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Cyclicality of tax expenditures: the case of Israel

Michel Strawczynski[1]

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[1] Bank of Israel, Research Department and the Hebrew University of Jerusalem, Department of Economics - Email: Michel.Strawczynski@boi.org.il

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חטיבת המחקר, בנק ישראל ת"ד 780 ירושלים 91007
Research Department, Bank of Israel. POB 780, 91007 Jerusalem, Israel

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By Michel Strawczynski

ABSTRACT

Tax expenditures have been rarely investigated internationally because of lack of data. This paper analyzes the cyclicality of tax expenditures in Israel, a country that has gradually intensified the use of this tool, becoming quantitatively important in terms of GDP when compared to other OECD countries. Using quarterly data for the period 1986 to 2016, I find that the pattern of cyclicality of government decisions on tax expenditures changed after 1997, following a notorious reduction of government's deficit and debt: tax expenditures became pro-cyclical in expansions and counter-cyclical in recessions. The latter finding resembles the pattern documented in the literature for government spending in selected developing economies, who achieved in recent years counter-cyclical implementation of spending.

Key Words – Tax Expenditures, Cyclical Policy.

JEL Numbers– H24, H25 and H61.

המחזוריות בהענקת הטבות מס: המקרה של ישראל

מאת מישל סטרבצ׳ינסקי

תקציר

ההענקה של הטבות מס נחקרה בעולם רק לעתים נדירות עקב חוסר נגישות של נתונים מהימנים. מאמר זה מנתח את תופעת המחזוריות בהענקת הטבות מס בישראל, מדינה שהעצימה בהדרגה את השימוש בכלי זה תוך הגעה לרמה יחסית גובהה במונחי תמ״ג בהשוואה למדינות אחרות בארגון ה-OECD. בהסתמך על נתונים רבעוניים לתקופה בין 1986 עד 2016, אני מוצא שדפוס המחזוריות של החלטות הממשלה בדבר הענקה של הטבות מס השתנה לאחר שנת 1997, בעקבות ההפחתה המשמעותית של משקל הגירעון בתקציב ושל החוב של הממשלה בתוצר: ההענקות של הטבות המס הפכו לפרו-מחזוריות בתקופות של צמיחה ולאנטי-מחזוריות בתקופות של האטה. ממצא אחרון זה דומה לדפוס שמתועד בספרות בשנים האחרונות עבור הוצאות ממשלתיות במבחר של כלכלות מתפתחות, שהצליחו לשנות את דפוס המדיניות יחסית לעבר ולהשיג יישום אנטי-מחזורי של הוצאות אלה בתקופות שפל.

מילות מפתח - הטבות מס, מדיניות מחזורית.

מספרים של כתב עת לספרות כלכלית (JEL) של אגודת הכלכלה האמריקאית - H24, H25 וכן H61.

1. Introduction

Tax expenditures are tax exemptions or tax benefits, that are conferred in situations that can sometimes be related to a market failure - like myopia in long-term saving, or to issues associated to social welfare and income distribution - like exemptions in indirect taxation aimed at reducing prices of socially targeted goods (food or fruit and vegetables). Sometimes they are part of labor arrangements, like the Working Fund that has been operated in Israel for decades. In OECD countries tax expenditures became a significant tool (Figure 1) that is used by governments both to implement their fiscal policy and to achieve political targets.

The lack of current information and transparency in the framework of the budget, and the lack of a formal commitment for publishing and keeping track of tax expenditure data, derived in scarcity of empirical research on this issue at an international level. Moreover, the inexistence of a clear commitment for publishing data on tax expenditures by governments, generates by itself an incentive for considering tax expenditures as a tool for achieving political economy targets.[1] Since ministers are usually prone to be involved in the common pool issue,[2] they may prefer using this tool for implementing political commitments.

Figure 1 shows the total amount of tax expenditures in Israel as a percent of GDP, compared to OECD countries. The use of tax expenditires varies among countries, while Israel is one of the countries with relatively high use of this tool. Beside Israel the list of countries that use them intensively includes Mexico, Australia, Spain, USA, UK and Italy.

This paper is one of the first atempts to inquire into the cyclicality of tax expenditures, based on reliable data as published by Israel's Ministry of Finance.

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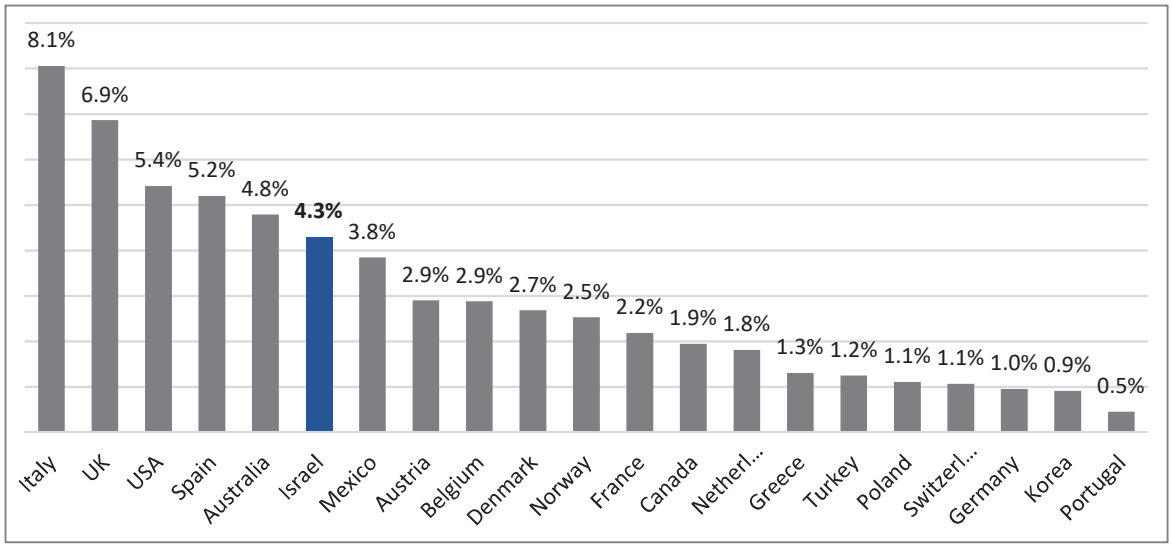
[1] In the long run tax expenditures will clearly take part of the multi-period government budget constraint. However, as analyzed in the common pool problem, the problem arises because ministers deciding about tax expenditures today may not be in function once the lack of revenue binds. Concerning the lack of transparency, see Milessi Ferreti (2003).

[2] See Von Hagen and Harden (1995).

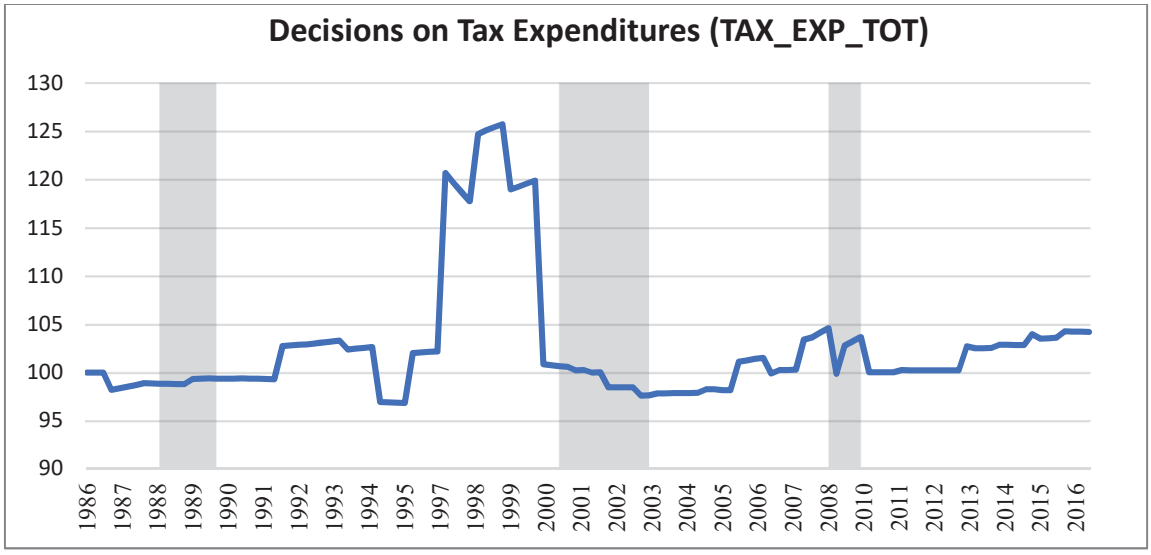
FIGURE 1: Tax Expenditures as a percent of GDP (2010)



Source: "Choosing a Broad Base - Low Rate Approach to Taxation", OECD 2010 (Israel data - Ministry of Finance).

In order to characterize the cyclicality of tax expenditures I build a variable called "decisions on tax expenditures" (TAX_EXP_TOT). This variable reflects government decisions in all five categories of tax expenditures: capital markets, factors of production, tax expenditures is taken by the government, I add (substract) to the previous level the estimated implied addition (reduction), starting from a basis that is set equal to 100 in the first quarter of 1986 (see Figure 2). A detailed explanation of the data, including the definition of cycles, appears in appendix A.

FIGURE 2: (Shaded Areas: Recession Periods[3])



[3] The dates of cycles follow Flug and Strawczynski (2009).

Note that while this methodology takes into account only the direct decisions on tax expenditures, in reality there are also indirect effects related to the fact that tax expenditures depend sometimes on decisions taken in other issues – like in the example of mandatory pensions. A decision of imposing mandatory pension derives, as a side effect, in an increase of tax expenditures related to pensions, especially in years of rapid growth of wages. While this effect is important, I decided to keep track only after decisions that are straightforwardly related to tax expenditures.

One clear pattern of total tax expenditures is that during the 2000s, tax expenditures gradually increased in expansions. In order to make a characterization of the decisions on tax expenditures along the bussiness cycle, it is necessary to control for explaining factors – as shown in section 3.

2. Literature Survey

2.1 Tax Expenditures

Swift (2006) presents the basic benchmark of tax expenditures, including the concept and definition, size, effects, and the framework for fiscal accountability and transparency. The basic conclusion of his analysis is that current practices in tax expenditures do not fulfill the desired principles of fiscal accounatability and transparency according to the Campos/Pradhan (1996) fiscal accountability model and the IMF's fiscal transparency code. His main finding is that the practices related to tax expenditures in most countries should be strenghthed when the main problem is at a very basic level: publication of current decisions and implications.

