

THE ASYMMETRY IN THE EFFECTS OF DEFENSE SPENDING SHOCKS ON
ECONOMY: AN EMPIRICAL ANALYSIS FOR TURKEY

A Master's Thesis

By

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Bilkent University
Ankara
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The Institute of Economics and Social Sciences
of
Bilkent University

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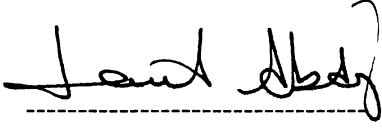
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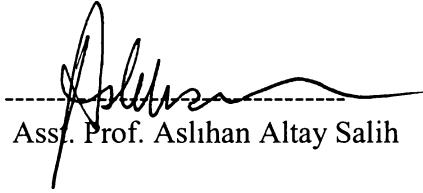
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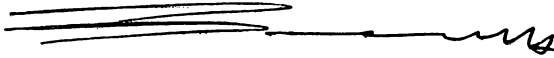
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ABSTRACT

THE ASYMMETRY IN THE EFFECTS OF DEFENSE SPENDING SHOCKS ON ECONOMY: AN EMPRICAL ANALYSIS FOR TURKEY

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The purpose of this study is to asses, whether or not the expansionary and contractionary defense spending shocks have asymmetric effects on the Turkish economy. It is widely believed that decrease in the government spending resulted from decrease in defense spending — although there is no guarantee that savings on defense spending would be applied to deficit reduction—will be followed by decrease in prices providing stability in the market. But contrary to these beliefs there can be asymmetry in the effect of defense spending innovations because of some factors. We have investigated the reactions of macroeconomic variables— real income, prices, money, exchange rate, and employment— to the defense spending innovations by applying vector autoregression (VAR) methodology. The empirical evidence reported here gives evidence on that there is statistically significant asymmetric effect on real income (positive defense spending shock increases the real income) and on price level (positive defense spending shock decreases price level), but there is no statistically significant evidence on the effect of expansionary and contractionary defense spending on: money supply, exchange rate, and employment variables.

Keywords: Defense spending, asymmetric effects, VAR.

ÖZET

SAVUNMA HARCAMALARINDAKİ BEKLENMEDİK DEĞİŞİMLERİN EKONOMİ ÜZERİNE ASİMETRİK ETKİSİ: TÜRKİYE İÇİN AMPİRİK BİR ÇALIŞMA

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Bu çalışmanın amacı savunma harcamalarındaki beklenmedik artış ve azalışların Türkiye ekonomisine olan etkisinin asimetrik olup olmadığını araştırmaktır. Genel inanış, savunma harcamalarındaki düşüş neticesinde azalan bütçe giderlerinin (savunma harcamalarındaki kısımların bütçeye her zaman yansıtılmamasına rağmen) ekonomideki fiyat seviyesini aşağılara çekip piyasadaki istikrarın sağlanmasına katkıda bulunduğu yönündedir. Fakat bu inanışın aksine savunma harcamalarındaki aşağı yukarı dalgalanmaların ekonomiye etkisi asimetrik olabilir. Bu çalışmada, reel gelir, fiyatlar, para arzı, döviz kuru ve istihdam değişkenlerinin savunma harcamalarındaki dalgalanmalara olan reaksiyonlarını vektör oto-regresyon (VAR) metodunu kullanarak araştırdık. Elde edilen empirik kanıtlara göre; savunma harcamalarındaki dalgalanmaların reel gelir ve fiyat seviyesi üzerine asimetrik etkisi istatistiki olarak anlamlıdır (harcamalardaki beklenmedik artış reel geliri arttırmış, fiyat seviyesini azaltmıştır). Fakat para arzı, döviz kuru ve istihdam değişkenleri üzerinde istatistiki olarak anlamlı herhangi bir etkisi bulunmamıştır.

Anahtar Kelimeler: Savunma harcamaları, Asimetrik etki, Vektör otoregresyon.

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CHAPTER 1

INTRODUCTION

Before focusing on the possible economic consequences of defense spending in Turkey, it will be useful to view the reasons why Turkey gives great importance to defense. Looking at the global trend over a long period, world military expenditure reached its peak in 1987. With the end of the cold war there was a period of consistent annual reductions in real terms until 1998, and after 1998 there have been significant real increases. By 2000 world military expenditure was roughly 40 % lower in real terms than it was in 1987 (SIPRI Yearbook, 2001). In spite of these reductions there are still vast amounts devoted to military spending in the World (see Table 1).

Security, technology, politics, economy, industry, the geopolitical situation, historical relations, regional differences within the countries, and the political regime of a particular country can be named as determinants of defense expenditures. Dissimilar trends in expenditures of countries depending on different factors change over time. For

example the reason behind the increase in the defense expenditures of North America and Europe after 1998 is primarily the peace support operations. Economic factors in East Asia can be seen as the main determinant of the expenditure trend. Restructuring of armed groups and the existence of local conflicts are the reasons behind the acceleration of Africa's spending (Deger and Sen, 1990).

Table 1: Military Expenditure by Region, in Constant US dollars, 1992-2001

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
World Total	847	814	793	941	722	732	719	728	757	772
Africa	9.3	8.8	9.3	8.9	8.5	8.8	9.3	10.9	11.3	12.2
Americas	383	367	348	333	314	315	308	308	319	317
Asia	105	108	109	112	115	117	117	119	123	129
Europe	296	278	275	239	235	238	227	233	241	242
Middle East	52.3	51	50.9	47.9	48.9	53.5	57.8	56.1	63.1	72.4
NATO	557	533	508	481	466	462	457	467	478	472

Notes: (1) Figures are in US \$b., at 1998 prices and exchange rates (2) Source: SIPRI Yearbook, 2002

Turkey is located at a place where political uncertainties, regional turmoil and instabilities are intense. Defense expenditures have always been a main issue of concern in Turkey because of the threat of terrorism and radical fundamentalist movements, proliferation of weapons of mass destruction in the region, and border disagreements with Greece. For these reasons Turkey couldn't follow the decreasing trend in the defense expenditures of NATO countries in the post bi-polar period. For example the military equipment expenditure of Germany (see Table 2) fell by 47, 9 % from 1987 to 2000. Within the same period, Spain decreased by 57 %, while Turkey increased by

235.2 %. However neighboring country Greece followed Turkey with 41.6 % increase in the same period.

Table 2: Expenditure on Military Equipment

	Change %					
	1987-90	1990-95	1995-2000	1999	2000	1987-2000
Germany	-8,1	-52,1	18,4	6	5,8	-47,9
Greece	24,7	-11,5	23,2	-1,4	-2,4	41,6
Italy	-12,5	-24,5	0,7	-2	4,2	-33,4
Netherlands	-1,8	-27,5	-9,6	16,2	-20	-35,6
Spain	-53,4	-2,7	-5,2	-1,7	12,6	-57
Turkey	16,7	73,2	65,9	36,7	43,2	235,2
UK	-32,3	-1,3	16,3	0,3	0,4	-22,2
USA	-13,5	-12,8	-21,2	-2,3	-4,9	-40,5
Total NATO	-15,1	-14,5	-13,1	-0,3	-2	-36,9

Notes: (1) Figures are percentages, based on figures in US\$ at constant 1998 prices and exchange rates. (2) The NATO definition of expenditure on equipment (procurement and R&D) differs significantly from the national definition in many NATO countries, and so therefore do the value and the trend. (3) Total NATO excludes France (4) Source: SIPRI Yearbook, 2001

When we compare the defense expenditure-GDP ratios of NATO countries in 1990s, we can see that Turkey and Greece have the highest ratios. (See Table 3) The percentage shares in these two countries are nearly two times that of other countries presented in table 3.

Table 3: Defense expenditure-GDP ratios of some NATO countries

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Germany	2.3	2.1	2	1.8	1.7	1.6	1.6	1.5	1.5
Spain	1.7	1.6	1.7	1.5	1.5	1.4	1.4	1.3	1.3
Italy	2.1	2	2.1	2	1.8	1.9	2	2	2
Belgium	2.3	1.8	1.7	1.7	1.6	1.6	1.5	1.5	1.4
Denmark	2	2.9	1.9	1.8	1.7	1.7	1.7	1.6	1.6
Greece	4.3	4.5	4.4	4.4	4.3	4.5	4.6	4.8	4.8
Turkey	3.7	3.7	3.8	4.1	3.9	4.1	4.1	4.4	5.4

Notes: (1) Figures are in terms of ratios (2) Source: SIPRI Yearbook, 2001

The figures in Table 2 and Table 3, however, will not be sufficient to explain the situation. In order to better understand the reason behind these high ratios of Turkey, we should compare the military expenditures of Turkey with its neighbors also. As shown in the Table 4, the neighboring countries of Turkey also have increasing trends in defense spending, which brings difficulties to Turkey in reducing its defense spending.

