Bank of Israel **Research Department**

The Effect of Legislated Tax Changes on Tax Revenues in Israel[1]

Adi Brender and Eran Politzer

Discussion Paper 2014.08
December 2014

Bank of Israel http://www.boi.org.il

* Adi Brender, Research Department – adi.brender@boi.org.il, Phone: 972-2-655-2618
** Eran Politzer, Research Department – eran.politzer@boi.org.il, Phone: 972-2-655-2653

[1] The authors thank Michel Strawczynski and Mirco Licita for their helpful comments as discussants of the article, and to the participants of the Bank of Israel Research Department seminar, the Tel Aviv University macroeconomic seminar, the Ben-Gurion University of the Negev departmental seminar, the Public Policy section of the 2014 annual meeting of the Israeli Economic Association and the Public Economics workshop at Banca d'Italia. The authors thank Yehudah Poch for his assistance in translating the Hebrew article to English.

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

The Effect of Legislated Tax Changes on Tax Revenues in Israel

Adi Brender and Eran Politzer

Abstract

We estimate the extent to which tax revenues in Israel are influenced by legislated tax changes, using a database that includes all such changes during the period 1991–2012. We use the tax revenue forecasts, which are presented to the Knesset each year alongside the proposed changes in taxation, as a proxy for the information possessed by policy makers at the time tax policy changes were legislated (after verifying that these forecasts are not manipulated). This makes it possible to overcome the endogeneity problem which makes it difficult to identify the effect of legislated tax changes on tax revenue and economic activity. We find that the effect of legislated tax changes on actual tax revenue is about 70 percent of the amount predicted by a static calculation based on multiplying the tax revenues in the previous year by the change in the tax rate. The offset is a result of the effect of the tax change on economic activity, which peaks in the second year following the implementation of the tax change and declines subsequently. This finding implies that policy makers should be aware during periods of tax rate changes that the effect of the changes on revenue stabilizes at its peak only about two years after being affected. The results disprove the claim that the Israeli economy was located during the sample period on the "wrong side" of the Laffer curve where reducing tax rates leads to higher tax revenue.

We find that after a transition period of two years, a change in the corporate income tax rate yields 90 percent of the revenue expected by a static prediction—a greater share than that of revenue collected from a change in the personal income tax (65 percent), or in indirect taxes (53 percent).This order is in contrast with the short term, where changes in corporate income taxes have the lowest actual effect on revenues. We also find that reducing personal income tax rates has a negative effect on the average gross wage in the economy. Thus net wages increase by about 65% of the benefit, and the employers' labor costs decrease by the rest of the expected revenue loss.

ההשפעה של שינויים בשיעורי המס על גביית המסים בישראל

עדי ברנדר וערן פוליצר

תקציר

המחקר אומד כיצד מושפעים תקבולי המסים בישראל משינויים סטטוטוריים במסים, באמצעות בסיס נתונים הכולל את כל השינויים הללו בשנים 1991 – 2012. התחזיות לגביית המסים, אשר הוגשו בכל שנה לכנסת לצד ההצעות לשינויי המיסוי, ואשר משקפות את המידע שהיה בידי קובעי המדיניות בזמן ההחלטה על השינויים, מאפשרות לנו להתמודד עם בעיית האנדוגניות המקשה לזהות את השפעתם של שינויי המיסוי על הגבייה ועל הפעילות. זאת לאחר שבדקנו כי תחזיות אלו אינן מוטות בצורה מניפולטיבית. המחקר מוצא כי שינוי בשיעור המס משנה את הגבייה בפועל בכשבעים אחוזים מהסכום הנגזר מחישוב סטטי פשוט, המבוסס על הכפלת סך תקבולי המס לפני השינוי בשינוי בשיעור המס. האפקט המקזז נובע בטווח הארוך רק מההשפעה של שינוי המס על הפעילות במשק (התוצר, השכר ויבוא מוצרי הצריכה), השפעה אשר מגיעה לשיאה בשנה השנייה לכניסת השינוי לתוקף, ומצטמצמת אחר כך. ממצא זה חשוב לעיצוב המדיניות בתקופות של שינויים בשיעורי המס, שכן השפעת השינויים על הגביה מתייצבת רק בחלוף כשנתיים מהחלתם. תוצאות המחקר שוללות את הטענה כי המשק נמצא (בתקופת המדגם) 'בצד הלא נכון' של עקומת לאפר וכי הפחתת מסים סטטוטורית מביאה לגידול בגביית המסים.