Redonda and Neubig (2018) present a detailed description of tax expenditures in different countiries (G20 and OECD countries). They document that a list of advanced economies report in a current and systematic basis the developments on tax expenditures – including Australia, Austria, Canada, France, Germany, Italy, Netherlands, Korea and Sweden. On the opposite situation, i.e., no systematic report we find an heterogeneous list of countries including China, Czek Republic, Indonesia, Japan, Luxembourg, Russia, Saudi Arabia and Slovenia. Finally, the vast majority of countries report tax expenditures in a Basic Report which does not have necessaraly a fixed periodicity – creating a situation of basic accoubtability but not with a high standard. This list of countries include Belgium, Chile, Iceland, Ireland,Norway New Zealand, UK, US and many other OECD countries. Israel, which is at the center of the present study, belongs to this group. These authors

stress the importance of transparency on this subject, including the need of re-assessing tax expenditures in retrospective.

An analysis of the general equilibrium impact of tax expenditures on employers and employees is presented by Zax (1988). He shows that the impact differs according to the decision of the social planner, depending on the imlementation that can be or cannot be budget balanced. Lenjosek (2004) analyzes with explicit formulas the distortions created by tax expenditures. One notable distortion comes from market diversion, since the tax expenditure implies an increase in consumption of the benefited product at the expense of a reduction in demand of the substitutes (close or far). This author shows explicit formulae for calculating the distortion. The main formula shows that the distortion increases for products that cause market diversion and is directly related to the ratio between the adopted tax expenditure and the relevant general tax rate. This aspect will be present also in the model introduced below.

Listokinn (2012) is one of the single papers that investigated qualitatively the relationship bewteen tax expenditures in the US and the bussiness cycles. His analysis differentiates between destabilizing tax expenditures (exclusion for employer-provided health insurance, tax deductability of mortgage interest, tax expenditure for charitable giving, deductability of state income tax payments and tax expenditures for investment), tax expenditures with stabilizing or neutral effects (countercyclical expenditures, 401 (k) saving plans and other saving incentives) and standard tax expenditures with phase-outs (standard deduction of income tax, phasing out of programs like EITC). His analysis stresses that tax expenditures belonging to the first group are expected to be exacerbated in expansions, since many of the tax expenditures are subject the cycle. For example – incentives for investment depend on the actual implementation of investments which is usually pro-cyclical. While this analysis is quite informative, we will add to new dimensions to the literature. First, we will include an empirical analysis using econometric tools; Second, the mechanism affecting the cycle will not be based only on automatic reactions to the cycle, but mainly on optimal government behavior which internalizes political economy considerations.

2.2 Cyclicality of Fiscal Policy: spending and statutory taxes

In the last two decades a lot of research has been performed on the subject of fiscal policy cyclicality, concentrated mainly on spending and budget deficit. That literature documents an assymetric pattern in OECD countries, characterized by rising spending in recessions that is not reverted during expansions (Hercowitz and Strawczynski, 2004a). Lane (2003) shows that in many developed economies fiscal policy tends to be counter-cyclical. By contrast, in developing economies expenditure is highly pro-cyclical, implying an increase of spending in expansions and spending cuts in recessions (Gavin and Perotti, 1997; Strawczynski and Zeira, 2011). This finding was recently corroborated also for Israel by Brender (2021), who shows that in a sample between 1998 and 2016 the cyclically adjusted budget deficit acted pro-cyclically. However, in recent years, different papers have documented an improvement ("graduation") in implemented spending policy by developing countries, that reduced pro-cyclicality (Frankel, Vuletin and Vegh, 2013).

Concerning taxation, the lack of research had been related to the inexistence of available data about statutory tax changes and data on tax exemptions, and also about tax expenditures. Lately different papers were written on this subject. Vegh and Vuletin (2015) show that taxation policy in advanced economies is acyclical, with the exception of indirext taxes which are changed pro-cyclicaly. Strawczynski (2015) confirms this finding by looking at detailed data in Israel through many different taxation channels. It is interesting to stress that similarly to the reported finding on deficits and spending, it seems to be the case that also for statutory tax rates there was an improvement after the 2000s: Srebrnik and Strawczynski (2014) show that for a sample of developing countries procyclicality of tax rates in countries with high external debt declined during this period. Since their finding concentrates on countries that have a high external debt, they provide a possible mechanism that is at the background of implemented fiscal policy.

2.3 Political Economy Considerations

Since the paper written by Roubini and Sachs (1989) it is widely accepted that weak coalitions will tend to raise the debt, which can be directly associated to tax exemptions, tax reductions and government spending increases. Many papers that were written afterwards, like Von Hagen and Harden (1995), provide a framework for explaining the incentives of ministers in creating a deficit bias that is based on political forces.

Two features shall be mentioned about this literature concerning the present paper: i) I will include political variables as explanators of tax expenditures; ii) all three government budget tools mentioned above will take part of my empirical implementation (government spending will be used as a control variable).

Another related issue is the unawareness of politicians about the importance of long-term considerations when designing fiscal policy. An important role in this aspect is played by international rating agencies, that rate the governments around the world and constraint politicians about their degrees of freedom for ignoring future generations. They stress the importance of deficits and debt, since these variables represent the tool through which consequences of present policies are traspassed to future generations.[4]

3. Tax Expenditures in Israel

There are several categories of tax expenditures that were mostly historically created and rarely abolished. Tax expenditures in Israel can be classified into four categories (beside "other"):

i) Capital Market Tax Expenditures (TAX_EXP_CAP) - including Pension Funds (exemptions at deposit and funding with further tax exemptions with withdrawal); Working Funds (6 years savings that benefit from income tax exemptions); Interest payments exemptions; Workers' options in capital savings program. This category is shown in Figure 3 and Appendix C.

ii) Factors of Production Tax Expenditures (TAX_EXP_PRO) - Capital Investment Stimulus Law (general program in the periphery and an alternative program that stimulates employment); Research and Development exemptions; Oil Discoveries; Movies; Security Workers; Accelerated Capital Depreciation. This category is shown in Figure 4.

[4] A recent analysis that is focused on the case of Israel is presented by Michalson and Stein (2021).

FIGURE 3: (Shaded Areas: Recession Periods)

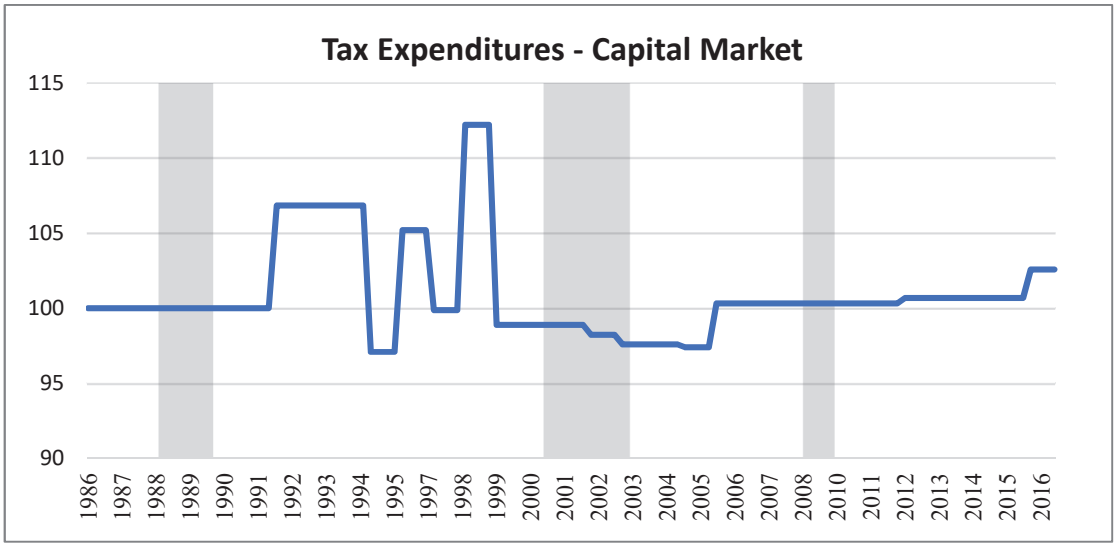
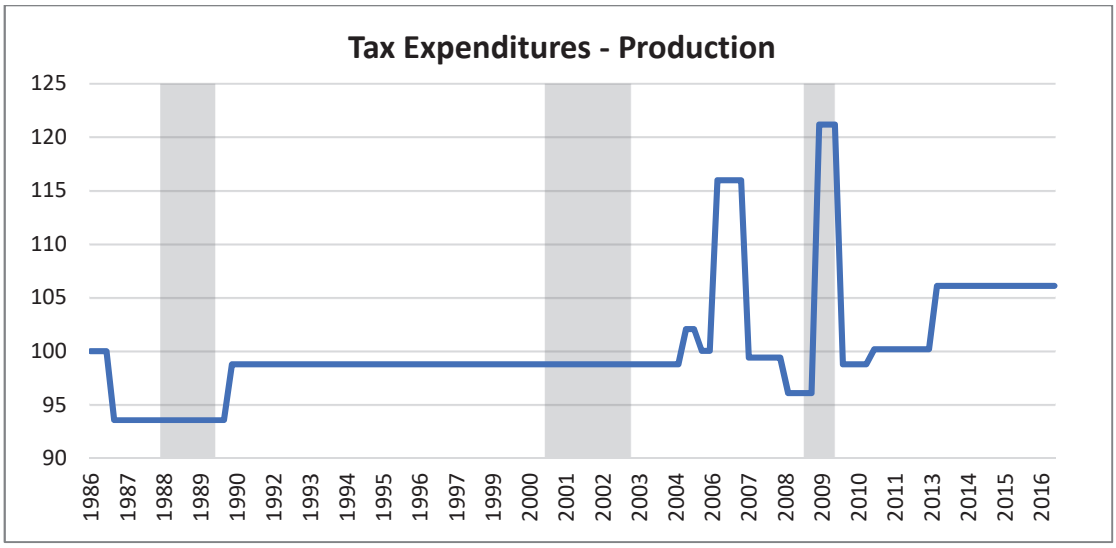


FIGURE 4: (Shaded Areas: Recession Periods)



iii) Indirect Tax exemptions (TAX_EXP_VAT) – Custom duties and VAT exemptions; historically the first group includes exemptions for immigrants, Returning Home Program, safety parts for cars, tourist exemptions; VAT exemptions includes VAT in Eilat (vacational city), fruits and vegetables, tourism, internet purchases. This category is shown in Figure 5.

iv) Welfare Tax expenditures (TAX_EXP_WELFARE) – exemptions for NGO's, Exemptions for National Institute allowances, income tax exemptions for immigrants, income tax exemptions for the disabled, income tax reductions for

workers living in the periphery, income tax reductions for workers in the Defense Sector and others. This category is shown in Figure 6.

