ECONOMIC FACTORS AFFECTING THE THIRD WORLD ARMS TRADE

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The neglect given by economic researchers to third world arms trade is somewhat surprising. Particularly, considering that as a group these countries have accounted for three quarters of the world trade in conventional weapons.

Even to the limited extent that the topic has been covered in the literature, the concentration has been on economic and political policies of the major suppliers. In contrast, the purpose of this study is to provide some analysis of the key issues surrounding third world arms production and purchases in recent years.

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I. INTRODUCTION

One of the more neglected areas of international trade research has been the third world arms trade. This is somewhat surprising considering the fact that since 1965 third world countries have jointly comprised the

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world's leading market for conventional weapons, accounting for as much as three-quarters of the international trade in military systems. Between 1978 and 1985 alone, the less-developed countries ordered an estimated $259 billion worth of arms and ammunition (in current dollars) from foreign suppliers.

Traditionally, analysis of the third world arms trade has concentrated on the economic and political policies pursued by the major suppliers. The policy on supply adopted by each country is invariably determined by political decisions which may reflect not only the position of the supplying country in the international system but also, in the case of Western countries, of the economic profitability of these sales.[1] Broadly speaking, there are three factors that determine the pattern and level of supply of arms:

1. The influence factor --which refers to the control of arms transfers by a supplier in order to maintain or achieve a position of hegemony or domination, either within the receiving country, or more widely within the third world.
2. The economic profitability factor --which relates to the economic advantages of large-scale production and long production runs. Both the government in the form of the military, and the firms producing arms benefit by selling more and thereby reducing unit costs. As long as an item is procured by a foreign country's armed forces, the cost to the government of producing country drops correspondingly, but firms may also benefit with higher profits.
3. The restrictive factor --whereby the supplier declines to provide arms to other countries if it is likely to operate against the economic and/or hegemony interests of the supplier.[2]

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[1] See for example Albrecht, Ulrich, "West Germany and Italy: New Strategies," *Journal of International Affairs*, Summer 1986, pages 129-142; Brigagao, Clovis, "The Brazilian Arms Industry," *Journal of International Affairs*, Summer 1986, pages 101-115; and Klieman, Aaron, "Middle Range Arms Suppliers: The Israeli Case," *Journal of International Affairs*, Summer 1986, pages 115-29.

[2] Ayres, Ron, "Arms Production as a Form of Import-Substituting Industrialization: The Turkish Case," *World Development*, Vol. II, No. 9, September 1983, pages 813-823.

Similarly to date, most of the literature on the subject of third world arms production has cited strategic and political factors as the predominant motives underlying the creation of arms industries in developing countries:

> The establishment of the domestic arms industry is often predominantly a political act which naturally has strong economic and technological underpinnings. The domestic capacity to produce weapons is a means of isolating oneself from the political and commercial pressures which the suppliers of advanced weapon systems, both governments and firms, can apply. That is why the arms-production capacity is concentrated in those developing countries which have faced an actual or a threat of an arms embargo and/or which have become involved in protracted regional conflicts.[3]

What economic literature there is on the subject has tended to concentrate largely on the supply of arms exports from the industrial countries. The economic element of demand has largely been ignored, with emphasis largely confined to arms races, and local conflicts in accounting for the observed patterns of third world arms imports.[4]

Approaches towards understanding the motivation for the establishment and growth of indigenous arms production in the third world have also been sketchy on the role played by and relative importance of economic factors. Presumably, one of the major reasons for establishing indigenous manufacturing capability is to reduce the level of arms imports, thus alleviating somewhat the overall pressures on the balance-of-payments.

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[3] Vayrynen, Raimo, "The Arab Organization of Industrialization: A Case Study in the Multinational Production of Arms," *Current Research on Peace and Violence*, 1979, page 66.

[4] See for example the country studies of Argentina and Venezuela in Looney, Robert E., *The Political Economy of Latin American Military Expenditures*, Lexington, MA: Lexington Books, 1986. See also the country studies in Katz, James, (ed.), *Arms Production in Developing Countries*, Lexington, MA: Lexington Books, 1984; Naur, Maja, "Industrialization and Transfer of Civilian and Military Technology to the Arab Countries," *Current Research on Peace and Violence*, 1980, pages 153-176; Adekanye, J. Bayo, "Domestic Production of Arms and the Defense Industries Corporation of Nigeria," *Current Research on Peace and Violence*, 1983, pages 258-269.

Interestingly enough, the literature has had little to say on this aspect of the subject. Nor has there been any detailed empirical examination of the impact that indigenous production has had on third world arms imports.[5]

The main purpose of the analysis that follows is to shed some light on several key issues surrounding third world arms production and importation. Specifically:

1. Have developing countries producing arms been able to significantly reduce their importation of arms, relative to non-arms producing countries?
2. What other variables significantly affect the importation of arms by developing countries?
3. Are the determinants of arms imports fairly uniform throughout the third world, or are there several significant subgroupings of countries characterized by unique patterns of arms imports? And,
4. How important has external public borrowing been in facilitating arms imports by developing countries? And, again, is this factor fairly uniform throughout the third world or is it specific to certain subgroupings of countries?

The general approach taken in the present analysis is one of integrating and extending several themes developed recently in the literature.[6] Of particular interest is to identify and quantify the

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[5] For a notable start in this direction see the framework for analysis developed in Alexander, Arthur; Butz, William, and Mihalka, Michael, "Modeling the Production and International Trade of Arms: An Economic Framework for Analyzing Policy Alternatives," *Rand Series in International Security and Arms Control*, March 1981.

