
The Effect of Declining Military Influence on Defense Budgets in Latin America

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Despite a tradition of military governments in many Latin American¹ countries, a relatively small, yet stable, portion of Gross Domestic Product (GDP) is allocated to defense: the defense burden has remained below 2 percent since 1970, and for most of the time was at least half that amount.² On the other hand, similar defense burdens for all developing countries fell from between 6 and 7 percent in the early 1970s to less than 3 percent in 1995. Because of the defense burden stability, previous studies examining the determinants of defense spending pointed out that economic factors were often the major determinants and could dominate geopolitical factors in determining defense burdens. In other words, any attempts to forecast defense expenditures should pay serious attention to economic factors.

Most of the recent studies employed data only through the mid-1980s. Sweeping economic and political changes have since taken place, and especially in Latin America. Concomitantly, several new statistical techniques have been developed with the potential to better identify the dynamics of defense expenditure determinants. This article uses the procedure of co-integration analysis to examine the factors that influenced Latin American defense allocations in the 1980s to the mid-1990s. Specifically we test to see whether the determinants have changed over time, and whether a common pattern exists across all countries—or whether national experiences have been so varied that no such pattern can be identified.

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ARMED FORCES & SOCIETY, Vol. 26, No. 3, Spring 2000, pp. 437–449.

Review of Some Recent Studies

Although Hill noted that "the military spending level of any nation is likely to be a product of a number of separate forces,"³ (such as arms races, military alliances, military aid, the form of government, and the like),⁴ much of the recent research has focused specifically on the role of economic variables. Westing⁵ pointed out the correlation between increases in military expenditures and increases in wealth. Treddenick concluded that "recent large increases in Canadian defense expenditures have been influenced more by economic than by security considerations."⁶ Maizels and Nissanke⁷ found the availability of foreign exchange (to purchase arms), relations with power blocs, and the need by the ruling elite to repress any internal opposition to be important determinants. Harris⁸ examined five ASEAN countries and found that domestic economic conditions (especially government revenue) exert an important influence on defense levels. In the same year, Looney⁹ found that allocations to defense and nondefense sectors often depended on whether or not the country was an arms producer. Looney and Frederiksen¹⁰ found that a large proportion of the variability in Latin American military expenditures was explained by economic variables such as the overall GDP constraint (especially in Chile, Ecuador, Mexico, Venezuela, and Argentina) and fiscal funding variables (primarily government expenditures and government revenues). However, no one model was preferred overall, and attempts to forecast defense spending have been limited. Verifying the Harris study, Looney and Frederiksen¹¹ expanded the sample to six ASEAN countries in 1990 and employed distributed lag functions in their regression analysis. Interestingly, Indonesia's defense patterns seemed to be influenced by expectations of future oil revenues. Six years later, Looney and Frederiksen¹² examined budgetary patterns in the Middle East and the Mediterranean region and found defense shares were a function of (a) expected and unexpected (transitory) government deficits or surpluses, and (b) expected and unexpected defense expenditures. Once again, no pattern emerged across all countries, reflecting different national priorities. In addition, defense and socioeconomic tradeoffs varied widely among countries.

Recent Latin American Defense Spending Patterns

Had we used our 1988 model to forecast Latin American defense expenditures for the 1980s and 1990s, we would have predicted lower defense expenditures. In fact, the level rose for most countries. In this section

we suggest three alternative explanations for the observed increase in the military burden in this later time period—budgetary inertia, residual military influence, and regional/internal conflict.

While a rising military burden is not, *per se*, inconsistent with our model, it would require a rather fortuitous set of circumstances: a distributed lag function¹³ describing a budgetary inertia whereby military reductions respond very slowly to a declining resource base. Since the military's share of the central budget (as opposed to GDP) declined in the 1980s, this approach would also require a set of budget priorities through which the defense budgets contract at a faster rate than several of the other main government programs. Hicks and Kubisch¹⁴ found that in countries where real government expenditures declined, the defense sector was more vulnerable to cuts than, for example, was the social sector.