FIGURE 5: (Shaded Areas: Recession Periods)

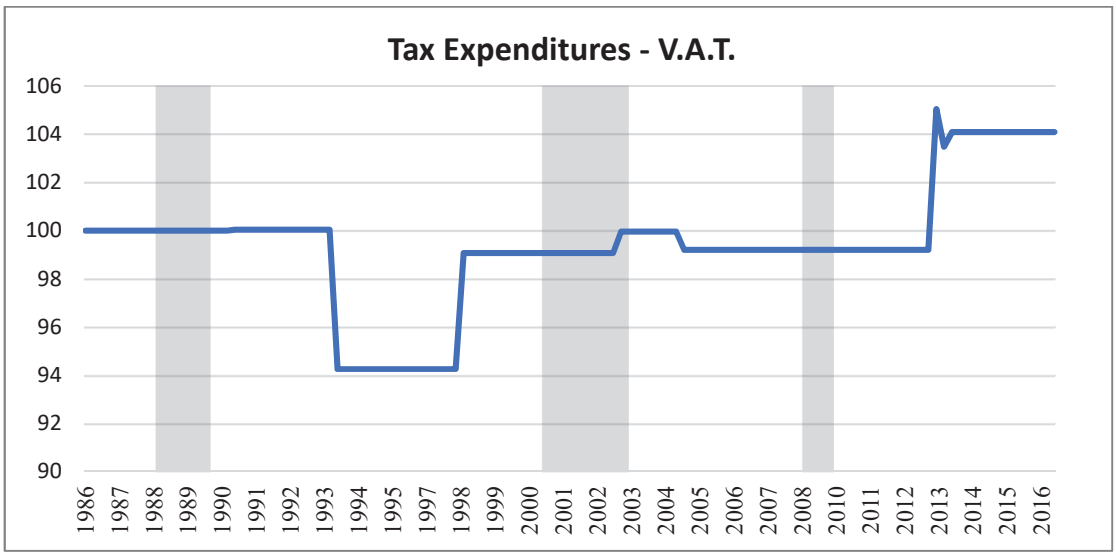
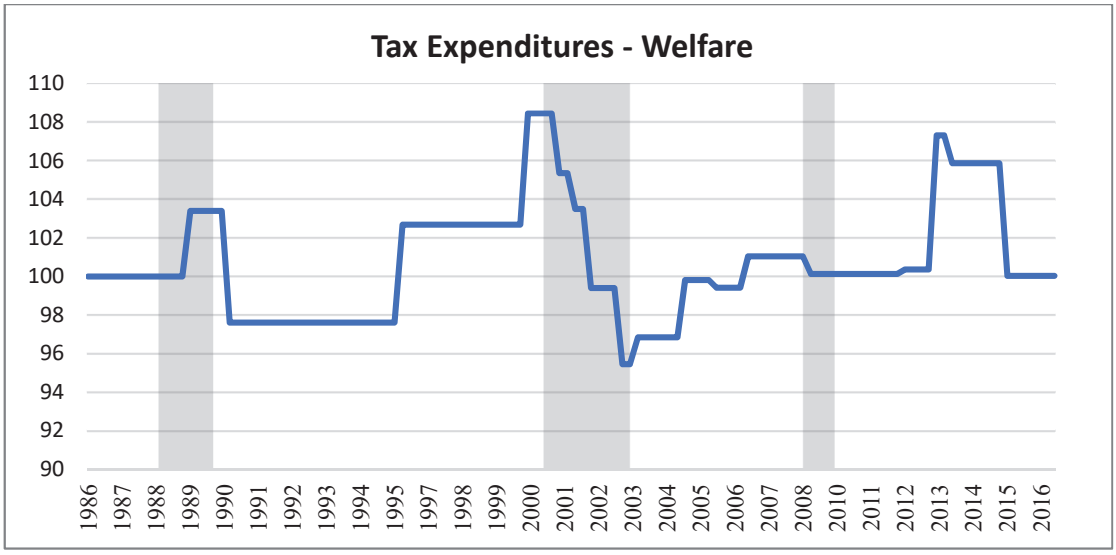


FIGURE 6: (Shaded Areas: Recession Periods)



By looking at the development of all four categories, it is possible to see that the development in the different items is quite heterogeneous, and in many cases (like welfare) they were determined historically, remaining relatively constant since then. A common factor for all categories is that during recessions the tax expenditures were not increased, while most jumps occurred during expansions.

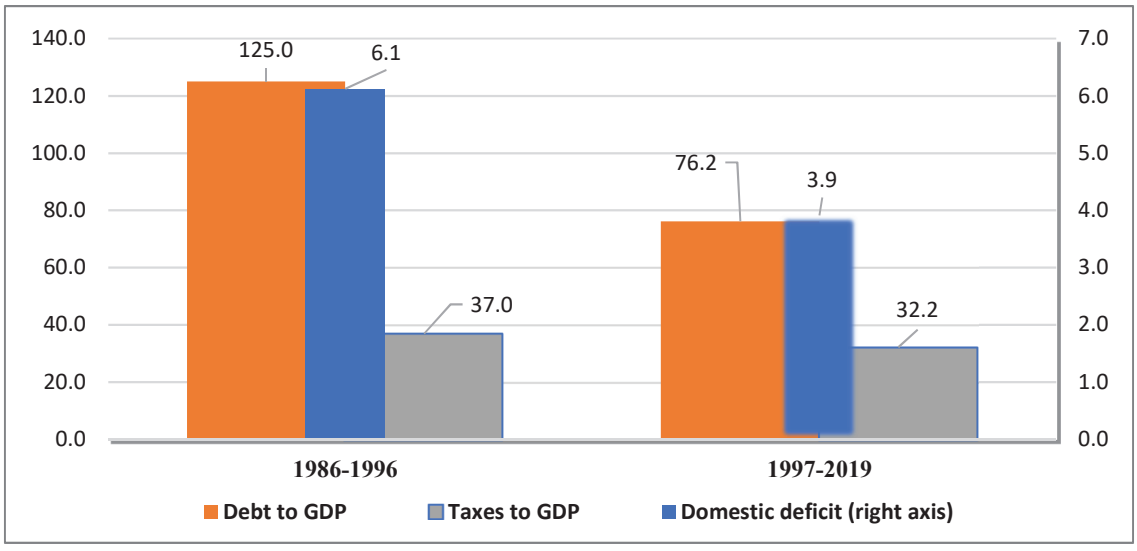
In Appendix C I show the decisions taken under the category TAX_EXP_CAP and the number of decisions taken in each of the categories.

Tax expenditures and expected cyclical behavior

During the eighties Israel experienced an economic crisis characterized by huge deficits in both the balance of payments and government budget, accompanied by hyperinflation that arrived to its maximum in 1985. Strawczynski and Zeira (1999) show that there was a reduction in procyclicality after the stabilization plan of 1985. Later, using a more updated sample, Mehl (2017) shows that after 1985 fiscal policy became gradually less procyclical, becoming even acyclical after 2009. This finding is similar to the one shown by Frankel, Vegh and Vuletin (2013) for developing economies.

In Appendix D I perform a formal test, following the methodology of Gregory and Hansen (1986), in order to test a change in the fiscal policy regime after the stabilization plan of 1985. I found that behavior of tax expenditures as a reaction to GDP changed after 1997. In fact, in Figure 7 I show that domestic deficit and the total debt in the period 1997 until 2016 decreased substantially compared to the period from 1986 to the end of 1996. Note that I use in this Figure the domestic deficit, since the total deficit includes defense aid from US, that according to existing rules must be spent on its majority by buying US means of defense, and consequently it is exogenous. Also the tax rate was substantially reduced, from 37 percent of GDP to 32.2.

FIGURE 7: Domestic Government deficit, debt and the tax rate (% of GDP)



During the immediate years after 1985 stabilization plan, and with a lesser extent afterwards during the nineties, the awareness of governments about the need of fiscal consolidation was scarce, creating a situation in which politicians were not prone to perform tax expenditure reductions; in fact we can see in Table 1 that before 1997, the number of tax expenditure reductions was proportionally lower (10 and 0 in expansions and recessions respectively) than after 1997 (22 and 7, respectively) – a period when the consciousness of fiscal consolidation became larger.

Concerning tax expenditure additions, note that when government's deficit and debt are large the rating agencies threaten to reduce country's rating, making difficult for governments to freely decide about optimal policy. Thus, before 1997, when Israeli government's deficit and debt were high, this feature affected government's decisions during recessions. In these periods, budget deficit and debt increase following the decline in tax revenues, making difficult the possibility of performing counter-cyclical policy.[5] Thus, after 1997, we expect more additions in recessions than before 1997 – as we see in Table 1. This new situation provides the government with an opportunity to perform counter-cyclical fiscal policy – a fact that will be checked in the next sub-section, after controlling for all relevant variables.[6]

During expansions, while a low deficit "covers" fiscal miss-behavior[7], there is an opportunity to correct the deficit bias and consequently in the period when debt and deficits were high – the government was forced to reduce tax expenditures. In contrast, after 1997, when government deficits and debt became low, there is a political opportunity to increase tax expenditures.

Table 2: Tax expenditure additions and reductions along the business cycle

		ADDITIONS	REDUCTIONS
Expansions	**Before 1997**	4 (15)	10 (31.2)
	After 1997	23 (85)	22 (68.8)
	TOTAL	27	32
Recessions	**Before 1997**	1 (33)	0 (0)
	After 1997	2 (67)	7 (100)
	TOTAL	3	7

[5] Strawczynski (2014) shows that indirect statutory taxes were consistently increased in Israel during periods of crisis.

[6] Frankel, Vegh and Vuletin (2013) show that developing countries "graduated" after improving institutional quality and reducing their debt. In expansions, a low deficit and a low debt allow actually for procyclical behavior.

[7] For a characterization of government behavior n advanced economies during the cycle see Hercowitz and Strawczynski (2004a), Balassone, Francese, and Zotteri (2010), and Strawczynski (2015).

