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Military Participation and Economic Development in LDCs: New Evidence*

Kwabena Gyimah-Brempong
and
Ishmael P. Akaah**

This paper uses data from 31 Less Developed Countries (LDCs) and employs a five equation simultaneous model to investigate the relationship between military participation ratio on the one hand and economic growth and income distribution on the other. We find a weak support for the hypothesis that high military participation ratio is associated with equitable distribution of income. However, we also find that high military participation ratio is associated with slow economic growth. This makes it impossible to use military employment as a long term strategy for income distribution in LDCs.

I. Introduction

Research into the relationship between defense resources and economic development in Less Developed Countries (LDCs) has yielded mixed results. Following Benoit's study that found a positive relationship between defense spending/GDP ratio (defense burden) and economic growth rate, several critics (Deger and Smith (1983), Deger (1985), Faini, Annez and Taylor (1984) and Libovich and Ishaq (1986)) have found a negative relationship between defense burden and economic growth rate. Other researchers (Frederickson and Looney (1983)), have found evidence to support Benoit's results. Still other researchers (Biswas and Ram (1986))

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** Associate Professor, Department of Economics, Wright State University and Marketing Department, Wayne State University, respectively.

mechanized or a nonmechanized armed force and hence the force ratio. As an example, ACDA figures show that the force ratios of OPEC countries — where defense spending grew rapidly because of oil boom — were consistently lower than those of LDCs as a whole during the 1973/83 period even though OPEC's defense burden was about one and a half to two times that of the Developing World as a whole.

Second, since soldiers have to be fed, housed, trained, and equipped, a large armed force translates into a large defense burden. Many researchers (Deger (1985), Deger and Smith (1983), Joerding (1986)) have shown that the defense burden is related to growth rate. This means that even if the force ratio is not directly affected by growth rate, it is affected indirectly through defense burden.

The economic development literature is divided on whether fast growth improves or worsens income distribution. There is a consensus, however, that economic growth makes income redistribution possible. If so, income distribution depends on economic growth rate which in turn influences the force ratio. Therefore income distribution is not independent of other endogenous variables. The literature on income distribution in LDCs also argue that income distribution depends on growth rate as well as the *structure* of growth. Faini, Annez, and Taylor (1984) finds that military burden influences the structure of the economy. Could force ratio be picking up the effects of the excluded structural variables in Weede's distribution equation?

By using a single equation model, Weede (1986) and Weede and Tiefenbach (1981) are not able to account for the interrelationship among these variables. These studies account for the benefits of force ratio but not the cost of acquiring such a force ratio. At best, they estimate the partial rather than the total effects of force ratio on economic growth and income distribution.

Does higher force ratio cause faster economic growth after indirect effects are considered? Does income distribution in LDCs improve with the force ratio after allowance is made for the effects of economic growth and structural change? This paper investigates these two issues using data from a sample of 31 LDCs for the period 1973 to 1983.[2] We estimate a five equation — growth rate, investment, force ratio, defense burden, and

[2] Our sample countries are those used by Weede (1986). However, the time period differs from Weede's time frame. The sample countries are: Argentina, Bangladesh, Bolivia, Brazil, Cameroon, Chile, Colombia, Egypt, Ethiopia, Ghana, India, Indonesia, Ivory Coast, Jamaica, Kenya, Korea, Malawi, Malaysia, Mexico, Nigeria, Pakistan, Peru, Philippines, Senegal, Sri Lanka, Tanzania, Thailand, Tunisia, Turkey, Uruguay and Yugoslavia.

LDCs. Such skills are available to the economy when these soldiers complete their tours of duty. In LDCs, such technical and managerial skills are extremely scarce and constitute an effective growth bottleneck. By augmenting the supply of such skills, increased defense resources help to break this growth bottleneck. However, it is possible that increasing military participation ratio will increase the defense burden. This could decrease national expenditure on education, hence human capital formation in the civilian sector. Moreover, soldiers are recruited from the ranks of the educated people trained by civilian educational institutions. Under such conditions, it is not clear whether increasing the military participation ratio will increase the supply of skilled personnel to the economy. This is an empirical question not treated in this paper for lack of data.

