AN ECONOMETRIC ANALYSIS OF THE MILITARY EXPENDITURE AND EXTERNAL DEBT IN ARGENTINA

I. INTRODUCTION

As discussed in Feridun (2004), following the IMF’s guidance, Argentina cut tariffs on imports, privatized its state enterprises, reduced social service expenditure, and welcomed multinational corporations in 1980s. Problems began in 1990s when policy makers decided to implement a fixed exchange rate linking its peso to the dollar at a rate of one to one. As a result, when US dollar became overvalued, the peso became overvalued as well, making exports expensive and imports cheap. This, in turn, increased Argentina’s trade deficit, interest rates, level of unemployment and diminished its national production. Hence, Argentina wined up with no choice but to borrow more and more from the IMF in order to maintain a large reserve of dollars to sustain an overvalued currency. A thorough analysis of the Argentinaan economy prior to the recent financial crisis by Eichengreen (2002) reveals that Argentina had suffered extended periods of economic stagnation and high levels of inflation prior to its financial crisis episodes. Then, it pegged their exchange rates as an attempt to stabilize its ailing economy and to bring down inflation. Argentinaan policy makers chose to implement an inflexible peg by adopting dollar-based currency board. Further analysis by Eichengreen (2002) reveals that following extended periods of economic instability, Argentina managed to bring inflation down in the context of the exchange rate based stabilization policy. Then, it experienced a post-stabilization boom as the reduction in the interest rates toward global levels stimulated the domestic demand, especially for durable and semi-durable consumption goods and private investment. In addition, volume of exports increased as the economy reached stable levels. However, export growth reached was highly insufficient to finance the buoyant import demands. This rendered the country dependent on capital inflows. As a result, the country made intensive efforts to balance the public-sector accounts and pursued ambitious programs to privatize the public enterprises. Furthermore, it took
steps to strengthen the banking system. However, when crisis hit the country in 2001, the fiscal consolidation movement was incomplete and as Eichengreen (2002) points out, the political support for cuts in public spending was highly fragile and fragmented. In Argentina, political disturbance jeopardized the fiscal and economic adjustment attempts and the trigger of the crisis was the breakdown of support for the fiscal cuts demanded by the Economy Minister Jose Luis Machinea and his politically successor, Roberto Lopez-Murphy. The crisis required the immediate assistance of the IMF, which initially rejected a $1.3 billion-credit demand by Argentina and allowed its financial crisis to deepen. IMF finally provided credit to Argentina only after it became completely unable to maintain its peg to the dollar due to the devaluation of the Brazilian Real.

Dunne et al. (2004) explains that the relationship between military expenditures and external debt can be of two forms. As a budget item, military expenditure creates the need for funding. If a rise in military expenditure cannot be financed through taxation, creates a deficit which may be financed in four different ways: printing money, using foreign exchange reserves, borrowing abroad or borrowing domestically. However, each of these methods has some limits and implications, which are widely discussed in the literature and, while interrelated, are associated with particular macroeconomic imbalances: printing money with inflation; using foreign reserves with the onset of exchange crises; foreign borrowing with an external debt crisis (Fischer and Easterly, 1990). High public sector deficits relative to GDP, therefore, potentially create a need for foreign borrowing and external debt accumulation, particularly when the means to finance deficits domestically is limited. Hence, there is likely to be a relatively close relation between the deficits and foreign borrowing in developing countries, where the ability of using tax revenues to finance public expenditures is likely to be limited, money creation is likely to have already been misused, financial markets are relatively thin and domestic borrowing possibilities are relatively restricted (Dunne et al. 2004). A component of military spending will be allocated to pay for arms imports, which will create the need for foreign exchange. If the economy lacks foreign exchange, it will need to obtain it from external sources, usually by borrowing. It is also possible that depreciations in the currency could lead to increases in foreign exchange requirements from those expected over the life of a project. In the 1970s, external borrowing was often a preferred means of financing balance of payments deficits for South American countries. Furthermore, far from using up foreign
reserves to pay for overseas purchases, Argentina saw its reserves increase over the second half of the 1970s, at the same time she was building up her debt (Dunne et al. 2004). The key question in analyzing the effect of military expenditure on debt then, is how such expenditure is financed. If it is through higher tax revenues or lower government spending in other areas, it will not create a deficit; if higher military spending does create a deficit, this may or may not be financed through external debt. In the case of arms imports, the question is whether they can be funded through export earnings or existing reserves, or whether they require new credit (Dunne et al. 2004). Figure 1 below shows the military spending and arms imports of Argentina at constant prices. As the figure indicates, military expenditure falls gradually up to the mid-1980s, and then rises thereafter. Somewhat surprisingly, the turning point coincides roughly with the restoration of democracy in 1984. The debt crisis that struck Argentina followed a typical pattern. The country borrowed heavily during conditions of easy international credit and relatively strong domestic economies. Then a change for the worse in both domestic and especially international circumstances led to a situation in which the most debtor countries including Argentina could not service their debts, leading to loss of international credit-worthiness, severe recession, and crippling debt service payments, even when restructuring agreements were reached. One potentially