המחקר מוצא כי לאחר תקופת מעבר של כשנתיים, שינוי במס החברות מניב שיעור גבייה של כתשעים אחוזים מהתחזית הסטטית להשפעת השינוי – גבוה יותר משיעור הגבייה עקב שינוי במס ההכנסה על יחידים (65 אחוזים) או שינוי במיסים העקיפים (כ-53 אחוזים). זאת בניגוד לטווח הקצר, אז יש לשינוי במס החברות את ההשפעה הנמוכה ביותר על הגבייה. המחקר מוצא עוד כי להפחתת מס ההכנסה על יחידים יש בחלוף הזמן השפעה שלילית על השכר הממוצע במשק (ברוטו), כך שהעובדים והמעסיקים חולקים בשווי ההטבה כמעט שווה בשווה.

1. Introduction

We examine the effect of changes in tax rates[1] on tax revenue in Israel, in an attempt to answer the question facing policy makers: how will tax revenues actually change as a result of a change in tax rates? For instance, to what extent, if any, will a tax reduction lead to a decline in revenues, and to what extent, if any, will its positive effect on the economy offset the initial change in tax revenue? Furthermore, will the potential economic effects of a tax reduction, including the stimulation of economic activity and the reduction in the incentives for tax evasion, be large enough (during the given period) to result in an increase in tax revenue, as it is claimed will occur on the "wrong side" of the Laffer Curve? Or perhaps, even when the positive effects on economic activity are taken into account, the reduction in tax rates will reduce tax revenue?

The estimation uses a comprehensive database of legislated tax changes that were implemented in Israel from 1991 until 2012. The main data source is the annual reports issued by the State Revenue Division, which present the proposed changes in taxation that were included in the budget proposal that preceded the year of the report, as well as the changes that went into effect in the preceding years. Each proposed change is accompanied by an estimate of its effect on tax revenue. Up to 2012, the last year in our sample, the estimation was based on a static calculation, i.e., multiplying the change in the tax rate by the size of the relevant tax base. Beginning in 2013, the estimations in the budget also take into account the dynamic effects of tax changes on the tax base. The availability of the static estimations makes it possible to use them in this work as a benchmark, which helps to identify the dynamic effects of tax changes on revenue.

In addition, the reports include details of the overall tax revenue forecast, which is included in the proposed budget alongside the proposed tax changes. The availability of tax revenue forecasts (without the effects of the proposed tax changes) allows us to overcome the problem of endogeneity in estimating the effect of tax changes. The endogeneity derives from the fact that changes in taxation not only affect tax revenue but are also affected by it. For example, a decline in tax revenue that is expected to continue as the result of an economic crisis may lead policy makers to raise tax rates in an effort to reduce the growing deficit (in the case of procyclical policy) or to reduce them as a fiscal stimulus (a case of countercyclical policy). The simultaneity implicit in the connection between tax policy changes and tax revenues (or forecasted tax revenues) makes it difficult to identify the effect of tax policy changes on tax revenues (and similarly on economic activity) and has been dealt with at length in the tax multiplier literature. To overcome this problem, Romer and Romer (2010) (hereinafter: RR) use a narrative method in order to identify "exogenous" tax changes, i.e., those that are implemented for ideological reasons or in order to deal with accumulated deficits, rather than as a response

[1] The examined changes include both changes in tax rates for the general population and changes in tax payment obligations for certain population groups or for certain products (for instance, the creation or cancellation of exemptions). We use the terms "changes in tax rates", "changes in taxation", "tax changes" and "legislated tax changes", interchangeably, all of which have an identical meaning: discrete changes in the tax laws, which change the tax liabilities of the population.

to trends in economic activity. On the assumption that the identification of these changes is accurate, they affect economic activity but are not affected by it and therefore the endogeneity problem is overcome. Blanchard and Perotti (2002) (hereinafter: BP) used the time elapsed between a change in economic activity and when policy makers become aware of the change and respond with a tax change, in order to identify structural tax shocks using a SVAR model.