Increased defense participation ratio implies increased defense burden since it requires large amounts of money to maintain a large army. Increased defense burden, all things equal, crowds out investment. For example, Deger (1985) finds that increased defense burden decreases the savings ratio in a sample of LDCs, thus reducing the resources available for investment. It is however possible that increasing defense resources will foster a sense of increased security among a nation's business people, leading them to increase investment. The net effect of these two opposing forces is an empirical question to be investigated below.

The interconnections between participation ratio, defense burden, investment, and economic growth are very complex. These interconnections cannot be captured in a single equation model. Because of the endogeneity of some of the explanatory variables, parameter estimates from single equation models will be biased. The appropriate modeling approach is a simultaneous equation system that accounts for the endogeneity of variables and also sheds some light on the interconnections between the variables. We provide such a model below.

The theoretical foundation of this work is provided by the results of previous research and growth accounting.[3] In light of the arguments above, we start from a production function framework. We assume that output (GDP) is a function of capital, labor, technology, and security:

$$(1)\quad GDP = Y(K,L,S,T)$$

$$\partial GDP/\partial K,\ \partial GDP/\partial L,\ \partial GDP/\partial S,\ \partial GDP/\partial T > 0$$

where GDP = gross domestic product, K = capital stock, L = labor,

[3] See, for example, Deger and Sen (1983), Deger and Smith (1983), and Faini, Annez, and Taylor (1984).

Finally, the force ratio will depend, in part, upon the financial resources available to the military, hence on the defense burden. This implies that the force ratio equation can be written as:

$$(5)\quad f=f(g,\ m,\ Z_f)$$

where Z_f is a vector of other variables that influence the force ratio. All other variables remain as defined above.

The military burden depends on force ratio because once a nation has decided on the size of its military, it has to find the money to train, equip, and maintain the soldiers. Therefore the higher the force ratio, all things equal, the higher will be the defense burden. The defense burden also depends on capital formation. The greater the share of resources devoted to capital formation, the less resources will be available for defense. The defense burden equation therefore is written as:

$$(6)\quad m=m(f,\ k,\ Z_m)$$

where Z_m is a vector of exogenous variables that influence defense burden.

While very little has been written on the relationship between force ratio and income distribution, Weede (1986) and Weede and Tiefenbach (1981) have argued that the income share of the poorest 40 percent of the population (L40) increases with force ratio. There are some reasons to believe that this is a reasonable proposition. First, one can consider the military as a public sector employment program, and like all public sector employment programs, it tends to redistribute income towards the poor. Second, the extended family system in LDCs makes it possible for relative of soldiers to benefit from their kin's employment in the military-food ration, medical benefits, even free military outfits are shared with relatives. Of course, remittances by soldiers to their relatives also tend to redistribute income towards the poor. The income share of the poorest 40 percent of the population is also dependent on the growth rate of the economy. While there is a debate as to whether fast economic growth is associated with equitable income distribution, the consensus in the development literature is that economic growth makes redistribution possible.[6] We therefore specify the L40 equation as a function of economic growth rate, the force ratio, and other exogenous variables.

$$(7)\quad L40=L(f,\ g,\ W_l)$$

6 See, for example, Chenery, et al.

With the exception of few countres, LDCs tend to be open economies whose growth rates tend to depend on revenues from a few export commodities, XGROW is introduced as a variable to account for this phenomenon. The coefficient of XGROW is expected to be positive. Price distortion leads to misallocation of resources, especially capital and labor. In LDCs, this frequently takes the form of establishing political and economic alliances to share in the economic rents created by distortion. This inevitably reduces economic growth. The World Bank (1983), Weede (1986), and Weede and Tiefenbach (1981) find empirical evidence to support this phenomenon. We therefore expect DISTORT to have a negative coefficient in the growth equation.

The *k* equation includes FLOWS in addition to *g, m,* and *f.* FLOWS is intended to measure a nation's ability to obtain capital from external sources. This variable, as well as *g,* is expected to have a positive coefficient, *f* and *m* cannot be signed a priori.

The *f* equation includes WAR, THRT, *m* and *g* as arguments. Nations at war or threatened by external aggression are expected to have higher force ratios than nations not so threatened. We expect WAR and THRT to have positive coefficient. *g* cannot be signed a priori in this equation.

We have included WAR, *g*dp, and THRT as arguments in the *m* equation. Countries that are engaged in a war or are threatened by a neighbor will tend to spend more on defense than nations that do not face such problems. These variables, together with the force ratio, are expected to have positive coefficients. *g*dp and *k* cannot be signed on theoretical grounds.