In addition to budgetary inertia, two circumstances occurred in the 1980s which had not been present earlier: constrained economic growth and also civilian governments replacing military regimes. These two factors led Franko¹⁵ to suggest a theory of "residual military influence," whereby military establishments in Latin America exerted enough influence so that military budgets were at least maintained during either democratic transition, economic stagnation, or both. This residual influence could explain the rising defense burden during the 1980s but does not explain the fall in defense's share of the national budget. However, one could argue that the defense cuts might have been even greater given no residual military influence.

Furthermore, many countries, especially in Central America, faced internal conflicts or potential regional threats (or both), which would argue for maintaining or even expanding military expenditures. This internal or external threat might account for a substantial part of the rise in the armed forces and arms imports in the early 1980s.

It is difficult to specify the mechanism by which these three factors, either individually or jointly, influenced defense expenditures in Latin America. The military/civilian regime cycle could easily overlap with the growth/austerity cycle. Furthermore, as other authors have pointed out, lag structure specification is difficult between, say, a change in GDP and the resulting budget adjustment (in defense or other sectors). Incorporating these effects is made harder because all three factors may have subtle multiperiod impacts rather than a one-time impact on the budget.

An Alternative Methodology

Given that the mechanisms described earlier may or may not work independently, assigning probable causes for observed variability in re-

gional patterns in defense spending has been quite elusive. Available aggregate data provide little understanding of the budgetary process at work; political factors, budgetary or other economic resource considerations, and internal or external threat considerations could easily account for the observed differences in a region such as Latin America.

If we are to propose that a long-run relationship exists between defense expenditures and some other measure, a methodology must be used to overcome problems of spurious correlations common to many of the studies cited earlier. Large percentages of defense burden variability (as a percent of the total variation)¹⁶ being "explained" might well reflect the use of time-series data where often the variables are correlated with time itself. The model estimates are often spurious and fail to indicate or uncover any economic relationship. To avoid this issue some researchers have suggested that the first differences between data values be used instead of the levels themselves.¹⁷

This article adopts the cointegration and error correction modeling (ECM) originally developed by Granger¹⁸ and extended by Engle and Granger.¹⁹ Briefly, error correction modeling can identify long-run equilibrium patterns in time series data, such as GDP, government expenditures, defense burdens and the like. As Figure 1 indicates, in many of the Latin American countries the defense burden (defense expenditures as a percent of GDP) appears to be extremely stable in the long-run at a level of 2-3 percent. However, short-run recessions, spurts of growth in GDP, or other factors such as a regional arms race or a shift to civilian government may at times disturb this long-run relationship. If, in a statistical sense, there is some form of equilibrating relationship in the long run (where, for example, the 2-3 percent in the case of Latin America is restored), the ECM model will identify the equilibrating pattern by decomposing year-to-year movements in the defense burden into two components: (a) one associated with the shorter-run factors, and (b) one associated with correcting the deviation from the established pattern. The advantage of this approach (over normal multiple regression analysis) is that spurious correlations (often associated with regression analysis of time-series data) are avoided. Another advantage of the technique is that it provides the researcher some insight as to how defense budgets adjust over time—almost immediately or over a period of years—to restore the long-term equilibrium relationships.

Essentially, error correction is the way each country alters its defense spending to return to the long-run stability of its defense burden. So if the defense burden were to gradually rise above the target level—for example GDP declines induced by a recession—defense spending would decline enough to restore the percent balance between defense and GDP. Similarly,

other variables, such as changes in the military's influence over policy or increased regional military expenditures, may also form long-run relationships with defense, and can adjust in the short term to a disequilibrium in the long-run relationship. Thus they can be thought of as long-run "forcing" variables explaining defense spending allocations by central governments. The ECM procedure has recently been used successfully by Looney²⁰ to explain changes in defense expenditures in Pakistan as a result of short-run disequilibria.