Table 4: Military Expenditures of Turkey and its Neighbors

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Avg. Δ %
Turkey	6470	7153	7006	7184	8044	8380	8781	9696	9383	8885	3.7622
Greece	4675	4564	4642	4742	5025	5355	5836	6110	6449	6577	3.9149
Syria	4592	3635	3923	3948	3669	3786	4104	4184	4526	4737	0.78.4
Iran	3596	4516	6129	4537	5131	5745	6064	6148	9110	11515	15.766
Russia	80400	70900	68600	43400	39500	42200	30600	35900	40300	43900	-4.76

Notes: (1) Figures are in US m\$, at constant 1998 prices and exchange rates

(2) Source: SIPRI Yearbook, 2002

From early 1980s Turkey's defense spending and its arms imports have raised parallel to the sharply increasing external debt. Increasing terrorist activities by separatist PKK (Kurdish Workers Party) and a developing defense industry are the main reasons behind this increase. In addition to the PKK, almost all neighboring countries have hostile intentions toward Turkey. Armenia is continuously trying to disturb Turkey in international arena by putting forward the 'on-called genocide during World War I' and supporting PKK. Russia still preserves its well known historical desire to reach southern seas and perceives Turkey as the main hindrance in front of this desire. According to Syria, Hatay case is still not solved. Water deficiency in the region and Hatay problem can be expected to spoil the relations between two countries in the future

although currently it is normal. Because of the lack of authority, Northern Iraq became headquarter for the militants of PKK since the 1992 Gulf War. Nuclear armament attempts of Iran also increase the anxiety in the region.

Greece is the most problematic of all the neighbors that we should make special emphasis. Disputes over territorial waters in Aegean, dispute over the extent of territorial airspace, disputes over the continental shelf rights, disputes over the militarization of certain Aegean islands, disputes over Cyprus, and disputes over the minorities are expected to keep on the everlasting disagreements. Turkey is perceived by Greek security and defense policy as the main source of external threat to its national interests. There is a wide range of literature about the Greek-Turkish conflict. Ozturk (2004) analyzed the effects of foreign threats on military spending and indicated an arms race between two countries finding that Turkey military spending is granger caused by Greek military expenditure. For further evidence you can see: Georgiou et al., 1996, Kollias and Makrydakís (1997).

Thus far we have tried to explain the reasons behind the high defense expenditures of Turkey. Henceforth we are going to draw attention to the effects of defense spending on economy as an important budget item. Fluctuations in defense purchases may influence the economy in numerous ways: it may have effects on real interest rates, on the quantities of output, consumption and investment. It may have direct effects on price or indirect effects through the monetary growth. Defense spending may also have effects

on current-account deficit and budget deficits, which may have additional influences on the economy. Moreover, the effect of an increase in defense spending on macroeconomic variables may be different from that of a same amount of decrease and the outcomes may be asymmetric. Whether or not the expansionary and contractionary defense spending shocks have asymmetric effects on the Turkish economy is the main concern of our thesis.

Examining the asymmetric effects of defense spending shocks will be interesting in Turkey since the country has a high amount of a defense budget and experiences chronicle high rates of inflation for decades. As the Turkish government has been running deficit for many years, the expansionary defense spending shocks are likely to have increased borrowing and in contrast, the contractionary defense spending shocks are likely to have decreased it. Following two scenarios will be instructive in understanding the asymmetric behavior of macroeconomic variables in the face of defense spending innovations.

Looking from the traditional perspective, as a budget item, the increased defense expenditure will be expected to stimulate aggregate demand. But there exists some factors complicating the effects of defense spending. The first factor is the effect of defense spending on financial markets. An increase in defense spending is likely to increase the budget deficit. As a result, government increases the borrowing to finance the increased budget deficit. Since the supply of loanable funds is limited, an increase in

borrowing will lead to an increase in interest rates and, in turn, will crowd out private spending. By this way, the expansionary effects of increased defense spending on aggregate demand will be relieved. In a similar way, the decrease in defense spending will increase the amount of loanable funds. This increase in the amount of loanable funds will decrease the interest rates and, in turn, increase the private spending. As a result the private spending is likely to decrease when defense spending increases and increase when defense spending decreases. The effects of defense spending on price level and output level through increasing the aggregate demand will be offset by the behavior of the private agents. Thus, as a future research, investigating the effects of defense spending on interest rates can be helpful in illuminating this link.

From another perspective, the importance of changes in the interest rates is the question. The expectations of future government spending will have effects on the current behavior of the private agents. Increased government spending indicates future tax liability for the private agents. Since agents behave as if they are infinitely lived, private consumption is likely to decrease and private savings is likely to increase in the face of increased government spending. Demand expansion slows down with the reduction in the private consumption and the availability of loanable funds increases with the increase in private savings and, in turn, decreases the interest rates. Briefly this channel will relieve the upward pressure of increased defense spending on interest rates. With a similar logic, if the private sector foresees a reduction in the future taxes with the reduction in government spending the private consumption may increase and the private

savings will decrease. The decrease in the supply of loanable funds by this way will tend to increase the cost of borrowing. Stating briefly, the downward pressure on interest rates by decreased defense spending will be offset by increased private consumption and decreased private savings.

The purpose of this study is to assess, if the expansionary and contractionary defense spending shocks have an asymmetric effect on Turkish economy. It is important to assess the asymmetric effect of defense spending on the economy because it is widely believed that decrease in the government spending resulted from decrease in defense spending—although there is no guarantee that savings on defense spending would be applied to deficit reduction—will be followed by decrease in prices providing stability in the market. But contrary to these beliefs there can be asymmetry in the effect of defense spending innovations because of some factors. First of all, wages can be rigid in the downward direction while flexible in the upward direction due to effects of persistent positive inflation on contract indexation. Secondly, downward rigidity of prices will cause them to respond more to an increase in defense spending than to a decrease. Thirdly, because of the interest rate movements caused by the defense spending, the private agents will exhibit adverse movements—i.e. consumption may decrease in the face of expansionary government shock and increase in the face of contractionary government shock.

In this study the existence of any asymmetric effect on the economy is tested by applying unrestricted vector autoregression (VAR) methodology. We are mainly concerned with the asymmetric effects of defense expenditures on aggregate demand and price level. But in addition to these variables, we also test the effect of defense spending innovations on: money supply, exchange rate, and employment. In our analysis we use the annual data from 1950 to 2003. The source of data is explained in detail in Chapter 3.

The organization of thesis is as follows: Chapter 2 is literature review of the asymmetry in the economy and presents empirical evidence about the effect of defense spending on different macroeconomic variables. The model and methodology followed is explained in Chapter 3. The test results of the empirical study are discussed in Chapter 4 and finally the conclusion is presented in Chapter 5.

CHAPTER 2

LITERATUR REVIEW

2.1. Introduction

Kandil (2001) examined the asymmetric effects of government spending on US economy and found that output growth and price inflation are decreasing despite expansionary government spending shocks and also found that contractionary government spending shocks are not offset by an increase in private spending. Negative government spending shocks slowed output growth and price inflation. With a similar approach to Kandil (2001), Berument and Dogan (2004) observed the asymmetric effect of expansionary and contractionary government spending shocks on Turkish economy using quarterly data from 1987:1 to 2001:1. They argue that private consumption and investment decrease in the face of expansionary government spending shocks while they either don't change in the face of contractionary government spending shocks.

By following the same methodology with the above studies, we observe the asymmetric effects of defense spending shocks on Turkish economy. Especially for Turkey, defense budget constitutes a significant portion of government spending, so the factors—forces— that create asymmetry in the face of government spending innovations will be same as those ones in the face of defense spending innovations. Some of these factors are commonly stated in the economy literature to explain the asymmetry created by government spending. In the next step, we are going to introduce these views in order to gain a better understanding of the topic—asymmetry. Later in this chapter, we are going to present some empirical evidence on relationship between defense spending and economic variables.

2.2. Possible Explanations for the Asymmetry Created by Economic Policy Shocks

Some of the possible reasons of asymmetric reaction of macroeconomic variables to the economic policy shocks can be stated under the following views: nominal wage flexibility in labor market, price flexibility in the product market, behavioral effects on private sector, and effects of interest rates that change with the default risk level in the credit market.