The availability of tax revenue forecasts—which are prepared at the same time as tax change proposals—makes it possible, in this paper, to explicitly control for the information possessed by decision makers at the time that changes are planned. Thus, it is possible to identify the effect of tax changes that are not dependent on expected tax revenue (or on forecasted economic activity). Thanks to the control on revenue forecasts, we can use all the tax changes that have been implemented and not just those with an "ideological" motivation—a classification that is problematic from the outset in many countries.[2] We show below that that there were no potential biases in the revenue forecasts that are correlated with legislated tax changes. Furthermore, stability in Israel's tax policy cyclical response (Strawczynski (2014)) also makes it easier to identify the effects of tax changes.

We estimate an error-correction model that shows a cointegrative relationship between tax revenues and the factors that influence them in the long run, including tax changes and tax revenue forecasts. The other explanatory variables include GDP and imports of consumer goods - which are included in order to account for macroeconomic influences that are characteristic of a small open economy such as Israel's (particularly in view of the high tax rate imposed on some imported consumer goods). In addition, we included the average wage in the economy to account for the different rates of taxation on capital and labor and for the long-run connection between wages and tax rates.

The estimation results show that the simple arithmetic effect of a legislated tax change on tax revenue is not fully achieved. On average, a tax increase that went into effect in the past raises tax revenue in the long run by only about 70 percent of the amount predicted by a static calculation. The offsetting effect, mainly through the effect of the tax change on economic activity, is higher in the first two years following implementation of the change: Actual collection in the first year is about 60 percent of the change's expected value (according to a simple static calculation), and it declines to about one-third during the second year.

This work corresponds with the issue of the tax multiplier, but it does not deal with it directly. While the literature dealing with the multiplier tries to examine the effect of tax changes on GDP, we focus on an examination of the change on revenue itself. Some of this effect is through the effect of the change on economic activity, but the analytical framework used here makes it difficult to isolate the effect through GDP directly from the estimated equations. Nonetheless, to compare the results that we obtained with the tax multipliers obtained in the literature, we used the known multipliers to calculate the

[2] For instance, the political echelon may present a counter-cyclical tax change as resulting from a permanent structural change in the tax system (due to "ideological" reasons) in order to moderate Ricardian effects in the public's response to the measure, thereby increasing its effectiveness.

offsetting effect of a tax change on tax revenue due to its effect on GDP (according to the multiplier).[3] The offsetting effect derived from RR's basic tax multiplier is -0.84 percentage points out of each percent of planned revenue at its peak, while that derived from BP's estimation is between -0.21 and -0.36. The offsetting effect found in this study (as stated, not only via GDP) is -0.72 at its peak, which is closer to RR's results but still lower. We emphasize again that this comparison should be treated with caution since our offset coefficient is not directly comparable to the coefficient derived from the tax multipliers.

Our analysis does not directly test whether tax changes affect the scale of tax evasion or tax avoidance. Nonetheless, we found that in the long run—once accounting for the effect of domestic economic variables on tax revenue—the resulting tax revenue is consistent with predictions derived from a static calculation. This finding tends to imply that tax changes affect tax evasion and tax avoidance, only to the extent that this effect is reflected in the measurement of domestic economic variables. Nevertheless, the testing of each type of tax separately found evidence that in the short run, tax changes are likely to result in changes in behavior, which may be indicative of tax planning at the time the change goes into effect.

The study also separately tested the effects of changes in corporate income tax, personal income tax and indirect taxes on the corresponding tax revenue. The estimates indicate differences in the revenue elasticities, both between tax types and between the short and medium term. During the first year following the implementation of the tax change, an increase in personal income tax generates the highest revenue among all tax types—76 percent of expected revenue—and indirect taxes generate a similar rate (74 percent). In contrast, an increase in corporate taxes does not have a significant effect on revenue in the first year. After two years and beyond, the order is reversed: A change in corporate taxees generates the highest revenue (89 percent of expected revenue), while personal income taxes generate 65 percent and indirect taxes 53 percent.