**Figure 1 – Military Spending in Argentina**
important contributor to the growth of external debt was military spending and the focus of this study is to evaluate empirically the effect of military spending on debt in Argentina.

This article is structured as follows. Section II reviews the literature on the impact of military spending on developing country debt. Section III presents the data and introduces the methodology followed. The last section points out the conclusions that emerge from the study.

II. Literature review

There exists a wide literature covering the impact of military spending on developing country debt. Brzoska (1983) Looney (1987, 1989, 1998), Dunne et al. (2004) have attempted to investigate the potential effect of military spending on developing country debt, and have provided some useful initial findings, but point to the need to understand better the dynamics within the individual countries. The results present a very mixed picture, though most studies do tend to show an insignificant or negative impact (Dunne, 1996). Analysis of the effect of military expenditure on external debt is, however, more limited. Some authors, starting with Brzoska (1983), have pointed to military expenditure as being an important variable in explaining the rise of foreign debt in a number of developing countries, suggesting that this has led to reduced economic growth. Looney and Frederiksen (1986) follow Brzoska (1983) in suggesting that the impact of high external borrowing due to defence on a country’s overall growth performance and resource allocation depends on the country’s capacity for international borrowing. Looney (1989) and Looney and Frederiksen (1986) allocate developing countries to these groups based on their capability to raise external debt, using factor analysis and discriminant analysis. They suggest that unconstrained countries will be able to support higher level of arms imports. Looney (1989, 1998) then drew attention to the weakness of the literature on the motives of debt accumulation and indicated the significance of military expenditures, specifically arms imports, for the Third World indebtedness. In his empirical analysis Looney (1989), developed three models, for ME, PDB (Public External Debt), AI (Arms Import) and ran regressions for whole sample, resource-constrained countries and resource-unconstrained countries, using two-stage least squares. In a more recent contribution Sezgin (2004) considered the relation between military debt and arms imports in
Turkey. As direct data are not available on cash payments for arms imports and military debt, he resorted to an indirect analysis and considered the likely impact of defence on external indebtedness via a model of debt and arms imports (in fact arms transfers to Turkey). To do this, he estimated a model where the growth of external debt was a function of the growth of real GNP, the growth of merchandise imports, the growth of merchandise exports, the growth of real defence expenditures, the growth of real defence equipment expenditures and the growth of real arms imports. He found arms imports to be the only significant defence related variable, although it was not strongly significant. Dunne et al. (2004) use panel data techniques to explore the effect of military expenditure on debt on a sample of industrializing economies around the world between 1960 and 2000. Their model estimates the share of external debt in GDP as a function of GDP growth, exports as a share of GDP, international reserves as a share of GDP, and military expenditure as a share of GDP (military burden). GDP growth, exports and reserves are included as they may measure the ability of the economy to finance military expenditure and arms imports without resorting to borrowing. In a static panel data model, they find military burden to have a positive but insignificant effect on the debt burden, while GDP growth and reserves have a significant negative effect, and exports a significant positive effect. However, when a dynamic panel data model was created and estimated, using the Arellano–Bond (1991) GMM estimators, a significant positive effect of military burden was found. GDP growth is still significant and negative, indicating that a strong economy makes it easier to manage debt, while the export and reserve variables become insignificant. The lagged dependant variable is very strongly significant and positive.

