Israel Economic Review Vol. 5, No. 1 (2007), 47–66

CYCLICALITY OF FISCAL POLICY IN ISRAEL

MICHEL STRAWCZYNSKI [*] AND JOSEPH ZEIRA [**]

This paper tests the cyclicality of fiscal policy in Israel. We find that government deficits are mildly counter-cyclical, mainly in recessions. Expenditures, and in particular, public investment, are pro-cyclical. However, we find that both the government deficit and expenditures have become more counter-cyclical after 1985, a period that is characterized by improved fiscal discipline, following the Economic Stabilization Program. We interpret this result as an indication that Israel is nowadays in a transition from pro-cyclical fiscal policy, as in many developing countries, to counter-cyclical fiscal policy, as is more common in developed countries.

"The state production enterprises are urged to prepare yearly building programs for ten years in advance. They are asked to have at all times technical and economic plans, ready for speedy action. The idea is that next crisis we shall not be caught unawares. The blueprints shall be at hand, the measures shall be decided upon in advance, and the government shall have only to press the button to set the machinery in motion. Meantime, state investment, which had already been planned and decided upon, was stopped during the boom period."
Gunnar Myrdal (at the annual meeting of the American Economic Association, March 1939)

1. INTRODUCTION

This paper examines the cyclicality of fiscal policy in Israel. Recent studies have shown that in developed countries fiscal policy tends to be counter-cyclical, while in less developed countries fiscal policy is much more pro-cyclical. These studies measure cyclicality in a uniform method, that when applied to Israel it shows that fiscal policy in Israel is highly pro-cyclical.[1] This paper claims that this finding can change significantly if we take into consideration three elements. First, the measured strong pro-cyclicality

[*] Michel Strawczynski, Research Department, Bank of Israel.
[**] Hebrew University of Jerusalem and CEPR.
We are grateful to Mark Gradstein and participants at the annual conference of the Research Department at the Bank of Israel in December 2006 for useful comments and discussions. We also thank Polina Dovman for excellent research assistance. Joseph Zeira thanks the Bank of Israel for financial support of the research. The opinions expressed in the paper are the authors' and do not reflect in any way the positions of the Bank of Israel.
[1] Alessina and Tabelini even take out Israel from their study as it is an outlier in its pro-cyclicality in their measures.

depends to a large extent on the specific history of long-run output growth and of fiscal policy in Israel. Second, the cyclicality of fiscal policy changed significantly in 1985, after inflation was stabilized and fiscal discipline was renewed. Third, we claim that most tests of cyclicality of fiscal policy do not pay sufficient attention to the issue of endogeneity, since fiscal policy also affects output. When we try to deal with this problem we find that it further strengthens the reduction of pro-cyclicality of fiscal policy in Israel after 1985.

The issue of cyclicality of fiscal policy is important because it reveals to a large extent the constraints faced by the government in forming its policies. Some parts of fiscal policy are pro- and counter-cyclical almost by definition, due to what are called 'automatic stabilizers.' Tax revenues rise during booms and fall during recessions. Unemployment insurance rises in recessions. These reactions are counter-cyclical. Counter-cyclicality becomes even stronger if the government follows an active Keynesian stabilization policy. But even if the government adheres to a much more conservative policy, following Barro (1979), of keeping expenditures and tax rates constant over time, deficits are counter-cyclical, since tax revenues are pro-cyclical. Countries with pro-cyclical fiscal policy are therefore usually countries with governments that face severe credit constraints. If a government faces reduced tax revenues during a recession and as a result reduces its expenditures to avoid an increase in its deficit, it is usually because such a government finds it hard to borrow in order to finance the deficit. We would therefore expect poorer countries to have more pro-cyclical fiscal policy, while rich countries to have more counter-cyclical fiscal policy.[2]

Another reason why poor countries tend to have more pro-cyclical fiscal policies is that they have much smaller welfare expenditures. Welfare mechanisms like unemployment insurance and other forms of means-tested subsidies tend to raise public expenditures during recessions. This mechanism is much weaker in less developed countries. And indeed, recent empirical studies have found that less developed countries have much more pro-cyclical fiscal policies than developed countries.

This makes the puzzle of cyclicality of fiscal policy in Israel even more disturbing. Israel is a developed country. Its GDP per capital puts it in the 25th place among the countries of the world. Further than that, Israel enjoys high credit rankings and its access to global credit market is excellent, largely due to loan guaranties it received twice from the US, in 1992 and in 2003 and to the ongoing aid it receives from the US. Hence, Israel can follow a Barro-type policy without worrying about cyclical fluctuations in the deficit. Furthermore, Israel has rather strong welfare state mechanisms, mainly due to its immigration absorption policies. These welfare expenditures should play a role as 'automatic stabilizers' and the question is why they don't seem to play it.

This paper tries to cope with this puzzle in three ways. First we note that the history of economic growth and of fiscal policy in Israel has been unique. Israel was growing fast until 1973 and its growth declined significantly afterward. Incidentally, fiscal expenditures

[2] Interestingly, we would expect public investment to be the most counter-cyclical, as explained by Myrdal in the quote above. But the empirical studies show that public investment is the most pro-cyclical fiscal variable, as shown by Lane (2002) and others. This shows that when income falls, investment for the future is the first to be reduced, opposite to the recommendation of Myrdal.

increased significantly in the late 1960s and early 1970s, due to the escalation of the Israeli-Arab conflict after 1967. As a result measured cyclicality reflects to a large extent the long-run correlation of output and of fiscal policy. Once these are controlled for, the measured pro-cyclicality is reduced and even becomes insignificant.

The second characteristic of fiscal policy that we take into account is the change in regime that occurred in 1985. The years of rising defense costs after 1967 led not only to higher expenditures and deficits, but also to a loss of fiscal discipline. This is shown in Strawczynski and Zeira (2002), which also shows that 1985 marked a significant regime change, and fiscal discipline was restored thereafter. In this paper we show that the cyclicality of fiscal policy changed after 1985 as well. This is indeed expected, since the return of fiscal control improved significantly Israel's position in global credit markets after 1985.

Finally, we point to a general problem regarding testing cyclicality of fiscal policy, which is common to most of the research in the area we know. Measuring the reaction of fiscal policy to contemporaneous output ignores the possibility that output is not completely exogenous, since fiscal policy has an effect on it, mainly through aggregate demand. This effect has been documented in many empirical papers, like Blanchard and Perotti (2002), Fatas and Mihov (2005) and many others. We develop a new method to cope with this endogeneity. We use lagged output data through a system of equations that takes into consideration the two-way causality between cycles and fiscal policy.[3] Using this method further strengthens our result that cyclicality changed significantly after 1985.

