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# THE DEMAND FOR TURKISH DEFENCE EXPENDITURE

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Although a number of studies concerning Turkish defence-growth relation have been published in recent years, little attention is given the demand for Turkish defence expenditure. This is an important issue for understanding which variables contribute to the determination of the demand for military expenditure. However, it is difficult to develop a general theory or a standard empirical approach for the determination of the demand military expenditure. This study models and estimates the demand for Turkish defence expenditure for the period 1951–1998 using autoregressive distributed lag approach to cointegration (ARDL) following the methodology outlined in Pesaran and Shin (1999). This procedure can be applied regardless of the stationary properties of the variables in the sample and allows for inferences on long-run estimates, which is not possible under alternative cointegration procedures. The findings suggest that Turkish defence spending is determined by NATO's defence spending, Greece's defence spending and some security considerations.

*Keywords*: ARDL models; Cointegration; Model selection; Turkey; Unit root tests

*Classification*: D74, H56, O57

## 1. INTRODUCTION

Turkey is strategically located at the crossroads between Asia and Europe. It is one of the largest countries in terms of population and yet the poorest member of NATO, with just over 60 million inhabitants and a per capita national income in 1998 of about $3156. Even though Turkey still keeps the developing country status with its poor economic performance, high inflation levels, large budget deficits, it still allocates a significant part of its resources for defence. Although the share of education and health spending out of GDP has been decreasing over the years, Turkey's defence burden is one of the highest in NATO. In 1998, defence expenditure of Turkey reached TL. 2,165 million (NATO, 1999: current prices), amounting to 3.3% of GDP, whereas the NATO average was 2.1%. Moreover, Turkey is also one of the leading arms importing countries in the world. Turkey defence spending shows some important characteristics. Unlike the world's decreasing trend, Turkish defence

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spending has been continuously increasing. Although Turkish defence spending has a significant affect on the Turkish economy, the determinants of Turkish defence spending have not been extensively investigated. Brauer (2002) indicates that the nature of the demand for Turkish defence expenditure is not clearly known. Thus this study aims to fill a gap in the defence economics literature.

In this paper, firstly, the models concerning the determinants of defence spending are reviewed and the model for this study is developed (Section 2). In Section 3, the data, its sources and definitions of variables are given. Section 4 explains the estimation method and the recent econometric technique of ARDL approach to cointegration. Empirical results are presented in Section 5. Finally Section 6 concludes the paper.

## 2. DETERMINANTS OF TURKISH DEFENCE EXPENDITURE

There are a number of models explaining the determinants of defence expenditure.[1] Ball (1988) argued that in the developing countries external security issues for defence are not the main concern, but internal security considerations are as important as external security considerations. It is generally agreed that the level of military expenditure are determined by five factors, which can be stated as follows:

a. the influence of external conflicts
b. the requirements of internal security
c. domestic bureaucratic and budgetary factors
d. the influence of the armed forces themselves
e. the role of the major factors such as military coups, regimes and arms sales (Ball, 1988).

These factors are all political and security related. Although 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 the determinants of defence expenditure as income, population because of its public good nature, political and security dummy variables (Deger, 1986). This type of demand equation has been used for many countries and the results are mixed (see, Hartley and Sandler, 1990). Spill and threat variables are frequently lagged by one year when time series data are used, as a nation must experience the threat and spill before responding to it (Sandler and Hartley, 1995).

Dunne and Nikolaidou (2001) estimated demand for Greek defence expenditure using a variation of the above model, which can be formulated as:

$$\mathrm{ME} = f(\mathrm{GDP}, \mathrm{POP}, \mathrm{NG}, \mathrm{TB}, \mathrm{SPILL}, \mathrm{THREAT}, \mathrm{WAR}, \mathrm{POL}) \quad (1)$$

where GDP is income, POP is population representing public good nature of defence, NG is non-defence government spending representing the opportunity cost of defence, TB is trade balance representing the openness of the economy, SPILL shows the defence spending of allies and THREAT is the defence spending of a rival. Their model also includes two dummy variables, one for war and one for political developments. This model is more appropriate in that it considers of both economic and political factors.