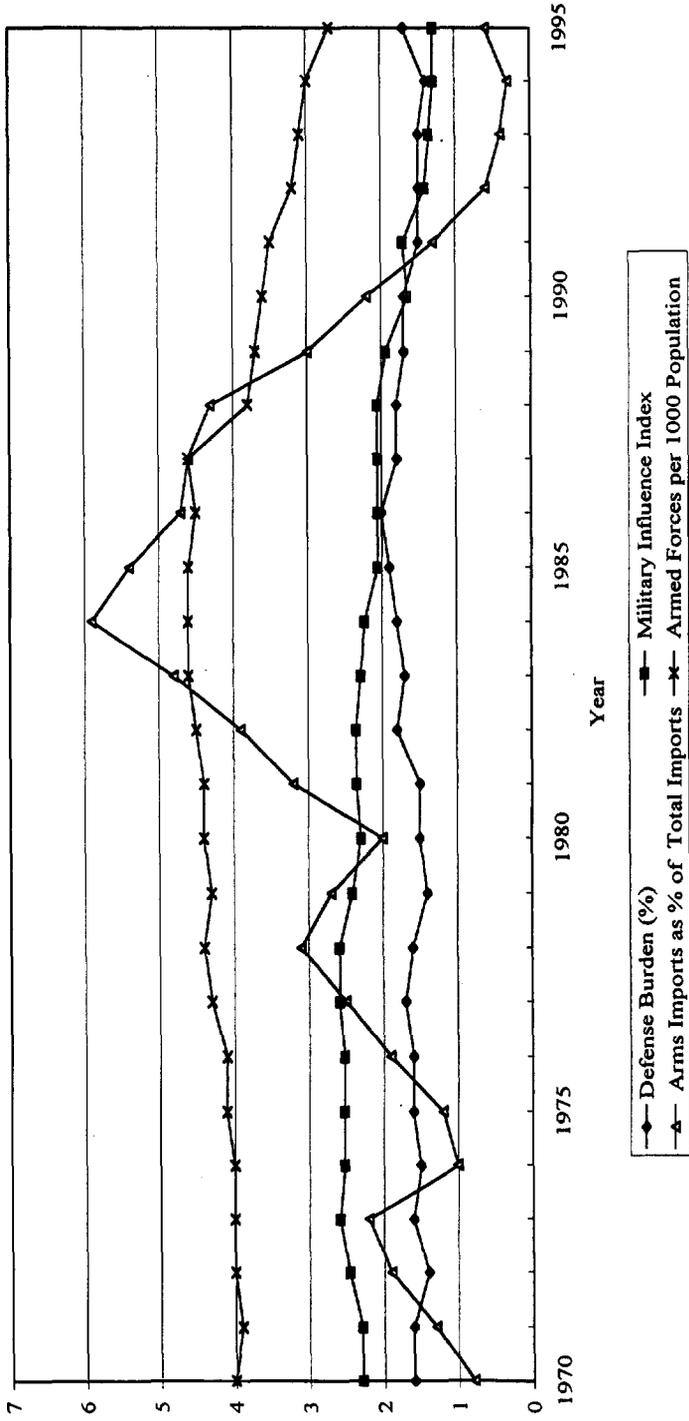
Military Intervention Index

A key element is to recognize the military's influence over the budget and to examine whether or not this influence has remained stable. While no simple measure (civilian regime versus military regime) or comprehensive nonjudgmental measure exists, Putnam²¹ developed a proxy measure called the military intervention index (MII), which was recently updated by Dix.²² Annually, each country is scored to reflect the "degree of military intervention."²³ A score of zero indicates an apolitical military; a score of three indicates a strong military role where civilians are supplicants of the military. Table 1 shows the MII for 15 Latin American countries between 1970 and 1997.^{24,25} For inclusion in the table, the country must have (a) been in the original Dix sample and (b) also have had a change in the MII in the time period (a necessary requirement of the model). Thus countries such as Nicaragua, Colombia and Mexico were excluded because they did not meet the second criterion.