Another issue the paper deals with, which is novel, is to examine whether fiscal policy reacts differently to temporary and permanent shocks to output. We assume that the reaction should be different as it would have different long-run effects on balancing the budget. In order to examine this issue we split output shocks into permanent and temporary shocks, using the well-known Blanchard and Quah (1989) methodology, and then estimate the reaction of fiscal policy to temporary and permanent shocks over time.

The paper is organized as follows. Section 2 presents a survey of recent literature on cyclicality of fiscal policy. Section 3 describes the specific history of Israel's economic growth and Israel's fiscal policy. Section 4 measures the cyclicality of public expenditures controlling for these specific developments and finds that pro-cyclicality is significantly reduced. Section 5 performs similar tests for the public budget deficit. Section 6 deals with the issue of endogeneity, suggests a method to deal with it, and shows that the period after 1985 is indeed more counter-cyclical. Section 7 applies the Balnchard and Quah (1989) decomposition of cycles to test the reaction of fiscal policy to temporary and permanent shocks. Section 8 concludes.

[3] Actually, Lane (2003) also copes with the endogeneity problem by use of instrumental variables in an unpublished appendix to his paper.

2. LITERATURE SURVEY AND RELEVANT THEORIES

Recently there has been a renewed interest in the issue of cyclicality of fiscal policy. This interest was triggered by a work of Gavin and Perotti (1997) which found that fiscal policy is highly pro-cyclical in Latin American countries. This finding was in contrast with previous studies, by Galí (1994) and by Fiorito and Kollintzas (1994), and Fiorito (1997), which found that for developed countries expenditures were either counter-cyclical or a-cyclical. It therefore followed that cyclicality of fiscal policy differed significantly between developed and less developed countries. Since then research in the area increased and deepened in two main directions. The first was to measure in more detail the degree of cyclicality, mainly with respect to more fiscal variables, like deficits, public investment, public consumption, transfers, subsidies etc. The second direction of research was to find explanations to why countries differ in cyclicality of fiscal policies.

Examples of the first direction of research are Arreaza, Sørensen, and Yosha (1999), Akitoby et al (2004), Fatas and Mihov (2005), Lane (2003), and others. Examples of papers who follow the second direction and try to explain differences in cyclicality are Lane (2003), Gali (2005), Gali and Perotti (2003), and Alesina and Tabellini (2005). We briefly survey these main papers.

Lane (2003) shows that cyclicality of fiscal policy displays significant variability across categories and also across OECD countries. He finds that most advanced economies have counter-cyclical policies, and that the countries with volatile output and dispersed political power are the most likely to run pro-cyclical fiscal policies. Counter-cyclicality in OECD countries was documented also by Gali and Perotii (2003). They test whether it changed after the adoption of the Maastricht Treaty and the Stability and Growth pact. While the general feeling was that these pacts constrained the ability of running discretionary policies by policy-makers, they found that counter-cyclical policy became even stronger after the adoption of the Maastricht Treaty. This finding holds both for EU countries and non-EU industrialized countries within the OECD. Gali (2005) shows that this finding holds in general for all industrial countries. He finds that fiscal policy became more counter-cyclical after 1991 and raises the hypothesis that it is related to public debt reduction. This is relevant for this paper, in light of the fact that Israel is still characterized by a high level of public debt.

As mentioned above, the findings in developing countries are very different. Talvi and Vegh (2005) show, based on a large sample of less developed countries, that government spending and taxes are highly pro-cyclical. These authors develop a model of political pressures to explain this finding. According to these authors, the volatility of the tax base is the main difference between developing countries and the G-7 countries. The finding of pro-cyclicality in developing countries is corroborated also by Akitoby et al (2004), who find that the main components of government expenditure are pro-cyclical in about half of the developing countries in the sample. In general, public investment was found to be very pro-cyclical, and more so in countries characterized by financial risks and output volatility.

It is important to stress that there is no consensus even on the empirical regularities. Fatas and Mihov (2003) find that while the primary deficit is clearly counter-cyclical in advanced countries, this is achieved mainly by the action of automatic stabilizers.

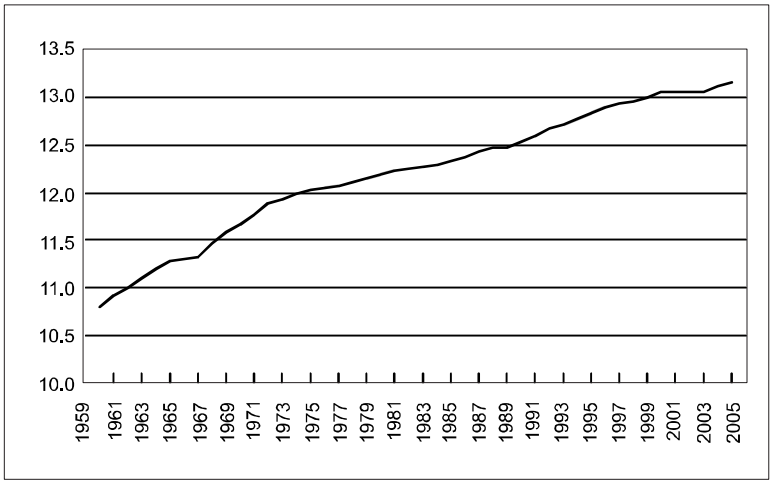
According to these authors expenditure is a-cyclical, i.e. it follows the theory of Barro (1979).

Finally, Alessina and Tabellini (2005) measure cyclicality of deficits in both developed and developing countries. They corroborate the finding that developed countries follow counter-cyclical policies, while developing countries are characterized by pro-cyclical fiscal policies. According to their analysis, the main reason for this development is not related to borrowing constraints, but rather to the desire of the public to avoid undesired rents by politicians when the economy is doing well.

3. OUTPUT AND FISCAL TRENDS IN ISRAEL

Output growth in Israel was very rapid in its first 25 years. Output increased at an average annual rate of 10% from 1950 to 1972. Actually, this has been a continuation of 25 years of rapid growth of the Jewish community during the British Mandate, in 1922-1947. The fifty years of rapid economic growth ended in 1973, and economic growth declined to an average annual rate of 4% since then. There have been many attempts to explain this slowdown, which are beyond the scope of this paper.[4] The marked change in growth in 1973 is shown clearly in Figure 1, which presents the logarithm of GDP over time in Israel, in the years of the study: 1960-2005.