[6] See in particular: Looney, Robert E., and Frederiksen, P.C., "Profiles of Latin American Military Producers," *International Organization*, 1986; Looney, Robert E., "Military Expenditures in Latin America: Budgetary Tradeoff Analysis," *Journal of Economic Development*, 1986, Looney, Robert E., "Determinants of Per Capita Military Expenditures in Developing Countries," *Manchester Papers on Economic Development*, November 1986; and Looney, Robert E., "Impact of Arms Production on Third World Income Distribution and Growth," *Economic Development and Cultural Chagne, 1988; (forthcoming).*

interrelationships between arms imports, general resource constraints, third world arms production, central government budgetary priorities, and external public debt associated with military expenditures.

The main premise of this study is that a number of key issues surrounding third world arms imports cannot be adequately explained or understood without simultaneously addressing the general environment of economic constraints facing third world policy makers, that is the factors affecting arms production, arms imports, military expenditures/budgetary priorities, and external public debt are so interrelated that emphasis on one to the exclusion of the other will more often than not produce gross overgeneralizations incapable of providing guidance as to likely levels of future third world arms imports.[7]

II. PATTERNS OF ARMS PRODUCTION AND IMPORTS

Vayrynen has argued that the indigenous production of various types of weapons systems in developing countries is unlikely to produce overall reductions in total arms imports:

> The domestic production of arms is, indeed, an effort to ensure capacity to pursue independent foreign and military policy. This independence is, however, often a mere myth because the domestic production of arms only seldom significantly curtails the import of arms and even if this happens the dependence on foreign military technology assumes only new, and even deeper forms. The economic effects of arms imports are mostly financial by their character, while the dependence on technology and intermediary inputs needed in the military industry has a negative impact on the entire industrial structure of the country.[8]

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[7] More importantly single equation estimates of the factors contributing to arms imports are likely to lead to biased coefficients. A two stage least squares estimation procedure is a more appropriate technique for assessing the relative role played by economic factors in affecting arms imports, indigenous production, and external public debt.

[8] Vayrynen, *op. cit.*

On the surface, this image of indigenous third world arms production seems to be borne out to a certain extent by the limited amount of information available on these industries. What statistics we have on the subject comes largely from the Swedish International Peace Research Institute (SIPRI).[9] SIPRI's data value weapons produced under license as both production and imports. This share not only reflects the substitution of production for imports, but it also indicates the degree of independence in third world arms production. The SIPRI data show a slow but steady increase in arms import replacement during the 1960s after which the ratio leveled off at about 10 percent during the 1970s.[10] The large increases in arms imports during the 1970s by a number of countries without sizeable arms production --such as Iran, Iraq, Libya, Saudi Arabia and Syria-- explain the leveling off despite the steady increase in total production values. For the 1980s, there is again an upward trend. Interestingly enough, however, the SIPRI figures show that it is not the countries with the highest production values that have become least dependent on arms imports. The import values are still much higher than the production values in India and Israel. In India, substitution is even decreasing. The highest production-to-import ratios are instead found in Brazil (also reflecting substantial arms exports), North Korea and South Africa. To a lesser extent this is also true for South Korea and Taiwan.[11]

If this is in fact the case, it would appear that the arms industry in developing countries is following a path fairly typical of the package of policies often used to encourage import-substitution industrialization. In this regard, the literature on import-substitution has been fairly negative, again much of it questioning whether or not the programs associated with

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[9] See for example, Brzoska, Michael, and Ohlson, Thomas (eds.), *Arms Production in the Third World*, Philadelphia: Taylor and Francis, 1986.

[10] *Ibid.*, page 27.

[11] *Ibid.*, page 28.

import-substitution have resulted in reducing imports in those sectors singled out for import replacement.[12]

While it is apparent that the import substitution policies in the arms industry initiated by a number of developing countries have actually reduced the imports of specific armaments, have these same policies resulted in a general reduction in arms imports? How much of this reduction in arms imports is attributable to the import substitution process? To answer these questions an assessment must first be made of the factors (both economic and strategic) affecting arms imports.

III. FACTORS AFFECTING THIRD WORLD ARMS IMPORTS

A number of economic and political factors interact to affect the level of third world arms imports. The model developed below attempts to capture the impact of as many of these variables as possible, recognizing of course that for any individual country in any one year arms imports may deviate considerably from their average or normal levels due to:

1. a big purchase, associated with the adoption of a major new system;
2. the outbreak of internal or external conflict;
3. the completion of a phase of equipment modernization;
4. a marked change in government priorities, due to a change in regime;
5. a shift in foreign alliances.

This list is of course not exhaustive, but simply intended to stress the potential year-to-year instability of arms imports. On the other hand, many of these problems can be assumed to average out in cross-section analysis.

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[12] Bruton, H.J., "The Import Substitution Strategy of Economic Development: A Survey," *Pakistan Development Review*, 1970, pages 123-146.

The Economic Environment

There is a growing body of literature suggesting that a number of governmental budgetary patterns are reflective of the relative degree of foreign exchange scarcity faced by policy makers. Here foreign exchange scarcity is seen as a multidimensional factor, not easily characterized by one simple index such as a country's holdings of international reserves.[13] Research on the impact of military expenditures on growth has indicated that general groupings of countries on the basis of their overall degree of resource scarcity can be useful in identifying contrasting governmental expenditure patterns in the third world.[14]

Presumably, those countries which have either more domestic resources (savings and investment) or greater access to foreign captial *ceterius paribus* will be able to support a higher level of arms imports. On the other hand, those countries with a lower level of domestic resources or less access to international capital will not have as high a level of arms imports.