The differences in revenue rates between tax types and over time are influenced by the different effects each tax has on economic activity and on the behavior of agents. The low revenue from corporate income tax in the short run may not only be the result of the negative effect it has on economic activity, but also the result of tax planning that shifts economic activity and tax payments between quarters, and of timing differences in tax collection. After two years, these effects subside and the offset is fully accounted for by the effect of the tax reduction on economic activity. The results we obtained differ from those of Mertens and Ravn (2013b) who found that changes in corporate income tax have only minor effect on the corresponding tax revenue, due to the large (and negative) elasticity of the tax base with respect to changes in corporate tax rates. Our results show large changes in behavior as a result of changes in corporate tax rates too, but these are limited to the first two years following a tax decrease.

[3] For this purpose, we used the tax burden in Israel and assumed unit elasticity of tax revenue relative to GDP (in accordance with previous empirical findings).

The missing revenue from an increase in **personal income tax** rates beyond two years after implementation is the result of the negative effect of the tax increase on economic activity. This effect is partly offset by the positive effect on real (gross) wages. Two years after an increase in the personal income tax, and subsequently, the component of the wage that is not correlated with GDP increases by about one-third of the size of the tax increase (in a static calculation, as a share of total revenue).The negative impact on GDP resulting from the tax change which, for its part, creates pressure for a decline in wages offsets only part of this positive effect. In other words, the burden of a tax increase on individuals is also borne by employers, whose cost of labor (meaning gross wages) increases by 54 percent of planned revenue from the tax increase. Similarly, due to a *decrease* in income tax—real (gross) wages decline, and employers thereby also benefit from a decrease in the tax on their employees.

In the case of **indirect taxes**, we found that over time the effect that offsets about half of expected revenue is entirely due to the effect of the tax change on economic activity, primarily its effect on imports of consumer goods, which are tax-intensive.

The remainder of the paper is structured as follows: Section 2 briefly reviews the literature on the effect of tax changes on economic activity and the estimation of the tax multiplier. It also presents the methods for dealing with endogeneity and the multipliers that were obtained in Israel and other countries. Section 3 presents the data used in this study. Section 4 presents the analytical framework, which consists of a simple theoretical model that demonstrates the problem of endogeneity in estimation and how forecasts of tax revenue make it possible to overcome it. Section 5 estimates a system of dynamic equations for tax revenue as part of an error-correction model. Section 6 estimates the basic model in order to measure the total effect of tax changes on tax revenue and on economic activity. Section 7 tests the separate effects of changes in the personal income tax, the corporate income tax and indirect taxes. Section 8 presents several robustness tests and an examination of potential biases in the budgets' tax revenue forecasts. Section 9 concludes.

2. The literature on the effect of legislated tax changes

a. Estimating the tax multiplier

The effect of tax changes on tax revenue is related to the tax multiplier—the effect of tax changes on GDP. The estimates of the tax multiplier in the literature have a relatively broad range: According to some of them, a tax increase of one percent of GDP will (at the peak of its effect) lower GDP by less than one percent. According to other estimations, GDP will shrink by about 3 percent. The estimates of the size of the multiplier depend on the tax shocks being considered, the method of estimation and the estimation period.

BP use a Structural Vector Auto Regression (SVAR) model to identify structural tax shocks and to estimate the response of economic activity to them. The identification of structural tax shocks is made possible by using quarterly data and imposing short-run

restrictions on the order of the shocks' effect. The restrictions also include assumptions regarding the size of the elasticity of taxes with respect to economic activity, which is not estimated as part of the model. BP find the tax multiplier to be negative in the US and that its absolute value ranges between 0.78 and 1.32.[4] The peak of a tax change's effect (i.e., the high or low point in GDP) is reached five to seven quarters after the change. Mazar (2013) used a similar method to estimate several SVAR models for Israel. He used the Cholesky decomposition to identify structural shocks and distinguished between the effect of direct and indirect taxes on GDP. According to the results, the multiplier for direct taxes is -0.98 at the peak, which is reached 18 months after the tax change goes into effect. The average effect during the three years following a tax change was estimated at -0.26. With respect to indirect taxes, the effect was estimated at -2.17 at its peak, which was reached after two quarters, and the average quarterly effect, over a three years period, was estimated to be -0.61.