Figure 1
Logarithm of GDP in Israel: 1960-2005



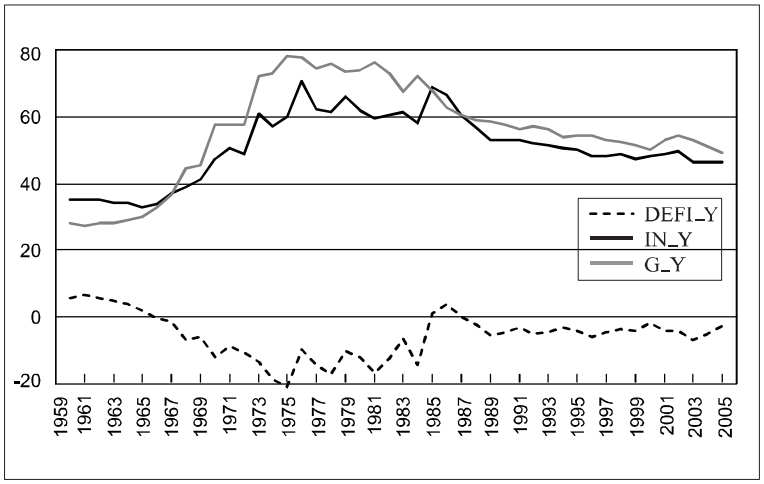
[4] The best explanation in our view is that sometime in the early 1970s Israel finished its catch-up with the world's frontier. Since then it has remained in a similar position relative to the leading countries in the world.

In addition to the change in the growth trend it is interesting to note also the Israeli business cycles in Figure 1. First, business fluctuations and especially recessions were not very common in Israel, for two reasons: the first is that Israel is a growing immigration economy and second is the Israeli-Arab conflict. These two raised aggregate demand, whether through investment for growth and immigration absorption, or military expenditures. Note that there are four main business cycles during this period: a sharp recession in 1965-1966, which ended with the 1967 war; a beginning of a recession in 1989, which ended after a year with the immigration from the CIS countries; a recession in 1997-1999 as a result of the end of immigration absorption and the difficulties in the peace process; and the recession in 2001-2002, which was triggered by the Al-Aqsa Intifada and the collapse of the peace process. Hence, recessions were few, and tended to end quickly as a result of immigration or wars.[5]

We turn next to discuss the dynamics of fiscal policy. The aggregate trends in fiscal policy in 1960-2006 are presented in Figure 2. It describes total public expenditure, total public income and public deficit as a ratio of GDP. The public sector includes the central government, the National Insurance Institute, which is responsible for welfare transfers, local government–cities and municipalities–health institutions–like the main HMOs and hospitals–universities and colleges, and the Jewish Agency. Public income includes not only taxes but also profits of state-owned firms, overseas donations and intergovernmental transfers, mostly from the US.

The dynamics described by Figure 2 are quite striking. In the years 1960-1966, prior to the Six Day War, expenditures were low, at less than 30% of GDP, and the budget was in

Figure 2
Public Expenditures, Income and Deficit in 1960-2005



[5] While conventional wars with Arab armies were very costly and tended to increase demand and have an expansionary effect, the confrontations with the Palestinians were not costly, but contractionary through the decline in tourism and through the pessimism they created, which reduced investments.

surplus. Following the war, the conflict with the Arab world intensifies, through occupation of land from Egypt, Jordan and Syria. A war of attrition develops with Egypt, Syria and the Palestinians, and the conflict reaches a peak in 1973 with the Yom Kippur War against Egypt and Syria. This was a very costly war both in terms of human life and economically, and it led to a costly arms race throughout the 1970s. The intensification of the conflict increases defense costs to more than 30% of GDP and as a result public costs rise up to 75% of GDP in the years 1973-1985. Income rises as well, but by less, and a budget deficit of around 15% of GDP develops. This leads to a rise in debt and to inflation, which reached an annual rate of more than 400% after 1983.[6]

The stabilization program of July 1985 brought inflation down, reduced the deficit and began a gradual reduction of public expenditures. These were reduced from 75% of GDP in the period 1973-1985 to around 50% of GDP nowadays. It is important to note that the reduction of deficit was immediate, and deficits have stayed low since then, even in times of large exogenous shocks, such as mass immigration and peace agreements. The immediate reduction of the deficit was achieved both by immediately reducing subsidies by 10% of GDP and by increasing income, through the special one-time US aid of $1.5 billion and through the recovery of tax collection after the stabilization.

We therefore observe a huge "hump" in fiscal policy in the years 1970-1985, which was caused by the intensification of the Israeli-Arab conflict after 1967. This has been a long-run development, which we will have to control for if we wish to examine the high frequency dynamics of fiscal policy. It is important to note that after 1985 not only expenditures and deficit were reduced, but also fiscal discipline increased significantly, as shown in Strawczynski and Zeira (2002). A possible explanation for the increased fiscal control can be the effect of the trauma of the inflationary period. Fiscal discipline was also strengthened by the Non-Money Printing Law of 1985, which prohibits the Bank of Israel from lending money to the government to finance its deficit.

4. FISCAL CYCLICALITY IN ISRAEL: EXPENDITURES

We begin our analysis with the simplest specification of a test of cyclicality of fiscal policy, as suggested by Lane (2002) and by Fatas and Mihov (2003):

$$(1) \quad \Delta \log G_t = \alpha + \beta \Delta \log Y_t + v_t .$$

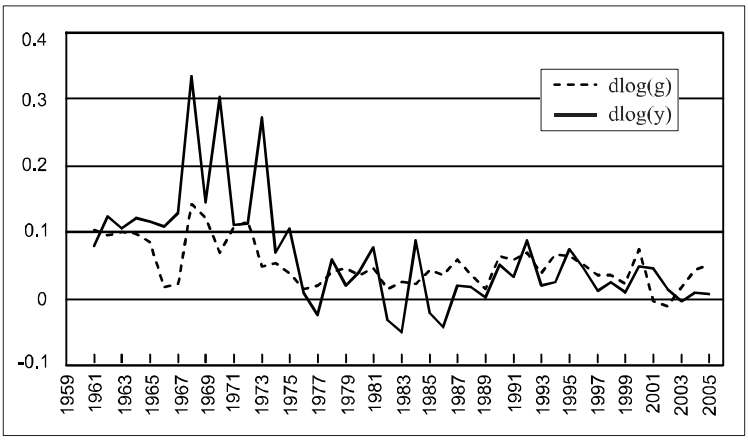
This test examines the response of the rate of change of expenditures to the rate of growth of output. A straightforward application of the model (1) to Israel over the years 1960–2005 yields a very high coefficient β, 1.379, as shown in Table 1. Estimation of the model with AR(1), as is actually done by Lane (2002), yields a similar coefficient, 1.285. This means that according to this test fiscal policy in Israel is very highly pro-cyclical. We

[6] Although defense costs were reduced from 35% to 20% of GDP toward 1980, they already caused in increase of other expenditures, such as interest payments and subsidies to basic goods, due to inflation. Thus total public expenditures remained high until the Economic Stabilization Program of 1985.

next show that the specific dynamics of Israeli growth and fiscal policy during this period tend to bias this estimate upward significantly.

