differences in wages between industries reflect on the level of inequality. The between-groups components are easily computed from basic information on group – in these case industries within countries – employment share and average relative income. The between-groups component of Theil's T has the following formula:

$$Theil = \sum_{i=1}^{n} \frac{y_i}{y} \log \left(\frac{\frac{y_i}{y}}{\frac{N_i}{N}} \right)$$

where n is the number of industry groups in the sample, y_i is the earnings in industry i (i=1,2,….,n) and y = total wage earnings. N and N_i represent total employment and employment of industry i, respectively. For a detailed discussion on the properties of Theil's T, one may refer to Theil (1967) and Galbraith (1998). Comprehensive data on industrial pay inequality worldwide are available from the University of Texas Inequality Project (UTIP),[3] with measures computed for 160 countries over the period 1987–1997.

Theil statistics are more consistent across time and countries than Deininger and Squire's data. It is worthy of note that Theil statistics do not measure household income inequality; rather, they measure the dispersion of pay across industrial categories in the manufacturing sector. However, Ali (2004) presents a positive relationship between Estimated Household Income Inequality (EHII) data and military spending. EHII data are a combination of industrial pay inequality data and the Deininger and Squire data-Gini coefficient, which is widely used as a measure of household income inequality, accounting for a sample design and adjustment to missing data (Galbraith and Kum, 2004). Galbraith and Kum have taken a significant step toward understanding the correlation between manufacturing pay inequality and survey-based measures of household income inequality, and have shown that the correlation, particularly in comparison across countries, is not clear. Regardless of type of inequality data – industrial pay inequality or Gini data – our model results will not depart significantly from our stated hypotheses.

In the sample used in this paper, there is generally an increase of inequality in most countries. Table I shows a selected group of countries from different regions of the world. Countries in South America, Central America, Western Europe, South America, North Africa and the Middle East demonstrate cyclical patterns of inequality movements. For example, during the 1980s, the United States witnessed a sharp rise in inequality followed by a sharp decline in the early 1990s. By the late 1990s, inequality had risen again. These patterns are clearly reflected in Table II. In East Asia, Malaysia experienced falling inequality in the1990s, whereas Taiwan and South Korea show cyclical patterns.

Table II reports the average values of Theil's T, military expenditure and size of armed forces. Military expenditures in column 3 show that the United States, the United Kingdom, and Bahrain have the highest per capita military spending compared to the rest of the world. However, when military spending is normalized as a percentage of GNP, Bahrain and Syria move to the top while the United States and the United Kingdom drop to the middle of the

[3] For the most recent data on the Theil index, refer to the UTIP website at http://utip.gov.utexas.edu.

TABLE I Theil Values Corresponding to Country Selected Years

Country	*1987*	*1992*	*1997*
Sub-Saharan Africa			
Kenya	0.083	0.077	0.048
Tanzania	0.098	0.095	0.141
Republic of Congo	0.137	0.159	0.188
Zimbabwe	0.036	0.183	0.077
Central America			
Guatemala	0.082	0.25	0.104
Haiti	0.034	0.047	0.088
Panama	0.065	0.096	0.1
East Asia			
South Korea	0.023	0.02	
Malaysia	0.046	0.028	0.028
Philippines	0.068	0.076	0.079
Taiwan	0.011	0.018	0.014
OECD			
Austria	0.018	0.015	0.022
Greece	0.026	0.037	0.058
Ireland	0.027	0.027	0.055
Italy	0.016	0.017	0.021
UK	0.017	0.017	0.016
US	0.027	0.026	0.038
South America			
Bolivia	0.072	0.101	0.083
Chile	0.093	0.065	0.07
Colombia	0.039	0.05	0.043
Ecuador	0.041	0.066	0.09
Venezuela	0.045	0.065	0.12
Middle East			
Algeria	0.007	0.001	0.015
Bahrain	0.298	0.042	0.045
Egypt	0.054	0.074	0.084
Iran	0.011	0.038	0.039
Syria	0.008	0.008	0.009

Source: UTIP

pack. In addition, Syria ranks first, followed by Greece, South Korea and Bahrain in size of per capita armed forces.

