ARMS RACE AND ECONOMIC GROWTH: CASE OF INDIA AND PAKISTAN

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Abstract:
India and Pakistan maintained a hostile relationship since their creation in 1947, mainly due to religious differences. This ongoing hostility is believed to led an arms race between the two countries even though the government officials deny that on both sides. Although India and Pakistan have witnessed economic growth, it is agreed that they failed to generate a dynamism found in other parts of the developing world. Arms race between the two countries has long been seen as the major cause for their retarded economic growth. This paper investigates this twin problem of arms race and economic growth employing Toda-Yamamoto's approach to Granger non-causality, for the time period 1949-2000. After establishing the nature of the arms race between the two countries, the causality from military expenditure to economic growth is investigated for both countries. The empirical results suggest that there is a mutual causal relationship between the military expenditures of India and Pakistan. Moreover, even though military expenditure does not Granger cause economic growth in Pakistan, there is a one-way causality from military expenditure to economic growth in India.

Keywords: Military Expenditure, Arms Race, Growth, India and Pakistan

I. INTRODUCTION

India and Pakistan have been in constant conflict with each other since their creation as separate states in 1947. They used to be a single country before 1947. But the division of the country in 1947, mainly due to religious differences, has led to a complete breakdown in the social, economic and political system of the country. However, the creation of two separate states could not end the enmity, rather the countries have been allocating a bulk of their resources for defence purposes. The conflicts between the two countries are characterized by a low threshold of violence, limited scope and short duration. Ganguly (1995) argues that the limited extent of these conflicts might have been due to the common British imperial heritage, the lack of doctrinal innovation and paucity of highly sophisticated weaponry.[1]

For Pakistan, India is the major threat due to their historical relationship and India's size. Thus Pakistan is ready to allocate bulk of its resources for defence spending, in spite of the weaknesses of the domestic economy. The democratic traditions in Pakistan are believed to be weak as the military has been directly involved in internal security with long periods of military rule. This may explain why its military spending is independent of economic variables. However, India has other rivals, such as China and the Indian Ocean, to consider. Deger and Sen (1990) note that Indian military spending is more subject to checks and balances, both a product of larger population with intense entitlements demands as well as the democratic process.

This ongoing hostility has led to an arms race between the two countries, even though the government officials on both sides deny that. Tibbett and Akram-Lodhi (1997) argue that arms race between the countries have retarded the economic growth in both of them. Because large quantities of scarce resources has been allocated for military purposes rather than alternative productive investment, such as education and health provision. Seiglie and Liu (2002) note that detection of arms race between any developing countries is important considering the growth effects. Because if there is an arms race, then foreign

[1] See Alexander (1987), Deger and Sen (1990), Tibbett and Akram-Lodhi (1997) and Ganguly (1995) for the historical review of the conflicts between the two nations.

aid provided by countries or by international organizations may be allocated to the military sector rather than any productive purposes such as education and health.

Even though the arms race between India and Pakistan has received considerable attention in the literature, the empirical results are not conclusive about the possible relationship between the military expenditures of the two countries. Oren (1994) notes that every hypothesis with regard to the nature of the arms race receive some support.[2] More recently, Deger and Sen (1990) report an asymmetric arms race between India and Pakistan, with Pakistan responding to Indian military spending. Ocal (2003) employed nonlinear models to investigate the nature of arms race between India and Pakistan and confirmed the findings of Deger and Sen (1990). However, Dunne *et. al.* (1999) how that there is a bi-directional causality between the military expenditures of both countries.

Considering the growth effects of military expenditures in two countries, the empirical findings are rather limited. Tahir (1995) claims that there is bi-directoral causal relationship between the military expenditure and output for both India and Pakistan. Similarly, LaCivita and Fredericksen (1991) report a feedback relationship between military expenditure and output for Pakistan.

This study aims to add to the existing literature of Indo-Pakistani arms race by employing a vector autoregressive causality analysis for the time period 1949-2000, and emphasizes the growth effects of this arms race in the two countries. To our best of knowledge this is the first empirical study which examines arms race and its growth effects. The paper is structured as follows: Section II gives a brief account of the model and the estimation method employed. Empirical results are presented in Section III, while Section IV concludes.

II. MODEL AND THE ESTIMATION METHOD

In this paper the approach introduced by Toda and Yamamoto (1995) and extended by Zapata and Rambaldi (1997) and Rambaldi and Doran (1996) have been employed.

[2] For a brief literature review see Oren (1994) and the references therein.