Figure 3 presents the two variables in the regression of (1): the rate of change of output and the rate of change of public expenditures. As explained in Section 3 and as Figure 3 shows, the trend of output growth changed significantly in 1973. From an average rate of growth of 8.96% annually in 1961-1972, it declined to 3.85% in 1973-2005. Incidentally, the years of the huge increase in the fiscal variables due to defense costs, which are also described in Section 3, were 1968-1974, mainly during the period of high growth. This creates a long-run positive correlation between fiscal policy and output growth that has nothing to do with the cyclicality of fiscal policy. As Figure 3 shows, the long-run correlation between output growth and expenditures growth is very high and might dominate the short-run correlation. We therefore need to control for this long-run correlation in order to derive a more accurate estimate of cyclicality of fiscal policy.

Figure 3
Rates of Growth of Output and Expenditures



An additional characteristic of Israel that might bias pro-cyclicality of fiscal policy upwards is immigration. As mentioned in Section 3 Israel absorbs many Jewish immigrants, and these tend to come in waves. Such immigration waves create a spurious correlation between fiscal policy and output. On the one hand, each immigration wave increases labor input, and boosts investment and growth. On the other hand, such immigration waves increase government investment, mainly in construction but also in infrastructure. This effect of such an immigration wave, which is quite unique to Israel, should also be controlled for, to get a more comparable measure of cyclicality of fiscal policy.

We control for the long-run developments of output and fiscal policy in Israel in the following way. We first create a new variable TREND, which is equal to the average rate of growth in each period, namely TREND = 0.0896 in 1961-1972, and TREND = 0.0385 in

1973-2005. This variable controls for the long-run changes in output growth in Israel. We next add to the regression dummy variables for the years of large increases in defense costs. The first year is 1967 (WAR67), although most of the military costs started after the war, when the new territories had to be fortified and when the war of attrition began. That is why the second year is 1968 (WAR68). The third variable is for 1970 (WAR70), the most intense and last year in the war of attrition. The fourth dummy variable is the year 1973 (WAR73) of the Yom Kippur War, which was very costly. In addition to these variables we add another dummy variable for the year 1986. As described above, after the July 1985 Stabilization Program many public subsidies were slashed significantly. This change appears in the data in 1986. We add it since this reduction of expenditures was clearly not a cyclical move but a long-run change in fiscal policy. We denote this dummy variable by STAB.

The effect of immigration is controlled for by use of a variable IMM, which is the ratio between the number of immigrants in a year and the incumbent population. We assume that it is an exogenous variable, as it usually reflects ability of Jews to leave their countries, like the ex-Soviet Union, or Ethiopia, rather than developments within Israel. In addition to the specific Israeli variables we also add to some regressions a dynamic error-correction variable, to examine the return to trend from the high fiscal policy. This variable is $\log G_{t-1} - \log Y_{t-1} - \log A$, namely the difference between the share of expenditures in GDP and some long-run fiscal goal, where: $G = AY$. Adding this variable to the model makes it comparable to the Akitoby et al (2004) model, except that we assume that δ is equal to 1.

Table 1 presents the results of the regression of equation (1), when the new variables are added one by one. The dependent variable is $\Delta \log G_t$ and the regressions include also a constant, which is not reported. Model (1) is identical to equation (1) and to the models of Lane (2002) and Fatas and Mihov (2003). Model (2) describes the same estimation but with AR(1). In model (3) the output growth trend is added and it already reduces pro-cyclicality by half, from 1.38 to 0.67. Adding the years of war in model (4) reduces the measure of pro-cyclicality even further to 0.48. The stabilization year comes out significant as well in model (5), but it does not affect the measure of pro-cyclicality by much. Model (6) shows that immigration affects fiscal policy mostly with a delay of 2 years. Adding the effect of immigration leads to a reduction of the pro-cyclicality coefficient to 0.35 and it becomes insignificant. Interestingly, the error-correction variable in model (7) has a very weak effect on the regression. It is insignificant, its coefficient is very small and it does not have any effect on the prediction power of the regression. We therefore omit it from the analysis from here on.

Table 1 clearly indicates that the strong pro-cyclicality of fiscal policy in Israel, which is derived by using the uniform tests of Lane and of Fatas and Mihov, is significantly weakened when the specifics of Israel's long-run processes of growth and fiscal policy are taken into account. The measure of pro-cyclicality drops to one quarter of its original level and becomes insignificant. The new coefficient of pro-cyclicality, 0.35, is now within the range of the coefficients found by Lane (2003) for OECD countries. It is close to Switzerland (0.34), Denmark (0.33), Greece (0.35), and lower than Ireland (0.43), Japan (0.41), Portugal (0.37) and much lower than Norway (0.68).

Table 1
Cyclicality of Public Expenditures - Explained variable: $\Delta \log G_t$ *

Explanatory Variables	(1)	(2) AR(1)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta \log Y_t$	1.38 (4.7)	1.29 (3.8)	0.67 (1.8)	0.48 (2.1)	0.471 (2.12)	0.35 (1.8)	0.35 (1.7)	0.83 (3.3)
$\Delta \log Y_t$*D85								-0.56 (-2.7)
TREND			1.59 (2.9)	1.20 (3.4)	1.172 (3.45)	1.31 (4.4)	1.34 (3.1)	0.08 (0.3)
WAR67				0.05 (1.2)	0.05 (1.3)			0.09 (2.3)
WAR68				0.20 (5.3)	0.20 (5.5)	0.21 (5.9)	0.21 (5.8)	0.20 (5.4)
WAR70				0.20 (5.5)	0.20 (5.8)	0.20 (6.0)	0.20 (5.8)	0.23 (6.6)
WAR73				0.24 (7.0)	0.24 (7.3)	0.24 (7.5)	0.24 (7.4)	0.21 (6.4)
STAB					-0.07 (-2.1)	-0.06 (-2.0)	-0.06 (-2.0)	-0.06 (-1.9)
IMM_{t-2}						1.16 (2.0)	1.18 (1.9)	1.35 (2.2)
$\log G_{t-1} - \log Y_{t-1}$							0.002 (0.1)	
Adjusted R^2	0.32		0.42	0.83	0.84	0.86	0.86	0.85
Durbin-Watson	1.77		2.07	1.99	2.23	2.31	2.31	2.35

* In all tables we present the t-statistics in parentheses.