Indicators of Military Activities

The United States Department of State's Bureau of Verification and Compliance (BVC) (1998) reports that world military expenditures in the decade from 1987 to 1997 were an average of $237 dollars per capita. By comparison, some countries in Africa have a per capita income of $250 dollars or less. Military expenditures in poor countries are often high relative to their average income. Collier and Hoeffler (2004), for example, found that during a long period of military government in Nigeria, the navy accumulated more admirals than it had

TABLE II Theil Per Capita Military Expenditure as Averages and Percentage of GNP for Selected Countries

		(1987 - 1997) Averages		
Country	*Theil*	*MILEN*	*MILEN/GNP*	*Armed forces per 1000 people*
Sub-Saharan Africa				
Kenya	0.069	8.72	2.51	0.86
Tanzania	0.119	6.12	1.96	1.65
Republic of Congo	0.158	6.11	3.97	4.86
Zimbabwe	0.065	29.41	4.13	4.36
Central America				
Guatemala	0.173	18.9	1.36	3.97
Haiti	0.052	10.72	1.74	0.85
Panama	0.086	40.02	1.56	4.76
East Asia				
South Korea	0.072	236.04	3.75	15.8
Malaysia	0.034	83.99	3.04	6.54
Philippines	0.078	24.5	1.91	1.63
Taiwan	0.015	446.17	4.94	19.45
OECD				
Austria	0.017	237.97	1.01	6.31
Greece	0.039	490.64	4.59	19.96
Ireland	0.036	178	1.39	4.09
Italy	0.018	392.37	2.12	8.12
UK	0.017	802.87	3.7	4.85
US	0.028	1210.93	4.65	7.6
South America				
Bolivia	0.084	24.83	2.72	4.42
Chile	0.071	134.9	3.46	7.37
Colombia	0.037	10.04	3.76	3.5
Ecuador	0.064	47.67	3.21	4.96
Venezuela	0.069	83.73	2.2	3.68
Middle East				
Algeria	0.028	45.22	2.82	4.87
Bahrain	0.217	730.63	8.65	13.24
Egypt	0.052	42.88	4.3	7.46
Iran	0.022	103.25	4.76	8.97
Syria	0.049	379.72	9.15	28.03

Source: Bureau of Verification and Compliance (1998) and UTIP

ships. In addition, pressure from interest groups can sway policymakers to extract greater shares from government budgets for military purposes. Tanzi (1998) estimated that bribes account, on average, for as much as 15% of the total spending on weapon acquisition. Electoral competition in campaign financing may also tend to increase public spending on the military and arms trade (Pieth, 1999).

To understand the impact of military expenditures on economic inequality, we will introduce the two most important indicators of military institutions: per capita military spending and the size of the armed forces.

Per Capita Military Spending

Data on per capita military spending are provided by the BVC. Since most of the literature relies on data from the Stockholm International Peace Research Institute (SIPRI), we also provide a second analysis using SIPRI data. Table III shows that in most regions of the world, military expenditure declined after the end of the Cold War. In North America, military expenditure declined from 4.1% of GNP in 1993 to 3.1% in 1997. In Western Europe, military expenditure fell from 2.5% of GNP in 1993 to 2.1% in 1997. However, East Asia shows no change in military expenditure, which remains at 1.9% of GNP between 1993 and 1997. South America and North Africa show increases in military expenditure in 1997 from 1.9 to 2.7% and from 3.8 to 4.1% of GNP, respectively. In our thesis, as military expenditure increases, inequality also increases.

The Size of Armed Forces

The military remains a major employer and provider of jobs, and this function also has an economic impact. We introduce the size of armed forces independently to capture the full impact of military activity on inequality. Why not treat the armed forces as an endogenous variable? A country can retain large standing forces as a result of conscription. Conscripts cannot voluntarily withdraw their services, and when the government allocates military spending, the size of the armed forces may therefore be taken as predetermined. In addition, military doctrines define the force structure and size of the armed forces to meet any future requirements. Some countries in our sample use conscription, such as Turkey, Egypt and Syria, all of which have high unemployment and also depend heavily on conscripts to build their armed forces. By holding military spending constant, any increases in the size of the armed forces will tend to reduce inequality. In other words, our hypothesis is that as the size of the armed forces increases, inequality decreases due to supply-side pressure on the