The following is a selective list of tax expenditures that were performed after 1997 in expansion years:

1997Q1: The benefit rate of income tax exemption for advanced study fund deposits of independent workers was raised to 3% for a deposit of up to 4.7% of income.

1998Q1: The benefit rate of income tax exemption for advanced study funds deposits of independent workers was raised to 4.5% for a deposit of up to 7% of income.

2000Q1: New law granted a 15% income tax exemption for the residents of Acre.

2001Q1: Maximum of donations entitlements to tax benefits raised to 2 million NIS, retroactive from 2000; Credit rate for Qiryat Shemona residents was raised to 25%.

2002Q1: New tax exemption for foreign athletes and couches.

2005Q1: Amendment no.60 of the capital investments encouragement law allowed a "green track" for tax benefits at different factories.

2005Q3: Accelerated depreciation of 100% for investments in industry, agriculture, and tourism, July 2005 - December 2006.

2012Q1: Tax exempted part of pensions was raised from 35% to 42%.

A possible interpretation for the change in behavior after 1997 is that when the government decides to go for a fiscal consolidation – the task is achievable.[8] This also means avoiding high expenditure increase in expansions, in order to avoid an increase in the structural deficit that would jeopardize its ability to control deficits under 3 percent of GDP, which is the threshold mentioned in Maastricht agreement. Although Israel is not a part of this agreement, it was mentioned several times in the government budget document as a desired pattern of fiscal behavior.[9] The increased desire of keeping the deficit low after 1997 (surely compared to the period before 1985)[10] allows me to think a priori about a possible change in behavior after 1997. In fact, in Appendix E I show a model that characterizes such a policy framework. In order to check the viability of these thoughts, we turn in sub-section 4 to an econometric analysis – that controls for all relevant variables.

[8] See Brender (2007).
[9] For a description of this point see Hercowitz and Strawczynski (2004b).
[10] On the change that happened after 1985 see Strawczynski and Zeira (1999).

4. Econometric Analysis

4.1 Data

I use data for the period 1986q1 until 2016q4. Concerning tax expenditures, I build an index that rises or decline each time a government's decision on tax expenditures takes place. The quantification of such change is based on the weight of the specific item that reflects the decision (the categories shown in figures 2 to 6, including also "other") and the item being changed. A detailed description is available at Appendix A.

The explained variable in the econometric analysis will be denominated tax exp. This variable is built in the following way: each time that a tax expenditure decision is taken (abolished) we add (reduce) the proportional amount of this decision as estimated by the Ministry of Finance to the series level, which is fixed at 100 at the beginning of the sample. Since we apply the weight of the relevant category, tax exp evolves according to actual decisions.

4.2 Granger Causality

I am interested on checking causality between tax expenditures and GDP under different cyclical circumstances. Clearly the interesting case is the one related to the short run – i.e., using rates of change (dlog). As explained below, the relevant tests shall differentiate two periods: before and after 1997. In the fist part of table 2, I check whether there is causality before 1997 between dlog(GDP) - symbolized by GDP_FP- and dlog(tax expenditures) - symbolized as TAX_EXP_TOT. Results show that while there is a different pattern of causality when comparing recessions (symbolized by 1-D_CH_GDP) to expansions (symbolized by D_CH_GDP), in both cases it goes from GDP to tax expenditures. However, in the case of recessions causality is obtained at 10 percent only before 1997, and in both cases I had to use a very short span – with only 1 lag. The opposite occurs for expansions: I obtained significance only under 9 lags; i.e., 2 years and 1 quarter. This finding is consistent with the fact that expansions are much longer than recessions. In the second part of Table 2 I perform the same tests for the period after 1997. Again, in recessions we obtain better outcomes for short lags, while in expansions I need to look at long lags - of 12 quarters (3 years). While for recessions results are not significant, for expansions I obtained 5 percent significance. While causality tests provide partial evidence on the cyclical relationships, we turn in the next sub-section to regressions which

control for many other factors, allowing me to check whether there is a correlation between tax expenditures and explaining variables.

Table 2: Granger Causality

Total Tax Expenditures Decisions, Before 1997				
	Dlog(gdp_fp)*(1-d_ch_gdp) ; 1 Lag		**Dlog(gdp_fp)*d_ch_gdp ; 9 Lags**	
Variable	**This Variable does not cause dlog(Tax_Exp_Tot)**	**dLog(Tax_Exp_Tot) does not cause This Variable**	**This Variable does not cause dlog(Tax_Exp_Tot)**	**dLog(Tax_Exp_Tot) does not cause This Variable**
Probability	0.0546*	0.35	0.085*	0.87
Total Tax Expenditures Decisions, After 1997				
	Dlog(gdp_fp)*(1-d_ch_gdp) ; 1 Lag		**Dlog(gdp_fp)*d_ch_gdp ; 12 Lags**	
Variable	**This Variable does not cause dlog(Tax_Exp_Tot)**	**Dlog(Tax_Exp_Tot) does not cause This Variable**	**This Variable does not cause dlog(Tax_Exp_Tot)**	**Dlog(Tax_Exp_Tot) does not cause This Variable**
Probability	0.25	0.94	0.027**	0.40

4.3 Empirical evidence

The following regression reflects the main question asked in this paper for obtaining empirical evidence (expressed in rates of change):

$$(1)\quad dlog\ (tax\ exp) = \alpha_0 + \alpha_1 cycle + \alpha_2 cycle * after + \alpha_i X_i + \varepsilon$$

Where, as explained above, cycle will be symbolized by D_CH in expansions and (1-D_CH) in recessions; after represents a possible change in behavior during the 2000s; X represent a bunch of control variables which can be seen in the tables presented in Appendix B; and ε is the residual. Note that according to this setup we are interested in the sign and in the size of α_1, as compared to α_2. In particular, we will check whether α_1 in expansions (D_CH) is negative and α_2 is positive. In regressions that are run for recessions (1-D_CH) we expect that α_1 is positive and α_2 is negative. According to the theoretical model, we do not have a specific hypothesis about the sum of these coefficients. It is important to stress that the government has different tools for performing cyclical policy: tax expenditures, statutory tax rates and expenditure items. Thus, it is crucial to control for all other tools – namely: statutory taxes and government spending. Note that these variables are part of X: statutory taxes appear both as a composite tax rate and through the corporate tax rate; government expenditure appears through the most accepted

exogenous variables, as used in many papers that cope with cyclicality of government tools: education and defense expenditure, population increase, population under 15 years old and beyond 65 years old, political variables and immigration.[11] Empirical evidence will be checked in the following sub-sections under alternative frameworks. Through the different columns I will show regressions that gradually conduce to regression 1. In order to choose the right year for the variable after I check in Appendix E all relevant years, by looking at the ADF of a possible change in the cointegration relationship.[12]

4.3.1 A Plain Cointegration Approach

In this section, I analyze cyclicality of tax expenditures in a model that considers long-run relationships with the explaining variables. In Appendix B I show the definitions and the ADF tests for unit roots of the different variables that take part on the analysis. The long-run regressions are also presented in Appendix B, using different specifications for explaining log(tax expenditures). Following Engle and Granger, I will check whether the lagged residual is significant in the short-run regressions, which are presented in Tables 3 and 4. In Table 3 I use a plain approach, which checks the short-run behavior for the simplest specification of equation 1. Results show that the residual is significant in all the specifications, strengthening the conclusion of a cointegration relationship. Regressions show a substantial R squared in the preferred specification (column 3) and the DW statistic testifies the lack of serial correlation. With respect to cyclicality, the single regression that shows statistically significant results is presented in column 3. Results show that in expansions tax expenditures were counter-cyclical before 1997, and procyclical afterwards in a higher extent (i.e., the sum of coefficients is positive). In recessions tax expenditures changed procyclically after 1997, and counter-cyclically afterwards, a result that is consistent with the "graduation" story.

[11] For a paper about Israel see Strawczynski (2014); and for papers using international data, see Ilzetski and Vegh (2008). For immigration I follow the approach of Flug and Strawczynski (2009).

[12] This approach is explained in Strawczynski and Zeira (1999).

Table 3: Short Run Regression for the plain approach

Explanatory Variables	Dependent Variable: dlog(TAX_EXP_TOT)		
	(1)	(2)	(3)
9.5	-0.01 (0.01)	-0.01 (0.01)	-0.03* (0.02)
DLOG(GDP_HPTREND)	1.46* (0.74)	1.59** (0.76)	2.75** (1.25)
DLOG(EDUCATION)	-0.25*** (0.09)	-0.25*** (0.09)	-0.29** (0.13)
DLOG(DEFENSE)	0.11 (0.09)	0.1 (0.09)	0.09 (0.07)
DLOG(IMMIGRATION)	-0.01 (0.02)	-0.01 (0.02)	0 (0.01)
DLOG(POP_UNDER15_ABOVE64)	-2.25 (1.57)	-2.08 (1.61)	-2.14 (1.6)
DLOG(POP_THOUSAND)	-1.11 (1.51)	-1.21 (1.54)	-1.64 (1.43)
COALIT_LISTS	0 (0)	0 (0)	0 (0)
DLOG(GDP_FP)*(D_CH_GDP)		-0.13 (0.12)	-0.4** (0.16)
DLOG(GDP_FP)*(1-D_CH_GDP)		0.09 (0.28)	0.79** (0.33)
DLOG(GDP_FP)*(D_CH_GDP)*AFTER_1997			0.59*** (0.2)
DLOG(GDP_FP)*(1-_D_CH_GDP)*AFTER_1997			-1.02*** (0.37)
TTT_TOT(-1)	-0.18*** (0.06)	-0.19*** (0.06)	-0.22** (0.09)
Adj R^2	0.078	0.071	0.126
Durbin-Watson	1.941	1.965	1.877

4.3.2 TSLS Analysis

Given possible endogeneity between GDP and tax expenditures we repeat the analysis using the world trade as an instrumental variable for the GDP.[13] Since Israel is a small open economy, I expect the world trade to be correlated to the GDP but not with tax expenditures. Thus, I will include the world trade as an instrumental variable for GDP. In Appendix B I show the long-run regressions where log(world trade) acts as an instrumental variable for log(GDP). While that table shows that ADF is not always significant, note that also in this analysis the lagged residuals in the short-run regressions are significant (Table 4), and the R squared and DW statistic show normative values.