Another hypothesis, which is tested in Table 1, is that cyclicality of fiscal policy changed over time. During the years of fiscal crisis, 1970-1985, it was hard to finance deficits, which were large to begin with, and hence the government reacted pro-cyclically. In the following years, when the deficit was smaller, the government felt less constrained and reacted more counter-cyclically. To test for this hypothesis, we add an interaction variable, a dummy of 1 for the years 1986-2005, called D85, to the model. The results are presented by model (7) in Table 1. Indeed after 1985 expenditures are significantly less pro-cyclical, but are still not counter-cyclical.

We next turn to measure cyclicality of two main categories of public expenditures: consumption and investment. Table 2 contains the results of similar regressions to Table 1, but the dependent variables here are public consumption GC and public investment GI. Government consumption happens not to depend on the trend of output growth, but it depends strongly on the war dummies in 1967, 1970 and 1973. It is also interesting that GC has strong error-correction to output, in all specifications. The effect of immigration on government consumption is insignificant. As model (3) in Table 2 shows, the years after 1985 are less pro-cyclical than the previous years, but the effect is not significant.

Table 2
Cyclicality of Public Consumption and Investment

Dependent Variable	$\Delta\log GC_t$	$\Delta\log GC_t$	$\Delta\log GC_t$	$\Delta\log GI_t$	$\Delta\log GI_t$	$\Delta\log GI_t$
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta\log Y_t$	0.97	0.81	0.80	2.98	3.48	3.75
	(2.6)	(3.3)	(3.3)	(4.0)	(5.3)	(5.6)
WAR67		0.20	0.19			
		(3.6)	(3.4)			
WAR70		0.17	0.17			
		(3.2)	(3.1)			
WAR73		0.31	0.30			
		(5.7)	(5.6)			
STAB		-0.14	-0.14			
		(-2.6)	(-2.5)			
IMM_{t-2}					8.11	8.90
					(3.3)	(3.6)
$\log GC_{t-1}$-$\log Y_{t-1}$		-0.13	-0.14			
		(-3.0)	(-3.1)			
$\log GI_{t-1}$-$\log Y_{t-1}$					-0.28	-0.35
					(-4.0)	(-4.3)
$\Delta\log Y_t$*d85			-0.31			-1.55
			(-0.9)			(-1.7)
Adjusted R^2	0.11	0.71	0.66	0.26	0.50	0.52
Durbin-Watson	2.25	2.25	2.31	2.40	2.10	2.04

The growth of government investment also has a very strong reaction to its deviation from a goal, as shown by the error-correction significant coefficient in all three models (4), (5) and (6) in Table 2. In addition public investment depends strongly on immigration. That can be attributed mainly to public housing and to public subsidization of housing for immigrants. It can also be related to the need to invest in infrastructure as population grows. The pro-cyclicality of public consumption and investment is reduced by adding some Israeli-specific explanatory variables, but still remains quite high. This is true especially for government investment which has a pro-cyclicality coefficient of more than 3, which is higher than all countries in Lane (2002). But here again, the period after 1985 is much less pro-cyclical, with a coefficient close to 2. Hence, we note a significant change in cyclicality after 1985.

5. FISCAL CYCLICALITY IN ISRAEL: DEFICITS

In this section we examine the cyclicality of the public deficit. Relative to expenditures deficits are expected to be much more counter-cyclical due to strong pro-cyclicality of tax revenues. This section examines whether this is indeed the case in Israel. Unlike

expenditures, which are measured in rates of change, deficits are measured as shares of GDP, to avoid non-stationarity.

We begin our analysis with the simple model suggested by Fatas and Mihov (2005), which is similar to the Lane (2002) model, except that deficits relative to GDP replace the rate of change of expenditures:

$$(2) \quad D_t / Y_t = \alpha + \beta \Delta \log Y_t + v_t .$$

Table 3 presents the results of this model. We first present the regression of this equation without additional variables in model (1) in the table. The deficit is counter-cyclical, but insignificant and the regression is very weak. We then add two more variables which are specific to Israel. One is Rivals, which measures the military costs of the countries bordering Israel which have been fighting with it in the 1970s, Egypt, Syria and Jordan. The other is US8586, which is a dummy for the years 1985 and 1986, when the US transferred a large sum to Israel to help in the Stabilization Program.[7] This enabled Israel to reduce its deficit significantly in those two years. We therefore add these two years as an exogenous event, which is specific to Israel. Controling for these two additional variables the deficit is pro-cyclical but still insignificant, as shown in model (2) in Table 3. Adding an error-correction mechanism in model (3) improves the Durbin-Watson statistic of the regression but leaves the cyclicality effect insignificant. Model (4) limits the analysis to the years 1986-2004 after the stabilization and after restoring fiscal discipline. Here the results are very different, as deficits become counter-cyclical and significant at 5%.

Table 3
Cyclicality of Deficits – the Fatas and Mihov Test, Explained Variable : D_t/Y_t

Explanatory Variables	Model			
	(1)	(2)	(3)	(4) (1986-2004)
$\Delta \log Y_t$	-0.47 (-1.7)	0.18 (1.0)	0.11 (0.7)	-0.23 (-2.1)
Rivals		1.25 E-5 (9.4)	0.7 E-5 (3.11)	
US8586		-0.12 (-4.8)	-0.11 (-4.7)	-0.06 (-4.7)
D_{t-1}/Y_{t-1}			0.41 (3.0)	0.40 (3.5)
Adjusted R^2	0.04	0.72	0.76	0.75
Durbin-Watson	0.49	1.50	2.16	1.99

We next turn to a different model of cyclicality of deficit, which is used by Alesina and Tabellini (2006). This model differs in a number of ways from (2). First, its dependent

[7] The special US aid was quite significant. The sum was $1.5 billion, which is around 5% of GDP, or one third of the previous deficit.

variable is not the share of deficit in GDP but its change over time. Second, this model measures the business cycle not by rate of growth of GDP, but by the gap between output and its trend, as measured by the Hodrick-Prescott method. More specifically they estimate cyclicality using the following model:[8]

$$(3) \quad \Delta(D/Y)_t = \alpha + \beta YGAP_t + \gamma(D/Y)_{t-1} + \delta TOT_t + v_t .$$

The explanatory variables are the output gap $YGAP_t$, an error correction variable D_{t-1}/Y_{t-1}, and the terms of trade TOT (export prices/import prices). Given the change in the trend of economic growth described in Section 3, we calculate the deviations of output from trend in the two sub-periods separately: 1960-1972 and 1973 to the present.