Using factor analysis on a large group of World Bank variables depicting government debt, export and import patterns, and capital flows, the main trends in the data were identified and a discriminant analysis was then performed using as variables those with the highest loading on each of

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[13] Looney, Robert E., and Frederiksen, P.C., "Defense Expenditures, External Public Debt and Growth in Developing Countries," *Journal of Peace Research*, December 1986; Looney, Robert E., "Impact of Military Expenditures on Third World Debt," *Canadian Journal of Development Studies*, 1987.

[14] See Frederiksen, P.C. and Looney, R.E., "Defense Expenditures and Economic Growth in Developing Countries: Some Further Empirical Evidence," *Journal of Economic Development*, July 1982, pages 113-125; Frederiksen, P.C. and Looney, R.E., "Defense Expenditures and Economic Growth in Developing Countries," *Armed Forces and Society*, Summer 1983, pages 633-645; Frederiksen, P.C. and Looney, R.E., "Another Look at Defense Spending and Economic Growth in Developing Countries," *Defense Analysis*, 1985; Frederiksen, P.C. and Looney, R.E., "Defense Expenditures and Economic Growth in Developing Countries: A Reply," *Armed Forces and Society*, Winter 1985, pages 298-301; and Looney, R.E. and Frederiksen, P.C., "Defense Expenditures, External Public Debt and Growth in Developing Countries," *Journal of Peace Research*, December 1986, pages 329-332.

the individual factors.[15] The orthogonal rotation assures that each variable selected had a relatively low degree of correlation with the others in the sample. The variables thus selected for splitting the countries into two groups on the basis of relative foreign exchange scarcity were:

1. Gross Inflow of Public Loans/Exports, 1982
2. Total Public External Debt, 1982
3. Gross International Reserves, 1982
4. Public External Debt as a Percent of GDP, 1982
5. Growth in Imports, 1970-1982
6. External Debt Service as a Percent of GDP, 1982
7. Public External Debt as a Percent of GDP, 1970.

The results of the discriminant analysis show a high degree of probability of correct placement in each group, that is, the discriminating variables selected from the factor analysis are able to split the sample countries into two fairly distinct groupings based largely on the external debt situation facing each set of countries. (See Table, I page 386). Group I countries in general seem to be the poorer, less economically dynamic nations, this group being heavily weighted with African and poorer Latin American countries. The Group II countries, on the other hand, consists of several major oil exporters and several of the more dynamic newly industrializing nations such as Mexico, Greece, India, Korea, Spain, Algeria and Malaysia.

Further insight into the two groups can be gained by examining the means of the variables used in the discriminant analysis:

1. The Group I countries resorted to a much higher (3.6 times) inflow of external public loans in 1982 relative to their exports that year.

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[15] Data were taken from the World Bank, *World Development Report*, Washington, D.C.: The World Bank, (various issues.) The analysis is based on *SAS User's Guide: Statistics*, Cary, NC: SAS Institute, 1982.

Table I

Groupings of Third World Countries on the Basis of Resource Constraint

Group I		Group II	
Country	Probability of Correct Placement	Country	Probability of Correct Placement
Israel	69.3	Greece	57.8
Honduras	83.5	India	84.9
Cameroon	60.7	Nigeria	89.3
Sudan	66.5	Indonesia	90.6
Costa Rica	92.6	Egypt	68.2
Bolivia	86.3	Korea	89.9
Somalia	86.5	Rwanda	69.1
Tunesia	68.3	Turkey	66.9
Morocco	73.1	Spain	51.9
Guatemala	54.9	Venezuela	80.3
Malawi	91.4	Mexico	99.7
El Salvador	65.9	Brazil	99.0
Mali	97.1	Algeria	76.4
Pakistan	86.9	Philippines	55.8
Paraguay	60.0	Libya	75.7
Ecuador	56.6	Colombia	54.6
Dominican Rep.	74.1	Thailand	60.9
Liberia	94.8	Malaysia	65.1
Ivory Coast	84.4	Argentia	66.1
Mauritania	96.0	Saudi Arabia	94.7
Sierra Leone	86.1	Kuwait	81.3
Panama	94.4	Syria	63.9
Chile	70.1	Jordan	50.8
Chad	87.2		
Uruguay	67.9		
Tanzina	79.9		
Uganda	88.8		
Ethiopia	70.2		
Central Africa Rep.	76.9		
Ghana	78.7		
Burma	82.9		
Sri Lanka	75.4		
Jamaica	90.7		
Trinidad	77.6		
Zambia	95.9		
Peru	71.7		
Zimbabwe	85.7		
Kenya	86.6		

2. On the other hand, the overall level of total public external debt in 1982 averaged nearly 4.5 times as much for Group II countries as is the case for Group I countries.
3. The level of international reserves is also much higher for Group II countries --nearly ten times as much as the average for Group I countries.
4. With regard to shares of debt in gross domestic product, however, Group I countries have much higher levels of attainment, averaging nearly twice as much as Group II countries in both 1970 and 1982. The debt service ratio to exports is correspondingly higher for Group I countries.
5. The rate of growth of imports was nearly ten times higher over the 1970-1982 period for Group II countries.

In terms of other indicies, the Group II countries are considerably larger, more affluent (in terms of per capita income), and less reliant on external debt as a percentage of gross domestic product. They tend to spend relatively large amounts on military activities, but not necessarily significantly greater amounts of their overall budgets. Given relatively fewer constraints, the Group II countries should have a relatively easier time in attaining some optimal balance beween arms imports, total military expenditures and the level of personnel (armed forces).