TABLE III World Military Expenditure and Armed Forces

	Military expenditure as percent of GNP			*Armed forces per 1000 people soldiers*		
	1987	*1993*	*1997*	*1987*	*1993*	*1997*
World	5.2	3.1	2.6	5.7	4.4	3.8
Developed	5.3	3.2	2.5	4.3	3.6	3.2
Developing Region	4.9	2.9	2.7	4.3	3.6	3.2
North America	5.6	4.1	3.1	7.2	5.5	4.7
Western Europe	3.2	2.5	2.1	9.5	2.3	6.7
East Asia	2.3	1.9	1.9	4.7	4.2	3.6
Eastern Europe	11.9	5	4	13.4	9.3	8.2
Middle East	15.7	9	7.6	15.7	12.1	11.1
South America	1.9	1.7	2.7	4.3	2.9	2.8
South Asia	4	3.2	3.1	1.8	1.8	1.7
Central America	3	1.6	1.5	10.2	6	2.7
Southern Africa	4.7	3.3	2.9	2.9	2.5	1.8
North Africa	5.6	3.8	4.1	8.4	6.6	5.9
Central Africa	2.2	2.4	1.8	2.7	1.9	1.8
Central Asia	–	2.7	2.4	–	2.7	4.1
Europe, all	6.4	3	2.4	11.5	8.2	7.4
Africa, all	1.9	3.1	2.7	2.8	2.6	2.2

Source: Bureau of Verification and Compliance (1998)

low-skilled labor market. In the aggregate, Table III shows that the size of the armed forces is on the decline in most regions of the world, except for Central Asia and Western Europe.

The Economic and Conflict Variables

GDP Growth and Per Capita Income

It is conventional in inequality models to incorporate GDP growth (GDPG) and per capita income (RGDP1) into the analysis of income distribution. The theoretical argument is based on the Kuznets' hypothesis and a voluminous literature on inequality (Galbraith, 1998; Loury, 1981; Champernowne, 1953). Even though we are not testing the Kuznets' hypothesis, in general, we anticipate that as per capita income increases, inequality will fall. Thus, most countries are on a downward sloping portion of the Kuznets' curve. The literature gives a mixed view of the relationship between the economic growth rate and inequality; our view is simply that during times of economic boom, jobs are plentiful and pay inequalities tend to decline as employers compete for labor and offer efficiency wages. Data on income level and GDP growth are obtained from the Penn World Tables (1998).

Imports

Researchers have argued that international trade accounts for about a fifth of the rise in inequality experienced by the United States in the last two decades (e.g. Feenstra and Hanson, 1999; Borjas *et al*., 1992; Baldwin and Forslid, 2000). In general, the effects of imported civilian goods on inequality are complex and depend on the trade regime and policies. For example, the policy of import substitution in newly industrialized and as well as developed countries in general is designed to protect some civilian industries and thereby quell the disparity in wages and ease the pressure on inequality. Under this trade regime, we assume that the gains from protection flow into the pocket of the poor. On the other hand, if the proceeds of the trade flow into pockets of the already-rich, we might observe more inequality rather than less inequality. Therefore, the expected overall sign of the imports variable is ambiguous. Data on the volume of imports of civilian goods are obtained after subtracting military goods for all of the imports obtained from BVC (1998).

Conflict Variables

Our study includes 160 countries that are divided into two groups by introducing control variables: known internal security threats (INTSEC) and known external security threats (EXTSEC). INTSEC and EXTSEC correspond to civil and international wars, respectively. The source of the data is the Heidelberg Institute for International Conflict Research (HIIK). HIIK uses qualitative definitions, including the duration of the conflict and the magnitude of death, to define violent conflicts. While many alternative relationships between conflict and inequality are possible in principle, we believe that the predominant effect of conflict is to damage and disrupt the lives of people, complicating their access to basic necessities and thus increasing economic inequality. Peace and reconstruction reverse these conditions, permitting inequality to decline again. In any event, whether there exists a clear relationship between conflict and inequality in either direction is a matter we can test.

MODEL AND EMPIRICAL METHODOLOGY

This section describes the econometric model. We use a panel regression, on country level observations, extending from 1987 to 1997. We initially discuss the determinants of inequality followed by a specification of the demand for military expenditures.

Inequality equation

Our starting point is the following model for pay inequality:

$$THEIL_{i,t} = \beta_1 + \beta_2 MILEN_{i,t} + \beta_3 GDPG_{i,t} + \beta_4 RGDP1_{i,t} + \beta_5 TIMN_{i,t} + \beta_6 ARMF_{i,t} + \beta_7 INTSEC_{i,t} + \beta_8 EXTSEC_{i,t} + \nu_i + \varepsilon_{i,t} \quad (1)$$

$$MILEN_{i,t} = \alpha_1 + \alpha_2 THEIL_{i,t} + \alpha_3 RGDP1_{i,t} + \alpha_4 AITI_{i,t} + \alpha_5 ARMF_{i,t} + \alpha_6 INTSEC_{i,t} + \alpha_7 EXTSEC_{i,t} + \mu_i + \eta_{i,t} \quad (2)$$

For a description of the variables in equation (1), refer to Table IV. Equation (1) regresses inequality (*THEIL*) on explanatory variables: military expenditure (*MILEN*) for BVC and SIPRI data, GDP growth rate (*GDPG*), per capita income (*RGDP*1), the share of imported civilian goods in GNP (*TIMN*), the size of the armed forces (*ARMF*), known internal security threats (*INTSEC*) and known external security threats (*EXTSEC*). is a country-specific factor such as geopolitical, cultural and other attributes. represents a white noise error term.