2.2.1 Asymmetric Wage flexibility

Within this context it is assumed that wages are upward flexible. When there is expansionary government spending—in our study it is defense spending—the demand in the economy will increase and wages will rapidly adjust to this increase. This increase in wages will, in turn, increase the production costs and consequently lead to inflationary effects on prices. On the other hand, because of the small or zero indexing parameter in the face of negative demand shocks, the wages response to the negative demand shocks will be more rigid. This rigidity causes increases in real wages which, in turn, increases the contractionary effect of negative demand shocks and consequently moderates deflationary effect on prices. Stating briefly, while increased spending will have inflationary effects, decreased spending will not have same amount of deflationary effects on prices. The remaining part of this topic will explain the upward flexibility of wages in detail and present some empirical studies on this argument.

Wages are determined in advance for a specific duration by explicit formal contract agreements or implicit informal contract agreements. Gray (1978) states that wage rigidities are produced by setting of a nominal base wage and an indexing parameter before receiving full information on the economic variables relevant to production decisions. Since the base wage is fixed for the period of contract, production function and money supply shocks cause changes in real wage rate and thus, may cause employment and output fluctuations.

While cost of contracting increases the length of contracts, the increasing uncertainty about economic fluctuations decreases that length. An increase in the economic uncertainty directs the agents to write shorter contracts to avoid the risk of fixing nominal wages for long periods. Asymmetry may be created by the settings of these contracts that make distinctions between the upward and downward movements of wages and salaries. Indexing parameters included in contracts allows for adjustment of wages to the unexpected changes in the price level of the product that are realized in the contract period. The response of index parameter to the expansionary shocks will be larger than to the contractionary shocks.

“Firms may be reluctant to take aggressive measures towards adjusting wages in the downward direction during recessionary periods. This is because the search and training cost of hiring new workers may actually exceed the perceived loss of retaining workers at wages that exceed the marginal physical product of labor during recessionary periods.”(Kandil, 1996: 442)

Kandil (1995) argues that the asymmetric wage indexation will cause changes in the slope of the aggregate supply curve. This change will depend on the direction of the government spending shocks. The rapid inflationary effects of positive spending shocks on price level indicate a very steep supply curve. On the other hand little deflationary effects of negative spending shocks because of the downward rigidity of wages indicate a very flat supply curve.

Alternatively Kandil (1996) points out the asymmetric flexibility as an endogenous response to total uncertainty in the economy. Gray (1978) emphasized in his model that the degree of indexation depends on the variability of unsystematic disturbances in the economy. For example, agents are inclined to be more flexible for upward adjustments than the downward adjustments in economies experiencing high persistent inflations.

The empirical suggestions of the studies referred are as follows. Kandil (1996) analyzed the cyclical behavior of the real wage in United States, using sample period 1955-1991, and found that the cyclical behavior of the real wage varies in response to the demand shocks over time. She also concluded that cyclical behavior of the real wage appears asymmetric in response to the positive and negative demand shocks. In another study, Kandil (1995) examined nineteen industrial countries and found downward rigidity of wage and price inflation for the countries under investigation. Wage and price inflation exhibited a larger response to the positive monetary shocks compared to the negative monetary shocks. Demand variability accelerated the wage inflation across the countries where wages are less flexible in downward direction. But the negative impact of the increased variability on output didn't appear significant in this study.

2.2.2 Asymmetric Price flexibility

According to this view, prices react rapidly to the positive demand shocks created by increased government spending—in our study it is defense spending—while there is no tendency to move in the face of negative demand shocks. In the remaining part of this topic we are going to explain sticky price argument in detail and present some empirical studies on the issue.

Sticky price explanation tells that for a particular period the price level across the sectors is fixed. In the short run the unchanged prices will absorb the positive and negative demand shocks. Models of this explanation have emphasized rigidity in the product market. Competitive firms faces “menu costs” when they decide to change the prices of their product. With the increase in inflation, firms regularly need to make price changes in their menus. The cost of menu changes and the uncertainty in the economy are the main determinants of the frequency of this change. As uncertainty increases, the risk of fixing costs encourages firms to pay menu costs. For a detailed understanding of this practice the study of Sheshinski and Weiss (1977) can be helpful, which is concerned with the real costs associated with the transmission of price information to the consumers (menu costs) and the role of inflationary expectations on pricing decisions

Ball and Mankiw (1994) argue that the asymmetries in the prices are caused by positive trend inflation. When there is a negative demand shock firms will not intend to decrease

their prices, because the positive trend inflation automatically decreases the relative price of a firm between price adjustments. With a positive demand shock, firms tend to make a greater adjustment in order to close the gap between desired and actual prices, because as time passes the gap between the desired and actual prices increase with the effect of inflation. According to this view the downward rigidity of prices is caused by positive inflation so that the asymmetry is endogenous to inflation. The empirical result in Ball and Mankiw (1994) suggest that output is affected asymmetrically from the aggregate demand fluctuations. Because of the sticky downward prices, a negative change in demand reduces output substantially while a positive demand has a smaller effect on output.

Downward rigidity of prices also triggers the short run inflation in the case of relative price changes among sectors. In the markets in which excess demand exists, price rises; if there is excess supply, actual price does not fall. The result is the larger the variability of relative disturbances in the sectors, the higher the average inflation rate. Ball and Mankiw (1994) also imply that shifts in prices with the sectoral shocks are inflationary in the short run. With the relative price adjustments among the sectors the desired increases cause greater price adjustment than the desired decreases. Fischer (1981) supported that unanticipated changes in money or interest rates are associated with increased relative price variability.

In addition to the cyclical behavior of the real wage in United States, Kandil (1996) also analyzed flexibility of prices. She proved that the upward flexibility of prices appears larger than that of the wages in response to positive demand shocks while the downward rigidity of prices is larger than that of the wages in response to the negative demand shocks.

DeLong and Summers (1988), find that shifts in aggregate demand have asymmetric effects on output on US data. They proved that output responses stronger to the negative monetary shocks than to the positive shocks. Evidence presented in Cover's (1992) study supported the hypothesis that negative money-supply shocks have larger and more important effect on output than positive shocks have. Barro's (1978) empirical study reports the relation of money to output and price level. The results suggest lagged response of price level and the output to unanticipated money movements.

One alternative explanation for the downward price flexibility is that the firms hesitate to cut prices because they fear that customers will interpret a price cut as a signal of quality reduction—when, in fact, there has been no quality reduction. But the respondents to the Blinder's (1991) questionnaire didn't judge the quality by price, and the suggested results didn't conform to this explanation.

2.2.3 Private Sector Behavior

Variations in government spending will have different consequences on the behavior of the private sector. The increase in government borrowing to finance the expansionary spending may be paralleled by a greater decrease by private spending. With the increased government borrowing, uncertainty about the future income of the risk-averse household increases because the eventual payment of these liabilities will eventually lead to tax increases. The increased uncertainty leads to higher rate of discount in capitalizing these future taxes. (Kandil 2001)

According to the Barro's (1974) model each individual's utility also depends on the consumption of his heir. So there is a strong link between the utility of current generation and the utility of future generation. When government borrows, this indicates wealth for the current generation but a liability for the future generation. With the issuance of a bond, a liability for the future interest and principle payments of that borrowing is created automatically. For this reason government borrowing is an implication of a shift in the current taxation to the future. Since the utility of the current generation depends on the utility of future generation, current generation will try to offset this redistribution of wealth from their heirs to themselves by increasing savings. For example, Tobin (1971) (cited in Barro (1974)), notes: "How is it possible that society merely by the device of incurring a debt to itself can deceive itself into believing that it is wealthier? Do not the additional taxes which are necessary to carry interest charges reduce the value of other

components of private wealth?” Barro (1974) states that: “current generations act as if they were infinite-lived when they are connected to future generations by a chain of operative intergenerational transfers.” The link between current generation and future generation can also be seen in the study of Kotlikoff and Summers’ (1981), in which they try to estimate the contribution of intergenerational transfers to aggregate capital accumulation. Kormendi (1983) also shares the same idea with Barro in that “a current period tax reduction financed by issuing government debt shifts the timing of tax collection from the current period to the future.”

“If the future taxes implied by government debt are not fully perceived and discounted by the private sector, there will be a “net wealth effect” that increases private sector consumption, thus reducing capital accumulation and growth. If , on the other hand, the implied future taxes are perceived and discounted by the private sector, the current period tax reduction will be used to increase private savings to pay for the future taxes and the government debt will be absorbed without any real effects on the economy.” (Kormendi, 1983: 994)

But as long as the interest rates on government debt is not greater than the rate of economic growth, governments can create debt that is never have to be paid by future generations because the ratio of debt to national income will not increase. Knowing this, the generation that receives the debt will not increase its previously planned savings and thus increase the consumption. (Feldstein, 1976)

The explanation of Feldstein and Elmendorf (1990) differs slightly from that of Barro’s (1974). In this view, higher level of current government spending indicates higher level of future government spending because; once a program is launched with a budget

increase it is not likely to reverse the situation. Since it is assumed that the future government spending will increase, future tax obligations will also increase parallel to this process. Anticipation of higher future taxes resulting from increased future government spending will lead individuals to reduce their own current spending.