Effect of Economic Environment on Arms Imports

Logically, arms imports should be related to the overall ability of the country to purchase weapons. This effective demand for weapons can be proxied by either military expenditures (ME) or the general level of central government expenditures (GEC). The composition of military forces between equipment and troops (AF) together with the ability to substitute one for the other will also condition the incentive to import additional weapons --especially during times of severe foreign exchange scarcity.

The hypothesis to be tested here is that the constrained (Group I) countries financed a large proportion of their military expenditures with public external indebtedness. In our model for these countries public external debt (PDB) would have a positive sign when regressed on arms imports. On the other hand, unconstrained countries, given alternative sources of funding, should not experience a particularly strong link between arms imports and public external debt.

Several other structural factors were also considered significant in affecting arms imports. Everything else equal, whether or not the country was an arms producer (PRODUCE) should be a factor in affecting arms imports. For purposes of analysis, producer and non-producer countries were classified following Neuman's definition of arms producers as countries capable of producing at least one major weapon system.[16]

Arms producers should have higher levels of technical and industrial capabilities relative to those countries lacking an indigenous arms industry. Furthermore, the linkages between military expenditures and the economy, together with the import component of military equipment associated with a given level of military expenditures should be considerably different for arms producers and non-producers.

In general, we would imagine the non-producers to be much more reliant on imports of military equipment to meet a given level of defense expenditures. Furthermore, given the high cost of sophisticated imported weaponry, we would expect a high proportion of it, *ceteris paribus*, to be financed by external debt.

Given their relative flexibility to expand weapons production, countries which are both arms producers and resource unconstrained should experience over time the greatest reduction in arms imports.

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[16] Neuman, Stephanie, "International Stratification and Third World Military Industries," *International Organization*, Winter 1984, pages 167-197.

Finally, to the extent that third world countries produce their own weapons systems, we would expect a looser relationship to exist between arms imports and overall public external indebtedness. That is because equipment can be obtained from local sources in addition to imports, with added domestic inputs occurring when the country's credit-worthiness might be placed in jeopardy by additional external borrowing to finance arms acquisitions.

Since data are not available on the actual value of arms output in third world countries, the effect of arms production on arms imports was estimated by creating a dummy variable (PRODUCE) with values of zero for the countries not having an indigenous arms industry and one for those possessing such an industry. The expected sign of this variable is negative in the regression equation, that is everything else equal, indigenous arms production should reduce the need for imported arms.

Political/security factors were introduced by utilizing Rothstein's classification of countries based on political/security and resource constraint considerations.[17] Those countries which have a high level of internal and/or external threat combined with a low level of governmental legitimacy and effectiveness were assigned a value of one (CONFLICT = 1) and those with a high level of governmental legitimacy and faced relatively low internal and/or external threats were assgined a value of zero (CONFLICT = 0).

In summary the "need" for weapons (CONFLICT), together with the ability to purchase and/or substitute local resources will determine the general range of arms imports.

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[17] *Cf.* Rothstein, Robert L., "The 'Security Dilemma' and the 'Poverty Trap' in the Third World," *The Jerusalem Journal of International Relations*, December 1986, pages 1-38; and Rothstein, Robert L., "National Security, Domestic Resource Constraints and Elite Choices in the Third World," in Deger, Saadat and West, Rober (eds.), *Defense, Security, and Development*, London: Frances Pinter, 1987, pages 140-158.

(1) Arms Imports (AI)

AI = [ME(+), PDB(+c, ?uc), PRODUCE(?uc, +c), AF(-c, ?uc), CONFLICT(+)]

where:

ME = Military Expenditures

c = Resource Constrained Countries and

uc = Resource Unconstrained Countries

PDB = Public External Debt

Produce = Arms Producer

AF = Armed Forces Personnel

Factors Affecting Arms Production

Limited economic and financial resources explain, at least partially, the difficulties of third world countries in developing an independent weapons industry. The development of an arms industry, especially a totally independent one, requires very large financial resources. These are often beyond the reach of most third world states. It is well-known that even some of the advanced industrial nations such as Britain and France have been compelled to cancel military production plans due to financial difficulties.

In short, we might expect that countries with relatively abundant sources of foreign exchange and domestic savings capable of being appropriated by governments are likely to be the arms producers.

An examination of the means of various indicators of economic performance, external debt and structural composition of the arms producers and non-producers indicates that the arms producers can be characterized as possessing much higher levels of domestic savings, less export instability, superior export performance, higher external debt, but a much lower debt burden (as a percent of GDP) and higher captial inflows than the non-producing countries.

In fact, in a recent study, Looney and Frederiksen, using discriminant analysis, indicated that a nearly perfect classification of Latin American arms producers and non-porducers could be made using only debt and import/export indicators as discriminating variables.[18] That study also demonstrated that military and size variables were not capable of discriminating between arms producers and non-producers. Interestingly enough, debt and external variables and their relative magnitudes are nearly identical to those used above to discriminate between the constrained and unconstrained countries, with producers very similar to unconstrained countries and non-producers in general behaving in a manner similar to constrained countries.

Based on these considerations we should expect the arms producers to have relatively strong balance of payments positions.

(2) Military Production (PRODUCE)

PRODUCE = [BIY(+uc, ?c), GNP(?), PDA(+), EGB(+)]

where:

BIY = Trade gap as a percentage of GNP

PDA = External Public Indebtedness in 1972

EGB = Average annual growth in exports during 1970-1982

While not anticipating a significant result, overall economic size as proxied by gross national product (GNP) was included in the regression equation for completeness.