Compared with other industries, labor in a defense-related industry is more specialized and inelastic in supply; therefore, an increase in demand for defense will increase inequality. If the estimates using a single equation model are biased and inconsistent, then it becomes necessary to estimate the determinants of military spending with instruments that may be used to treat the simultaneity bias. The second equation for the inequality model is the military expenditure equation.

TABLE IV Description of Variables and Data Unit

Variable	*Description*
Theil (Theil Index)	Theil Index
MILEN	Per capita Military Expenditure in (1997 dollars)
EHII	Estimated Household Income Inequality
LGMILEN	Log Per capita Military Expenditure
SIPRI	SIPRI Per Capita Military Spending in dollars
LGSIPRI	Log SIPRI Per Capita Military Spending in dollars
GDPG	GDP Growth Rate
AITI	Arms Imports as % Total Imports
ARMF	Armed Forces per 1000 People
TIMN	Total Imports as % of GNP
*RGDP*1	Real GDP per Capita (1997 price)
*LRGDP*1	Log Real GDP per Capita (1997 price)
INTSEC	Known internal security threats
EXTSEC	Known external security threats

Military Expenditure Equation

Our model defines per capita military expenditure as a function of levels of inequality (*THEIL*), per capita income (*RGDP*1), share of arms imports in total imports (*AITI*), size of the armed forces (*ARMF*) and known security threats (both *INTSEC* and *EXTSEC*). μ represents the country effects, and η represents the error term.

It should be recognized that there is no unique model for estimating the determinants of military expenditure. For a further discussion see Sandler and Hartley (1995). Recent writings on the demand for military expenditure emphasize social choice theory; resources committed for public and private consumption and investment are determined by a benevolent leadership whose objective is to maximize social welfare (Hewitt, 1992; Smith, 1980 and 1995). In addition, a survey of empirical analyses (Dunne, 1996) suggest that military expenditure has at most no effect on growth and is likely to have negative impact. Therefore, disarmament provides an opportunity to improve economic performance.

A study by Deger and Sen (1990) shows some evidence that military spending has been motivated by domestic factors and government priorities. This finding suggests that it is difficult to envisage a cross-national theory of determinants of military expenditure. However, Adams and Ciprut (1994), Hewitt (1991) and Dunne and Perlo-Freeman (2003) present cross-national models of determinants of military spending. A detailed case study by Batchelor *et al*. (2002) shows a simple model of demand for military expenditure as a function of economic, political and strategic variables.

Similarly, in the economic theory of alliances, Sandler and Hartley (1995) develop a well-designed partial equilibrium model in which military expenditure is a function of the level of income, threat and the relative price of defense to non-defense goods. Within this framework, they show that income level is a crucial determinant of military expenditure. Given that many alliances fell apart or changed after the end of the Cold War, we borrow part of the Batchelor, Dunne and Sander, and Hartley models without the alliances variable.

Inequality (THEIL)

Inequality is a source of social tension, fueling demands for social and political change. Sometimes, increased military spending is the response of those in power to maintain social order. In its quest for stability, the establishment expresses its preferences of preserving peace by increasing military spending. Therefore, the level of inequality has an impact on the demand for military spending. In other words, as inequality increases, military spending should be expected to rise.

Per capita income (RGDP1)

Sandler and Hartley (1995) suggest that as income rises, the nation has both more resources to protect and greater means to provide protection. In general, the higher per capita income, the higher military spending; military needs are normal goods. For robust analysis, we would use the log per capita income variable to test the impact of per capita income on inequality.

The Armed Forces (ARMF)

The size of the armed forces is an important determinant of military expenditure. Military doctrine provides guidelines governing the force structure at any given manpower level. Once the government commits to a specific size of armed forces, it maintains spending to meet the requirements of combatant commanders. Military expenditure is, therefore, an endogenous

consequence of force structure, and as the size of armed forces increases, military spending should increase.