Zapata and Rambaldi (1997) argued that the advantage of this procedure is that it is applicable without any need to address the cointegration properties of the system, as long as the order of the integration of the process does not exceed the true lag length of the model. Toda and Yamamoto (1995) utilises a modified Wald (MWALD) test for restrictions on the parameters of the VAR(k) model, where k is the number of lags in the VAR model. The first step of the procedure is to determine the lag length, using alternative lag length selection criteria such as Schwartz's Bayesian Information Criterion (BIC) and Hannan-Quinn (HQ) Information Criterion, and the maximum number of integration of the series (d). Then a levels VAR is estimated with a total of p=[k+d(max)] lags. Next, standard Wald tests are applied to the first k VAR coefficient matrix to make Granger causality inference. This test has an asymptotic chi-squared distribution with k degrees of freedom. Rambaldi and Doran (1996) have shown that this method can be applied by using a seemingly unrelated regression (SUR) framework and provided appropriate programme input for alternative econometric packages.

In order to examine the direction of causality between the military expenditures of India and Pakistan the causality approach of Toda and Yamamoto (1995) is applied where a VAR is estimated based on the model employed by Sezgin and Yildirim (2002). There are a number of methods explaining determinants of defence expenditure[3]. It is generally agreed that the level of military expenditure is determined by five factors, such as the influence of external conflicts, the requirements of internal security, domestic bureaucratic and budgetary factors, the influence of the armed forces themselves, the role of the major factors (Ball, 1988). Even though these political and military influences are quite important, the most crucial and central determinants of defence expenditure is budgetary, financial and resource constraints (Deger and Sen, 1995). Deger (1986) defined determinants of defence expenditure as income, population, defence expenditures of allies and rivals and political and security dummy variables.

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3 See Hartley and Sandler (1990); Chletsos and Kollias, (1995); Ball, (1998); Dunne and Nikolaidou, (2000).

In VAR analysis it is important to include all relevant variables, otherwise the estimated causal relationship will not be accurate. However, this may lead to insufficient degrees of freedom problems in the estimation. Thus the final decision about the variables to be included in the analysis should be made considering the trade-off between these two issues. In a recent study Seiglie and Liu (2002) investigated the direction of causal relationship between the military expenditures of potential adversaries employing VAR analysis in the framework of bivariate relationships. The major shortcoming of this study is that Seiglie and Liu did not consider any explanatory variables other than the rival's military expenditure, which may render their causality analysis inaccurate as there are other factors explaining military spending of a country as described above. Accordingly, we propose to model the military expenditures of India and Pakistan using the following model, which could be more appropriate in that it considers of both economic and political factors.

$$MB = f(\Delta Y,\ THR,\ POP, TBY, DUM) \qquad \textbf{(1)}$$

where MB denotes the military burden, that is military expenditure over GDP, Y is income, POP is population representing public good nature of defence, TBY is share of trade balance out of GDP, representing openness of the economy and THR is the defence burden of the rival, which is defined as the share of military expenditure out of GDP of the rival country.

The model can be expressed in econometric form as follows:

$$MB_i = \alpha_0 + \beta_{1i}\,\Delta Y_i + \beta_{2i}\,THR_i + \beta_{3i}\,POP_i + \beta_{4i}\,TBY_i + \varepsilon_i \qquad \textbf{(2)}$$

Where subscript i refers to India and Pakistan. As defence is considered as a public good, as income (Y) increases the security spending is also expected to increase. As GDP rises a nation has both more resource to produce and greater means to provide protection (Sandler and Hartley, 1995). The defence burden of rival (THR) is included in the analysis to determine if there is a rivalry between the defence spending of both countries. (POP) is population and included to capture the public good aspects of military expenditure.

Equation (2) is estimated for both India and Pakistan by using seemingly unrelated regression (SUR) form, which can be represented as follows:

$$\begin{bmatrix} MB_{i,t} \\ \Delta Y_{i,t} \\ THR_{i,t} \\ POP_{i,t} \\ TBY_{i,t} \end{bmatrix} = A_0 + A_1 \begin{bmatrix} MB_{i,t-1} \\ \Delta Y_{i,t-1} \\ THR_{i,t-1} \\ POP_{i,t-1} \\ TBY_{i,t-1} \end{bmatrix} + A_2 \begin{bmatrix} MB_{i,t-2} \\ \Delta Y_{i,t-2} \\ THR_{i,t-2} \\ POP_{i,t-2} \\ TBY_{i,t-2} \end{bmatrix} + ... + A_k \begin{bmatrix} MB_{i,t-p} \\ \Delta Y_{i,t-p} \\ THR_{i,t-p} \\ POP_{i,t-p} \\ TBY_{i,t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{MBi} \\ \varepsilon_{\Delta Yi} \\ \varepsilon_{THRi} \\ \varepsilon_{POPi} \\ \varepsilon_{TBYi} \end{bmatrix} \quad \textbf{(3)}$$

Where As are five by five matrices of coefficients with A_0 being the identity matrix, t denotes time, i denotes country, ε_{ni} are the disturbance terms with zero mean and constant variance, and p is the total number of lags as defined above.