There are numerous empirical studies on this issue. Kormendi's (1983) paper provides strong empirical support for Richardian equivalence by showing that increases in government spending on goods and services depress consumer spending while changes in tax receipts have no effect on consumer spending. But Feldstein and Elmendorf (1990), excluding the World War II period from the same data, have found that taxes depress consumer spending while government outlays on goods and services have either a smaller or a totally insignificant effect.

Aschauer (1985), studying US data, indicated that there is some substitutability between private consumer expenditure and government spending. The results of Katsaitis (1987) is different from that of Aschauer's (1985), suggesting that government spending substitutes poorly for private consumer expenditure and also implying that temporary increases in government spending will result in an expansion of real output in US. In another study, Aschauer (1989) examines the crowding-out and crowding-in effects of public capital accumulation to the private capital accumulation for US data.

Barro (1987), in his introduction of the Carroll and Summers studies, noted that the increase in relative value of Canadian private saving rate to US was partly due to the decrease in relative value of public savings rate. Kochin (1974) explored the effect of including federal government deficit among the explanatory variables to explain the level of the private consumption. The result presented that consumers anticipate future taxes implied by present deficits and that private consumption respond as to offset the effect of government deficits.

2.2.4 Asymmetry created by increased inflation risk

With the positive government spending shock, the demand for loanable fund increases in the credit market. Positive spending shocks increase the debt stock of the government. The accumulation of the government debt increases the inflation risk. The increased inflation risk will indicate possible drastic political measures in the near future and create a psychological crowding out effect in private behavior because private sector will tend to save more to avoid from the inflation risk. (Miller, Skildesky, and Weller, 1990). Kandil (2001) suggests that interest rates increased from this risk premium, in the face of fiscal expansion, will cause private spending decreases. On the other hand, government efforts to lower risk premium by reducing debts will be responded with positive private spending.

From another perspective, government fiscal expansion may decrease economic growth by decreasing the private savings and market efficiency. If an increase in government spending is temporary, it may reduce the degree of risk aversion. If a consumer becomes less risk averse then he will reduce his insurance for the future by saving less and consuming much. This reduction in savings causes increases in interest rates, thus lowers investment in physical capital. This eventually causes a decline in productivity and long-run economic growth. On the other hand the effect of an announced permanent government spending on the risk aversion of the private sector is uncertain. (Hatzinikolaou and Ahking, 1995)

2.3. Empirical Investigation on the effects of defense spending

Fluctuations in government spending have direct effects on real interest rates, consumption, investment, output, and price level. There are also indirect effects on exchange rate through the interplay with interest rate fluctuations and indirect effect on price level through interplay with monetary growth. Defense spending as a component of government spending is not different. This part of the chapter 2 aims to present some empirical findings about the effect of defense spending on macroeconomy.

According to Dunne, Freeman and Soydan, (2002) there are various channels by which military spending can influence the economy in both positive and negative ways.

Military can remove the skilled labor from civil production. On the other hand, especially in developing countries, military can create valuable skills by training workers. It can take the best capital equipment from the civil industry in order to produce high technology weapons, but this investment on high technology can have positive consequences on civil sector. It can create wars but it is the main force that ensures the existence of the peace at the same time. With the weapon imports it will also affect balance of payments. On the other hand, in a situation when the aggregate demand is inadequate relative to potential supply military would contribute increased employment of labor and utilization of capital. Military may induce development of new domestic supply by creating demand for particular products. Military may be the introducer of new technology to the society or the developer of new infrastructure such as roads, power supplies, and communication services, which will have consequent effects on productivity.

As a budget item, military expenditure creates the need for funding. When a government cannot cover its expenditures by the revenues, there are four ways to finance the deficit occurred: printing money, using foreign exchange reserves, borrowing abroad and borrowing domestically. Each of these methods has some restrictions and implications. If the preferred way for the financing is printing money, then we can mention about the effects of defense spending on money supply. If it creates need for foreign exchange (for arms imports), then we can mention about the effects of military expenditures on exchange rate.

Barro (1981) differentiates the defense spending from non-defense spending and examines whether their effect on output is temporary or permanent. According to the Barro's conclusion, defense spending associated with war is temporary and has a significant expansionary effect on output while other changes in defense spending are largely permanent and have a significantly weaker but positive effect on output. In another study Barro (1987b) covered the data over the period 1701-1918 and found the connection between military spending and price level straightforward in UK where governments use printing process to finance wartime expenditures.

According to Schultze (1981) (cited in Payne and Ross (1992)) defense spending can affect the overall price level by changing aggregate demand or aggregate supply. In the demand side, rapid defense spending contributes nominal demand growth. This demand growth would accelerate inflation if it is not counterbalanced by tax increases or restrictive monetary actions. However if the economy is not operating at full employment, the existing output gap would prevent the increased defense expenditures from being inflationary. Also, as long as lowering consumption pays for the increased defense expenditure, it will not necessarily be inflationary.

Payne and Ross (1992) examined the effect of defense spending on real output, the unemployment rate, price level, and interest rate covering quarterly U.S. data from 1960:1 to 1988:1 using an unrestricted VAR framework and couldn't find granger

causality in either direction between defense spending and economic performance and couldn't find cointegration amongst the variables.

Vitalliano (1984) (as cited in Payne and Ross (1992)) finds no inflationary impact of defense spending while Nourzad (1987) using the common factors in the Vitaliano's (1984) model concludes that rapid defense buildups have a significant positive effect on the rate of price inflation that appears to be temporary. The difference in the results of the two studies is attributed (by Nourzad) to the different measures of expected inflation rate. Günana (2004) applied Johansen Cointegration analysis and Granger causality tests to the annual Turkish data over the period 1950-2001 and concluded that defense expenditure and inflation have a significant effect on each other both in the long and short run

There is an argument against high military expenditures for developing countries as the scarce resources are allocated to unproductive products. According to this argument military spending is a concern for issues of waste, inefficiency, procurement fraud, trade-off with social budget, private sector crowding out. Yıldırım and Sezgin (2003) stated that this is not the case for Turkey. They found that increase in military expenditure leads to economic growth in Turkey. Deger (1986) developed a model to examine the interaction of defense expenditures, savings and growth in less developed countries. Conclusion is that the defense expenditures had a small positive effect on growth through modernization effects and a larger negative effect through savings. Since

the negative savings effect is larger than the modernization effect the net effect on the growth is negative. Also the consumption and investment behavior of public is affected from interest rates. In their empirical study using 1953-87 US data, Mintz and Huang (1991) hypothesize that increased level of defense spending dampens investment, which reduces growth.

By recognizing the borrowing capacities of countries, Looney and Frederiksen (1986) examined the relationship between defense spending and growth for 61 developing countries in which Turkey is included. Their findings suggested a negative relationship between defense and economic growth for those countries that have unlimited borrowing capacity and a negative relationship between the same variables for those countries limited in borrowing capacity. Importance of variables such as, foreign exchange, net capital inflows, external debt, and public sector growth on economic growth are also suggested.

Looney (1994), in his study of Algeria, suggested the defense is a semi-luxury good, expanding rapidly when extra revenues are available, but cut back during periods of austerity. In his study of Egypt he found that the multiplier effect associated with defense expenditures is greater than that with other types of government procurement and suggested that the defense expenditures as the preferred way of fine tuning the economy.

According to Yildirim and Sezgin (2003) military spending would increase employment because a great number of workers are employed either directly by military related operations or in service and supporting roles. Also increased demand in the economy resulting from military spending would increase employment. But on the other hand, military expenditures made for high-technology labor saving weapon systems will lead to increased unemployment. Their findings indicate that military expenditures negatively effects employment in Turkey. The theory that the unemployment effect of unanticipated money growth is larger than that of the anticipated money growth or only the unanticipated money growth is responsible for unemployment have found support in the literature. (Barro (1977), Mishkin (1982)). As a government budget item, considering the effects of unanticipated defense spending on monetary growth can be useful in understanding the defense unemployment relationship. Hooker and Knetter (1994) estimated the response of unemployment to military procurement spending and found that changes in procurement spending significantly affect unemployment in states heavily dependent on military sector and subject to large changes.