Arms imports (AITI)

Although arms imports are a component of military spending, they may be funded off-budget, by credit and by grant aid. This can create a substitution effect so that a government will spend less on the military from its own budget resources than would otherwise be the case. Arms importers also face a foreign exchange constraint and may have less powerful local lobbies than arms producers. In addition, it is cheaper for labor-intensive countries to import arms from capital-rich and industrialized countries than to produce them at home. The notion of comparative advantage on the arms trade is driven by cross-country differences in relative factor endowments. It might, perhaps, be one of the reasons why industrialized countries remain the sole arms exporters. For this reason, we expect that countries that import a larger share of their armaments will spend less overall than countries that produce armaments at home.

Conflict variables (INTSEC and EXTSEC)

Conflict variables categorize countries according to security threats both internal and external, known respectively as INTSEC and EXTSEC; this is done in view of the hypothesis that known security threats matter to the level of military expenditure. Conflict variables are categorical variables; it is not possible to distinguish low-intensity conflict from high-intensity conflict. The consequence of high-intensity conflict is the total destruction of wealth followed by a period of declining military expenditure as the warring parties deplete their war chests. However, in low-intensity conflict the warring parties can boost military spending to contain the threats and keep the balance of power. The sign for the conflict variable is, therefore, ambiguous. Controlling for the level of conflict is important to isolate the impact of other variables on military spending. Yet it is difficult to determine the direction of the military expenditure's movement as threat levels increase.

ESTIMATION RESULTS

Equations (1) and (2) are estimated by using two-stage least squares. We postulate two endogenous variables, *THEIL* and *MILEN*, and several predetermined variables (instruments). The exact identification of the inequality function rises mainly from the inclusion of GDPG and the exclusion of AITI. As equation (2) is overidentified by the exclusion of GDP growth and total imports, we performed an overidentification test to investigate the extent that the excluded variables are correlated with the residuals. Prior to our identification test, we conducted the Hausman test to see if military expenditure and inequality variables are correlated with ε_i. The test shows that the residuals for equation (1) are statistically different from zero. Therefore, we conclude that endogeneity bias is present in this case. In addition, the overidentification test is conducted by generating the residuals from our estimation of equation (2) using OLS and then regressing these residuals on the entire set of exogenous variables in the system. This generated chi-square statistic $\chi^2=R^2\times N$, with a degree of freedom equal to the number of exogenous variables minus the number of explanatory variables. For the overidentification test of equation (2), the chi-square statistic is equal to zero, as shown in the regression in Tables VIII and IX, later, which is not significant at any level.

TABLE V Simple Statistics on Military Expenditure and Pay Inequality

Variable	*N*	*Mean*	*Std. Dev*	*Minimum*	*Maximum*
Theil	1106	0.081	0.096	0.001	0.893
MILEN	1556	239	713.015	0	17800
SIPRI	1279	364	4577	0	16136
EHII	966	37.96	5.4	20.25	52.46
GDPG	1435	3.155	6.462	-41	54
AITI	1708	4.731	22.038	0	604
ARMF	1693	7.17	8.055	0	75
TIMN	1694	0.304	0.224	0	1.838
*RGDP*1	1396	7241	7234.9	276	37511
INTSEC	1725	0.201	0.4	0	1
EXTSEC	1725	0.103	0.305	0	1

Table V presents descriptive statistics for key variables. For example, Kuwait spent $17,800 per capita on military spending during the invasion in 1992. Angola spent $604 per capita military spending in 1987 and Iraq in 1990 reports $75 dollars per capita spending. The partial correlations are shown in Table VI, which indicate that we do not have an extreme multicollinearity problem.

Panel data undoubtedly provides heterogeneous information at the country level while reporting more reliable estimates via large sample property. Missing data on variables used in statistical analysis further reduced the sample to 776. The rise of East European countries in the 1990s, as a result of the break-up of the Soviet Union, as well as the sample size, resulted in a larger number of developing countries with missing data. Both of these have contributed to lowering the sample size. We are treating the missing data as random. The drawback of this procedure, if the assumption is incorrect, is that it could result in a loss of efficiency. Therefore, the cross-section inequality model is used as a vehicle for our analysis of the missing data's impact on our estimates. Our contention of experimenting with the cross-country regression model is that we assume the parameters' homogeneity, meaning that the model is assumed to be country invariant, as discussed by Brock & Durlauf (2001).