In order to test the hypothesis that military spending of Pakistan (India) Granger cause the military spending of India (Pakistan), we test

H_0: $\alpha_1^{13} = \alpha_2^{13} = ... = \alpha_k^{13} = 0$

where α_j^{13} are the coefficients of the threat variable, $THR_{i,t-1}$, $THR_{i,t-2}$, . . . , $THR_{i,t-k}$, in the first equation of the system presented in equation (3), where the system is being estimated as a VAR(p).

If he above null hypothesis is rejected, which requires finding the significance of the MWALD statistic for the group of the lagged threat variables, a causality from the military expenditure of Pakistan (India) to that of India (Pakistan) can be established. Moreover, similar causality tests can be applied to the alternatives that no granger causality from GNP, population and trade balance to military expenditures. Additionally we can test the causality from military expenditure to output by testing the following hyphotesis:

H_0: $\alpha_1^{21} = \alpha_1^{21} = ... = \alpha_k^{21} = 0$

where α_j^{21} are the coefficients of the military burden variable, $MB_{i,t-1}$, $MB_{i,t-2}$, . . . , $MB_{i,t-k}$, in the second equation of the system presented in equation (3), where the system is being estimated as a VAR(p).

III. EMPIRICAL RESULTS

In this study, the causality between the military expenditures of India and Pakistan for the time period 1949-2000 is investigated by employing Toda-Yamamoto's approach to Granger causality. The military expenditure data for India and Pakistan are taken from SIPRI yearbooks, whereas all remaining data are obtained from IMF IFS statistics yearbooks. All data is in 1995 constant prices, except population which is in millions.

Before estimating a VAR system we have to establish the stationary properties of the variables used in the estimation. Thus an Augmented Dickey Fuller test (ADF) was carried out for the levels and the first differences of the variables. The results suggest that each series can be concluded as being integrated of order one, implying that the series are difference stationary.[4] After the stationary properties of the series are established, we have to determine the appropriate lag length of the VAR model. The choice of lag length for the VAR may affect inferences made from the causality tests in that if the lag length is too large degrees of freedom are wastes, and if it is too small the model may be mis-specified. Thus we started the analysis with a six lag for all variables. To determine the optimal lag length of the models the multivariate versions of the Akaike Information Criterion (AIC), Schwarz Criterion (SC) and Hannan- Quinn Criterion (HQ) are employed, which suggest that the appropriate lag lengths for Indian and for Pakistan model is 2.[5] As the order of integration of the series used in the analysis is one (d(max)=1), we estimated a VAR(3) for both India and Pakistan, then performed the Granger causality tests which are presented in Table 1.

[4] These results are not reported here to conserve space but are available from the authors.

[5] In order to establish the robustness of the results, the tests of causality were conducted using several lag lengths for each model. The results, which are not presented here to conserve space, are not sensitive to the choice of the lag length.

Table 1: Granger Causality Test Results for India and Pakistan

	India		Pakistan	
H_0:	P-value	Mwald	P-value	Mwald
THR $\not\rightarrow$ MB	0.038	6.522	0.000	17.837
$\Delta Y \not\rightarrow$ MB	0.072	5.254	0.005	12.504
TBY $\not\rightarrow$ MB	0.298	2.416	0.978	0.191
POP $\not\rightarrow$ MB	0.112	4.373	0.049	7.837
MB $\not\rightarrow \Delta Y$	0.037	6.592	0.366	3.170
TBY $\not\rightarrow \Delta Y$	0.015	8.358	0.355	3.252
POP $\not\rightarrow \Delta Y$	0.544	1.229	0.049	7.845

Note: $\not\rightarrow$ denotes do(es) not cause.