According to Deger and Sen (1990) US defense spending in the 1980s grew rapidly. The low taxation policy and tight control on money supply—Reagan policies— increased the government borrowing to finance the resulting deficit. Increase in borrowing raised the interest rates rapidly causing a foreign financial capital inflow into the USA, which, in turn, appreciated dollar quickly. Findlay and Parker (1992) concluded that increases in military spending have a positive and significant impact on interest rates and this impact

is found to be significantly larger than that associated with non-military spending. The conclusion that the interest rates are affected more by the composition rather than the level of government expenditures is interesting. The interaction between the defense spending and interest rates is important in understanding the effect of the spending on exchange rates.

Especially in developed economies, additional demand and output from increases in defense spending will increase capacity utilization which in turn will have a positive impact on the actual rate of profit and could lead to acceleration in investment. Defense spending because it does not increase productive capacity can best fill the demand gap in the economy, it can have possible effects on technological innovations which can stimulate profitability and avoiding economic crisis. Kollias and Maniatis (2002) examined the effect of military expenditure on the profitability on the Greek economy for the 1962-1994 periods. Their empirical result indicates that military expenditures have had a contractionary effect on profitability, stimulating effective demand in the short run, but affecting rate of profit over the long run.

Looking to the defense spending from another perspective some studies examined the defense-welfare trade-off. It is assumed that there is trade-off between defense spending, spending on education and spending on health. Yildirim and Sezgin (2002) analyzed the relationship between defense spending, health expenditure and military expenditure for the Turkish data. The findings of their study indicate that there are trade-offs between

defense and welfare spending although defense-spending decisions are made independently. The study of the Gunluk-Senesen (2002), on the other hand, suggests no such trade-off between the security spending and non-security government spending in Turkey.

Since the defense expenditures reduce scarce resources, it is expected to have effects on the internal and the external debt amounts of a country. Kollias, Manolas, and Paleologou (2004), examined the effects of Greek defense spending on internal and external debt of the country. Their results suggested that government debt; in particular, external debt has been adversely affected by military expenditure. Departing from the argument that defense expenditures are one of the main reasons for the recent increasing trend of Turkey's external debt, Sezgin (2004) made an empirical examination. The results showed negative relationship between external debt and defense expenditure in the long run showing no clear evidence of defense-debt relationship for the period 1979-2000. Gunluk-Senesen's (2004) study is another informative study about Turkey's defense debt relationship in the post-1980 era.

CHAPTER 3

DATA AND METHODOLOGY

3.1. Data

The data of price level (1987 GDP deflator), nominal GDP, employment, exchange rate (TL/US \$) and M2 money stock between 1950 and 2001 are provided from a publication of State Institute of Statistics: “Statistical Indicators 1923-2002”. Same group of data for the remaining two years (2002 and 2003) are provided from the web page of the Central Bank of the Republic of Turkey: “<http://tcmbf40.tcmb.gov.tr/cbt.html>”. Government spending data is provided from the web page of State Planning Office: “<http://www.dpt.gov.tr>” and SIPRI Yearbooks (Swedish International Peace Research Institute) are the source of the defense spending data of Turkey.

3.2. The Measurement of defense Expenditures

One of the main problems faced in defense expenditure related studies is to how to define defense expenditures. Different countries assign different roles to their armed forces so the measurement of the defense expenditure becomes more and more complicated. As a result it cannot be said that there is a standard definition of defense expenditures. Disagreement on this subject can be seen on the different definitions of defense expenditure made by North Atlantic Treaty Organization (NATO), International Monetary Fund (IMF) and United Nations (UN). Among them, the UN definition is the most comprehensive one. The definition made by NATO is consistent with that of the SIPRI. (Giray, 2003).

In addition, the unusual financing of the defense expenditures makes this amount uncertain for Turkey. Defense Industries Support Fund (DISF), for example, receives funding from special levies placed on earned income, on alcohol, on cigarette, gambling, betting and so on. A substantial amount of these payments goes to defense related expenditures and they are not included in the budget. Existence of Türk Silahlı Kuvvetlerini Güçlendirme Vakfı (TSKGV) and Ordu Yardımlaşma Kurumu (OYAK) complicates the calculation process of these expenditures. (Brauer, 2002)

In this study, as in many other previous studies, defense expenditure data of SIPRI yearbooks are used. Detailed explanation of SIPRI data is as follows: (SIPRI Yearbook, 2001:279)

The main purpose of the data, presented in the books, on military expenditure is to provide an easily identifiable measure of scale of resources absorbed by the military. SIPRI military expenditure data include all current and capital expenditure on:

- The armed forces, including peace keeping forces;
- Defense ministries and other government agencies engaged in defense projects;
- Paramilitary forces, when judged to be trained and equipped for military operations;
- Military space activities.

Such expenditures should include: (i) military and civil personnel, including retirement pensions of military personnel and social services for personnel; (ii) operations and maintenance; (iii) procurement; (iv) military R&D; and (v) military aid. Civil defense and current expenditures for previous military activities are excluded.

SIPRI data reflect the official data reported by governments. Estimates are made when the coverage of official data does not correspond to the SIPRI definition or when there is no consistent time series available. Estimates are based on the official government budget and expenditure accounts empirically.

The sources are: (i) primary sources, that is, official data provided by national governments, either in their official publications or in response to questionnaires; (ii) secondary sources which quote primary data; and (iii) other secondary sources. Secondary sources include international statistics such as NATO and IMF, and the other secondary sources include specialist journals and newspapers.

3.3 Vector Autoregressions (VARs)

Vector autoregressions, as a type of multivariate time series model, have been widely used in econometrics. In cases that time series variables are jointly determined (endogenous), VAR is an appropriate forecasting model in capturing their dynamic and interdependent relationship. The VAR approach eliminates the necessity for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all the endogenous variables in the system. The use of VAR has been advocated by Sims (1980) as a way to estimate dynamic relationship between jointly endogenous variables, without imposing strong a priori restrictions.

Suppose that the $1 \times m$ vector y_t denotes the t th observation on a set of variables. Then the mathematical representation of vector autoregressive model of order p (VAR (p)) can be written as follows:

$$y_t = \alpha + y_{t-1}A_1 + \dots + y_{t-p}A_p + \varepsilon_t, \quad \varepsilon_t \sim \text{IID}(0, \Omega)$$

where α is a $1 \times m$ vector, A_1 through A_p are $m \times m$ matrices of coefficients to be estimated. If y_{ti} denotes the i th element of y_t and $A_{j,ki}$ denotes the ki th element of A_j , the i th column of the above formulation can be written as follows:

$$y_{ti} = \alpha_i + \sum_{j=1}^p \sum_{k=1}^m y_{t-j,k} A_{j,ki} + \varepsilon_{ti}$$

As you can see, this is just a linear regression, in which y_{ti} depends on a constant term and lags 1 through p of all of m variables in the system.

3.4. Creation of the Positive and Negative Shock Terms

In our study we used the positive and negative defense spending shocks as explanatory variables in the VAR. In order to obtain the shock terms we regressed the defense spending over the explanatory variables of real income, price level, and real government spending. The regression is shown in following equation:

$$X_t = C + Y1_t + Y2_t + Y3_t + \varepsilon_{\text{def } t}$$

Here C is the constant, X_t is the logarithmic first difference of real defense spending $Y1_t$ is the logarithmic first difference of real GDP, $Y2_t$ is the logarithmic first difference of GDP price deflator, $Y3_t$ is the logarithmic first difference of real government spending, and the $\epsilon_{def,t}$ is the residual created from the regression. By using the residual created from the above regression ($\epsilon_{def,t}$) we calculated the positive and negative shock terms. We measured positive and negative shock terms in a similar way to Cover (1992), Kandil (2001) and Berument and Dogan (2004) as follows:

$$Pos1_t = ((|\epsilon_{def,t}| / \epsilon_{def,t}) + 1) \times 0.5$$

$$Neg1_t = 1 - Pos1_t$$

Here, $Pos1_t$ stands for expansionary defense spending shocks; $Neg1_t$ stands for contractionary defense spending shocks, $\epsilon_{def,t}$ is the residual term created from the above regression at time t. As it can be seen from the above equations if the residual of the regression ($\epsilon_{def,t}$) is positive then $Pos1_t$ becomes 1 and $Neg1_t$ becomes 0, if the residual ($\epsilon_{def,t}$) is negative then $Pos1_t$ becomes 0 and $Neg1_t$ becomes 1. After obtaining the shock terms from the above equations we inserted them as explanatory variable in the following VAR process.

$$\begin{bmatrix} \mathbf{d} \\ \mathbf{x} \end{bmatrix}_t = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \end{bmatrix} * \begin{bmatrix} \mathbf{d} \\ \mathbf{x} \end{bmatrix}_{(t-1)} + \begin{bmatrix} \alpha_{13} & \alpha_{14} \\ \alpha_{23} & \alpha_{24} \end{bmatrix} * \begin{bmatrix} \mathbf{d} \\ \mathbf{x} \end{bmatrix}_{(t-1)} * \begin{bmatrix} \mathbf{Pos} \\ \mathbf{Neg} \end{bmatrix}_{(t-1)} + \begin{bmatrix} \mathbf{E}_1 \\ \mathbf{E}_2 \end{bmatrix}$$

Where d_t is the logarithmic first difference of real defense spending, x_t is the vector of other economic variables: logarithmic first difference of real GDP, logarithmic first difference of GDP price deflator, logarithmic first difference of real government spending, logarithmic first difference of money supply, logarithmic first difference of exchange rate and logarithmic first difference of employment. α_{10} through α_{24} are the coefficients to be estimated, Pos_{t-1} and Neg_{t-1} are the defense spending innovations, $n = 1,2,3,4$.