The MII and three broad defense measures (the defense burden, the share of arms imports to total imports, and armed forces per 1000 population) are compared in Figure 1. As can be seen, the MII peaked in the middle and late 1970s and has gradually declined since then. While all defense measures generally increased to the mid-1980s and then declined, the arms imports variable seems to coincide with the life cycles of various major weapons systems—approximately 15-20 years.²⁶ As these systems reach block obsolescence, modification or modern replacement becomes a requirement and implies a funding requirement. Although none of the variables show a one-to-one relationship, the frequent short-run changes in the defense burden suggests that other factors, and not just military influence, are at work in the budget process. If the military influence factor is operative, it is an equilibration process whose influence is felt over a fairly long time and at different strengths each year.

Figure 1

Military Influence and Defense Measures, Latin America, 1970-1995



Model Construction

The primary purpose of the model is to explain changes in defense expenditures over time. The model must separate the short-run shocks (influences) on defense spending (such as changes in GDP or a regime change in a neighbor country) from changes in defense spending, so that a long-run equilibrium, or balance, in the defense burden can be restored—the error correction.²⁷ The model that is estimated specifies that real defense expenditures in a country at a point in time will be influenced by internal and external factors. The internal factors we include are (a) the lagged defense expenditure values²⁸ that captures the error (i.e., long-run) correction, (b) the resource base (changes in the country's real GNP and its population), and (c) the MII. Regional defense spending is included as an external factor since we assume that changes in regional militarization could well induce an almost immediate change in a country's defense spending.^{29, 30}

Results

The model was estimated for each country using economic data from the World Bank³¹ and military data from the U.S. Arms Control and Disarmament Agency,³² and the results appear in summary form in Table 2.³³ The table shows the major underlying determinants—military influence, domestic resources, and regional considerations—and the strength of each variable for all 15 countries. The countries have been divided into four groups corresponding to the strength of the variables. The strength of the determinant—strong (S), medium (M), or weak (W)—reflects the value of the t coefficient for each variable that indicates whether the estimated coefficient is statistically different from zero.

The time period for adjustments in defense spending is shown as either long-run or short-run. If the error correction term was not statistically significant from zero, the defense spending equilibration process is short-run. Defense spending reacts only to changes in the independent variables—the determinants. In other words, the country does not try to maintain a target level for the defense burden. If, on the other hand, the error correction term was found to be statistically different from zero, we can conclude that countries alter defense spending to restore a long-run target of military spending as a percent of GDP, the military balance.

For the first group of countries—Argentina, Guatemala, and Panama—the model indicates that the military has a significant influence on allocations to defense. The military influence dominated any regional militarization