Military Expenditures and Public External Indebtedness

The recycling of the flood of petro-dollars which followed increases in oil prices in 1973 resulted in large amounts of money being lent by Western

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[18] Looney, Robert and Frederiksen, P.C., "Profiles of Latin American Arms Producers," *International Organization*, Summer 1986, pages 745-752.

banking syndicates to third world countries in anticipation of relatively high rates of return. In retrospect, it is clear that while some of the money was used to finance development projects which presumably would generate sufficient income to repay the loans, much of it was used for increased consumption and capital flight. There is also the suspicion among many observers that a considerable amount of this funding was used to finance higher levels of military expenditures.[19]

Support for this position is largely based on two similar trends that developed in the 1970s and early 1980s. More specifically, government and government-guaranteed debts of the non-oil developing countries grew from $130 billion in 1973 to $729 billion in 1984, accounting for 85 percent of the external debts of developing countries. The value of arms transferred to non-oil developing countries more than doubled in real terms between 1972 and 1982 and their share of total world arms transfers increased from 31 percent to 41 percent in the same period.[20] Analysts stressing the link between arms imports and third world debt note that these two patterns represent more than just a coincidence.

Further substantiation of the link between arms transfers and public external debt is found in the fact that arms purchases grew in importance during the 1970s as the two major arms donors switched their policy from one of gifts to one of sales.[21]

Weapons purchased with scarce foreign exchange have an obvious allocation cost in terms of reduced resources available for aiding socio-economic development. Clearly, however, whether or not third world countries have reduced their borrowing for these purposes proportionally to the amount spend on arms imports is quite conjectural and ultimately resolved only by empirical testing.

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[19] Tullerg, R., "Military-Related Debt in Non-Oil Developing Countries, 1972-1982," *Bulletin of Peace Proposals*, 1986, page 261.

[20] *Ibid.*, page 262.

[21] Brzoska, Michael, "The Military-Related External Debt of Third World Countries," *Journal of Peace Research*, 1983, pages 271-278.

The model developed below attempts to identify the role played by military expenditures in affecting external indebtedness.[22] For this purpose, a formal model indicating the equilibrium level of external debt is developed. This equilibrium level is solved for by a "reduced form" equation derived from a set of relationships that account for the major supply and demand determinants of external debt.[23]

In selecting variables responsible for the volume of public external debt accumulated by 1982, it is reasonable as a first step to assume that a country's size will have a direct relationship both to the amount of external indebtedness and its capacity to service this debt. Clearly, a large country as measured by GNP will *ceteris paribus* have more financial and commercial relations with the rest of the world economy and, therefore, will be more likely to accumulate a larger debt volume than a small country. At the same time, due to the diversity of output and resource base, the debt servicing capacity of a large country is apt to be greater than that of a small country (and, consequently, a larger external debt can be accumulated). In general, we postulate that the larger the LDC economy, as measured by its gross national product (GNP), the greater its demand for external indebtedness.

Second, a country's external debt should, in general, be related to its general volume of merchandise imports (TI). For LDCs, the volume of merchandise imports often tends to have a direct relationship to the country's GNP, thus providing an additional source of demand for debt. Since in a growing economy a share of imports will have to be financed, a country's indebtedness will be higher as total imports increase.

Third, international reserve holdings may be another important factor in affecting the volume of a country's external debt. Here the relationship is likely to be more complex. Logically, as a country's reserves increase, its

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[22] The model is based on that developed by Heller, H. Robert and Frenkel, E., "Determinants of LDC Indebtedness," *The Columbia Journal of World Business*, Spring 1982, pages 28-34.

[23] External debt is defined as public external debt owed to non-residents and repayable in foreign currency and having a maturity of over one year.

ability to service a growing external debt and, hence, its credit worthiness should also increase. On the other hand, everything else equal, one might expect that the larger a country's external revenues, the less pressing the need for additional debt to finance imports. Therefore, possession of a large volume of international reserves may result in larger or smaller volumes of external debt.

Finally, three types of governmental expenditures --military (ME), health (H) and education (E) were introduced as independent variables in the demand for external debt.[24]

Clearly, because of multicolinearity between the independent variables defined above, it is not possible to determine through regression analysis the percent of LDC public external debt stemming from military expenditures. Given this constraint, the analysis below attempts to answer the two part question of (a) whether military expenditures (after controlling for GDP, imports, reserves, and other independent variables) have signifcantly contributed to LDC external indebtedness and, (b) if so, what type of environments have been most conducive to external borrowing for the purpose of increasing military expenditures.

The next step in the analysis is to isolate the main supply and demand influences on third world indebtedness by deriving a reduced form equation that is capable of measuring the influence of all independent variables simultaneously.

In the specification, Gross National Product (GNP), was the principal demand variable, followed by total imports (TI), and the individual public sector expenditures: military expenditures (ME), health (H), and education (E).

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[24]Government expenditures on health and education were taken from Sivard, Ruth, *World Military and Social Expenditures,* 1983, Washington, DC: World Priorities, 1983. Military expenditure data were taken from U.S. Arms Control and Disarmament Agency, *World Military Expenditures and Arms Transfers, 1975-1982,* Washington, DC: ACDA, 1984.

On the supply side, the main variable was foreign reserves (GIRB). Notationally:

a) Total debt (PDB) supply = f1 (reserves), and

b) Total debt (PDB) demand = f2 (GNP, military expenditures, education expenditures, health expenditures)

c) Total debt (supply) = total debt (demand) and, dividing equations (a) and (b) by the equilibrium level of total debt as specified in equation (c), we obtain equation (d)

d) f1 (total debt) = f2 (total debt) expressing equation (d), we can write

e) x1 [f1 (total debt) - f2 (total debt)], = 0, or

f) x2 (total debt, GDP, imports, reserves, military expenditures, eduational expenditures, health expenditures = 0.