3.5. Heteroskedasticity Consistent Standard Errors and Covariances

In our computations we used the Least Squares (LS) rule and one of the important assumptions of this rule is homoskedasticity of the data. However we are likely to encounter heteroskedasticity frequently in economic data. Like non-linearity, heteroskedasticity is also often due to the skewness in the distribution of the variables under study. A suitable transformation can make the heteroskedasticity disappear while making the average relationship linear at the same time. However you may not always be able to do this. There may be cases that the relationship will look linear but the scatter plot indicates heteroskedastic errors.

If the assumptions of linearity of regression, independence of error terms between each other and, zero expected mean of error terms are valid, then we can say that the coefficients of LS are not made biased by heteroskedastic errors. But validity of these assumptions under heteroskedastic errors prevents LS estimators from being best linear unbiased estimators (BLUE). In addition, since the standard formulas for standard errors are based on homoscedasticity assumption, they will not be valid and hence, confidence intervals and hypothesis tests that use these standard may be misleading. (Mukharjee, White and Wuyts 1998). In analysis of macroeconomic data, Engle (1982) (as cited in Greene, 1990) have found evidence that for some phenomena the disturbance variances in time series models are less stable than usually assumed. In analysis of time series, large and small forecast errors appear to occur in clusters suggesting heteroskedasticity. Forecast error depends on the size of the preceding disturbance. One can rarely be certain that the data are heteroskedastic. To learn this there are several tests that can be suggested.

Presence of heteroskedasticity in the residuals is probably a result of model misspecification. However, even when we are sure about the true specification of the model, heteroskedasticity may remain as a problem. In dealing with the heteroskedasticity, estimating regression model by weighted least squares (i.e., GLS) can be used when the error terms follows a pattern determined by a known skedastic function. Also it is easy to estimate a model by feasible GLS or maximum likelihood when the parameters of the skedastic function are not known, but its form is known

(Davidson and McKinnon, 1993). But when the form of heteroskedasticity is not known, it may not be possible to obtain efficient estimates of the parameters using weighted least squares. Employing heteroskedasticity consistent covariance matrix estimator when almost nothing is known about the form of skedastic function will be possible as a cure for this problem.

White (1980) has derived a heteroskedasticity consistent covariance matrix, which provides correct estimates of parameters in the presence of unknown heteroskedasticity form. The white covariance matrix is given by:

$$\sum_w = \frac{T}{T-k} (X'X)^{-1} (\sum u_i^2 x_i x_i') (X'X)^{-1}$$

Where the T is number of observations, k is the number of regressors, and u_i is the least squares residual. Supplemental information about the detailed derivation of the matrix can be provided from the White's (1980) article.

CHAPTER 4

ESTIMATES

In our investigation of the possible asymmetric effects of defense spending on the economy, we employed following empirical model:

$$\begin{bmatrix} \mathbf{d} \\ \mathbf{x} \end{bmatrix}_t = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \end{bmatrix} * \begin{bmatrix} \mathbf{d} \\ \mathbf{x} \end{bmatrix}_{(t-1)} + \begin{bmatrix} \alpha_{13} & \alpha_{14} \\ \alpha_{23} & \alpha_{24} \end{bmatrix} * \begin{bmatrix} \mathbf{d} \\ \mathbf{x} \end{bmatrix}_{(t-1)} * \begin{bmatrix} \mathbf{Pos} \\ \mathbf{Neg} \end{bmatrix}_{(t-1)} + \begin{bmatrix} \mathbf{E}_1 \\ \mathbf{E}_2 \end{bmatrix} \quad (1)$$

Where d_t is the logarithmic first difference of real defense spending, x_t is the vector of other economic variables: logarithmic first difference of real GDP, logarithmic first difference of GDP price deflator, logarithmic first difference of real government spending, logarithmic first difference of money supply, logarithmic first difference of exchange rate and logarithmic first difference of employment. α_{10} through α_{24} are the coefficients to be estimated, Pos_{t-1} and Neg_{t-1} are the defense spending innovations, $n=1,2,3,4$.

In order to calculate positive (Pos1) and negative (Neg1) defense spending shock terms, we used the residuals created from the regression of defense spending over the explanatory variables of real GDP, implicit GDP deflator and real government spending. We measured positive and negative shock terms in a similar way to Cover (1992), Kandil (2001) and Berument and Dogan (2004) as follows:

$$\text{Pos1} = ((|\mathcal{E}_{\text{def}t}| / \mathcal{E}_{\text{def}t}) + 1) \times 0.5 \quad (2)$$

$$\text{Neg1} = 1 - \text{Pos1} \quad (3)$$

Here, Pos1 stands for expansionary defense spending shocks; Neg1 stands for contractionary defense spending shocks, $\mathcal{E}_{\text{def}t}$ is the residual term created from the above regression at time t.

In order to examine asymmetric effects of defense spending innovations on real income and price level we constructed our first VAR by using aggregate demand, price level and defense spending innovations as explanatory variables. A simple demonstration of the inclusion of the shock terms in the VAR is as follows:

$$\mathbf{Y}_t = \Gamma_0 + \Gamma_{11}\mathbf{X}_{1t-1} + \Gamma_{12}\mathbf{X}_{2t-1} + \Gamma_{13}\mathbf{X}_{3t-1} + \Gamma_2\mathbf{Y}_{t-1} + \Gamma_3 \text{Pos1}_{t-1} + \Gamma_4 \text{Neg1}_{t-1} + \eta_t \quad (4)$$

Where Y_t is the variable we are interested (real income or price level), Γ_0 stands for constant terms, X_{t-1} is the set of explanatory variables, Y_{t-1} is the concerned variable, Γ_{11} , Γ_{12} , and Γ_{13} are the coefficients of explanatory variables, Γ_3 and Γ_4 are the coefficients of the positive and negative defense spending shocks on the concerned variable respectively, η_t is the error term. Explanatory variables of the regression, used for estimations of shock terms, are as same as those of the VAR above.

Since we are concerned with only the effects of shock terms, Tables 5 through 16 visualize only the coefficients and the statistics of these shock terms.

Table 5: The Asymmetric Effects of Defense Spending Innovations Real Income

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos1)	0.133367	0.061122	2.181997**	0.0343
Negative spending shock (Neg1)	-0.085370	0.117294	-0.727829	0.4704

** Significant at 5%

For real income if we examine the effect of defense spending shock on the real GDP, we find that the effect of expansionary defense spending shocks is positive and statistically significant while we can't find any statistically significant evidence on the negative effects of contractionary shocks. Asymmetry in the effects of defense spending innovations on real income can be suggested from the results of Table 5.

When we consider the economy from the Keynesian perspective we expect the increased government spending to stimulate aggregate demand and increase output. However this may not always be the story, because increased government spending may crowd out private consumption or investment. Military spending as a component of government spending and its effects on the economic output is researched by numerous studies in the history. Even these empirical studies gave conflicting results. Deger (1986), Huang and Mintz (1990) and Dunne et al (2001) report a negative relationship between defense spending and growth while Grobber and Porter (1989), Ward and Davis (1992) found no significant relationship between the two variables. The economic outcome might be affected and changed by the perceptions and the expectations of the public. If the expansionary shock is perceived to be permanent by the public, then it will increase the demand, but if the public perceives it as temporary, then the expansionary spending shock will not affect demand very much. Thus, when the increase in spending is perceived as permanent and the decrease in spending is perceived as transitory, the effect of increasing and decreasing defense spending on economic outcome will be asymmetric. (Berument and Dogan, 2004). It can be suggested from the Table 5 that the expansionary defense spending has permanent growth effect on real income while contractionary defense spending has no effect on income growth.