The demand for Turkish defence expenditure is estimated by Chletsos and Kollias (1995) for the period 1960–1992. They used a rather simple model with a relatively short sample period. In that model, explanatory variables are the national income of Turkey, defence bur-

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

den of NATO for allies defence spending and Greek defence spending for rival defence spending. Additionally, Cyprus conflict and Kurdish conflict dummy variables are added in their estimation. The findings of this study indicate that Turkish defence expenditure was strongly affected by its NATO membership, adopting a follower mode. Greek defence spending also positively affects Turkish defence spending in the long run. This study for Turkey will provide a clear understanding of the issue and also test reliability and robustness of the Chletsos and Kollias (1995) results. In this study, a relatively longer sample period will be used as well with a different econometric technique. This study is also encouraged by Brauer (2002) who indicates that there is no rigorous study of the demand for Turkish military expenditure.

Given the discussion in the previous section, demand for Turkish defence expenditure can be modelled as follows:

$$m = \alpha_0 + \beta_1 y + \beta_2 n + \beta_3 b + \beta_4 \mathrm{gr} + \beta_5 \mathrm{ng} + \beta_6 \mathrm{pop} + \beta_7 \mathrm{cyp} + \beta_8 \mathrm{Trend} + \varepsilon_t \qquad (2)$$

Defence is considered as a public good and the share of defence spending ($m$) should be positively related to income, as higher income levels tend to generate higher security spending. ($y$) denotes the growth rate of GDP. As GDP rises a nation has both more resource to produce and greater means to provide protection (Sandler and Hartley, 1995). ($n$) indicates the average defence burden of NATO. If Turkey were a free rider the coefficient of NATO will be negative; on the other hand, if Turkish defence planners adopt a follower mode of response, the coefficient will be positive. The share of trade balance in GDP ($b$) represents the openness of the economy and its sign is ambigious. The defence burden of Greece (gr) is included in the analysis to determine if there is a rivalry between the defence spending of both countries. Following Dunne and Nikolaidou (2001), we used share of non-defence government spending (ng) representing the opportunity cost of defence. The sign for this variable is expected to be negative. (pop) is population and is included to capture the public good aspects of military expenditure. The dummy variable for the Cyprus conflict in 1974 is also included in the analysis which captures the threat of war and the expected sign is positive.

## 3. DATA

In econometric studies, it is important to use the right data to get reliable results. However, there is no agreement concerning the form of the data set to be used. Thus, it is an important issue for empirical studies whether or not to use levels of military expenditure or shares of military expenditure out of GDP. Brauer (2002) argues that results of the empirical studies appear to depend whether level or share data are used. Hartley and Sandler (1995: 213) argue that if the variables are used in levels, the nature of the demand for military expenditure is better explained. However, using level variables has some difficulties. First, due to the conversion problems, when estimating the demand for defence we need time series data for alliance (NATO), for rival country (Greece) and the country in question (Turkey). However, NATO consists of more than 10 countries and each country has its own currency and conversion to one common currency makes the data less reliable. Rival country's defence spending also needs to be converted. Although use of share variables is not the perfect solution, it may overcome some conversion problems. Moreover, as Brauer (2002) argues, when the main concern is about the economic impact of the military expenditure on economic growth, share data may be more appropriate than the level data. Thus, in order to avoid conversion problems, the share variables and growth rates are used in this study.