Empirical results suggest that there is a mutual causal relationship between the military expenditures of India Pakistan. This result is in line with the findings of Dunne et al. (1999), who report a bi-directional causality between the military expenditures of both countries. For both countries increases in their GNPs lead to an increase in their respective military expenditures, whereas trade balance does not Granger cause military expenditure. Even though there is a one-way causality from population to military expenditure for Pakistan, this is not the case for India. When the growth effects of military expenditures are considered, Granger non-causality tests suggest that military spending and trade balance in India Granger causes economic growth, but there is no such relationship for Pakistan.[6] Moreover, test results indicate that population Granger causes economic growth in Pakistan unlike India.

IV. CONCLUSION

India and Pakistan have been rivals since their creation as separate states in 1947. Even though there have been many small scale conflicts between the two countries, the nuclearization of the region is believed to bring stability at higher levels of violence. The

[6] Additional empirical estimates revealed that military expenditure negatively effects economic growth in India.

retarded economic growth in both countries could be associated with the ongoing arms race between the two countries, as scarce resources are allocated for military purposes. In this paper the nature of the arms race between India and Pakistan has been examined by employing Toda-Yamamoto's approach to VAR non-causality for the time period 1949-2000. The empirical findings indicate that there is bi-directoral causality between the two countries military expenditures. Moreover, the causality between military expenditure and economic growth has been investigated. The empirical results indicate that there is a bi-directional causality between military burden and economic growth in India. However, for Pakistan causality is from economic growth to military expenditure. There is no empirical evidence of causality from military burden to economic growth in Pakistan.

References

Alexander, D.L., (1987), "Security Profile: India vs. Pakistan", *Harvard International Review*, 9, 39-41.

Ball, N. (1988) *Security and Economy in the Third World,* Princeton University Press

Deger, S. (1986) *Military Expenditure and Third World Countries: The Economic Effect,* Routledge and Kegan Paul, London

Deger, S. and Sen, S. (1990), "Military Security and the Economy:Defence Expenditure in India and Pakistan", in K. Hartley and T. Sandler, ed., *The Economics of Defence Spending*, Routledge, London and NY.

Deger, S. and Sen, S. (1995), "Military Expenditures and Third World Countries",in K. Hartley and T. Sandler, ed., *Handbook of Defence Economics,*, Elseiver Science, BV Amsterdam, Ch.11.

Dunne, P., Eftychia, N. and Smith, R., (2001), "An Econometric Analysis of the Arms Race between Greece and Turkey", paper presented at the 5th Annual Middlesex Conference on Economics and Security, Middlesex University Business School, London, June 2001.

Ganguly, Š., (1995), "Wars without End: The Indo Pakistani Conflict", Annals, AAPSS, 541,167- 178.

IMF, International Financial Statistics Yearbooks (various years).

Ocal, N., (2003), "Are the Military Expenditures of India and Pakistan External Determinants of Each Other: An Empirical Investigation", Defence and Peace Economics, 14(2), 141-149.

Oren, I., (1994), "The Indo-Pakistani Arms Competition: A Deductive and Statistical Analysis", Journal of Conflict Resolution, 38(2), 185-214.

Rambaldi, A. N. and Doran, H. E., (1996), "Testing for Granger Non-Causality in Cointegrated Systems Made Easy", Working Papers in Econometrics and Applied Stastistics, No: 88, Department of Econometrics, The University of New England.

Sezgin, S. and Yıldırım, J., (2002), "The Demand for Turkish Defence Expenditure", *Defence and Peace Economics*, Special Issue on Military Affairs in Turkey and Greece, 12, (6).

Seiglie, C. and Liu, P. C., (2002), "Arms Races in the Developing World: Some Policy Implications", Journal of Policy Modelling, 24,693-703.

SIPRI (Swedish International Peace Research Institute), *World Armaments and Disarmaments, SIPRI Yearbook*, Oxford University Press, Oxford (various years).

Tahir, R., (1995), "Defence Spending and Economic Growth: Re-examining the Issue of Causality for Pakistan and India", The Pakistan Development Review, 34:4, Part III,1109-1117.

Tibbett, J.S. and Akram-Lodhi, A.H., (1997) "Militarization and Maldevelopment: The India-Pakistan Arms Race," *Scandinavian Journal of Development Alternatives and Area Studies*, 16, 157-182

Toda, H. Y. and Yamamoto, T., (1995), "Statistical Inference in Vector Autor egressions with Possibly Integrated Processes", Journal of Econometrics, March/April, 225-250.

Zapata, H. O. and Rambaldi, A. N., (1997), "Monte Carlo Evidence on Cointegration and Causation", Oxford Bulletin of Econonmics and Statistics, 285-298.