Table 1

Military Intervention (MI) Scores, Latin America 1970-1997

Year	Country														
	Argentina	Bolivia	Brazil	Chile	Dominican Repub	Ecuador	El Salvador	Guat- emala	Haiti	Honduras	Panama	Paraguay	Peru	Uruguay	Venez- uela
1970	3	3	3	1	2	2	3	2	2	3	2	3	2	0	1
1971	3	3	3	1	2	2	3	2	2	3	2	3	2	0	1
1972	3	3	3	3	2	3	3	2	2	3	2	3	3	1	1
1973	3	3	3	3	2	3	3	2	2	3	3	3	3	1	1
1974	2	3	3	3	2	3	3	3	2	3	3	3	3	1	1
1975	2	3	3	3	2	3	3	3	2	3	3	3	3	1	1
1976	2	3	3	3	2	3	3	3	2	3	3	3	3	2	1
1977	3	3	3	3	2	3	3	3	2	3	3	3	3	2	1
1978	3	3	3	3	2	3	3	3	2	3	3	3	3	3	1
1979	3	2	3	3	1	3	3	3	2	3	3	3	2	3	1
1980	3	2	3	3	1	2	2	3	2	3	3	3	2	3	1
1981	3	3	3	3	1	2	2	3	2	3	3	3	2	3	1
1982	3	3	3	3	1	2	2	3	2	3	3	3	2	3	1
1983	3	2	3	3	1	2	2	3	2	3	3	3	2	3	1
1984	3	2	3	3	1	2	2	3	2	2	3	3	2	3	1
1985	2	2	2	3	1	2	2	3	2	2	3	3	2	2	1
1986	2	2	2	3	1	2	2	3	2	3	3	3	2	2	1
1987	2	2	2	3	1	2	2	2	3	2	3	3	2	2	1
1988	2	2	2	3	1	2	2	2	3	2	3	3	2	2	1
1989	2	2	2	3	1	2	2	2	2	2	3	3	2	2	1
1990	2	2	1	2	1	2	2	2	2	1	2	2	2	1	1
1991	2	2	1	2	1	2	2	2	2	2	2	2	2	1	1
1992	2	1	1	2	1	1	1	2	2	1	2	2	2	1	2
1993	1	1	1	2	1	1	1	2	2	1	2	2	2	1	1
1994	1	1	1	2	1	1	1	1	2	1	1	2	2	1	1
1995	1	1	1	2	1	1	1	1	2	1	2	2	2	1	1
1996	1	1	1	2	1	1	1	1	2	1	2	2	2	1	1
1997	1	1	1	2	1	1	1	1	2	1	2	2	2	1	1

Legend: 0 = apolitical military, 1 = little military intervention, 2 = medium military intervention, 3 = military rules directly.

Table 2

Characterizations of Military Allocations in Latin America, by Country, 1970-1997

	Strength of Major Determinants			Adjustment Period	
	Military Influence	Domestic Resources	Regional	Long-Run	Short-Run
Major Determinants					
Strong Military Influence					
Argentina	S		S	X	
Guatemala	S		M		X
Panama	S	M	M		X
Strong Resource Constraints					
Brazil	W	S	M	X	
Paraguay	W	S	M	X	
Strong Regional Considerations					
Ecuador	W	M	S		X
Honduras		W	S		X
El Salvador			S		X
Mixed Influences					
Chile	M	M	M		X
Venezuela	W	M	W	X	
Haiti	W	M	W	X	
Peru	M		M	X	
Uruguay		M	W	X	
Dominican Republic		M	W	X	
Bolivia		W	M	X	

S=Strong, M=Medium, W=Weak.

concern that was important to some degree in all three countries. Argentina reacted to Brazilian military expenditures, while Guatemala and Panama reacted to overall Central American defense spending patterns. The domestic resource base appeared to be important only in Panama. In the case of Argentina, since the country's resource base has had little measurable effect on defense spending, defense expenditures have fallen sharply with the restoration of democracy and the generally lower defense budgets throughout the region. Argentinian defense expenditures change so that a long-run balance is reestablished between defense and the military influence and regional (Brazilian) defense expenditures. No such long-term equilibration process exists for Guatemala or Panama.

The domestic resource base for Brazil and Paraguay is the major determinant of defense spending, especially the arms import component. Brazil reacts to changes in Argentinean defense spending by changing the size of its armed forces. In both countries, defense spending adjusts to reestablish a long-run balance with all three determinants. These adjustments are at least consistent with the budgetary inertia model described above.

Defense budgets in Ecuador, Honduras, and El Salvador are primarily affected by changes in regional defense spending patterns. In all cases, this is specified as the size of regional armed forces. Domestic resource constraints play a lesser role, and any residual military influence is weak. Changes in defense expenditures appear to be merely a reaction to changes in the region's military patterns, rather than an attempt to maintain a long term balance.