We estimate the cross-section on average values for the period from 1987–1997. The results are reported in Table VII, regression 1. The cross-section estimates model shows that *MILEN*,

TABLE VI Correlation Coefficient across Explanatory Variables (the p-value in parenthesis)

	GDPG	*RGDP1*	*ARMF*	*TIMN*	*AITI*	*INTSEC*	*EXTSEC*
MILEN	0.03	–0.02	0.24	0.04	0.04	-0.08	0.11
	(0.15)	(0.40)	(0.00)	(0.11)	(0.06)	(0.00)	(0.00)
GDPG	1.00	–0.00	0.05	0.09	0.01	–0.06	0.02
		(0.76)	(0.02)	(0.00)	(0.57)	(0.01)	(0.29)
RGDP1		1.00	–0.00	0.04	–0.01	0.03	–0.03
			(0.81)	(0.09)	(0.59)	(0.18)	(0.25)
ARMF			1.00	0.00	0.17	–0.07	0.05
				(0.91)	(0.00)	(0.00)	(0.02)
TIMN				1.00	–0.07	–0.15	–0.10
					(0.00)	(0.00)	(0.00)
AITI					1.00	0.08	0.08
						(0.00)	(0.00)
INTSEC						1.00	0.07
							(0.00)
EXTSEC							1.00

TABLE VII 2SLS Estimates: Dependent Variable Theil

Regression	*Cross Section (1)*	*Fixed Effects (2)*	*Fixed Effects (3)*
Variable			
Intercept	0.194 (3.71)a	0.075 (9.53)a	0.074 (4.69)a
MILEN	0.590 (2.05)a	0.200 (3.55)a	— —
SIPRI			0.100 (1.66)c
GDPG	0.003 (0.47)	–0.001 (3.19)a	–0.001 (2.33)a
*RGDP*1	–0.020 (2.97)a	–0.001 (4.08)a	–0.01 (2.02)b
TIMN	–0.082 (1.01)	–0.032 (1.95)c	–0.015 (0.48)
ARMF	–0.007 (2.42)a	–0.001 (2.94)a	–0.001 (1.62)c
INTSEC	–0.024 (0.50)	0.033 (5.09)a	0.028 (2.35)a
EXTSEC	–0.027 (0.33)	0.091 (2.43)a	–0.001 (0.05)
F-statistic	0.16	12.66	3.31
R-squared	0.21	0.64	0.33
Number	115	774	716
Country Effect	no	yes	yes

With t-statistics in parentheses, a, b, c indicate significance at the 1, 5 and 10% level, respectively

*RGDAP*1 and *ARMF* are significant at the 1% level. The coefficient of *GDPG* is shown to be insignificant but have a positive sign, which could be explained by the long-term effect of growth on inequality, because in the short term, the impact of growth on inequality is picked up by the fixed effect. In other words, in the short term growth might have a negative impact on inequality through cyclical effects, but in the long-run the positive impact of growth on inequality might be picked up by the cross-section.[4] In addition, the coefficients of *TIMN*, *INTSEC* and *EXTSEC* are statistically insignificant. Using cross-section data, the coefficient does not significantly change in size; rather, its statistical significance falls with the fall in sample size. We suspect that the aggregation and missing information are responsible for the weak result in regression 1. The missing data are not only likely understating our model results, but also yield a very conservative model estimates.

Table VII shows that the estimates generated from the system of equations in regressions 2 and 3 are robust. In regression (2), the variables *MILEN*, *GDPG*, *RGDP*1, *ARMF*, *INTSEC* and *EXTSEC* are significant at the 1% significance level. The coefficient of imported civilian goods is negative and significant at the 10% level. Similarly, using the SIPRI military expenditure model instead of the BVC military expenditure, Table VII regression 3 SIPRI data show that the coefficients of military expenditure and the armed forces are significant at the 10% level. In addition, the coefficient of GDP growth and real GDP per capita are significant at the 5% level. The coefficient of *INTSEC* threats is significant at the 1% level; however, the coefficient for *EXTSEC* security threats is insignificant.

[4] I would like to thank an anonymous referee for the suggestion.

Overall, the results in Table VII show a positive and significant relationship between military spending and inequality, irrespective of changes in the data sets. As shown in columns 2 and 3, a $100 increase in per capita military spending, increases the Theil index by 2% and by 1% in the BVC and SIPRI data, respectively. The Theil value is small because we used the manufacturing pay data, which does not reflect the size of entire economy, but it works as a good proxy for the direction of inequality movement. In this paper we are more interested on the direction of inequality movement than its precise quantifiable impact.