[13] Ilzetski and Vegh (2008) stress the importance of considering endogeneity as a possible drawback of an OLS regression. They recommend using the income of trade partners as an instrumental variable.

Again, results are significant only in column 3 – under a similar pattern: counter-and procyclical tax expenditures in expansions and recessions respectively before 1997; and pro and countercyclicality in expansions and recessions, respectively, after 1997.

Finally, in Table 4 I show the results for all four categories - Capital Market Tax Expenditures (TAX_EXP_CAP), Factors of Production Tax Expenditures (TAX_EXP_PRO), Indirect Tax exemptions (TAX_EXP_VAT) and Welfare Tax expenditures (TAX_EXP_WELFARE). The regressions include the same explaining variables as in the analysis for total expenditure. While I ran regressions for both cointegration and TSLS, for exposition convenience I show results only for TSLS. In Table 5 I am showing the cyclical coefficients for the three regressions that were shown in columns 1, 2 and 3 in Tables 3 and 4. The main item that shows a similar pattern to the one obtained for total tax expenditures is capital markets tax expenditures (though results are significant only for expansions).

Table 4: Short Run Regression under TSLS approach*

Explanatory Variables	Dependent Variable: dlog(TAX_EXP_TOT)		
	(1)	(2)	(3)
C	0 (0.01)	0.01 (0.01)	-0.02 (0.01)
DLOG(GDP_HPTREND)	1.06 (0.92)	0.96 (0.92)	2.44** (1.01)
DLOG(EDUCATION)	-0.22*** (0.08)	-0.21*** (0.08)	-0.25** (0.1)
DLOG(DEFENSE)	0.07 (0.09)	0.05 (0.07)	0.05 (0.07)
DLOG(IMMIGRATION)	0.05 (0.04)	0.07** (0.04)	0.03 (0.02)
DLOG(POP_UNDER15_ABOVE64)	-4.32** (2.11)	-4.62** (1.97)	-2.83* (1.6)
DLOG(POP_THOUSAND)	-0.84 (0.97)	-0.89 (0.97)	-1.56 (1.19)
COALIT_LISTS	0.002 (0.0017)	0.002 (0.0017)	0.003* (0.0019)
DLOG(GDP_FP)*(D_CH_GDP)		-0.11 (0.13)	-0.46** (0.18)
DLOG(GDP_FP)*(1-D_CH_GDP)		0.51 (0.39)	1.05*** (0.38)
DLOG(GDP_FP)*(D_CH_GDP)*AFTER_1997			0.56** (0.22)
DLOG(GDP_FP)*(1-D_CH_GDP)*AFTER_1997			-1.31*** (0.4)
TTT_TOT_TSLS(-1)	-0.21*** (0.07)	 (0.08)	-0.16** (0.08)
Adj R^2	0.102	0.051	0.132
Durbin-Watson	2.029	2.053	1.979

* including AR terms (not reported) that were included to avoid autocorrelation.

Table 5: TSLS Analysis (HAC Newey corrected Standard Deviations)

	PRO	CAP	WELFARE	VAT
DLOG(GDP_FP)*(D_CH_GDP)	-0.08 (0.13)	-0.19* (0.11)	0.16* (0.094)	-0.12** (0.06)
DLOG(GDP_FP)*(D_CH_GDP) *AFTER_1997	-0.04 (0.2)	0.26** (0.12)	-0.05 (0.09)	-0.04 (0.08)
DLOG(GDP_FP)*(1-D_CH_GDP)	-0.5 (0.4)	0.23 (0.15)	0.61** (0.26)	-0.12 (0.12)
DLOG(GDP_FP)*(1-D_CH_GDP)*AFTER_1997	1.1* (0.7)	-0.14 (0.14)	-0.66* (0.35)	-0.04 (0.4)

4.3.3 Deviations from HP-filtered trend

It is well-known that an analysis of cyclical effects shall consider two alternative definitions of GDP cycles: rates of change of GDP and GDP levels. This is so since, f.e., the transition from a negative GDP change to a positive one reflects transition from a recession to an expansion under GDP changes definition, while concerning levels we shall wait for additional positive GDP changes that will drive levels to be above the GDP trend, a phenomenon that may take many additional quarters.[14] Thus, in Table 6 I show the results for deviations from HP-filtered trend.

Similarly to previous findings, results show a similar pattern of cyclicality before and after 1997.

4.3.4 A Pseudo-Panel

Following the methodology explained by Strawczynski (2014) I build a pseudo-panel for both statutory taxes and tax expenditures, with the purpose of comparing the strength of the use of these tools along the cycle. Results are reported in Appendix E. I found a stronger response of statutory taxes, which respond pro-cyclically to the cycle, as found by Strawczynski (2014). This result was significant for expansions before 1997 and for recessions after 1997.

For tax expenditures I found pro-cyclicality in recessions before 1997 and a counter-cyclical reaction after 1997 – similarly to the results above. However, the strength of the reaction is much lower than the one for statutory taxes, a result that survives a Wald test with 1 percent significance.

[14] For a graphical explanation see Flug and Strawczynski (2009).

Table 6: Short Run Regression under TSLS approach – deviations from trend

Explanatory Variables	Dependent Variable: dlog(TAX_EXP_TOT)		
	(1)	(2)	(3)
C	0.007 (0.008)	0.01 (0.01)	0.008 (0.008)
GDP_dif	-0.07 (0.06)		
DLOG(EDUCATION)	-0.25*** (0.09)	-0.26*** (0.09)	-0.24*** (0.09)
DLOG(DEFENSE)	0.07 (0.09)	0.09 (0.09)	0.04 (0.07)
DLOG(IMMIGRATION)	0.006 (0.02)	0.00006 (0.02)	0.04 (0.03)
DLOG(POP_UNDER15_ABOVE64)	-2.16 (1.58)	-2.4 (1.57)	-2.9* (1.7)
DLOG(POP_THOUSAND)	0.25 (1.37)	0.6 (1.37)	-2.1* (1.13)
COALIT_LISTS	0.0007 (0.001)	0.00003 (0.001)	0.004** (0.0016)
(GDP_dif)*(GDP_D)		-0.25** (0.11)	-0.49** (0.2)
(GDP_dif)*(1-GDP_D)		0.13 (0.13)	-0.36* (0.21)
(GDP_dif)*(GDP_D)*AFTER_1997			0.48** (0.19)
(GDP_dif)*(1-GDP_D)*AFTER_1997			0.36*** (0.2)
TTT_TOT_TSLS(-1)	-0.19*** (0.06)	-0.23*** (0.07)	-0.32*** (0.11)
Adj R^2	0.06	0.08	0.11
Durbin-Watson	1.91	1.93	2.02

The instrumental variables include the variables with a lag; the instrumental variable for GDP is WT (deviations from trend). Auto-regressive terms are included as far as we get significant contribution (4 terms).

5. Summary and Conclusions

This paper characterizes tax expenditures in Israel during the period 1986 until 2016. The literature documents that in general many countries, especially in developing economies, tend to perform pro-cyclical fiscal policy in both expansions and recessions. The literature also documents that the characteristics of cyclical policy during recessions depend on Fiscal Space for running counter-cyclical policy. Due to a remarkable reduction of external debt in developing economies, Frankel, Vuletin and Vegh (2013) show that selected developing economies changed their pattern in active spending policy achieving

"graduation"; i.e., a move from highly pro-cyclical spending policy to a more balanced policy during recessions.

In order to test the pattern of tax expenditures implementation in Israel along the cycle, I use four different frameworks that check cyclicality: by looking at rates of GDP growth I use a plain cointegration analysis, a two-stage analysis using the word trade as an instrumental variable, a framework that looks separately at four tax expenditures categories, and sensitivity of cyclicality to GDP levels (deviations from trend). Results show that in all frameworks there is clear evidence for procyclicality in expansions after 1997, and that there are signs of counter-cyclicality in recessions – as opposed to the predominant pattern in the period 1986-1996. Both findings are consistent with findings about cyclicality in statutory tax rates policy, as followed by developed economies. Moreover, the transition from procyclical to counter-cyclical policy in recessions has been documented in the literature mainly for developing countries.

Appendix A – Data

Tax Expenditures

Tax expenditures data is based on the yearly data provided by the Ministry of Finance. It is important to understand that the computation of tax expenditures has a complicated methodology, and it is not trivial to estimate them. For example, a benefit on a personal tax on pensions requires a counterpart in order to calculate the benefit amount. This means that in this example there is a need to choose the relevant marginal rate to compare – which requires a detailed methodology. Moreover, from time to time the Ministry of Finance adds to the database a previously uncovered exemption.[15] An additional complication relies from the fact that tax exemptions cause behavioral responses, that are not computed in tax exemptions measurement. Note, however, that these responses in the short run are quantitatively insignificant, and consequently their effect in our estimates is minor. In this paper I completely rely on calculations by the State Revenue Administration, which include tax expenditures from central government decisions; I exclude benefits created by the National Insurance Institute and local authorities.

In some cases, the revenue reports did not state the exact date in which a specific policy change came into force. In these cases, we collected information from the following sources: Government decisions and policy database (Prime Minister's office), the National Legislation database, National Insurance Institute of Israel and Israel Tax Authority. Moreover, through open sources we were able to keep track of the legislated process that gives place to each tax expenditure.

In order to build the explained variable, we start with a value of 100 at the basis quarter (1986q1). Then, this index changes according to decisions about tax expenditures taken by the government. In quarters where such decisions are not taken, the index remains constant. The computed change is based on the items where the decision took place – using the weight of this item. This method assures that our explained variable is related straightforward to the government decisions.

[15] For example, in 2007 the Administration started to compute fringe benefits given by employers to employees. Note that this decision does not affect my analysis, since this change does not affect the dependent variable in our analysis. Having said that, I built a dummy variable that takes the value of 1 when such change was performed and 0 otherwise (CALC_CH_TOT). I tried including this variable in the regressions (unreported) and as expected it was not significant in any regression.

Cycles

I follow the conventional approach in cycles literature and use two alternative definitions: I) based on rates of change of GDP - higher than sample average rate of change in expansions and lower than sample average rate of change in recessions; and II) based on GDP levels – higher than GDP HP filtered trend in expansions and lower than HP-Filtered trend in recessions.

Since cycles can be endogenous to changes in tax expenditures, I follow Ilzetski and Vegh (2008) methodology using the world trade as an instrumental variable.

Concerning the dependent variable, I keep always the rates of change approach, since we are interested on checking the short-term government's behavior.