Multiple determinants affect defense spending in the final group of countries, and no one factor is dominant. Generally, defense budgets are moderately affected by their respective resource bases, with regional considerations generally less important. The residual military influence was moderate in Chile and Peru, and weak in Venezuela and Haiti. Interestingly, with the exception of Chile, there appears to be long-term balance between defense expenditures and the underlying determinants.

Summary and Conclusions

This article expands the discussion on the determinants of defense spending for fifteen Latin American countries. While previous studies identified the important role of economic factors in determining defense budgets, it is our opinion that no study, if used for forecasting purposes, would have been very successful. We suggest three alternative explanations for part of the defense spending differences in the region: budgetary inertia,

a residual military influence, and regional or internal conflicts. We have therefore developed a model to identify changes in defense budgets as either (a) reactions to short-term shocks or (b) attempts by individual governments to reestablish some sort of long-run balance between defense spending and some measure of economic activity, military influence, or regional military activity.

Our results suggest that in a majority of cases a high proportion of national budget allocations to defense can be explained by a relatively small number of variables. Although our earlier article on Latin America did not test for the effect of military influence or regional militarization, the lower proportion of total defense expenditures accounted for by economic factors seems to suggest that the two may well have increased in importance in recent years. However, a military influence and/or a regional effect makes generalizations or forecasts of defense expenditures difficult. The methodology separates countries whose defense budgets only react to short-term shocks (such as changes in regional military spending) from countries whose defense budgets are changed to maintain a long-run target level. For nine countries, the latter exists: equilibrating corrections are made to the defense budget in response to short-term shocks. In the remaining six countries, no long-run trend target was identified; defense expenditures are determined by short-run shocks only.

In terms of future research, the predominance of countries experiencing long-term error corrections in their defense budgets suggests that this methodology could produce reliable forecasts of defense budgets. First however, feedback effects from defense allocations to regional patterns must be established. In addition, individual country explanations could no doubt be improved with the inclusion of country specific variables such as civil wars and the like. Furthermore, this article has focused on target levels of the military balance (military expenditures as a percent of GDP). We suggest that similar analyses can be done using target levels and error correction for either armed forces per capita, or the level of arms imports as a percent of GDP, or both.

Notes

This article was originally presented at the Conference on Civil-Military Relations in Latin America, September, 1998.

1. Central and South America.
2. United States Arms Control and Disarmament Agency, *World Military Expenditures and Arms Transfers*, (Washington, D.C.: U.S. Arms Control and Disarmament Agency, annual issues).

3. Kim Hill, "Domestic Politics, International Linkages, and Military Expenditures," *Studies in Comparative International Development* 13 (1978): 53. This paper provides an excellent summary of the literature up to 1978.
4. See Michael K. O'Leary and William D. Collin, *Quantitative Techniques in Foreign Policy Analysis and Forecasting* (New York: Praeger, 1975).
5. Arthur H. Westing, "Military Expenditures and Their Reduction," *Bulletin of Peace Proposals* 9 (1978): 24-29.
6. John M. Treddenick, "The Arms Race and Military Keynesianism," *Canadian Public Policy* 11 (1985): 78.
7. Alfred Maizels and Machiko Nissanke, "The Determinants of Military Expenditures in Developing Countries," *World Development* 14 (1986): 1125-1140.
8. Geoffrey Harris, "The Determinants of Defence Expenditure in the ASEAN Region," *Journal of Peace Research* 23 (1986): 41-49.
9. Robert E. Looney, "Military Expenditures in Latin America: Patterns of Budgetary Tradeoffs," *Journal of Economic Development* 11 (1986): 69-103.
10. Robert E. Looney and Peter C. Frederiksen, "Economic Determinants of Latin American Defense Expenditures," *Armed Forces and Society* 14 (1988): pp. 459-471.
11. Robert E. Looney and Peter C. Frederiksen, "The Economic Determinants of Military Expenditure in Selected East Asian Countries," *Contemporary Southeast Asia* 11 (1990): 265-277.
12. Robert E. Looney and Peter C. Frederiksen, "Defense Expenditures and Budgetary Patterns in Selected Middle Eastern and Mediterranean Countries: An Assessment," *Public Budgeting and Financial Management* 8 (1996): 93-105.
13. A distributed lag function recognizes the impact of past values of for example defense spending on today's defense spending level. A distributed lag function indicates how many historical defense levels affect today level and assigns a weight to indicate the strength—presumably the more recent having the higher weight, i.e. greater influence.
14. N. Hicks and A. Kubisch, "Cutting Government Expenditures in LDCs," *Finance and Development* 21 (1984): 37-39.
15. Patrice Franko, "De Facto Demilitarization: Budget-Driven Downsizing in Latin America," *Journal of Interamerican Studies and World Affairs* 36 (1994): 37-52.
16. Calculated as the R² value.
17. However, even this first difference procedure will mask any long-term restoration of a stable relationship between the defense burden and the independent variables if one exists.
18. C. W. J. Granger, "Some Properties of Time Series Data and Their Use in Econometric Specification," *Journal of Econometrics* 16 (1981): 121-130.
19. R. F. Engle and C. W. J. Granger, "Co-integration and Error Correction: Representation, Estimating and Testing," *Econometrica* 55 (1987): 251-276.