Replacing the dependant variable—the real income— with price level in the above VAR we examined the effects of defense spending shocks on price level. Following table shows the relevant LS test results:

Table 6: The Asymmetric Effects of Defense Spending Innovations on Price level.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos1)	-0.359252	0.126136	-2.848132***	0.0066
Negative spending shock (Neg1)	-0.220345	0.229570	-0.959813	0.3422

*** Significant at 1%

Table 6 suggests that, the effect of expansionary defense spending shocks on price level is negative and statistically significant but there is no statistically significant evidence on the negative effects of contractionary defense spending shocks. As a result, we can capture the asymmetric effects of defense spending innovations on price level.

Deflationary effect of expansionary government spending on price level can be attributed to its crowding out effect on private spending. The reasons behind the contradictory movements in the private spending with respect to government spending are explained in chapter 2 of this thesis. But these theories are not capable of explaining the decrease in price level in the face of expansionary defense spending shocks since, in our case, unexpected defense expansion leads to an increase in the demand (Table 5). Viewing the picture from the supply side of the economy we can produce meaningful explanations in this situation. From this view, the expansionary defense spending shock can be supposed to contribute to the technological improvement, which causes the supply curve shift to the right.

Although this shift can explain the decreases in the price level paralleled with an increase in demand, the significant effect of the defense spending on technology may not convince everyone especially for Turkey. But if we assume that the personnel related expenditures from one year to another do not fluctuate considerably, we can conclude that the volatile part in the defense budget can be attributed to technological expenditures through Aselsan and attributed to expenditures on high-tech weapon procurements. In our model, since we are testing only the volatile component—shock component— of the defense spending, the test results can be interpreted as meaningful. Also military demand for particular products in the domestic market may induce the development of extra domestic supply, which could have linkage effects on the technological progress. If we had the opportunity to split the defense data for the period analyzed we could have presented further empirical support for this conclusion by observing the components of defense spending.

Observing the effects of defense spending innovations on the whole government spending can help us in understanding the fiscal effects of defense shocks. From table 7 we observe that both expansionary and contractionary defense spending shocks increase the total government spending. The increased government spending in the face of contractionary defense spending shock indicates that the savings on defense haven't been applied to deficit reduction in the period.

Table 7: The Asymmetric Effects of Defense Spending Innovations on Government spending.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos1)	0.311365	0.144272	2.158179**	0.0362
Negative spending shock (Neg1)	0.545139	0.195467	2.788901***	0.0077

*** Significant at 1%

** Significant at 5%

After above examinations we added the money supply (M2) variable in the regression to see the shock effects of defense spending on this variable. In order to create the shock terms we regressed the defense spending with the explanatory variables of logarithmic first difference of real GDP, logarithmic first difference of implicit GDP deflator, logarithmic first difference of real government spending and logarithmic first difference of money supply. We applied the formula (2) and (3) by using the residuals of new regression and obtained the new negative and positive shock terms as Pos2 and Neg2 respectively. Pos2 and Neg2 are used in the calculations of the new VARs.

Observing the test results presented in Table 8, we cannot suggest any statistically significant evidence on the effects of expansionary and contractionary defense spending shocks on money supply. According to the theory, increased defense spending will be expected to increase interest rates, and thus, will enforce the Central Bank to inject liquidity into the system. Our inability to capture any statistically significant positive

relation between the positive defense spending shock and the money supply, further supports our conclusion about the supply side effects of the defense spending innovations in the economy.

Table 8: The Asymmetric Effects of Defense Spending Innovations on Money

Supply

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos2)	-0.071226	0.133810	-0.532290	0.5971
Negative spending shock (Neg2)	-0.099127	0.232774	-0.425852	0.6722

With the extended VAR—money supply explanatory variable included—we reexamined the effects of defense spending shocks on the real income. Second VAR result in Table 9 also confirms our previous findings. The statistically significant evidence on positive effect of expansionary defense spending shocks and the lack of statistically significant evidence on the effect contractionary defense spending shocks on real income indicate the asymmetry. But including the money supply variable in the regression decreased the statistical significance of positive defense spending shock effect to 10% when compared to the results in Table 5.

Table 9: The Asymmetric Effects of Defense Spending Innovations on Real Income

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos2)	0.135067	0.074632	1.809788*	0.0770
Negative spending shock (Neg2)	-0.083861	0.099368	-0.843941	0.4032

* Significant at 10%

Similarly we reexamined the effects defense spending shocks on price level with the extended VAR. Observing Table 10 we see that, the negative and statistically significant evidence on the effect of expansionary defense spending shocks and lack of significant evidence on the effect of contractionary defense spending shocks on price level are also consistent with our previous findings, but again the statistical significance of the positive defense spending shock is decreased to 5% when compared to the results in Table 5.

Table 10: The Asymmetric Effects of Defense Spending Innovations on Price level

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos2)	-0.299923	0.126912	-2.363248**	0.0225
Negative spending shock (Neg2)	-0.369879	0.230507	-1.604630	0.1156

** Significant at 5%

In our third trial we replaced the money supply explanatory variable with exchange rate in the regression and obtained the new positive and negative shock terms, Pos3 and Neg3 respectively, and followed the same processes. The effect of defense spending

shocks on exchange rate is shown in table 11. As in the money supply case we couldn't capture any significant evidence on the effect of defense spending innovations on exchange rate. Our inability to detect the effects of defense spending innovations on exchange rate may be due to the governments fixed rate of exchange policy. Otherwise we should expect the decreased price level (Table 6) to increase real money balance and, in turn, to decrease nominal interest rates, which will finally result with the increase in exchange rate.

Table 11: The Asymmetric Effects of Defense Spending Innovations on Exchange Rate

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos3)	0.119549	0.583483	0.204889	0.8386
Negative spending shock (Neg3)	0.410066	0.516978	0.793198	0.4318

The third examination of the effect of the defense spending shocks on real income, shown in Table 12, also supports our previous findings about the asymmetric effects of the defense spending innovations on real income.

Table 12: The Asymmetric Effects of Defense Spending Innovations on Real Income

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos3)	0.136347	0.067213	2.028579**	0.0484
Negative spending shock (Neg3)	-0.103712	0.127513	-0.813339	0.4203

** Significant at 5%

As in the real income case, the third examination of the effect of the defense spending shocks on price level, shown in Table 13, also confirms our previous findings about the asymmetric effects of the defense spending innovations on price level.

Table 13: The Asymmetric Effects of Defense Spending Innovations on Price level

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos3)	-0.361107	0.130873	-2.759219***	0.0083
Negative spending shock (Neg3)	-0.208925	0.237419	-0.879986	0.3835

*** Significant at 1%

In our fourth and the last trial we replaced the exchange rate explanatory variable with employment variable in the regression and obtained the new positive and negative shock terms, Pos4 and Neg4 respectively and followed the same processes. The effect of defense spending shocks on employment is shown in Table 14. In the interpretation of Table 6 we assumed that personnel related expenditures do not exhibit considerable fluctuations from one year to another. The result of Table 14, suggesting no statistically

significant evidence on the effect of defense spending innovations on employment, confirms our previous assumption. Although statistically insignificant, the downward movement tendency of employment in the face of expansionary defense spending shock and upward movement tendency in the face of contractionary shock are consistent with our previous suggestions that the volatile part of the defense budget is spent to technology investments and weapon procurements.

Table 14: The Asymmetric Effects of Defense Spending Innovations on Employment

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos4)	-0.205692	0.177631	-1.157977	0.2530
Negative spending shock (Neg4)	0.341711	0.401668	0.850728	0.3994

The fourth examination of the effect of the defense spending shocks on real income is shown in Table 15 and as in our third trial; our fourth trial also confirms our previous results about the asymmetric effects of defense spending on real income.

Table 15: The Asymmetric Effects of Defense Spending Innovations on Real Income

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos4)	0.129648	0.061709	2.100965**	0.0413
Negative spending shock (Neg4)	-0.118528	0.121092	-0.978824	0.3329

** Significant at 5%

And lastly the fourth examination of the effect of the defense spending shocks on price level is shown in the Table 16, which also confirms our previous findings about the effects of defense spending innovations on price level.

Table 16: The Asymmetric Effects of Defense Spending Innovations on Price level

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Positive spending shock (Pos4)	-0.348633	0.122759	-2.839978***	0.0068
Negative spending shock (Neg4)	-0.125675	0.236510	-0.531374	0.5978

*** Significant at 1%

In this chapter we have investigated the reactions of macroeconomic variables— real income, price level, money supply, exchange rate, and employment— to the defense spending innovations. In the first VAR we included the government spending, real income, price level and defense spending innovations as explanatory variables. In the following VARs we added the other variables one by one as explanatory variables. Briefing the results interpreted above; we found significant asymmetric effect of defense

spending innovations on real income (positive defense spending shock increases the real income) and on price level (positive defense spending shock decreases price level). But we couldn't capture any statistically significant evidence on the effect of defense spending on: money supply, exchange rate, and employment variables.