Appendix B – Unit root tests and Cointegration Equations

Table B.1 – Unit Root Tests

		ADF Test – Akaike Criterion			ADF Test – Schwartz Criterion		
Variable	**Definition**	**Level (P-Value %)**	**1st Difference (P-Value %)**	**Conclusion**	**Level (P-Value %)**	**1st Difference (P-Value %)**	**Conclusion**
TAX_EXP_TOT_IND2	Total tax expenditures index in constant prices	18.7	0.0	I(1)	28.8	0.0	I(1)
GDP_FP	Total GDP in constant prices	100.0	1.8	I(1)	99.9	0.0	I(1)
EDUCATION	Education Spending as a percent of GDP[16]	59.9	0.0	I(1)	77.8	0.0	I(1)
DEFENSE	Defense expenditure as percent of GDP	93.3	0.049	I(1)	89.0	0.0	I(1)
POPULATION	Total Population	99.5	0.0	I(1)	99.5	0.0	I(1)
WT	World Trade Index	100.0	51.0	I(2)	100.0	51.0	I(2)
IMMIGRATION[17]	Immigrants Effective Human Capital Stock	59.2	0.0	I(1)	59.2	0.0	I(1)
POP_UNDER15_ABOVE64	Share of Population above 64 years old	100.0	78.0	I(2)	100.0	78.1	I(2)
GDP_HP	Share of population below 15 years old	100.0	69.0	I(2)	100.0	89.0	I(2)
COALIT_LISTS	Number of Coalition lists	0.0	0.0	I(0)	0.0	0.0	I(0)

The unit root exams show that all variables are suitable for a cointegration analysis. COALIT_LISTS is included only in the short run regression.

[16] For a paper that explains education spending in Israel see Strawczynski and Zeira (2003).
[17] See Flug and Strawczynski (2009).

Table B.2 – Cointegration Analysis: Plain Approach

Explanatory Variables	Dependent Variable: log(TAX_EXP_TOT_IND2)		
	(1)	(2)	(3)
C	24.14***	19.53***	20.33***
	(7.34)	(6.64)	(7.63)
LOG(GDP_HPTREND)	1.34***	1.44***	1.33***
	(0.48)	(0.44)	(0.46)
LOG(IMMIGRATION)	0.05***	0.07***	0.04**
	(0.01)	(0.02)	(0.02)
LOG(POP_UNDER15_ABOVE64)	-5.33***	-5.71***	-5.41***
	(1.45)	(1.31)	(1.45)
LOG(POP_THOUSAND)	1.66**	2.47***	2.25***
	(0.71)	(0.65)	(0.73)
LOG(EDUCATION)	-0.2	-0.1	-0.23*
	(0.14)	(0.14)	(0.13)
LOG(DEFENSE)	0.24	0.24	0.17
	(0.15)	(0.15)	(0.16)
@TREND(1986Q1)	-0.01	-0.02**	-0.01*
	(0.01)	(0.01)	(0.01)
@TREND(1986Q1)^2	0***	0***	0***
	(0)	(0)	(0)
GOV_LEFT		-0.05**	
		(0.02)	
GOV_ACHDUT			-0.03*
			(0.02)
Adj R^2	0.509	0.563	0.520
ADF	-3.598	-3.271	-4.820

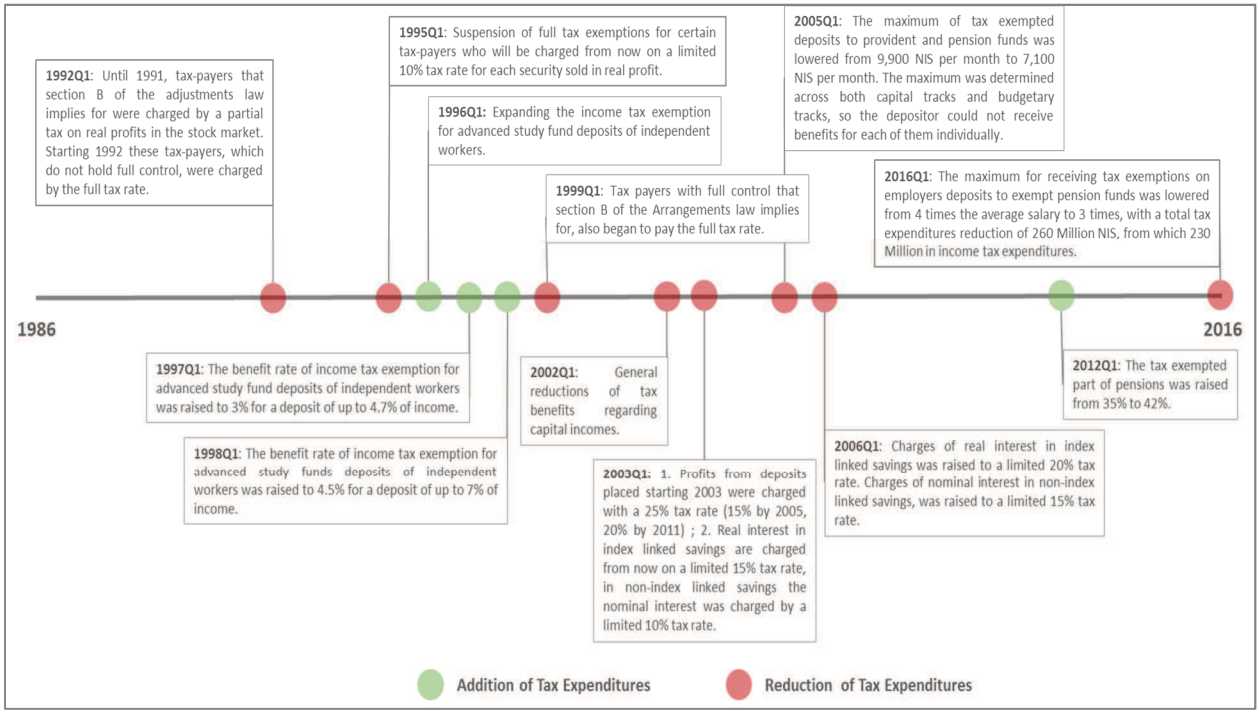
Table B.3 – Cointegration Analysis: 2SLS

Explanatory Variables	Dependent Variable: log(TAX_EXP_TOT_IND2)		
	(1)	(2)	(3)
C	23.85***	18.66**	19.59**
	(8.72)	(8.19)	(9.26)
LOG(GDP_HPTREND)	0.68	0.48	0.66
	(0.5)	(0.43)	(0.47)
LOG(IMMIGRATION)	0.05***	0.06***	0.03
	(0.02)	(0.02)	(0.02)
LOG(POP_UNDER15_ABOVE64)	-4.55***	-4.68***	-4.64***
	(1.46)	(1.37)	(1.46)
LOG(POP_THOUSAND)	1.4*	2.27***	2.06**
	(0.8)	(0.83)	(0.81)
LOG(EDUCATION)	-0.37	-0.37	-0.41*
	(0.25)	(0.24)	(0.24)
LOG(DEFENSE)	0.16	0.04	0.07
	(0.22)	(0.19)	(0.22)
@TREND(1986Q1)	0	0	0
	(0.01)	(0.01)	(0.01)
@TREND(1986Q1)^2	0***	0***	0***
	(0)	(0)	(0)
GOV_LEFT		-0.05	
		(0.03)	
GOV_ACHDUT			-0.04
			(0.03)
Adj R^2	0.260	0.376	0.282
ADF	-3.408	-4.315	-5.184

Instrumental variables: the same variables except for GDP_FP that is instrumented by the world trade (WT).

Appendix C

Capital Tax Expenditures Time-Line:



All Tax Expenditures Changes, Time-Line and Summary:

	Addition of Tax Expenditures	Reduction of Tax Expenditures
Total (after 2001)	**23 (16)**	**25 (16)**
PRO	6 (5)	6 (3)
CAP	4 (1)	8 (5)
WELFARE	11 (8)	6 (5)
VAT	2 (2)	5 (3)

APPENDIX D

In this appendix I check a change in the cointegration relationship starting at a particular year by the end of the nineties/beginning of 2000s (based on Gregory and Hansen, 1996). Each dummy variable takes the value of 1 starting at the year dummy, and 0 before that. We run two regressions that assume a change in the cointegration relationship: i) this change occurs in the two variables that are the center of the present study (GDP and a political variable – COALITION LIST); ii) the change in cointegration occurs in all explaining variables. Given the low number of degrees of freedom, I choose the first regression as the most relevant (Table F1). Note also that in this regression the ADF coefficient is higher.

TABLE: F1

Explanatory Variables	Year					
	1997	**1998**	**1999**	**2000**	**2001**	**2002**
C	10.82*	19.75**	22.89***	16.1***	15.38***	20.6**
	(6.08)	(8.46)	(8.18)	(4.72)	(5.23)	(8.04)
LOG(GDP_FP)	-0.23	-0.07	0.09	0.15	-0.29	-0.16
	(0.21)	(0.22)	(0.17)	(0.15)	(0.2)	(0.2)
LOG(IMMIGRATION)	0.06***	0.04**	0.02	-0.01	-0.01	0.02
	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
LOG(POP_UNDER15_ABOVE64)	-2.32**	-3.59***	-4.56***	-3.59***	-2.53***	-3.38***
	(0.98)	(1.23)	(1.45)	(1.02)	(0.88)	(1.24)
LOG(POP_THOUSAND)	1.51***	1.57**	1.98***	1.84***	1.29**	1.3*
	(0.56)	(0.64)	(0.66)	(0.54)	(0.51)	(0.68)
LOG(EDUCATION)	-0.15*	-0.51**	-0.67***	-0.51***	-0.54***	-0.55**
	(0.09)	(0.23)	(0.25)	(0.17)	(0.18)	(0.21)
LOG(DEFENSE)	-0.27**	-0.18	0.01	0.13	-0.1	-0.04
	(0.13)	(0.14)	(0.12)	(0.09)	(0.14)	(0.14)
@TREND(1986Q1)	-0.01*	0	0.01	0.01**	0.01**	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
@TREND(1986Q1)^2	0***	0*	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)
LOG(GDP_FP)*(AFTER_YEAR)	0.04***	0.01	-0.02*	-0.04***	-0.03**	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Adj R^2	0.641	0.404	0.481	0.735	0.532	0.424
ADF	-4.847**	-4.285	-4.444	-4.634	-4.782	-3.820

Using results in Table F1 we conclude that 1997 is the year that best represent the change in the cointegration relationship (significant at 5 percent). Note that in this year I obtained the highest ADF. Note also that the residual in the short-run is significant in the regressions shown in the paper, representing - according to Engle and Granger theorem – a further proof that cointegration exists.