In addition to *g* and *f,* we have included *g*dp in the L40 equation as a scale variable. If the argument that increased economic growth makes it easier to redistribute income is correct, the coefficient of *g* is expected to be positive. We cannot sign *g*dp and *f* a priori in this equation. Serious price distortion in an economy prevents employment growth, especially those of low skilled labor, hence distortion decreases the income share of the poorest 40 percent of the population. DISTORT is therefore expected to have a negative coefficient.

Not only does income distribution depend on *g*dp and growth rate; it also depends upon the *character* of economic growth. In LDCs, poverty tends to be concentrated more in the agricultural sector. Income growth in the agricultural sector, relative to other sectors, improves income distribution. To take account of this structural effect, we have included a variable AGPRO, defined as the ratio of agriculture's share of GDP to the share of total labor force employed in agriculture. This variable measures the share the use of official exchange rates to convert to a common currency unit. Besides the reliability problem, different countries have different resources available to them. To take account of differences in resource base of countries and differences in the reliability of exchange rates, we have measured the force ratio and all monetary variables as ratios of GDP.

Our data pertains to 31 LDCs between 1973 and 1983. We could have conducted a time series cross-sectional analysis but, because of unreliability of defense data, we decided to take the averages of variables over the eleven-year period. Each data point is therefore an average of the observations over the eleven-year period. In averaging, we lose some information about our data. However, the information we lose is the price we pay for improved reliability.

A second reason for taking the averages for the period is that while we had data for each year for most of the variables, the World Bank data on DISTORT and L40 were averages for the 1970s and early 1980s. This transformation therefore made the data consistent with the World Bank data.

Data for f and m were obtained from *World Military Expenditures and Arms Transfer 1985,* (Washington D.C., US Arms Control and Disarmament Agency (ACDA), August 1985). k is measured as the investment rate (gross investment as a proportion of GDP) and g is the annual growth rate of real GDP between 1970 and 1981.[8] Data on k, AGRO, and g were obtained from *World Development Report* (various years). Data for $g$dp and XGROW were obtained from *World Development Report* (various years), and the Workd Bank's *World Tables,* Third Edition (Johns Hopkins University Press, Baltimore), FLOWS is measured as net inflow of Foreign Capital including aid, private direct investment, and private sector loans as a proportion of GDP. Data for FLOWS were obtained from The International Monetary Fund's (IMF) *International Financial Statistics,* various years (Washington, D.C., IMF).

Distort is a composite measure of price distortion calculated by the World Bank in a background study for the 1983 *World Development Report.* Data for DISTORT and L40 were obtained from Agarwala (1983). Data on WAR and THRT were obtained from *Cross-National Time Series Data Archive,* Center for Social Analysis. State University of New York at Binghampton. Some summary statistics of the data are presented in Table

8 A better measure of capital formation is net investment, but lack of data for depreciation precluded us from using net investment in our estimation. We assume that depreciation is a constant proportion of gross investment.

Table 2

COMPARATIVE STATIC DATA OF DEFENSE RESOURCES OF THE SAMPLE LDC'S*

Year	Defense Exp. (M1982 US$)	GNP (M1982 US$)	Armed Forces (Million)	Defense Burden** (%)	Per Capita Defense Expenditure (1982 US$)	Force Ratio** (per 1000 people)
1973	26,025	918,046	6.055	3.24 (2.80)	17.37	4.88 (4.04)
1977	32,158	1,112,488	6.410	3.36 (2.89)	19.52	6.63 (3.89)
1980	33,783	1,310,846	6.050	3.38 (2.58)	19.14	4.81 (3.43)
1983	37,889	1,256,479	6.490	3.23 (3.02)	20.14	4.91 (3.45)

* Calculated from ACDA, *World Military Expenditures and Arms Transfers, 1985.*
** Unweighted averages. Weighted averages are in parentheses.

sample period. It provides some comparative static statistics for resources devoted to defense by the sample countries during the 1973-83 period. Between 1973 and 1983, total real defense spending in the 31 countries increased by 45.6 percent while total real GNP increased by 37 percent. Per capita defense spending increased by 15.9 percent. The weighted average defense burden increased by 7.8 percent during the period while the unweighted average defense burden increased until 1980 but declined in response to austerity caused by the world wide recession of the early 1980s.