CHAPTER 5

CONCLUSION

Defense spending and its effects on the economy took considerable attention in the literature. Since Turkey has been experiencing chronic budget deficit and inflation for years, the effects of such spending on the economy is an interesting topic. Defense spending has some direct and indirect effects on various macroeconomic variables. However, an increase in the amount of spending may have important effects on these variables while same amount of decrease may not have any effect. This situation points out the asymmetry in the relationships. The contribution of this thesis is that it provides empirical evidence on the asymmetric effects of the defense spending shocks on real income and price level.

Our first examination is the effect of defense spending shock on the real GDP. The results indicate that expansionary defense spending shocks have a positive and statistically significant effect on real income while there is no evidence on the effects of

contractionary defense spending on this variable. The economic outcome might be affected and changed by the perceptions and the expectations of the public. If public perceives the change in spending as permanent, then this will contribute to demand growth. According to the results, positive defense spending shocks contributed to the real income growth in Turkey.

In our next examination we tested the effects of defense spending innovations on price level. Positive shock decreases the price level while negative shock does not have any statistically significant effect on this variable. Deflationary effect of expansionary government spending on price level can be attributed to its crowding out effect on private spending. The reasons behind the contradictory movements in the private spending with respect to government spending are explained in chapter 2 of this thesis. But these theories are not capable of explaining the decrease in price level in the face of expansionary defense spending shocks since, in our case; unexpected defense expansion leads to an increase in the real income. However, viewing the picture from the supply side of the economy can produce meaningful explanations. From this view, the expansionary defense spending shock can be supposed to contribute to the technological improvement, which causes the supply curve shift to the right.

Although this shift can explain the decreases in the price level paralleled with an increase in demand, the significant effect of the defense spending on technology may not convince everyone especially for Turkey. But if we assume that the personnel related

expenditures from one year to another do not fluctuate considerably, we can conclude that the volatile part in the defense budget can be attributed to technological expenditures through Aselsan and attributed to expenditures on high-tech weapon procurements. In our model, since we are testing only the volatile component—shock component— of the defense spending, the test results can be interpreted as meaningful. Also military demand for particular products in the domestic market may induce the development of extra domestic supply, which could have linkage effects on the technological progress. If we had the opportunity to split the defense data for the period analyzed we could have presented further empirical support for this conclusion by observing the components of defense spending.

When we apply the same procedure to the government-spending variable, the increased government spending in the face of contractionary defense spending shock indicates that the savings on defense haven't been applied to deficit reduction in the period. Other economic variables (exchange rate, money supply and employment) are not affected from the innovations in the defense spending, since the test results fails to present any statistically significant evidence on them.

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APPENDIX: Data Set

Year	Defense Expenditures (1987-TL million)	Government Expenditures (1987-TL million)	GDP 1987 prices	Exchange Rate TL/US	Money Supply M2	Employment	1987 GDP Deflator
1950	460769.23	1504538.46	7472692.31	2.82	1774.00	8790.00	0.13
1951	465714.29	1471500.00	8334357.14	2.82	2201.00	9117.00	0.14
1952	517857.14	1886071.43	9586357.14	2.82	2576.00	9520.00	0.14
1953	551333.33	1714666.67	10425200.00	2.82	3182.00	9896.00	0.15
1954	585000.00	1704375.00	9974250.00	2.82	3617.00	10199.00	0.16
1955	598333.33	1918166.67	10661611.11	2.82	4511.00	10482.00	0.18
1956	579500.00	1855650.00	11072000.00	2.82	5697.00	10613.00	0.20
1957	527500.00	1823916.67	12270500.00	2.82	7262.00	10845.00	0.24
1958	525000.00	1875500.00	12552071.43	2.82	7873.00	11771.00	0.28
1959	652424.24	2135393.94	13310030.30	2.82	9232.00	11164.00	0.33
1960	708823.53	2290882.35	13816735.29	9.03	10044.00	11945.00	0.34
1961	755000.00	3296055.56	13840750.00	9.03	11118.00	12088.00	0.36
1962	764102.56	2498666.67	14839974.36	9.03	12125.00	12219.00	0.39
1963	770000.00	3034560.98	16331585.37	9.03	13738.00	12365.00	0.41
1964	819761.90	3405476.19	17018238.10	9.04	15797.00	12573.00	0.42
1965	868409.09	3504477.27	17372750.00	9.04	19085.00	12761.00	0.44
1966	850212.77	3877851.06	19313936.17	9.04	23442.00	13014.00	0.47
1967	919200.00	4310420.00	20237080.00	9.04	27101.00	13174.00	0.50
1968	992115.38	4473461.54	31442307.69	9.04	31398.00	13396.00	0.52
1969	963392.86	4770571.43	32642857.14	9.04	36566.00	13537.00	0.56
1970	1022459.02	5689852.46	33704918.03	15.00	44300.00	13768.00	0.61
1971	1178750.00	6816625.00	35430555.56	14.15	56600.00	14011.00	0.72
1972	1245125.00	6796625.00	38112500.00	14.15	70900.00	14405.00	0.80
1973	1256907.22	6961288.66	39536082.47	14.14	90300.00	14679.00	0.97
1974	1266480.00	6581992.00	41600000.00	13.99	113300.00	14985.00	1.25
1975	2000000.00	7471814.57	44642384.11	15.15	146600.00	15169.00	1.51
1976	2352080.92	8894208.09	49537572.25	16.67	181200.00	15380.00	1.73
1977	2315813.95	10922105.06	51000000.00	19.45	243600.00	15873.00	2.15
1978	2102825.40	10634350.55	51822222.22	25.25	328100.00	16085.00	3.15
1979	1686582.28	10792222.12	51547920.43	35.35	527700.00	16320.00	5.53
1980	1785153.85	10368759.51	50294230.77	90.15	881900.00	16523.00	10.40

APPENDIX: Continued

Year	Defense Expenditures (1987-TL million)	Government Expenditures (1987-TL million)	GDP 1987 prices	Exchange Rate TL/US	Money Supply M2	Employment	1987 GDP Deflator
1981	2089899.87	10117508.26	52743658.21	133.63	1637200.00	16664.00	14.98
1982	2331025.51	8338087.38	54618427.90	186.75	2554200.00	16837.00	19.21
1983	2295826.80	10773282.29	57343505.15	282.80	3288400.00	17004.00	24.25
1984	2233780.25	10526327.83	61188038.94	444.74	5179000.00	17260.00	35.95
1985	2244230.42	9654258.12	63775213.52	576.86	8145500.00	17547.00	55.03
1986	2495991.45	10910358.88	68251336.18	757.79	12173200.00	1765.00	74.84
1987	2477000.00	12696407.72	74721900.00	1020.90	17648000.00	18268.00	100.00
1988	2237378.21	12404133.45	76306170.65	1814.84	27194200.00	17754.00	169.35
1989	2408803.34	12805020.86	76498822.18	2313.69	47139200.00	18220.00	297.16
1990	2948387.38	14287631.04	83578260.22	2930.07	71569600.00	18539.00	470.29
1991	3166869.88	17438152.61	84352998.66	5079.92	117118300.00	19023.00	747.00
1992	3460337.45	18124096.48	89400490.60	8564.43	190736200.00	19086.00	1223.00
1993	3787670.47	23649571.36	96590219.46	14472.52	282441900.00	18048.00	2051.83
1994	3699724.34	21182167.99	91320748.61	38456.50	630348000.00	19401.00	4236.09
1995	3819239.07	21571960.73	97887831.58	59650.50	1256631500.00	19894.00	7929.95
1996	4336135.10	27938645.29	104745121.40	107775.00	2924893300.00	20387.00	14102.91
1997	4622001.92	31211372.22	112631193.45	205245.00	5658800400.00	20361.00	25602.04
1998	5090172.74	34687077.64	116113619.60	313475.00	11423281800.00	20871.00	44977.45
1999	5956599.35	40153468.72	110645882.11	541420.50	22402167800.00	21413.00	69966.70
2000	6673440.26	44785781.25	118789115.22	673384.50	31913383900.00	21153.00	104877.84
2001	5561874.96	49996318.11	109885337.59	1443038.50	47244754000.00	20704.00	162362.37
2002	5853680.89	50304263.10	119113698.17	1638442.50	61903709100.00	21658.00	233032.86
2003	6094577.13	48850786.30	125485200.00	1399201.00	80922936000.00	20811.00	286697.50