APPENDIX E

In this appendix I check a pseudo-panel that considers the main sources of statutory taxes (see Strawczynski, 2014) and the four categories of tax expenditures. The pseudo-panel is built by using the same explanatory variables as explained as explaining variables for each of the categories composing the broad fiscal tool (statutory taxes and tax expenditures, respectively). Results are shown in Table E.1.

TABLE E.1: A Pseudo Panel *

	Statutory Taxes	Tax Expenditures
DLOG(GDP_FP)*(D_CH_GDP)	-0.13**	-0.02
	(0.06)	(0.06)
DLOG(GDP_FP)*(D_CH_GDP) *AFTER_1997	0.05	0.04
	(0.08)	(0.05)
DLOG(GDP_FP)*(1-D_CH_GDP)	0.20	0.13***
	(0.17)	(0.01)
DLOG(GDP_FP)*(1-D_CH_GDP)*AFTER_1997	-0.53**	-0.17*
	(0.25)	(0.11)
Residual (-1)	-0.05***	-0.11**
	(0.01)	(0.04)
Number of Observations	1,078	450

* The first step is a 2SLS regression from which we transfer the residual to the short-run regression. Control variables include Coalition lists, defense, population under 15 and above 64, injured by terror and immigration. I used cross-section weights for the panel and White period coefficient covariance method. The instrumental variable for the GDP is the world trade.

For statutory taxes results show significance (at 5 percent) in expansions before 1997, implying pro-cyclical policy: taxes are reduced in good times. Also after 1997, the policy is procyclical: since the average GDP growth is negative, a negative coefficient (significant at 5 percent) means a positive reaction – i.e., an increase in taxes. Procyclicality of statutory taxes is consistent with the results shown by Strawczynski (2014).

For tax expenditures results are similar to the ones shown above: during recessions tax expenditures were reduced before 1997, and increased afterwards; this pattern implies pro-cyclical policy before 1997, and counter-cyclical after 1997. Note that the strength of the response is higher for statutory taxes (with a significant Wald test).

APPENDIX F

In this section I use a simple macroeconomic framework in order to analyze expected results related to fiscal policy in the different phases of the cycle.[18] For that purpose I follow Barro (1979) on the normative aspect of government taxes, and mimic empirical results widely accepted in the literature. According to recent findings in the empirical literature, a fiscal model shall allow for distinguishing between recessions and expansions, and also consider high deficit/debt versus low deficit/debt environments. In fact, in the past many papers have shown that in advanced economies fiscal policy is procyclical in expansions and countercyclical in recessions[19], while in emerging markets fiscal policy in the past was procyclical in both phases of the cycle.[20] However, as shown by Frankel, Vegh and Vuletin (2013) in recent times many emerging markets have transformed institutions and "graduated" from this negative pattern. These authors show that a third of these countries started to implement counter-cyclical spending policies.

According to the proposed framework the government acts to minimize the welfare loss of taxes (its share on GDP is symbolized by τ) minus tax expenditures (its share on gdp is symbolized by e). Additionally, the government maximizes utility from government expenditure (its share on GDP is symbolized by g and maximization is driven by the negative sign of this term) while taking into account political economy considerations; those are related to the fact that rating agencies look at low budget deficits as a signal for fiscal responsibility:

$$(1)\ \ Min\ L = \frac{1}{2}(\tau - e)^2 - \frac{1}{2}\delta(g^* - g)^2 + \frac{1}{2}\theta(g + e - \tau)^2 + \frac{1}{2}\beta((\tau - e) - \gamma^*)^2\ ,$$

$$\text{s.t. } \tau - g - e \leq c$$

where L is a loss function (related to the choice of net taxes), g^* represents the maximum acceptable amount of government expenditure as a share to GDP (once it is trespassed marginal utility from government expenditure becomes negative), δ represents the public good preference, θ represents rating agencies penalty for deficits, β represents

[18] I would like to stress that the model shown in this appendix serves only an illustrative purpose. There is no attempt or whatsoever to make a parallelism between this model and the empirical facts in Israel. In particular, the Laffer tax issue that appears in this theoretical model maybe related to developing economies in the past, and apparently not nowadays. In relation to Israel's case, using a sample between 1991 and 2012, Brender and Politzer (2014) stress that the tax rate in Israel is at the left side of the Laffer curve maximum. The theoretical Laffer tax feature shown in this model follows Srebrnik and Strawczynski (2016).

[19] See Hercowitz and Strawczynski (2004a) and Balassone et al. (2010).

[20] Among many contributions see Ilzetski and Vegh(2008), and Strawczynski and Zeira (2011).

the sensibility for active fiscal policy, γ^* represents a policy level consistent with full employment, and c is a constant that represents the limit of government budget deficit (in percent of GDP) that is accepted by rating agencies. Note that the implicit assumption is that the higher is the tax rate, the higher is the marginal deadweight loss. Note also that by deriving the second term with respect to g, the marginal utility of government consumption equals $\delta\,(g^* - g)$; i.e., as g goes up the marginal utility of government expenditure declines. This is a standard assumption in macroeconomic models. Finally, note the new term, which follows Frankel, Vegh and Vuletin (2013): the gap in the fourth term is expected to be negative unless we are in full employment; a large distance from full employment calls for government reaction through taxes or tax expenditures[21], which is enhanced for a high β.

The following is the Lagrange function:

$$(1)' \quad L = \frac{1}{2}(\tau - e)^2 - \frac{1}{2}\delta(g - g^*)^2 + \frac{1}{2}\theta(g + e - \tau)^2 + \frac{1}{2}\beta((\tau - e) - \gamma^*)^2 - \lambda[(\tau - e - g)]$$

In order to perform the maximization we derive by net tax rate $(\tau - e)$ and by government expenditure (g):

$$(2) \quad \frac{\partial L}{\partial(\tau - e)} = (\tau - e) - \theta(g + e - \tau) + \beta((\tau - e) - \gamma^*) \quad - \lambda = 0$$

$$(3) \quad \frac{\partial L}{\partial g} = -\delta(g - g^*) + \theta(g + e - \tau) + \lambda = 0$$

By using equations 2 and 3 we obtain the following equality:

$$(\tau - e) - \theta(g + e - \tau) + \beta((\tau - e) - \gamma^*) \quad = \delta(g - g^*) - \theta(g + e - \tau)$$

Which implies the following solution for the tax rate:

$$(4) \quad \tau = \frac{\delta(g - g^*) + \beta\gamma^*}{1 + \beta} + e$$

i.e., taxes go up with higher government expenditure and with higher tax expenditures (I assume that the whole expression is positive).

[21] Clearly, we would be interested on adding unemployment payments. Since those would be automatically adjusted as a function of the cycle, I leave them out of the maximization problem.

An interesting case is the one in which $\delta = 0$ (Barro, 1979); i.e., optimal policy is determined only by minimizing the deadweight loss. In this case I derive with respect to net taxes and obtain the following solution:

$$(2)' \quad \frac{\partial L}{\partial(\tau - e)} = (\tau - e) - \theta(g + e - \tau) + \beta((\tau - e) - \gamma^*) \quad - \lambda = 0$$

Which implies:

$$(4)' \quad \tau = \frac{\lambda + \theta g + (1 + \theta + \beta)e + \beta\gamma^*}{1 + \theta + \beta}$$

i.e., the optimal tax rate should be higher the higher is government expenditure, the higher are tax expenditures, and the higher is the desire for counter-cyclical policy (represented by β). Concerning θ, which represents the reputation fee for increasing the deficit d (where $d = g + e - \tau$), it interacts in the numerator with g and with e; i.e., reputation considerations imply that this parameter influences taxes in a higher extent when spending and tax expenditures are high.

This maximization is relevant for the normal case, without considering GDP cycles. Note, however, that one of the problems related to cycles is that it is possible to reduce statutory tax rates or increase tax expenditures at expansions in economic activity, without necessarily affecting the measured actual deficit; this is due to the fact that during these periods, revenues increase in a non-linear fashion, and consequently the deficit declines substantially – a fact that allows to "hide" these decisions:[22] Note also that empirical literature shows that there is a remarked asymmetry related to government behavior.[23] Since during expansions the tax revenues soar, it is possible to increase expenditure and reduce taxes without affecting the government budget constraint[24] which remains substantially below the cap represented by c. Thus, in real time there is no penalty by rating agencies, and governments can adjust behavior.

In order to deal with these issues, we will differentiate between two cases: credible fiscal path and non-credible fiscal path. In the first case, deficit, tax rate and debt are low, and markets and rating agencies understand that governments are more prone to perform counter-cyclical policy. In the non-credible fiscal path, deficit, tax rate and debt are high.

[22] On this point see Strawczynski (2015).
[23] See Hercowitz and Strawczynski (2004a) and Balassone et al. (2010).
[24] See Strawczynski (2015). One could think that maximization requires using the implicit function theorem; however, we look at results for small changes around the optimum.

Rating agencies announce in real time about possible credibility problems, which imply that the ability to do counter-cyclical policy is reduced. To give place to these new stylized policy findings I propose the following characteristics of the model:

Credible Fiscal Path (low tax rate, low debt to GDP, low deficit to GDP):

θ is independent of the exogenous shock ε, since there are no credibility problems. However, the government is willing to perform counter-cyclical policy especially during recessions; i.e., β is a function of the exogenous shock only when it is negative: $\beta = \beta(\varepsilon)\ for\ \varepsilon < 0$.

Non-credible Fiscal Path (high tax rate, high debt to GDP, high deficit to GDP):

In this case β is independent of the exogenous shock ε, since in practical terms governments constrained not to perform counter-cyclical fiscal policy in recessions as a consequence of the high debt (Srebrnik and Strawczynski, 2016). Given the high deficit and debt, θ is a function of the exogenous shock: $\theta = \theta(\varepsilon)\ both\ for\ \varepsilon < 0\ and\ for\ \varepsilon > 0$; i.e., when deficit and debt are high, the rating agencies "speak loud" about caution and impose a penalty fee that is reflected in the credibility coefficient. Moreover, since information is incomplete, I assume that in this case an increase in tax revenues is interpreted by the public and by rating agencies as an increase in government size, even if it is not accompanied by a statutory hike.[25]

Under these assumptions we will analyze four relevant results.