Mountford and Uhlig (2009) used economic theory to impose sign restrictions on the VAR response function and found that in the US the multiplier for a tax change (that leads to a deficit) is much larger in absolute value than that obtained by BP and reaches around -3 several years after the change.

An alternative method of identifying tax shocks that are not correlated with economic activity is the narrative method used by RR. They utilized documents related to the legislative process for approving tax changes in the US following World War II (which included, inter-alia, presidential speeches, government economic reports and minutes of Congressional sessions) in order to assess the motivation for each tax change. Tax changes that were ideologically motivated or resulted from a desire to reduce the deficit were classified as exogenous since they are not responses to current changes in economic activity. These tax changes served as structural tax shocks in estimating the reaction of economic activity to the changes. In comparison to BP and similar studies, RR found a large effect of tax changes on GDP and arrived at a multiplier of -3.08 at the peak, which occurred two and a half years after the change was affected.

Several studies have tried to explain the differences between the tax multipliers obtained in the various studies. Favero and Giavazzi (2012) claimed that the source of the differences between the SVAR method used by BP and the narrative method is not related to the character of the tax shock in the two methods but rather to the model in which these shocks were used. They included exogenous tax changes that were identified using the narrative method in RR within a fiscal VAR system similar to BP's and treated them as structural tax changes in this system. The resulting multiplier was smaller than 1 in absolute value – similar to the one estimated by BP. Mertens and Ravn (2013a) reviewed additional studies and concluded that the low multipliers obtained in earlier research essentially resulted from erroneous assumptions regarding the elasticity of tax revenue with respect to economic activity, or from ignoring measurement errors in

[4] The difference between the two estimates reflects a difference in assumptions regarding the trend of the variables. Assuming a deterministic trend, a lower estimate is obtained (0.78) and the trough is reached earlier. When a stochastic trend is allowed for, the tax multiplier is higher (1.32) and the low point is reached later.

narrative tax shocks. They used exogenous shocks that were identified using the narrative method as a proxy for structural shocks in the SVAR model. The multiplier they obtained was relatively high: from around -2 when the change went into effect, to a peak of -3 after 18 months.

Another study by Mertens and Ravn (2013b) differentiated between the effect of the personal income tax and that of the corporate income tax in the US. By including "exogenous"[5] tax changes within a fiscal SVAR system, they found that a reduction in the personal income tax by one percent of GDP increases GDP by 2.5 percent after three quarters (i.e., a multiplier of -2.5). Despite the positive effect on economic activity, the tax reduction still lowered total revenue from the personal income tax. In contrast, according to the VAR response functions, a reduction in the corporate income tax has only a small effect on tax revenue, even after five years. This is due to the positive and strong response of the tax base, which offsets the negative effect of the tax reduction on tax revenue.

b. The effect of expected or future legislated tax changes

Expected changes in tax rates may affect economic activity and total tax revenue even before going into effect. For instance, expected changes may lead to attempts to avoid tax by bringing forward or delaying purchases (such as bringing forward the purchase of a home or durable goods prior to an increase in indirect taxes), or properly timing revenue flows (around changes in income tax, corporate tax, or capital gains taxes).
Ignoring the effects of expected tax changes may bias the estimate of the multiplier and the effect of tax changes, particularly if this effect is felt a long time before the change goes into effect. In their study, BP tested a version of the SVAR model that allowed for tax changes to have an effect during the quarter prior to their going into effect. They did not find any evidence that the expectations of a tax change had a significant effect on GDP. RR also tested whether the present value of future tax changes has an effect on GDP but did not find any strong evidence for the effect of expectations. Mertens and Ravn (2012) used RR's exogenous tax shocks but also took into account the anticipation horizon of each change, i.e., the time from the passing of legislation until the legislation went into effect. They found that an expected tax reduction of one percent of GDP leads to a decline of 1.5 percent in GDP during the year prior to it going into effect and to an eventual increase of 1.5 percent two years after the implementation. Perotti (2012) warned that one should differentiate between anticipated and unanticipated *future* changes and also that one should allow tax changes to have a different effect for each