The percentage of GDP growth, the level of per capita income and the size of the armed forces show evidence of a negative relationship with inequality. If a country satisfies the condition of high income and high growth, then the level of inequality should fall because people are getting plenty of jobs with high pay. Estimates of the INTSEC threats appear to have significant and positive effects on inequality. The EXTSEC threats variable is statistically significant in regression 1 and insignificant in regression 2. Conservatively speaking, the impact of the EXTSEC threats variable is ambiguous. Overall, we find that the inequality model in Table VII, regressions 2 and 3, provides the best fit to the data, with an R-squared at 64 and 33%, respectively.

The Military Expenditures Estimates

The regression results from equation (2) are estimates of the demand for military expenditure. Table VIII presents evidence on the empirical relationship between military expenditure and Theil, level of income, size of arms imports, and conflict variables.

Military Variables

The significance of the coefficients on arms imports and the size of armed forces in columns 2 and 3 of Table VIII support the main hypothesis of the model of determinants for military

TABLE VIII 2SLS Estimates: Dependent Variable Military Expenditure

Regression	*Cross Section MILEN (1)*	*Fixed Effects MILEN (2)*	*Fixed Effects SIPRI (3)*
Variable			
Intercept	–243.82	–121.02	–163.84
	(1.47)	(3.79)a	(1.20)
THEIL	1201.44	1188.73	1791.08
	(1.93)a	(2.30)a	(0.82)
*RGDP*1	0.0308	0.0348	0.032
	(6.85)a	(26.68)a	(5.76)a
AITI	3.23	–3.117	–3.52
	(0.23)	(4.29)a	(11.30)
ARMF	10.87	4.966	6.764
	(1.76)b	(5.53)a	(1.75)c
INTSEC	14.06	–45.442	–63.10
	(0.18)	(2.05)a	(0.66)
EXTSEC	45.06	–63.343	27.17
	(0.34)	(3.28)a	(0.33)
F-statistic	2.03	120.11	7.52
R-squared	0.78	0.94	0.51
Overidentification test Statistic	(0.00)	(0.00)	(0.00)
Number	115	774	779
Country Effect	no	yes	yes

With t-statistics in parentheses a, b, c indicate significance at the 1, 5 and 10% level, respectively

expenditure. There is clear evidence of a positive link between the military variables and military expenditures. The coefficient of the armed forces remains positive and significant at the 5% level across the model. The size of arms imports is negative and found to be at the 5% level of significance. In the cross-sectional model in column 1, the coefficient of arms imports and armed forces are significant at 1 and 5%, respectively.

Economic Variables

The per capita income variable in Table VIII shows that for every dollar increase in income, $0.03 dollars are spent on the military after controlling for the other factors. The model estimates shows that $0.002 is the difference in military spending between the fixed effect model using BVC and SIPRI military expenditure's data. The coefficient for per capita income remains positive and significant at the 1% level of significance across the model in Table VIII.

Inequality Variable

Table VIII shows that the Theil variable has a positive and significant relationship with military expenditure, as shown by columns 1 and 2 using BVC's data, for an increase in the Theil index results in an increase of military expenditure by $12. However, in column 3, the inequality measure is insignificant when we use the SIPRI military expenditure variable. It is difficult to speculate which factors have weakened the Theil. However, we conduct a robustness analysis for model results in columns 2 and 3, using log military expenditure (LGSIPRI) and (LGMILEN) for log SIPRI and log BVC military expenditure data, respectively.

Conflict Variables

Using BVC data, Table VIII, column 2 shows that the coefficients of variables measuring internal and external security threats are negative and significant at the 1% level. However, the cross-sectional data in Table VIII shows that the conflict variable has a positive impact on military spending. Therefore, it is possible that long-run conflicts are explained by the country fixed effect.[5] This negative sign for the coefficient could also stem from our interpretation of this variable or the information it conveys. Our interpretation is that in the short run, whenever an attack occurs, there is physical destruction and disruption of the government's internal functions and ability to coordinate resources. Indeed, for any conflict to achieve its goals, the prerequisites are not only to inflict high and sustainable damage but also to prevent the military from utilizing its human and physical capital. This is what may be shown by our model results. The other interpretation is that the conflict variable is merely another dummy variable that controls further noises in the model, a claim supported by the SIPRI data. As shown in column 3, the conflict variable is insignificant when we used the SIPRI data. Overall, we might conclude that the impact of the conflict variable on military spending is ambiguous.

SENSITIVITY ANALYSIS

To examine the robustness of our regression results, we experimented with a case in which the dependent variable Theil has a different functional form by trying log military expenditure and

[5] I would like to thank an anonymous referee for this helpful suggestion.

per capita income variables to test if the relationship between Theil and military expenditure will hold.