III. DATA AND METHODOLOGY

This study analyzes the Argentina financial crisis of 2001 through investigating the impact of military expenditure on external debt in Argentina. For this purpose, Granger-causality testing procedure is applied on yearly data between 1971 and 2002. The military expenditure series, denotes as MEXP were obtained from the Stockholm International Peace Research Institute (SIPRI), and from the IMF’s Government Financial Statistics. External debt figures are obtained from World Development Indicators CD-ROM. In order to deal with the question of how to compare nominal values of debt
and military expenditures across time, they are taken as shares of GDP, and were transformed into logarithmic returns in order to achieve mean-reverting relationships, and to make econometric testing procedures valid. GDP per capita, denoted by GDP, is calculated as gross domestic product divided by midyear population. Table 1 presents the descriptive statistics of the logarithmic transformations of time series data. The measures of skewness and kurtosis as well as the probabilities of the Jarque-Berra test statistic provide evidence in favor of the null hypothesis of a normal distribution for all data sets.

### Table 1 - Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>MEXP</th>
<th>EDEBT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>19.28659</td>
<td>16.2605</td>
</tr>
<tr>
<td>Median</td>
<td>17.68135</td>
<td>19.21218</td>
</tr>
<tr>
<td>Maximum</td>
<td>50.51639</td>
<td>33.29383</td>
</tr>
<tr>
<td>Minimum</td>
<td>5.045352</td>
<td>5.045352</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>5.045352</td>
<td>0.50622</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.016068</td>
<td>0.157872</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>3.466944</td>
<td>3.80874</td>
</tr>
<tr>
<td>Jarque-Bera</td>
<td>2.064348</td>
<td>2.081383</td>
</tr>
<tr>
<td>Probability</td>
<td>1.923948</td>
<td>2.249988</td>
</tr>
<tr>
<td>Sum Sq. Dev.</td>
<td>83.67247</td>
<td>52.93766</td>
</tr>
</tbody>
</table>

### III.I. ADF Unit Root Tests

The first necessary condition to perform Granger-causality tests is to study the stationary of the time series under consideration and to establish the order of integration present. The Augmented Dickey-Fuller (ADF) (1979) unit root test is used in examining the stationarity of the data series. It consists of running a regression of the first difference of the series against the series lagged once, lagged difference terms, and optionally, a constant and a time trend. This can be expressed as:

$$\Delta y_t = \beta_1 y_{t-1} + \beta_2 \Delta y_{t-1} + \beta_3 \Delta y_{t-2} + \beta_4 + \beta_5 t$$  \hspace{1cm} (1)$$

The test for a unit root is conducted on the coefficient of $y_{t-1}$ in the regression. If the coefficient is significantly different from zero then the hypothesis that $y$ contains a unit root is rejected. Rejection of the null hypothesis implies stationarity. If the calculated ADF statistic
is higher than McKinnon’s critical value then the null hypothesis is not rejected and it is concluded that the considered variable is non-stationary, i.e. has at least one unit root. Then, the procedures are re-applied after transforming the series into first differenced form. If the null hypothesis of non-stationarity can be rejected, it can be concluded that the time series is integrated of order one, $I(1)$.

**Table 2 - Augmented Dickey-Fuller Unit Root Test Results**

<table>
<thead>
<tr>
<th></th>
<th>Test with an intercept</th>
<th>Test with an intercept and trend</th>
<th>Test with no intercept or trend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Levels</td>
<td>Δ1-st differences</td>
<td>Levels</td>
</tr>
<tr>
<td>IMMIG</td>
<td>4.869489</td>
<td>-32.0114</td>
<td>10.403</td>
</tr>
<tr>
<td>CV (5%)</td>
<td>-9.32397</td>
<td>-9.68364</td>
<td>-10.1817</td>
</tr>
</tbody>
</table>

* McKinnon Critical Value
The lag length was determined using Schwartz Information Criteria (SIC)

Table 2 summarizes the results of the ADF unit root tests on levels and in first differences of the data. Strong evidence emerges that all the time series are $I(1)$.