(3) Public External Debt (PDB)

PDB = [GNP(+), TI(+), GIRB(-c, ?uc), ME(+c, ?uc), H(?), E(?)]

Total Imports

The import variable (TI) is intended to identify several critical differences between resource constrained and unconstrained countries with regard to their flexibility in meeting increased defense requirements. Presumably the resource constrained countries will be forced to turn to local materials and personnel relative to their unconstrained counterparts when expanding overall military expenditures. In part this stems from their lack of foreign exchange to import extra weapons, but also from the fact that scarce foreign exchange will also have to be conserved for other priority allocations deemed necessary by the government (GEC). These countries will also have to earmark foreign exchange to assure that service can be

maintained and spare parts obtained to keep prior arms imports (AIL) operational.

Since the resource constrained countries have in most cases borrowed close to their limits, we would expect any additional debt to be earmarked for high priority situations and not related to the overall level of imports. That is, the higher the level of prior external debt, (PDBL), the less likely imports will be related to the level of external public debt in any particular year:

(4) Total Imports (TI)
TI = [GEC(+c, ?uc), PDBL(?uc, +c), ME(-c, ?uc), AIL(+c, ?uc)]

Military Expenditures

Total military expenditures are assumed to be largely a function of the level of armed forces personnel (AF), the overall size of the economy (GNP), and the ability of countries to finance added expenditures in the short run (proxied by the level of gross international reserves --GIRB). Since military expenditures have high priority in most countries, we would expect some relationship between past external debt and levels of allocation of the military. This pattern is likely to be more pronounced in the resource constrained countries given their lack of alternative financing. In the short run, some increases in military expenditures can be financed from government deficits (GDB --revenues minus expenditures). Again, for reasons noted above the resource constrained countries are more likely to be forced to resort to this type of financing for increased levels of defense expenditures:

(5) Military Expenditures (ME)
ME = [AF(+), GNP(+), GIRB(+), PDBL(+c, ?uc), GDB(-c, ?uc)]

Other Factors

The model is closed with four additional equations: total government expenditures, health expenditures, education expenditures, and the size of the armed forces. The logic behind the selection of the independent variables for each, together with their expected signs is similar to that given for the five functional equations above. Equations 7 and 8 do however explicitly introduce an added factor --the likely tradeoff between defense expenditures and education and health that will be faced by the resource constrained countries:

(6) Total Government Expenditures (GEC)

GEC = [GNP(+), PDBL(+c, ?uc), GIRB(+), AFPL(+c, ?uc)

(7) Health Expenditures (H)

H = [GEC(+), ME(-c, ?uc), PDBL(+c, ?uc)]

(8) Education Expenditures (E)

E = [GEC(+), ME(-c, ?uc), PDBL(+c, ?uc)]

(9) Armed Forces (AF)

AF = [POP(+), GNP(+), GIRB(+c, ?uc), PDBL(+c+c, ?uc)]

Finally, the last two equations examine the consequences of resource constraint, arms production, arms imports, and threat for several measures of the defense burden --the share of defense expenditures in the central government budget (GEDB) and the share of military expenditures in gross national product (MEY).

(10) Defense Share in Central Government Budget (GEDB)

GEDB = [PRODUCE(+), AI(+), AFPL(+), Conflict(+)]

(11) Share of military expenditures in GNP (MEY)

MEY = [PRODUCE(-), GEDB(+), AI(+c, ?uc)]

IV. RESULTS

The results show several intesting patterns. (For specifics see Appendix I). In particular:

1) Arms imports in constrained countries have a particularly strong link with total military expenditures. This link, while still significant is not nearly as strong (as evidenced by the standardized regression coefficient and t-values) for the unconstrained countries. Apparently, the unconstrained countries have more degrees of freedom in reaching some optimal balance between total military expenditures, arms imports, domestic production and armed forces.

2) Given the decidedly higher r^2 for arms imports in equations 1a and 1b (relative to equation 1) it appears that foreign exchange availability *per se* must be as or more important than political or strategic factors in affecting arms imports. Put differently, it appears that foreign exchange controls the amount of arms imports much more precisely than the "need" or "desire" for additional armaments.

3) As anticipated, external debt has been associated with arms imported by the constrained countries (but not the unconstrained).

4) Both constrained and unconstrained countries were, *ceteris paribus*, able to reduce their overall level of arms imports through the indigenous production of arms, but perhaps because of their relative access to foreign exchange, the unconstrained countries were able to expand domestic production to a greater extent, thus replacing a larger volume of imports.

5) The overall availability of resources as proxied by gross national product does not appear to be a factor affecting third world arms production --instead foreign exchange availability as proxied by the relative growth of exports and holdings of gross international reserves (depicted by the relative surplus in the balance of payments) differentiates arms producers from non-producers.

6) The high statistical significance and negative sign for armed forces in the resource constrained countries (but not in the unconstrained countries), suggests that foreign exchange shortage has forced large groups of countries to substitute personnel for imported equipment.

7) This conclusion is reinforced by the negative sign on military expenditure term in the total imports equation for resource constrained countries --these countries must conserve foreign exchange for "essential" imports such as food and certain raw materials needed to maintain industrial production.

8) As might be anticipated, unconstrained countries are more able to reach an optimal mix between armed forces and total military expenditures (as evidenced by the positive statistical significance of AF in equation 5a, but not in 5b in Appendix I).