[5] The study used the narrative method to eliminate endogenous tax shocks, according to the motivation of the legislation. In addition, they omitted some 'exogenous' tax changes- those for which the time elapsed between the time they were legislated and when they went into effect was greater than three months. After the data had been filtered in this manner, the database included 13 changes in the personal income tax and 16 in the corporate income tax.

anticipation horizon. An estimation that took these proposals into account found only minimal evidence for the effect of future tax changes on GDP.

c. Tax evasion and tax avoidance

Tax changes alter the costs and incentives facing individuals and companies and thus can lead to changes in behavior. These may be reflected in the scope of tax evasion or in the intensity of tax planning, with the goal of fully exploiting tax exemptions and shifting income to tax bases with lower tax rates. Such shifts can occur over time (delaying or pushing forward activity or reporting), between legal entities or taxpayers (between family members or from taxation as an individual to taxation as a corporation), between classifications of income and expenditure flows and between countries or geographic regions (for example, use of tax havens or moving to Regions of National Priority). Such shifting can affect the total tax revenue collected as a result of a tax change, even without it affecting actual and/or measured activity.

Theoretically, the direction of the effect of tax rate changes on the scope of tax evasion is uncertain. Allingham and Sandmo (1972) showed that the direction depends on the individual's risk aversion function while Yitzhaki (1974) showed that the structure of the punishment for tax evasion also influences it. Empirical studies have found conflicting evidence for the effect of the marginal tax rate on the estimated extent of tax evasion. For a survey of this research and the attempts to estimate the extent of tax evasion and the factors that affect it, see Slemrod and Yitzhaki (2002).

Several micro studies in Israel have found evidence for tax avoidance that is the result of raising the marginal tax rate on high-income individuals. Ben Naim (2004) studied the effect of changes in the marginal tax rate on individuals in 2002–03 and found that they had a significant effect on the reported income of managers and the self-employed. Ben Naim hypothesized that this large effect resulted from the provisional nature of some of the tax changes that encouraged the shifting of reported income between periods. Romanov (2006) examined the same period and showed that the increase in the marginal tax rate on individuals, as a result of changes in the National Insurance ceiling in 2000 and 2002, was the motivation for salaried individuals in the highest percentile of income to establish corporations; doing so allowed them to pay the lower marginal rates of the corporate income tax and the tax on dividends. However, the ability to extend the findings from very high-income individuals to the behavior of the general population is unclear and therefore so are the macroeconomic implications.

3. Data: Legislated tax changes in Israel 1991–2012

a. Sources

We use a Bank of Israel database of tax changes introduced by the central government during the period 1991–2012. We updated the database using primarily the annual reports of the State Revenue Division of the Ministry of Finance. Missing data was obtained

from the following sources: the proposed budgets presented to the Knesset, legislation passed by the Knesset and explanations accompanying proposed legislation, government decisions and Bank of Israel reports. The annual report of the State Revenue Division estimates the impact of legislative changes proposed in the current budget on tax revenue in each of the subsequent years. The estimate is based on a simple arithmetic calculation: the change in the tax rate multiplied by the size of the tax base. This static estimation basically ignores the dynamic effects of tax changes on activity and through it on revenue. Therefore, the estimation is used in this study as a kind of benchmark that makes it possible to identify the effect of tax changes on revenue through their effect on activity or on the volume of tax avoidance. Until 2012—the last year in this study's sample— the proposed government budgets used the static calculation of the effect of tax changes to show the size of the proposed changes. The 2013–2014 budget was the first to feature dynamic estimations of the effect of legislative changes on receipts—which also related to the effect of tax changes on activity and on the tax base.

Since this study uses quarterly data, we transformed the annual revenue forecasts using information on the exact date that the change would go into effect and the distribution of income across quarters, such that the total annual effect would be identical to the forecast of the State Revenue Division. The database makes it possible to differentiate between indirect taxes (or more accurately taxes collected by the Customs and VAT Division), direct taxes (income and corporate taxes collected by the Income Tax Authority) and fees. Details regarding all of the legislative changes and their quarterly effects appear in Appendix 1.