Total number of people under arms increased by 7.2 percent during the period. However, because of faster population growth, the force ratio showed a slight decline, the rate of decline accelerating between 1977 and 1983. Part of the dramatic decline in force ratio after 1977 can be attributed to the ending of wars in some of these countries. Increased defense spending coupled with a reduction in force ratios may be interpreted to mean that these nations opted for smaller but well equipped and better trained defense forces.

IV. Econometric Results

We append stochastic error terms, assumed to be normally distributed

Table 3

COEFFICIENT ESTIMATES OF THREE STAGE LEAST SQUARES REGRESSION

g	=	13.3842 +	0.330*k* +	1.2545*f* –	0.8031*m*
		(1.247)*	(1.369)	(1.339)	(2.386)
		–1.060gdp +	0.0919XGROW–1.0167DISTORT		– 0.049p
		(0.911)	(1.359)	(1.405)	(0.924)
		Hausman statistic = 9.383			
k	=	29.5344 +	0.5843*g* –	0.7209*m* –	35.290FLOWS
		(3.031)	(1.469)	(1.520)	(0.985)
		+ 1.370*f*			
		(0.943)			
		•Hausman statistic = 4.8104			
f	=	–6.9855 +	0.0888*m* –	0.4763WAR	+ 0.1319*g*
		(21.753)	(2.054)	(1.487)	(2.329)
		+ 1.0206THRT			
		(3.010)			
		Hausman statistic = 7.5091			
m	=	28.243 –	0.0944*k*	+ 2.666*f*	+ 1.1411WAR
		(2.965)	(1.524)	(3.279)	(1.830)
		– 1.2997gdp	+ 0.9587THRT		
		(1.172)	(4.143)		
		Hausman statistic = 8.922			
L40	=	58.9092 –	5.7776DISTORT	+ 1.8883*f*	– 3.019gdp
		(3.511)	(2.072)	(1.437)	(2.378)
		– 1.2141g +	4.1227AGPRO		
		(2.546)	(1.882)		

* Absolute value of t statistics in parentheses

However, the negative coefficient we obtain for *m* is the opposite of what Weede finds; it is also different from the positive coefficient obtained by Deger and Smith (1983). We note, however, that Deger and Smith used a different sample, so the difference in results could be due to sample differences. It could also be due to modeling differences. While we estimated four equations, adding investment and force ratio equations to the growth and defense burden equations, they estimated a three-equation model, adding a savings, rather than an investment equation, to the growth and defense burden equations.

$$dg/df = a_2 + a_1 b_3 + a_3 d_2$$

$$dL40/df = e_1 + e_2 a_2$$

Using the estimated coefficients to evaluate these expressions, we find that $dg/df = -0.4351$ while $dL40/df = 0.365$. These figures are significantly different from zero at the 0.05 significance level. While our calculations agree with Weede on the effects of force ratio on income distribution, we disagree with him on the effects that force ratio has on growth rate. While high force ratio tends to redistribute incomes towards the poorest 40 percent of the population, it does so at the expense of slowing economic growth. It is also interesting to note that the force ratio/L40 ''multiplier'' is relatively small compared to Weede's coefficient estimates. The negative effect of force ratio on growth is consistent with the results obtained by Deger and Smith (1983), Deger and Sen (1983), Faini, Annez and Taylor (1984), and Lobovic and Ishaq (1987), even though they all relate growth to the defense burden.[10]

That increased force ratio has a negative total effect on economic growth rate makes intuitive sense. The military drains manpower from the civilian sector. Contrary to the notion that the military employs unskilled and uneducated youth, trains them, and releases them to the civilian sector, modern armies require educated and skilled people who, most often, have been trained by civilian educational institutions. Except in countries that employ conscription, these young people are not released to the civilian sector. The so called ''discipline'' they learn in the military stays in the military.

Second, training, equipping, and maintaining soldiers drains resources from the productive sectors of the economy. The growth effect of such a resource drain is much larger than any positive effect that force ratio might have on growth.

Our results do have some policy implications. Though increased defense resources decrease economic growth, the evidence suggests that a labor intensive military has some positive distributional impact compared to one that is equipment intensive. In this regard, defense employment is no different from any other public sector employment program or, for that matter, employment policy in the private sector. Labor intensive production techniques have more egalitarian income distribution effects than capital intensive production techniques.

10 The corresponding figures for defense burden are: $dg/dm = -0.9296$ and $dL40/dm = 1.1427$.

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