[25] Given the lack of transparent information, in a high debt scenario this development might be misinterpreted by economic agents: even under a positive shock, markets and rating agencies adjust the default penalty represented by the parameter θ. Note also that under a positive shock, the tax ratio to GDP – which in the low credibility case is initially high - goes up because of a higher than 1 tax revenues elasticity (Strawczynski, 2015), achieving the proximity of the pick of Laffer curve; i.e., if raised further, government tax revenues would actually decline. For a "back of the envelope" calculation of the pick of the Laffer tax rate in both developed and developing countries, see Srebrnik and Strawczynski (2016).

Credible Fiscal Path

Result No. 1 – *Government behavior in the short-run during expansions is expected to be characterized by statutory tax reductions and by the adoption of more tax expenditures.*

Proof:

When there is an expansion the ratio of tax revenues to GDP goes up by ε.[26] Thus, if we were at an optimum, equation 2' becomes an inequality:

$$(2)'' \quad \frac{\partial L}{\partial(\tau-e)} = (\tau - e) - \theta(g + e - \tau) + \beta\left((\tau - e) - \gamma^*\right) \quad - \lambda + \varepsilon(1 + \theta + \beta) > 0$$

Restoring inequality allows for increasing tax expenditures, e, or reducing the statutory tax rate, τ. Theoretically governments would also increase expenditure, g[27]; however, in our case it is assumed to be constant.

Result No. 2 – *Government behavior in the short-run during recessions is also expected to be characterized by statutory tax reduction and by the adoption of more tax expenditures.*

Proof:

When there is a recession the ratio of tax revenues to GDP goes down by ε. Moreover, since in this case β is a function of ε, it will substantially increase. Thus, if we were at an optimum, equation 2' becomes an inequality. I assume that under the new value of β the following equation holds[28]:

$$\tau < \frac{1 + \theta + \beta}{e(1 + \theta + \beta) + \theta g + \beta\gamma^* + \lambda + \varepsilon(1 + \theta + \beta)}$$

Then the inequality becomes:

$$(2)'' \quad \frac{\partial L}{\partial(\tau-e)} = (\tau - e) - \theta(g + e - \tau) + \beta(\varepsilon) * \left((\tau - e) - \gamma^*\right) \quad - \lambda - |\varepsilon|(1 + \theta + \beta(\varepsilon)) > 0$$

Restoring inequality requires increasing tax expenditures, e, or reducing the statutory tax rate, τ.

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[26] A similar set-up for analyzing cyclical behavior is presented by Milesi-Ferretti (2003).

[27] In fact, both Hercowitz and Strawczynski (2004a) and Balassone et al. (2010) show that the cyclical asymmetry implies increasing government expenditure in expansions.

[28] This equation holds for a high λ; i.e., the shadow price of a surplus is high. This means that despite the high loss of performing counter-cyclical policy associated to the Lagrange multiplier, this kind of policy pays off in terms of the loss function.

Non-Credible Fiscal Path

Result No. 3 – *Government behavior in the short-run during expansions is expected to be characterized by statutory tax increases and by the reduction of tax expenditures.*

Proof:

When there is an expansion the ratio of tax revenues to GDP goes up by ε. Moreover, since in this case θ is a function of ε, it will increase. Thus, if we were at an optimum, equation 2' becomes an inequality. We assume that the new value of θ is sufficiently high, such that the following inequality holds:

$$\theta(\varepsilon) > \frac{\varepsilon(1+\beta)}{g+e-\tau-\varepsilon}$$

This is plausible since under benchmark parameter values the R.H.S. is expected to be around 0.1. Then the inequality becomes:

$$(2)'' \quad \frac{\partial L}{\partial(\tau-e)} = (\tau-e) - \theta(\varepsilon) * (g+e-\tau) + \beta\big((\tau-e) - \gamma^*\big) \quad -\lambda +$$
$$|\varepsilon|(1+\theta(\varepsilon)+\beta) < 0$$

Restoring inequality implies decreasing tax expenditures, e, or increasing the statutory tax rate, τ.

Result No. 4 – *Government behavior in the short-run during recessions is expected to be characterized by statutory tax increases and by decrease of tax expenditures.*

Proof:

When there is a recession the ratio of tax revenues to GDP goes down by ε. Since in this case θ is a function of ε, the reputation cost will increase. Thus, the inequality becomes:

$$(2)'' \quad \frac{\partial L}{\partial(\tau-e)} = (\tau-e) - \theta(\varepsilon) * (g+e-\tau) + \beta\big((\tau-e) - \gamma^*\big) \quad -\lambda -$$
$$|\varepsilon|(1+\theta(\varepsilon)+\beta) < 0$$

Restoring inequality allows for decreasing tax expenditures, e, or increasing the statutory tax rate, τ.; i.e., a pro-cyclical reaction.

References

Balassone, F., Francese, M. and S. Zotteri (2010), "Cyclical asymmetry in fiscal variables", *Empirica* 37, 381-402.

Barro, Robert (1979), "On the determination of Public Debt", *Journal of Political Economy*, 87 (5), 940-971.

Brender, A. (2007), "If You Want to Cut, Cut, Don't Talk: The Role of Formal Targets in Israel's Fiscal Consolidation Efforts, 1985-2007", Banca d'Italia Public Finance Workshop, *Fiscal Policy: Current Issues and Challenges*, Perugia, March.

Brender A. and E. Politzer (2014), "The effect of legislated tax changes on tax revenues in Israel", Bank of Israel, Research Department Discussion Paper no. 14.08.

Brender A. (2021), "Fiscal policy: the journey toward a low debt to GDP ratio and smaller government", Chapter 2 in *The Israeli Economy 1995-2017 – light and shadow in a market economy*, edited by Avi Ben-Bassat, Reuben Grounau and Asaf Zussman, Cambridge University Press.

Campos, J.E. and S. Pradhan (1996), "Budgetary institutions and expenditure outcomes: binding governments to fiscal performance", World Bank Policy Research Working Paper.

Flug, K. and M. Strawczynski (2009), "Persistent Growth Episodes and Macroeconomic Policy Performance in Israel1", Bank of Israel Economic Review (Hebrew) and SSRN (English).

Frankel, Vegh C. and G. Vuletin (2013), "On Graduation from Fiscal Procyclicality", *Journal of Development Economics* 100 (2), 32-47.

Gavin, M., and R. Perotti (1997), "Fiscal Policy in Latin America," *NBER Macroeconomics Annual* 12, 11–61.

Gregory and Hansen (1996), "Residual-based tests for cointegration in models with regime shifts", Journal of Econometrics, 70 (1), 99-126.

Hercowitz Z. and M. Strawczynski (2004a), "Cyclical ratcheting in government spending: OECD Countries", *Review of Economics and Statistics*, 86(1): 353–361.

Hercowitz Z., and Strawczynski M. (2004b), "Fiscal Policy dynamics with a Public Debt Guideline", *Israel Economic Review*, Vol.2 No.1, pp 91-106.

Ilzetzki, E., & Vegh, C. A. (2008). Procyclical Fiscal Policy In Developing Countries: Truth or Fiction? NBER Working Paper Series: http://www.nber.org/papers/w14191

Lane, P. (2003). “The Cyclical Behavior of Fiscal Policy: Evidence from the OECD.” *Journal of Public Economics* 87(12): 2661–75.

Lenjosek (2004), "A framework for evaluating tax measures and some methodological issues", Appendix included in *Tax Expenditures – shedding light on government spending through the tax system, Lessons from developed and developing economies*, edited by Hana Polackova Brixi, Christian Valenduc and Zhicheng Li Swift, The World Bank.

Listokin Y. (2012), "Equity, efficiency and stability: the importance of macroeconomics for evaluating income tax policy", Yale Law School Faculty Scholarship Series, 3879.

Mehl, A. (2017), "Cyclicality of Government Spending after the 2000s", M.A. Thesis (Hebrew), School of Public Policy, The Hebrew University of Jerusalem.

Michalson, N. and R. Stein (2021), "The factors that explain long-term government bond-returns in Israel and similar countries", Forthcoming as BOI Discussion Paper.

Milessi Ferretti (2003), "Good, bad or ugly? On the effects of fiscal rules with creative accounting", *Journal of Public Economics* 88, 377-394.

Redonda, A. and T. Neubig (2018), "Assessing tax expenditure reporting in G20 and OECD Economies", CEP (Council of Economic Policies), Discussion Note 2018/3.

Roubini and Sachs (1989), Political and Economic Determinants of Budget Deficits in the Industrial Democracies, European Journal of Political Economy, 33 (5), 903-933.

Srebrnik N. and M. Strawczynski (2016), "Cyclicality of taxes and External Debt", Applied Economics, Vo. 48, 4622-4634

Strawczynski M., Y. Zeira (1999), "Reducing the relative size of government in the Israeli economy after 1985", in The Israeli economy- 1985-1988, Avi Ben-Bassat Ed., M.I.T. Press.

Strawczynski M., and Y. Zeira (2003), "What determines education expenditure in Israel?" Israel Economic Review. Vol.1 No.1 pp. 11-34.

Strawczynski M., and Y. Zeira (2011), "Procyclicality of fiscal policy in emerging countries: the cycle is the trend", Fiscal Policy and Macroeconomic Performance, Edited by J. Gali and L.F. Cespedes, Central Bank od Chile.

Strawczynski, Michel (2014), "Cyclicality of statutory tax rates", Israel Economic Review Vol. 11, No. 1, 67–96.

Strawczynski, Michel (2015), "Optimal Design of New Generation Fiscal Rules: Coping with the Business Cycle and Discretionary Tax Reductions", Business and Economics Journal Vol. 5, No. 3, 1-10.

Swift, Z.L. (2006), "Managing the effects of tax expenditures on National Budgets", World Bank Policy Research Working Paper no 3927, May.

OECD (2010), *Tax expenditures in OECD Countries*.

Vegh, C. A., and G. Vuletin (2015) "How is Tax Policy Conducted over the Business Cycle?" *American Economic Journal: Economic Policy* 7 (3): 327–370.

Von Hagen, Jurgen and Ian Harden. (1995). "Budget processes and commitment to fiscal discipline," *European Economic Review* 39 (3-4), 771-779.

Zax, Jeffrey (1988), "Fringe benefits, income tax exemptions and implicit subsidies", *Journal of Public Economics* 37 (1988) 171-183.