20. Robert E. Looney, "Defense Expenditures and Macroeconomic Stabilization in Pakistan: A Test of the Military Keynesianism Hypothesis," *Rivista Internazionale di Scienze Economiche e Commerciali* 45 (1998): 599-613.
21. R. Putnam, "Toward Explaining Military Intervention in Latin American Politics," *World Politics* 20 (1967): 87-106.
22. R. H. Dix, "Military Coups and Military Rule in Latin America," *Armed Forces & Society* 20 (1994): 439-456.
23. This score is by necessity judgmental.
24. Haiti was included as it shares an island with the Dominican Republic. Currently Haiti has no military.
25. Data in Table 1 were derived from Dix, "Military Coups" for the period 1970 to 1991. In order to lengthen the period under study, we asked Professors Tom Bruneau, Maria Rasmussen, and Scott Tollefson (Department of National Security Affairs, Naval Postgraduate School, Monterey, California) to estimate the index for the period 1991 to 1997. The authors used these estimates for the last six years.
26. We are grateful to an anonymous referee for this observation.
27. For a technical description of the error correction model, see Looney, "Defense Expenditures and Macroeconomic Stabilization," 604-605.
28. See note 12 above for a description a lagged values and functions.
29. For Argentina we defined the regional defense variable as the Brazilian MII. For Brazil and Chile we used average military influence as a whole. For all other countries, the regional defense variable was calculated as the average defense burden for the region. This formulation was suggested by our earlier study, Robert Looney and Peter C. Frederiksen, "Economic Determinants of Latin American Defense Expenditures"; see also Robert E. Looney and P.C. Frederiksen "The Future Demand for Military Expenditure in Argentina," *Arms Control* (1986): 197-204.
30. The model also provides an objective means to identify the optimal lag structure (influence of past variables) between shocks in the independent variables and how these shocks are carried over into future budget decisions. To identify this lag structure, we used the procedure developed in M.H. Pearsan and B. Pearsan, *Microfit 4.0: Interactive Econometric Analysis* (Cambridge: Camfit Dats Ltd. 1997).
31. International Bank for Reconstruction and Development, *World Development Indicators 1997* (Washington, D.C.: World Bank, 1997).
32. All defense data from U.S. Arms Control and Disarmament Agency, *World Military Expenditures*. We recognize the fact that in many cases defense budgets between the countries are not directly comparable as they may contain different elements. However, since we are using ACDA time-series data, we assume the definitional differences are constant and carried forward over the time period we are looking at, inasmuch we feel that the data are comparable over time.
33. The complete set of regression equations can be obtained from the authors on request.