**III.II. Cointegration Tests**

Next, we perform cointegration analysis. Cointegration analysis helps to identify long-run economic relationships between two or several variables and to avoid the risk of spurious regression. Cointegration analysis is important because if two non-stationary variables are cointegrated, a VAR model in the first difference is misspecified due to the effect of a common trend. If cointegration relationship is identified, the model should include residuals from the vectors (lagged one period) in the dynamic Vector Error Correcting Mechanism (VECM) system. In this stage, Johansen cointegration test is used to identify cointegrating relationship among the variables. Within the Johansen multivariate cointegrating framework, the following system is estimated:

$$
\Delta z_t = \Pi_1 \Delta z_{t-1} + \ldots + \Pi_{k-1} \Delta z_{t-k+1} + \Pi z_{t-1} + \mu + \varepsilon_t; \quad t = 1, \ldots, T
$$

(2)
where $\Delta$ is the first difference operator, $z$ denotes vector of variables, $\varepsilon_t \sim \text{niid}(0,\Sigma)$, $\mu$ is a drift parameter, and $\Pi$ is a $(p \times p)$ matrix of the form $\Pi = \alpha \beta'$, where $\alpha$ and $\beta$ are both $(p \times r)$ matrices of full rank, with $\beta$ containing the $r$ cointegrating relationships and $\alpha$ carrying the corresponding adjustment coefficients in each of the $r$ vectors. The Johansen approach can be used to carry out Granger causality tests as well. In the Johansen framework the first step is the estimation of an unrestricted, closed $p$th order VAR in $k$ variables. Johansen (1995) suggests two test statistics to determine the cointegration rank. The first of these is known as the trace statistic

$$
\text{trace} (r_0/k) = -T \sum_{i=r_0+1}^{k} \ln(1 - \hat{\lambda}_i)
$$

where $\hat{\lambda}_i$ are the estimated eigenvalues $\lambda_1 > \lambda_2 > \lambda_3 > \ldots > \lambda_k$ and $r_0$ ranges from $0$ to $k-1$ depending upon the stage in the sequence. This is the relevant test statistic for the null hypothesis $r \leq r_0$ against the alternative $r \geq r_0 + 1$. The second test statistic is the maximum eigenvalue test known as $\hat{\lambda}_{max}$; we denote it as $\hat{\lambda}_{max} (r_0)$. This is closely related to the trace statistic but arises from changing the alternative hypothesis from $r \geq r_0 + 1$ to $r = r_0 + 1$. The idea is to try and improve the power of the test by limiting the alternative to a cointegration rank which is just one more than under the null hypothesis. The $\hat{\lambda}_{max} (r_0)$ test statistic is

$$
\hat{\lambda}_{max} (r_0) = -T \ln(1 - \lambda_i) \text{ for } i = r_0 + 1
$$

The null hypothesis is there are $r$ cointegrating vectors, against the alternative of $r + 1$ cointegrating vectors. Johansen and Juselius (1990) indicated that the trace test might lack the power relative to the maximum eigenvalue test. Based on the power of the test, the maximum eigenvalue test statistic is often preferred. Table 3 presents results from the Johansen cointegration test among the data sets. Neither maximum eigenvalue nor trace tests rejects the null hypothesis of no cointegration at the 5% level.

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Trace Statistic</th>
<th>5% Critical Value</th>
<th>Maximum eigenvalue Statistic</th>
<th>5% Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r = 0$</td>
<td>22.1233</td>
<td>32.1112</td>
<td>23.1722</td>
<td>23.1111</td>
</tr>
<tr>
<td>$r \leq 1$</td>
<td>15.3222</td>
<td>18.1442</td>
<td>9.7421</td>
<td>20.5453</td>
</tr>
</tbody>
</table>

$r$ is the number of cointegrating vectors under the null hypothesis.
A linear deterministic trend is assumed.
III.III. Granger-Causality Test

According to Granger (1969), Y is said to “Granger-cause” X if and only if X is better predicted by using the past values of Y than by not doing so with the past values of X being used in either case. In short, if a scalar Y can help to forecast another scalar X, then we say that Y Granger-causes X. Granger (1969) originally suggested the Granger test, which was improved by Sargent (1976). To implement the Granger test, we assume a particular autoregressive lag length k (or p) and estimate Equation (5) and (6) by OLS:

\[ X_t = \lambda_1 + \sum_{i=1}^{k} a_{1i} X_{t-i} + \sum_{j=1}^{k} b_{1j} Y_{t-j} + \mu_{1t} \]  

\[ Y_t = \lambda_2 + \sum_{i=1}^{p} a_{2i} X_{t-i} + \sum_{j=1}^{p} b_{2j} Y_{t-j} + \mu_{2t} \]  

\[ F \text{ test is carried out for the null hypothesis of no Granger causality } H_0: b_{11} = b_{12} = \cdots = b_k = 0, i = 1, 2. \text{ where } F \text{ statistic is the Wald statistic for the null hypothesis. If the } F \text{ statistic is greater than a certain critical value for an } F \text{ distribution, then we reject the null hypothesis that } Y \text{ does not Granger-cause } X \text{ (equation (1)), which means } Y \text{ Granger-causes } X. \]