Table 4
Cyclicality of Deficits – The Alesina and Tabellini Test, Explained variable: $\Delta(D_t/Y_t)$

Variable	(1)	(2)	(3)	(4)	(5)	(7)
$YGAP_t$	-0.000008 (-0.09)	-0.00008 (-0.9)				0.00005 (0.24)
D_{t-1}/Y_{t-1}	0.71 (6.26)	0.30 (1.77)	0.29 (1.71)	0.30 (1.78)	0.28 (1.70)	0.28 (1.61)
TOT	-0.01 (-0.1)	0.20 (1.8)	0.18 (1.7)	0.20 (1.7)	0.17 (1.6)	0.21 (1.88)
D_HIGHDEF		8.31 (3.3)	8.74 (3.4)	7.91 (3.1)	9.03 (3.6)	8.41 (3.27)
IMM_{t-1}		0.02 (1.0)	0.03 (1.1)	0.02 (0.8)	0.03 (1.2)	0.03 (1.07)
$YGAP_t$*recessions			-0.0002 (-1.2)			
$YGAP_t$*booms				-0.00006 (-0.4)		
$YGAP_t$*deep Recessions					-0.0003 (-1.7)	
Ygap*d85						-0.0002 (-0.66)
Adjusted R^2	0.51	0.61	0.61	0.60	0.63	0.60
Durbin-Watson	2.2	2.1	2.1	2.1	2.1	2.1

The results of this regression are shown in column (1) of Table 4; it turns out that the cyclicality coefficient is insignificant. However, following our above analysis, we add the relevant explanatory variables which are specific to the case of Israel. In column 2 we add variables that control for specific events in Israel: a dummy variable (D_HIGHDEF) for the high deficit period (1973-1985), which is clearly not related to cyclicality, and the flow of

[8] Alesina and Tabellini performed the regressions using the budget *surplus* as the explained variable. We use the budget *deficit*, which implies that a negative coefficient indicates counter-cyclical fiscal policy.

immigrants as a percentage of population, with a one period lag. Note that the regression improves substantially but the cyclicality coefficient is still insignificant.

In the next two regressions we try to find whether fiscal policy reacts differently to different phases of the cycle. This is done by multiplying the output gap with two dummy variables, one that has a value 1 for a negative output gap and zero elsewhere, for recessions, and one with value 1 when the output gap is positive and zero elsewhere, for booms. We find that in recessions the deficit is more counter-cyclical, but still insignificant. Column 5 focuses on periods of deep recessions, defined as periods with output gap higher than some threshold (excluding 1985 and 1986 which are related to the Stabilization Program). This regression has a higher explanatory power, and for the first time the cyclicality coefficient becomes significant at 10 percent. The negative coefficient implies that in these periods fiscal policy is counter-cyclical, namely, that automatic stabilizers work. However, the coefficient is very low. Finally, column (6) examines whether cyclicality of deficits was reduced after 1985, and finds that it was, though the effect is not very significant.

In summary, there is evidence that according to this model the public deficit follows an a-cyclical fiscal policy. This contrasts with advanced economies, like Canada (-0.359), Denmark (-0.840), Norway (-0.536), United Kingdom (-0.216) and United States (-0.389). A counter-cyclical policy with a coefficient close to zero was found for South Korea while Malaysia also has a coefficient that is close to zero, but positive.

6. COPING WITH ENDOGENEITY

So far our empirical tests have ignored the issue of endogeneity, as in most of the papers we follow. These tests examine how the cycle affects fiscal policy, but ignore the possibility that fiscal policy itself might affect the cycle. As we know since the times of Keynes (1936), fiscal policy might affect output during the cycle, through its effect on aggregate demand. There is ample empirical evidence in support of this effect, as in Blanchard and Perotti (2002), and Fatas and Mihov (2003) and many others. Hence, a test of cyclicality of fiscal policy should attempt to solve this endogeneity problem. This section presents such an attempt. This is done by using the dynamics of output and fiscal policy over time.

Consider a model where fiscal policy and output affect each other. Denote logarithms by lower case letters: $y_t = \log Y_t$ and: $g_t = \log G_t$. Assume that fiscal policy increases output through the Keynesian effect, and hence output evolves over time in the following way:

$$\Delta y_t = \gamma + \alpha \Delta y_{t-1} + \beta \Delta g_t + v_t . \quad (4)$$

The rate of growth depends on the lagged rate of growth, as is typical in business cycle AR models, and for simplicity assume that v_t is a white noise and not MA. Note that all variables in this equation are stationary. We also assume that the government reacts to the cycle, namely to the expected change in output, as assumed in the above models:

$$\Delta g_t = \varepsilon + \delta E_t(\Delta y_t) + \lambda(g_{t-1} - y_{t-1}) + u_t . \quad (5)$$

Note that the government cares about the expected rate of growth, but also about the size of government to output, as in Akitoby et al, namely, the government has a fiscal goal. Clearly, the policy is counter-cyclical if δ is negative. The expectations are formed in the beginning of the period, when fiscal policy is formulated. This assumption is similar to Galí (2005). We assume that u_t is also a white noise, which is independent of v_t. It reflects unanticipated fiscal needs.

In order to solve the model we need to formulate the expectations of output at the beginning of the period. We assume that at that time the government does not know the two shocks, to output and to fiscal policy. As a result the expectations for output growth satisfy, according to the rational expectations assumption and to equation (4):

$$E_t(\Delta y_t) = \gamma + \alpha \Delta y_{t-1} + \beta E_t(\Delta g_t).$$

From equation (5) we get that the expected increase in government is:

$$E_t(\Delta g_t) = \varepsilon + \delta E_t(\Delta y_t) + \lambda(g_{t-1} - y_{t-1}).$$

Substituting in the previous equation we get that the rational expectations of output are:

$$E_t(\Delta y_t) = \frac{\gamma + \beta\varepsilon}{1 - \beta\delta} + \frac{\alpha}{1 - \beta\delta}\Delta y_{t-1} + \frac{\beta\lambda}{1 - \beta\delta}(g_{t-1} - y_{t-1}).$$

Substituting in (5) leads to the following closed-form equation:

$$(6) \quad \Delta g_t = \frac{\varepsilon + \gamma\delta}{1 - \beta\delta} + \frac{\delta\alpha}{1 - \beta\delta}\Delta y_{t-1} + \frac{\lambda}{1 - \beta\delta}(g_{t-1} - y_{t-1}) + u_t.$$

Substituting (6) in (4) leads to the second closed-form equation:

$$(7) \quad \Delta y_t = \frac{\gamma + \beta\varepsilon}{1 - \beta\delta} + \frac{\alpha}{1 - \beta\delta}\Delta y_{t-1} + \frac{\beta\lambda}{1 + \beta\delta}(g_{t-1} - y_{t-1}) + \beta u_t + v_t.$$