### Data Sources and Definition of Variables

In this study the demand for military expenditure of Turkey is estimated for the time period 1949–1998. The defence expenditure data for Turkey, Greece and NATO are taken from various issues of SIPRI yearbooks. GDP, GDP deflators, trade balance, government consumption data are obtained from various issues of IMF/IFS yearbooks. Population data are taken from SPO of Turkey. The variables are defined as follows:

- *m*: share of Turkish defence spending in GDP (1987 constant prices)
- *y*: growth rate of Turkish GDP (1987 constant prices)
- *n*: average defence burden of NATO (D/Y)
- *b*: Turkish balance of trade (1987 constant prices) in GDP [(X-Y)/Y]
- gr: Greek defence burden
- ng: share of non-defence government expenditure (Government spending-defence spending) in GDP
- pop: Turkish population
- cyp: Cyprus conflict dummy variable takes value of one for the year 1974 and zero elsewhere
- trend: linear trend (1949–1998)

## 4. ESTIMATION METHOD

Although a number of alternative methods have been proposed to model and explain defence expenditure, it is difficult to develop a general theory or a standard empirical approach for the determination of the demand military expenditure. Generally, studies concerning the demand for military expenditure employ a multi-equation system estimation procedures. In the literature, three main reasons for using system estimators are stated. Firstly, systems allow cross-equation restrictions which permits hypothesis testing. Secondly, systems may allow for cross equation disturbance covariances thus improving efficiency. Finally, systems can allow for simultaneity, where explanatory and dependent variables are jointly determined. These models can be employed in alliance or arms race models where the military expenditures of a group of country are jointly determined.

Alternatively, the demand for defence expenditure functions can be examined in a cointegration framework using Engle-Granger two step method (Chletsos and Kollias, 1995). When the non-stationary variables are cointegrated, there may be some adjustment process which prevents the errors in the long run relationship becoming larger and larger. Engle and Granger (1987) have shown that any cointegrated series have an error correction representation which incorporates both the economic theory to the long run relationship between the variables and short run disequilibrium behaviour. They proposed a two step procedure where the first step is to estimate the long run function using the levels of the stationary series. In the second step, the lagged residuals from this regression are entered as error correction term in a dynamic error correction mechanism formulation, which captures the short run dynamics.

Even though these methods are generally employed in the literature, they do have shortcomings. System estimation procedures attract a lot of criticism concerning the endogenous-exogenous division of variables and the assumption of zero restrictions, which are imposed in order to achieve the identification of the model. Engle-Granger modelling approach, on the other hand, can be implemented if all variables are non-stationary. However the shortcomings of these two approaches can be overcome by employing vector autoregressive modelling (VAR). Firstly, there is no priori endo-exogenous division of the variables; secondly, no zero restrictions are imposed; and finally, there is no strict economic theory within which the model is grounded. A VAR model also allows us to identify long run and short-run dynamics of defence expenditure on economic growth. However, when the number of variables in the system is large, a VAR model is hard to implement due to the degrees of freedom considerations.

Bearing in mind the problems associated with alternative modelling methodologies, the autoregressive distributed lag approach to cointegration (ARDL) following the methodology outlined in Pesaran and Shin (1999) is employed in this study. The main advantage of this procedure is that it can be applied regardless of the stationary properties of the variables in the sample and allows for inferences on long-run estimates, which is not possible under alternative cointegration procedures. Moreover, the number of variables in the model may be large, contrary to the VAR models.

Consider the following ARDL $(p, q_1, q_2, \ldots, q_k)$ model:

$$\phi(L,p)y_t = +\sum_{i=1}^{k}\beta(L,q_i)x_{it} + \delta' w_t + u_t \tag{3}$$

where

$$\phi(L,p) = 1 - \phi_1 L - \phi_2 L^2 - \cdots - \phi_p L^p$$
$$\beta_i(L,p) = \beta_{i0} - +\beta_{i1}L + \cdots + \beta_{iq}L^{qi}$$

and $L$ is the lag operator and $w_t$ is a $s \times 1$ vector of deterministic variables such as the intercept term, seasonal dummies, time trends or exogeneous variables with fixed lags.