9) Constrained countries have a close link between armed forces and the overall level of government expenditures, indicating the relatively labor intensive composition of military expenditures.

10) Constrained countries face a zero sum option in terms of budgetary tradeoffs between military expenditures and socio-economic activities (the negative sign on military expenditures in equations 7a and 8a in Appendix I --as opposed to statistically insignificant values in equations 7b and 8b.

11) Given their relative inflexibility in producing and importing arms, resource constrained countries exhibit a much closer relationship between arms imports and the share of military expenditures in GNP (equation 11a vs. 11b).

V. CONCLUSIONS

The results presented above are suggestive of the importance of economic variables in affecting the pattern of arms imports to the third world. While this finding is not particularly novel, it does indicate the

fruitfulness of incorporating economic considerations, not only as factors affecting the supply of weapons, but their demand as well. Perhaps the lack of attention given to economic variables in the past stems from the fact that rather weak relationships exist when these factors are regressed on various aspects of militarization in developing countries as a whole. This is not the case, however, when third world countries are examined as more homogenous groups on the basis of their general degree of resource scarcity. Using this two-group approach, several general conclusions can be made concerning the observed patterns of arms importation by the third world.

1. Third world countries are not homogenous with regard to the factors affecting arms imports, overall miiltary expenditures, and arms production. It appears that access to foreign exchange is the common thread in accounting for fundamental differences between these countries with regard to both the production and importation of arms.
2. Similarly, the use of public external indebtedness to finance arms imports does not appear to be universal among developing countries. In fact, it is possible that a large group of relatively debt-free (debt as a percent of GDP) resource unconstrained countries have contained military expenditures within the limits imposed by self-financing rather than risk jeopardizing their overall credit worthiness.
3. On the other hand, it is possible that a large proportion of the debt accumulated by the resource constrained group of LDCs has stemmed from military expenditures. Apparently, the perceived need to expand defense expenditures by this group in the face of foreign exchange shortages has resulted in relatively high levels of external indebtedness measured either as a percent of exports or GNP for the group as a whole.
4. Indigenous arms production in the third world has tended to reduce the importation of arms. Again, however, the extent of

this reduction may vary by country type with the most significant reductions occurring in countries with relatively abundant supplies of foreign exchange.

5. Finally, it appears that arms imports most likely will not reach levels attained in the late 1970s due not so much to a general spirit of constraint on the part of suppliers and recipients, but more to lack of foreign exchange on part of many of the third world countries, and the development of indigenous production capabilities on the part of others.

Appendix I

The regression coefficients are in standardized form to facilitate a direct comparison of the relative strength of each variable. (This analysis is for the year 1981. This period roughly coincides with the classification schemes of Neuman and Rothstein. This period was also selected because it came at the end of a decade of rapidly increased third world borrowing in external markets. It is clear that external financial markets changed fundamentally after the *de facto* Mexican default in 1982. Also 1981 marks the end of the world wide boom in exports and imports. It is to early for the post 1982 events to be incorporated systematically in analysis of the type attempted here. However the results obtained here are suggestive of a number of patterns likely to develop in the later part of the 1980s).

(Two Stage Least Squares Estimates, standardized coefficients)

Arms Imports (AI)

total sample

(1) AI = -0.24 PROD + 1.12 ME - 0.19 PDB - 0.19 AF - 0.15 CONF
(-1.47) (5.11) (-1.33) (-0.95) (-1.24)
r^2 = 0.648; F = 9.92

resource constrained countries

(1a) AI = -0.05 PROD + 0.81 ME + 0.35 PDB - 0.21 AF + 0.01 CONF
(-2.06) (15.69) (6.31) (-6.34) (0.61)
r^2 = 0.993; F = 426.8

resource unconstrained countries

(1b) AI = -0.76 PROD + 0.44 ME - 0.28 PDB + 0.25 AF - 0.21 CONF
(-6.34) (2.08) (-2.36) (1.17) (-1.88)
r^2 = 0.994; F = 16.7

Arms Production (PRODUCE)

total sample

(2) PRODUCE = 0.25 BIY + 0.13 GNP + 0.30 PDA + 0.40 EGB
(1.40) (0.61) (1.42) (2.06)
r^2 = 0.412; F = 4.01

resource constrained countries

(2a) PRODUCE = - 0.13 BIY + 0.12 GNP + 0.37 PDA + 0.18 EGB
(-0.61) (0.37) (0.95) (0.83)
r^2 = 0.428; F = 3.04

resource unconstrained countries

(2b) PRODUCE = 1.11 BIY - 0.04 GNP + 0.06 PDA + 0.26 EGB
(7.17) (-0.31) (0.44) (1.81)
r^2 = 0.928; F = 19.1

Public External Debt (PDB)

total sample

(3) PDB = 0.64 GNP + 0.54 TI - 0.20 GIRB - 0.04 ME - 0.08 E + 0.11 H
(3.41) (5.54) (-2.60) (-0.65) (-0.35) (1.07)
r^2 = 0.947; F = 77.9

resource constrained countries

(3a) PDB = 0.07 GNP + 0.48 TI - 0.12 GIRB + 0.40 ME + 0.67 E - 0.61 H
(1.16) (2.63) (-1.31) (3.64) (4.58) (-4.48)
r^2 = 0.968; F = 76.0

resource unconstrained countries

(3b) PDB = 1.04 GNP + 0.44 TI - 0.01 GIRB - 0.14 ME - 0.41 E + 0.02 H
(6.58) (7.75) (-0.24) (-2.94) (-2.25) (0.22)
r^2 = 0.993; F = 99.4