Equations (6) and (7) are the two equations we estimate. The variables are stationary and the explanatory variables are lagged and hence exogenous. The estimation can already tell us if fiscal policy is pro- or counter-cyclical, by the sign of the coefficient of Δy_{t-1} in the regression of (6), which reveals the sign of δ. But from the estimation we can calculate all the structural parameters of equations (4) and (5). This is done in the following way. Let a, b, c, and d be the estimated coefficients of the two equations, respectively, without the constant terms. Then:

$$(8) \quad a = \frac{\delta\alpha}{1 - \beta\delta},\ b = \frac{\lambda}{1 - \beta\delta},\ c = \frac{\alpha}{1 - \beta\delta},\ d = \frac{\beta\lambda}{1 - \beta\delta}.$$

Using (8) we calculate the basic parameters of the model:

$$(9) \quad \delta = \frac{a}{c}, \beta = \frac{d}{b}, \lambda = b\left(1 - \frac{ad}{cb}\right), \alpha = c\left(1 - \frac{ad}{cb}\right).$$

These are the coefficients of the basic underlying model.

The results of the empirical tests of cyclicality of fiscal policy in Israel, which follow this method, are presented in Table 5. The test which uses only the basic variables of the model, namely last period rate of output growth and last period share of public expenditures in GDP, is model (1) in Table 5. All coefficients are significant and we get: a = 0.95 and c = 0.40. This means that the structural cyclicality coefficient is: 2.37. This means that Israel's public expenditures are strongly pro-cyclical. If we add the specific variables of Israel, like the war years, the stabilization year, the changing trend of long-run growth, we get much lower pro-cyclicality. The relevant coefficients become a = 0.49 and c = 0.33. But both coefficients are insignificant. That means that the structural cyclicality coefficient is 1.45, which is lower, and insignificant. But the most interesting results appear when we test for difference in cyclicality before and after 1985. Here the results are significant, as shown in model (3) in Table 5. While fiscal policy until 1985 is quite pro-cyclical, it is significantly less pro-cyclical after 1986. This is therefore another reason why the standard tests for Israel fail to represent the intricacy of its fiscal policy. It changed significantly after 1985.

Table 5
Expenditures and Lagged Growth Rates

Model	(1)		(2)		(3)	
Dependent Variable →	$\Delta\log G_t$	$\Delta\log Y_t$	$\Delta\log G_t$	$\Delta\log Y_t$	$\Delta\log G_t$	$\Delta\log Y_t$
Explanatory Variable ↓						
$\Delta\log Y_{t-1}$	0.95	0.40	0.49	0.33	0.92	0.29
	(2.8)	(2.8)	(1.9)	(1.7)	(4.7)	(1.9)
$\Delta\log Y_{t-1}$*D85					-0.53	
					(-2.7)	
$\log G_{t-1}$-$\log Y_{t-1}$	-0.08	-0.03	0.01	0.02	-0.02	0.02
	(-2.2)	(-1.8)	(0.4)	(0.9)	(-0.9)	(1.0)
$TREND_t$			1.14	0.84		0.91
			(2.4)	(2.4)		(2.9)
WAR67			0.06	-0.04	0.09	-0.04
			(1.5)	(-1.3)	(2.6)	(-1.6)
WAR68			0.26	0.07	0.30	0.07
			(6.9)	(2.6)	(8.8)	(2.7)
WAR70			0.18	-0.03	0.18	-0.03
			(5.2)	(-1.3)	(5.3)	(-1.3)
WAR73			0.20	-0.01	0.15	
			(5.4)	(-0.5)	(4.5)	
STAB			-0.07	-0.01	-0.06	
			(-2.1)	(-0.3)	(-1.8)	
IMM_{t-2}			1.00	0.04	1.06	
			(1.5)	(0.1)	(1.7)	
Adj. R^2	0.34	0.29	0.86	0.52	0.86	0.55
Durbin-Watson	1.69	1.94	2.51	1.95	2.51	1.94

7. TEMPORARY AND PERMANENT SHOCKS

This section addresses a final important question, whether fiscal policy reacts differently to permanent shocks than to temporary shocks to output. The previous tests examined the reaction of fiscal policy to the aggregate changes in output, but not all these changes are cyclical, and some are more permanent and long-run. In this section we therefore try to distinguish between permanent shocks, usually viewed as technology shocks, and temporary shocks, usually viewed as demand shocks. This distinction is important for fiscal policy, since it seems that the government should react differently to permanent shocks, as it might affect its long-run budget constraint. Reacting to an adverse permanent shock counter-cyclically might cause an imbalance to public finances and might even lead to a crisis. In contrast, reacting counter-cyclically to a temporary shock seems to be a reasonable policy, since it has no long-run implications and it smoothes the cycle. We therefore expect fiscal policy to be counter-cyclical with respect to temporary shocks and a-cyclical with respect to permanent shocks.

In order to split the rate of growth of output into permanent and temporary shocks we adopt the Blanchard and Quah (1989) methodology. They run a VAR model of GDP growth and unemployment in order to identify the supply and demand shocks. According to this method changes in supply are translated into permanent shocks to output, while changes in demand are translated into temporary shocks. They distinguish between the two shocks by a restriction that the long-run effect of the temporary shocks is zero. In order to run this methodology for Israel we use, as in Blanchard and Quah (1989), annual data for GDP growth and unemployment during the period 1961-2005, using two lags.

Figure 4
Temporary and Permanent Shocks

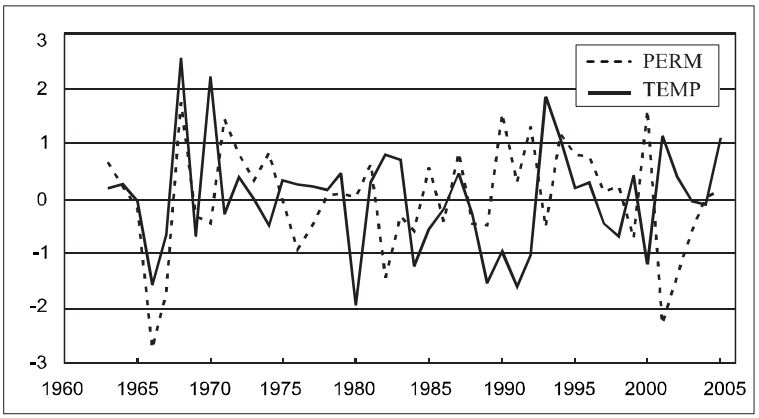


Figure 4 shows the temporary and permanent shocks in Israel calculated with this methodology. The $TEMP_t$ line describes the temporary shocks and the $PERM_t$ the permanent shocks. The analysis of how fiscal policy reacts to temporary and to permanent shocks is presented in Table 6. First note that expenditures react negatively to temporary

shocks over the whole period, although at low significance of 8%. The reaction of expenditures to permanent shocks is positive but not significant. Interestingly, the counter-cyclicality of expenditures to temporary shocks becomes much weaker and insignificant in the later period, after 1986. Furthermore, the pro-cyclicality of permanent shocks becomes more significant after 1986. One way to interpret this finding is that after 1986 fiscal caution increased, and whenever the economy was in a recession and government revenues declined, it reduced expenditures.