The error correction model associated with this model can be obtained by writing Eq. (3) in terms of lagged levels and the first differences of $y_t, x_{1t}, x_{2t}, ., ., ., x_{kt}, \alpha_0$, and $\alpha_1$, as follows:

$$\Delta y_t = -\phi(1-\hat{p})\mathrm{ECM}_{t-1} + \sum_{i=1}^{k}\beta_{i0}\Delta x_{it} + \delta'\Delta w_t - \sum_{j=1}^{\hat{p}-1}\phi_j^*\Delta y_{t-j} - \sum_{i=1}^{k}\sum_{j=1}^{q_{\hat{i}-1}}\beta_{ij}^*\Delta x_{t,t-j} + u_t \tag{4}$$

where the $\mathrm{ECM}_t$ is the error correction term defined by

$$\mathrm{EC}_t = y_t - \sum_{i=1}^{k}\hat{\theta}_i x_{it} - \hat{\psi}' w_t \tag{5}$$

and $\hat{p}$ and $\hat{q}_i$ i $= 1, 2, \ldots, k$ are the selected values of $p$ and $q_i$ $i = 1, 2, \ldots, k$. Note that $\phi(1,\hat{p}) = 1 - \hat{\phi}_1 - \hat{\phi}_2 - \cdots - \hat{\phi}_{\hat{p}}$ measures the quantitative importance of the error correction term.[2]

## 5. EMPIRICAL RESULTS

The first step in the ARDL procedure outlined by Pesaran and Shin (1999) is to test for the long-run significance of the dependent variables, by computing the $F$-statistic for testing the

[2]For an elaborate analysis of this approach, see Pesaran and Shin (1999).

significance of the lagged levels of the variables in the error correction form of the underlying ARDL model, which is similar to testing the significance of the error correction term in an error correction model.[3] In case of Eq. (2) it involves the testing of the joint long-run significance of all explanatory variables including constant, trend and the Cyprus dummy variable. As mentioned earlier, the share of non-defence government spending (ng) is included in the analysis in order to capture the opportunity cost of defence expenditure. Two of the major components of this variable are health and education expenditures. Thus, as an alternative specification of Eq. (2) the shares of health ($h$) and education expenditures (ed) are included in Eq. (2) instead of non-defence government spending (ng). It is expected, a priori, that the shares of health and education expenditures would be negatively related with the defence spending. Table I represents the results of long-run significance tests for the alternative specifications of Eq. (2), namely including only non-defence government spending (ng) as an opportunity cost variable (A); with the shares of health expenditure and education spending which replace the non-defence government spending (B). The tests are distributed according to a non-standard $F$-statistic irrespective of whether the explanatory variables are stationary or nonstationary. The critical value bounds for this tests are computed by Pesaran *et al.* (1996). The long-run significance tests indicate that specification A yields a long-run significance of above the 90th percentile significance level. However, we cannot expect to find a long-run relationship between the variables of the Model B. These tests give the preliminary indication that the shares of health and educational expenditures in the budget cannot be considered as opportunity cost variables for defence expenditure in Turkey. Thus the study proceeds with estimating Model A.

The regression results are given in Table II, where the error correction (ECM) representation of the short-run estimates and the implied long-run estimates are presented and all estimations are carried out by using Microfit 4.0. The optimal lag length for each variable is determined empirically by maximising the Akaike information criterion.

It can be shown from the table that Turkish defence burden seems to depend on previous year's burden. The change of income ($\Delta y$) has a negative and significant effect which implies that as GDP increases the share of military expenditure out of GDP declines, indicating that the growth rate of military expenditure is less than that of GDP. The effect of the change NATO's spending ($\Delta n$) is positive and significant implying that Turkey is a "follower". The change in share of trade balance ($\Delta b$) is negative and significant impliying that Turkey is a net arms importer. The effect of Greek defence burden ($\Delta$gr) and lagged value of the change in Greek defence burden ($\Delta \mathrm{gr}_{-1}$) are positive and significant. This suggest that Turkish defence spending is highly influenced by the Greek defence spending. Contrary to our expectations, the change of non-defence government expenditure ($\Delta$ng), which represents the opportunity cost of defence, is insignificant. The coefficients of the population and Cyprus dummy variables are not significant. The ECM coefficient is highly significant, reflecting the joint significance of the long-run coefficients. Additionally, the ECM coefficient is

TABLE I The results of long-run significance tests

| *Dependent variable: m* | |
|---|---|
| Model Specification | |
| A | $F(7, 22) = 3.8181$* |
| B | $F(8, 19) = 2.91$ |

*Indicates significance level of 90%.