Total Imports (TI)

total sample

(4) TI = - 0.56 GEC + 1.19 PDBL + 0.63 ME - 0.33 AIL
(-2.01) (4.47) (3.14) (-1.03)
r^2 = 0.872; F = 44.4

resource constrained countries

(4a) TI = 1.55 GEC - 0.14 PDBL - 1.22 ME + 0.75 AIL
(6.83) (-0.58) (-4.23) (2.10)
r^2 = 0.962; F = 95.2

resource unconstrained countries

(4b) TI = - 1.10 GEC + 1.74 PDBL + 0.45 ME - 0.35 AIL
(-2.05) (3.41) (1.19) (-0.93)
r^2 = 0.836; F = 7.5

Total Military Expenditures (ME)

total sample

(5) ME = 0.47 PDBL + 0.34 GIRB + 0.70 AF - 0.23 GNP - 0.53 GDB
(1.73) (2.87) (6.59) (-2.64) (-1.92)
r^2 = 0.801; F = 21.7

resource constrained countries

(5a) ME = 0.53 PDBL + 0.42 GIRB + 0.19 AF - 0.07 GNP - 0.26 GDB
(2.93) (3.76) (1.01) (-0.59) (-2.25)
r^2 = 0.912; F = 33.9

resource unconstrained countries

(5b) ME = 0.01 PDBL + 0.04 GIRB + 0.89 AF - 0.11 GNP - 0.09 GDB
(0.01) (0.17) (3.53) (-0.13) (-0.33)
r^2 = 0.735; F = 2.8

Government Expenditures (GEC)

total sample

(6) GEC = 0.70 GNP + 0.21 PDBL + 0.12 GIRB + 0.10 AFPL
(6.21) (1.97) (3.04) (3.04)
r^2 = 0.976; F = 285.7

resource constrained countries

(6a) GEC = 0.13 GNP + 0.30 PDBL + 0.20 GIRB + 0.51 AFPL
(1.85) (3.52) (2.95) (6.23)
r^2 = 0.970; F = 48.9

resource unconstrained countries

(6b) GEC = 0.78 GNP + 0.17 PDBL + 0.14 GIRB + 0.06 AFPL
(3.23) (0.73) (1.74) (0.67)
r^2 = 0.970; F = 48.9

Health Expenditures (H)

total sample

(7) H = 0.95 GEC - 0.14 ME - 0.55 PDBL
(4.95) (-1.09) (-1.84)
r^2 = 0.797; F = 37.9

resource constrained countries

(7a) H = 2.10 GEC - 1.32 ME + 0.03 PDBL
(7.32) (-3.84) (0.15)
r^2 = 0.879; F = 43.7

resource unconstrained countries

(7b) H = 1.40 GEC - 0.04 ME - 0.60 PDBL
(2.40) (-0.19) (-1.02)
r^2 = 0.737; F = 6.51

Education Expenditures (E)

total sample

(8) E = 1.12 GEC + 0.08 ME - 0.21 PDBL
(8.04) (1.74) (-1.47)
r^2 = 0.797; F = 37.9

resource constrained countries

(8a) E = 1.45 GEC - 1.28 ME + 0.78 PDBL
(6.93) (-5.13) (5.37)
r^2 = 0.936; F = 87.3

resource unconstrained countries

(8b) E = 1.27 GEC + 0.16 ME - 0.35 PDBL
(5.32) (1.95) (-1.47)
r^2 = 0.956; F = 11.0

Armed Forces (AF)

total sample

(9) AF = 0.85 POP - 0.50 GNP + 0.04 GIRB + 0.71 PDBL + 0.13 CONF
(9.24) (-1.92) (0.35) (1.66) (1.66)
r^2 = 0.863; F = 31.5

resource constrained countries

(9a) AF = 0.77 POP - 0.07 GNP + 0.20 GIRB + 0.30 PDBL + 0.10 CONF
(10.64) (-0.87) (2.67) (4.02) (1.81)
r^2 = 0.956; F = 70.1

resource unconstrained countries

(9b) AF = 0.94 POP - 0.31 GNP - 0.09 GIRB - 0.45 PDBL + 0.21 CONF
(4.95) (-0.45) (-0.47) (-0.70) (1.02)
r^2 = 0.875; F = 7.0

Share of Defense Expenditures in Central Government Budget (GEDB)

total country sample

(10) GEDB = - 0.01 PROD + 0.43 AI + 0.39 AFPL + 0.40 CONF
(-0.04) (2.57) (2.49) (3.49)
r^2 = 0.665; F = 13.9

resource constrained countries

(10a) GEDB = - 0.05 PROD + 0.50 AI + 0.30 AFPL + 0.34 CONF
(-0.39) (1.36) (0.82) (2.45)
r^2 = 0.671; F = 8.65

resource unconstrained countries

(10b) GEDB = - 0.79 PROD + 0.68 AI + 0.85 AFPL + 0.31 CONF
(2.25) (2.96) (2.57) (1.52)
r^2 = 0.884; F = 8.12

Share of Military Expendiutre in GNP (MEY)

total country sample

(11) MEY = - 0.23 PROD + 0.34 GEDB + 0.65 AI
(-2.53) (3.00) (5.45)
r^2 = 0.767; F = 31.9

resource constrained countries

(11a) MEY = - 0.10 PROD + 0.31 GEDB + 0.75 AI
(-1.42) (3.34) (7.74)
r^2 = 0.930; F = 79.9

resource unconstrained countries

(11b) MEY = - 0.89 PROD + 0.32 GEDB - 0.08 AI
(-10.07) (4.28) (-0.82)
r^2 = 0.972; F = 81.5