It is also interesting to note in Table 6, that the dynamics of the cyclicality of the deficit were opposite to those of expenditures. Thus, in the overall period the deficit reaction to shocks is insignificant. But the deficit became more counter-cyclical after 1986, both with respect to temporary shocks and with respect to permanent shocks. This finding can be explained by the reaction of tax revenues to cycles, but it must be rejected, because tests show that tax revenues, which are strongly pro-cyclical over the whole period, became less pro-cyclical after 1985. We therefore do not have a full explanation to this finding of Table 6.

Table 6
The Reaction of Fiscal Policy to Temporary Shocks

Dependent Variable →	$\Delta \log G_t$ 1963-2004	$\Delta \log G_t$ 1986-2004	D_t/Y_t 1963-2004	D_t/Y_t 1986-2004
Explanatory Variables ↓				
$TEMP_t$	-0.01 (-1.8)	-0.004 (-0.7)	0.003 (0.6)	-0.001 (-0.3)
$PERM_t$	0.01 (1.4)	0.01 (1.7)	0.004 (0.8)	-0.005 (-1.5)
TREND	1.56 (6.0)			
WAR68	0.25 (6.2)			
WAR70	0.23 (6.2)			
WAR73	0.24 (7.6)			
STAB	-0.06 (-2.0)	-0.06 (-2.8)		
IMM_t	1.38 (2.4)	1.16 (2.6)		
Rivals			7 E-6 (3.2)	9 E-7 (-0.3)
US8586			-0.11 (-4.8)	-0.06 (-3.4)
D_{t-1}/Y_{t-1}			0.35 (2.4)	0.43 (3.4)
Adjusted R^2	0.86	0.52	0.73	0.73
Durbin-Watson	2.39	1.89	2.19	2.26

8. CONCLUSIONS

This paper deals with the puzzle of why standard tests show such strong pro-cyclicality of fiscal policy in Israel. This is puzzling, since Israel is a developed industrial country and like other similar countries we would expect fiscal policy to be counter-cyclical, both due to automatic stabilizers, and according to both neoclassical and Keynesian recommendations. The paper presents some statistical answers to this puzzle. First, we show that standard estimation of cyclicality of fiscal policy of Israel reflects to a large extent the long-run trends of output and of fiscal policy. Once these are controlled for, the measure of pro-cyclicality is reduced significantly. Second, we show that cyclicality of fiscal policy changed over time and after 1985 it became much less pro-cyclical. Actually we show that public deficits have been mildly counter-cyclical throughout Israel's short history. Public expenditures were pro-cyclical, but this pro-cyclicality declined significantly after 1985, when fiscal discipline was restored.

This of course solves the puzzle only partially. The question which remains is why fiscal policy in Israel is still pro-cyclical. One possible explanation can be the trauma from the years of fiscal turmoil, 1973-1985, when public expenditures went up to 75% of GDP and the deficit reached 15% of GDP. This period created not only a trauma, but also a large public debt, which the government is trying to reduce. This debt, which was higher than 150% of GDP in 1985, was reduced but is still around 100% of GDP today. This explains why periods of recession, when revenues decline, are used by the fiscal authorities to reduce public expenditures, in order to continue with debt reduction, and do not lead to counter-cyclical measures. An interesting question is when will the public sector in Israel overcome this trauma and converge to policies implemented in most developed countries. Our finding, that pro-cyclicality declined significantly after 1985, can be interpreted as a first step toward the implementation of the type of policies that characterize most advanced economies.

REFERENCES

Akitoby, B., B. Clements, S. Gupta, and G. Inchauste (2004). "The cyclical and long-term behavior of government expenditures in developing countries", *IMF Working Paper* 04.202.

Alesina A. and G. Tabellini (2005). "Why is fiscal policy often procyclical?", mimeo, July.

Arreaza A., Sørensen, and O. Yosha (1999). "Consumption Smoothing through Fiscal Policy in OECD and EU Countries", in: James M. Poterba and Jürgen von Hagen (eds.), *Fiscal Institutions and Fiscal Performance*. University of Chicago Press.

Barro R. (1979), "On the determination of Public Debt", *Journal of Political Economy* 87, 240-271.

Blanchard O. and R. Perotti (2002). "An empirical characterization of the dynamic effects of changes in government spending and taxes on output", *Quarterly Journal of Economics* 117 no, 1329-1368.

Blanchard O. and Quah, D. (1989). "The dynamic effects of aggregate demand and supply disturbances", *The American Economic Review* 79, no 4, 655-673.

Fatas and Mihov (2000). "Fiscal policy and business cycles: an empirical investigation", mimeo, INSEAD.

Fiorito R. and Kollintzas (1994). "Stylized facts of business cycles in the G7 from a real business cycle perspective", *European Economic Review* 38, no 2, 235-269.

Fiorito R. (1997). "Stylized facts of government finance in the G7", *IMF Working Paper*, no 97/142.

Gali. J. and R. Perotti (2003). "Fiscal policy and monetary integration in Europe", *Fiscal Policy*, 533-572 (October)

Gali J. (2005), "Modern perspective of fiscal stabilization policies", *CESifo Economic Studies* 51, 4, 587-599.

Gavin M. and R. Perotti, "Fiscal policy in Latin America", *NBER Macroeconomics Annual* 12, 11-71.

Keynes, J. M. (1936). *The general theory of employment, interest and money*, London: Macmillan.

Lane P. (2003). "The cyclical behavior of fiscal policy: evidence from the OECD", *Journal of Public Economics* 87 no 12, 2261-2675 (December).

Myrdal G. (1939). "Fiscal policy in the business cycle", *The American Economic Review* 29 no 1, 183-193.

Strawczynski M. and J. Zeira (2002). "Reducing the Relative Size of Government in Israel after 1985", in Avi Ben-Bassat (ed.), *The Israeli Economy, 1985-1998: From Government Intervention to Market Economics*, The MIT Press, Cambridge MA, 2002. Also published in Hebrew by Am Oved, 2001.

Talvi E,. and Vegh C. (2005). "Tax base variability and procyclical fiscal policy", *Journal of Economic Development* 78 (1), 156-190.