[3] For details see Pesaran and Pesaran (1997).

TABLE II Error correction representation (short-run estimates)

| *Dependent variable* $\Delta m$ | | |
|---|---|---|
| | *Coefficients* | *t statistics* |
| $\Delta m_{-1}$ | 0.3948 | 3.5983 |
| $\Delta$y | *− 0.0447* | *− 3.0871* |
| $\Delta$n | 1.0150 | 3.7789 |
| $\Delta$b | *− 11.9106* | *− 4.6573* |
| $\Delta$gr | 0.2516 | 2.5525 |
| $\Delta gr_{-1}$ | 0.3296 | 3.6937 |
| $\Delta$ng | 2.4682 | 0.8795 |
| $\Delta$pop | *− 0.0738* | *− 0.3009* |
| $\Delta$ $pop_{-1}$ | *− 0.3711* | *− 1.4932* |
| $\Delta$ cyp | 0.2123 | 0.6406 |
| $\Delta$ Trend | 0.0358 | 1.5453 |
| $\Delta$Cons | *− 2.9928* | *− 1.5613* |
| $ECM_{-1}$ | *− 0.8446* | *− 7.5390* |
| $R^2$ : 0.7788 | DW statistics: 1.8513 | F (12.32) = 8.8065 |

Here,
$\Delta$ denotes the first difference of the variables and
$\Delta m_{-1} = m(-1) - m(-2)$
$\Delta gr_{-1} = gr(-1) - gr(-2)$
$\Delta pop\_1 = \Delta pop(-1) - \Delta pop(-2)$
ECM is the error correction term.

quite high indicating a quick adjustment to any disequilibrium in the short run. The *F* statistic is also highly significant and the Durbin-Watson statistic does not indicate any sign of serial correlation.

The estimated long-run coefficients are presented in Table III. All long run coefficients have the expected sign, except that of growth rate of Turkish GNP. It has a negative sign indicating that the share of military spending in Turkey decreases as the growth rate increases in the long-run. This may be due to the fact that, even though the level of Turkish military spending increases continuously, its share in GNP may not increase as fast as the GNP does. Moreover, one of the differences between the short-run and long-run estimates is that the effect of change of defence burden of Greece (gr) is positive and significant in the short run but it is insignificant in the long run. It suggest that Turkish defence spending is influenced by Greek defence burden only in the short run, but in the long run it is determined by other factors, such as NATO commitments, fears of Islamic fundamentalism desire to suppress Kurdish militants (Brauer 2002).

TABLE III Estimated long-run coefficients

| *Dependent variable m* | | |
|---|---|---|
| | *Coefficients* | *t statistics* |
| $y$ | − 0.0529 | − 2.8393 |
| $n$ | 1.2016 | 3.4977 |
| $b$ | − 14.1011 | − 4.3518 |
| gr | 0.1636 | 0.1468 |
| ng | 2.9221 | 0.9047 |
| pop | 0.7067 | 1.7910 |
| cyp | 0.2513 | 0.6457 |
| Trend | 0.0424 | 1.4732 |
| Cons | − 3.5433 | − 1.4927 |

## 6. CONCLUSIONS

This paper presents an analysis of the determinants of the demand for Turkish military expenditure the time period 1949–1998, employing ARDL model approach to cointegration. The results suggest that Turkish defence expenditure is mainly determined by the defence expenditure of the allies (NATO) and that of enemies (Greece) in the shortrun. However Greek defence spending does not have any significant effect on Turkish demand for defence spending in the long run, contrary to the spending of NATO. These results suggest that Turkey is in the follower mode considering the NATO defence expenditure and there does not seem to be an arms race or rivalry between Turkey and Greece in the long-run. However, in the short-run, there may be an arms race between the two countries due to the Cyprus conflict. Moreover, the short-run estimates has a significant and high adjustment coefficient, indicating that economy quickly returns to its equilibrium level, once shocked.

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