A time series with stable mean value and standard deviation is called a stationary series. If d differences have to be made to produce a stationary process, then it can be defined as integrated of order d. Granger (1983) proposed the concept of cointegration, and Engle and Granger (1987) made further analysis. If several variables are all I(d) series, their linear combination may be cointegrated, that is, their linear combination may be stationary. Although the variables may drift away from equilibrium for a while, economic forces may be expected to act so as to restore equilibrium, thus, they tend to move together in the long run irrespective of short run dynamics. The definition of the Granger causality is based on the hypothesis that X and Y are stationary or I(0) time series. Therefore, we can not apply the fundamental Granger method for variables of I(1).

The classical approach to deal with integrated variables is to difference them to make them stationary. Hassapis et al. (1999) show that in the absence of cointegration, the direction of causality can be decided upon via standard F-tests in the first differenced VAR. The VAR in the first difference can be written as:

\[ \Delta X_t = \lambda_1 + \sum_{i=1}^{k} a_{1i} \Delta X_{t-i} + \sum_{j=1}^{k} b_{1j} \Delta Y_{t-j} + \mu_{1t} \]
\[
\Delta Y_t = \lambda_2 + \sum_{i=1}^{p} a_{2i} \Delta X_{t-i} + \sum_{j=1}^{p} b_{2j} \Delta Y_{t-j} + \mu_{2t}
\]  

(8)

Since, maximum eigenvalue and trace tests do not reject the null hypothesis of no cointegration at the 5% level, aforementioned VAR method can be used. Table 4 shows the results of these regressions.

**Table 4 - Granger-Causality Test Results**

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Lag 1</th>
<th>Lag 2</th>
<th>Lag 3</th>
<th>Lag 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Military expenditure does not granger cause</td>
<td>1.2322</td>
<td>3.1211</td>
<td>3.1544</td>
<td>2.1231</td>
</tr>
<tr>
<td>external debt per capita</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External debt per capita does not granger cause military expenditure</td>
<td>1.8881</td>
<td>2.1342</td>
<td>0.1444</td>
<td>0.2333</td>
</tr>
</tbody>
</table>

* Reject the null hypothesis at the 10% level.
** Reject the null hypothesis at the 5% level.
*** Reject the null hypothesis at the 1% level.

Results of Granger-causality test show that the null hypotheses of military expenditure does not granger cause external debt is not rejected. Results show no evidence of reverse causality either.

**IV. Conclusions**

The debt crisis that struck Argentina followed a typical pattern. The country borrowed heavily during conditions of easy international credit and relatively strong domestic economies. Then a change for the worse in both domestic and especially international circumstances led to a situation in which the most debtor countries including Argentina could not service their debts, leading to loss of international credit-worthiness, severe recession, and crippling debt service payments, even when restructuring agreements were reached. One potentially important contributor to the growth of external debt was military spending and the focus of this study was to evaluate empirically the effect of military spending on debt in Argentina. Strong evidence emerged that military burden had no impact on the evolution of debt in Argentina. This finding invalidates the hypothesis that military burden may be important in determining debt in countries. Results of this study also contradict with Dunne
et al. (2004), where a panel data study of many countries was able to draw meaningful conclusions.

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**ABSTRACT**

This study analyzes the Argentine Financial Crisis of 2001 through investigating the impact of military expenditure on external debt in Argentina. For this purpose, Granger-causality testing procedure is applied on yearly data between 1971 and 2002. Strong evidence emerged that military burden had no impact on the evolution of debt in Argentina: Results of Granger-causality test show that the null hypotheses of military expenditure does not granger cause external debt is not rejected. Results show no evidence of reverse causality either. This finding invalidates the hypothesis that military burden may be important in determining the evolution of debt in developing countries.

Keywords: Military spending, external debt, Argentine financial crisis, Granger-causality

JEL Classification: H56, F40, O54

**RIASSUNTO**

*Un’analisi econometrica della spesa militare e del debito estero in Argentina*