Results in Table IX, columns 1 and 2, show that the BVC and SIPRI military expenditure positively affects Theil. For example, as Theil increases, the military expenditure increases by $7 and $6 for the BVC and SIPRI data, respectively. Higher military spending corresponds to greater inequality within countries. The relationship between GDP growth, size of the armed forces and Theil remains negative, consistent with the findings we obtained when we used Theil inequality in Table VII, columns 2 and 3, without changing the functional form. The results in Table IX show that some regression estimates are improved and become significant by using log military spending and log GDP growth. For example, the internal conflict variable is significant across the model. As shown in columns 1 and 2 of the regression results, all of the estimated coefficients (except for the imports variable) indicate the expected direction of change and are statistically significant at the 5% level. Therefore, columns 1 and 2 show that the inequality model results are not fundamentally different when logs of military expenditure and per capita income are used. With regard to log per capita income (*LRGDP*1), columns 2 and 3 show that the marginal increases in Theil is a decreasing function of per capita income; the t-value illustrates that per capita income is statistically significant. The linear model in equation (1) remains robust to change in the functional form.

TABLE IX 2SLS Estimates: Dependent Variables – Theil and Log Military Expenditure

Regression	*THEIL 2SLS* *(1)*	*THEIL 2SLS* *(2)*	*LGMILEN 2SLS* *(3)*	*LGSIPRI 2SLS* *(4)*
Variable				
Intercept	0.663 (5.02)a	0.575 (4.49)a	–7.743 (22.14)a	–8.185 (17.66)a
THEIL	— —	— —	3.763 (2.02)b	5.657 (2.28)b
LGMILEN	0.072 (4.12)a	— —	— —	— —
LGSIPRI	— —	0.059 (3.61)a	— —	— —
GDPG	–0.001 (3.65)a	–0.001 (3.14)a	— —	— —
*LRGDP*1	–0.108 (4.44)a	–0.091 (3.90)a	1.389 (39.57)a	1.419 (30.48)a
TIMN	0.010 (0.58)	0.003 (0.16)	— —	— —
ARMF	–0.0016 (3.51)a	–0.0016 (3.29)a	0.027 (8.33)a	0.030 (6.80)a
AITI	— —	— —	–0.0118 (4.32)a	–0.0117 (3.30)a
INTSEC	0.041 (5.79)a	0.042 (5.52)a	–0.256 (3.25)a	–0.350 (3.24)a
EXTSEC	0.017 (2.20)a	0.011 (1.43)	–0.149 (2.24)a	–0.095 (1.03)
F-statistic	11.87	10.64	138.6	70.99
R-squared	0.62	0.60	0.95	0.91
Overidentification test statistic	—	—	0.00	0.00
Number	771	780	771	780
Country Effect	yes	yes	yes	yes

With t-statistics in parentheses a, b, c indicate significance at the 1, 5 and 10% level, respectively

Similarly, the feature of the theoretical model is the interplay between military expenditure and inequality. Since military expenditure is central to our thinking, it is of interest to experiment with the log military expenditure. The dependent variable Theil was unchanged, but the military expenditure and per capita income variables appear in non-linear form. In columns 3 and 4, the model shows that the inequality variable Theil is statistically significant at the 5% level. In addition, in columns 3 and 4, the coefficients of GDP growth, size of armed forces, GDP growth and conflict variable are statistically significant. Thus overall, the estimates are not sensitive to the use of log function and the Theil variable was significantly improved with using log SIPRI military expenditure and per capita income.

CONCLUSION

This study has attempted to examine the relationship between military spending and inequality. Our hypothesis is that as per capita military expenditure increases, inequality increases controlling for the imports and known security threats. In addition, the GDP growth and per capita income and employment by the military helps reduce the level of inequality. The sensitivity analysis reveals the model's robustness across the variable definition and model specification. As military expenditure increases, inequality increases. This robust analysis leads us to support the argument that unequal societies spend larger amounts on military spending.

In addition, we developed a simple model of determinants of military spending as a function of economic, institutional and the level of inequality variables. Using BVC data, we obtain estimates that are robust and suggest a causal relation between the level of inequality and military expenditure. However, using SIPRI military expenditure we obtained a mixed result; when the log function versus the linear military expenditure variable is used, the inequality variable was significant. Log-linear functions improve the model results in SIPRI data but BVC data remain robust across functional forms.

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