For each quarter, we aggregated the effects of the tax changes during that quarter (in NIS and in fixed prices). Since the value derived from the tax change varies over time in accordance with developments in the tax base, and in order to estimate the effect of the change long after it went into effect, we used the ratio of the tax change to the total tax revenue.[6] We then calculated the accumulated amount of all tax changes from the start of the sample, in percent of revenue. Similar calculations were carried out for the specific taxes that we examine, according to the revenue from each tax.

The annual tax revenue forecasts were also taken from the reports of the State Revenue Division and from the proposed budgets presented to the Knesset. In a few cases (mainly changes made during the year), we also used minutes of the Knesset Finance Committee wherein Ministry of Finance forecasts were presented. We used the annual forecast of tax revenue without the effect of the proposed tax amendments. The forecasts we use start from 1992, since 1991 was a shortened fiscal year lasting only 9 months.

The data for tax revenue were taken from the reports of the State Revenue Division and the Tax Authority and are adjusted for one-off outlier events.[7] Details of these one-

[6] For the purpose of the calculation, we multiplied the shekel value of the tax change in a quarter by four, and divided it by total tax revenue in the previous calendar year.

[7] One-off revenue was defined as income from particularly large transactions of a one-time nature, including the sale of Iscar in 2006 and the sale of provident funds by the banks following the recommendations of the Bachar Committee. In addition, adjustments were made for outlier timing effects

off income effects appear in Appendix 1. A list of the variables used in the study appears in Appendix 2.

b. Tax changes during the period 1991–2012

There were many tax changes during the sample period. The database includes 218 unique tax changes, of which 83 were changes in indirect taxation, 66 in personal income tax, 34 in corporate income tax and 35 in other direct taxes (primarily related to the capital market and real estate). The tax changes include 111 tax increases and 107 tax reductions. Most of the changes in taxation (164 of them) went into effect during the first quarter of the year while 34 were affected during the third quarter. Of the 84 quarters in the sample, there were legislated tax increases during 31, of which 13 involved amounts exceeding NIS 100 million in a quarter (in 2012 prices). There were legislative tax reductions in 32 quarters, of which 25 involved amounts exceeding NIS 100 million. Figure 2 below shows the cumulative amount (in percent of total tax revenue relative to the beginning of 1991) of changes in each of the tax categories examined in this study, i.e., corporate income tax, personal income tax, and indirect taxes.

The period 1993–95 is characterized primarily by tax reductions, against the background of the continuing program to open up the economy to imports and reduce personal and corporate income taxes. With the rise in the deficit at the end of 1995, the trend reversed and indirect and personal income tax rates were increased. From the end of the first quarter of 1997 until 2001 there were only a few minor tax changes. In 2000, a reform was carried out in the area of real estate taxes following the recommendation of the Rabinovich Committee; however, the resulting tax changes (cancelation of the property tax, raising the purchase tax and imposing a sales tax) were largely revenue neutral. Against the background of the rapid growth in 2000, the government decided to reduce purchase taxes and in 2001 the Negev Law went into effect, introducing an income tax credit for residents of the Negev.

In 2002, as a result of the economic crisis and the growing deficit, there were a series of tax increases, but from 2003, with the moderation of the recession, a trend of tax reductions began that continued until the beginning of 2009. Then, as a result of the domestic and global recession and the sharp drop in tax revenue, the government decided on a series of increases in indirect taxes from mid-2009, while continuing the path of lowering direct taxes. This path was stopped only at the end of 2011.

Following the recommendation of the Trajtenberg Committee, and in order to deal with the growing deficit, further tax hikes were implemented during the second half of 2012, which continued beyond the sample period in the 2013 and 2014 budgets.

It is evident that many of the tax changes in Israel are closely connected to the business cycle and the budget deficit. A similar conclusion was reached by Strawczynski (2014), who found that the main reason for tax changes in Israel during the period 1980–2009

---

in tax collection due to work slowdowns by the employees of the Tax Authority in 2008. Tax revenue outliers in terms of timing or magnitude as a result of tax changes were not adjusted for.

was to respond to economic crises. He showed that endogenous changes in indirect taxes, according to RR's definition, were pro-cyclical, while changes in direct taxes were a-cyclical.

Figure 1: Quarterly tax changes in the years 1991-2012, NIS millions (2012 prices)

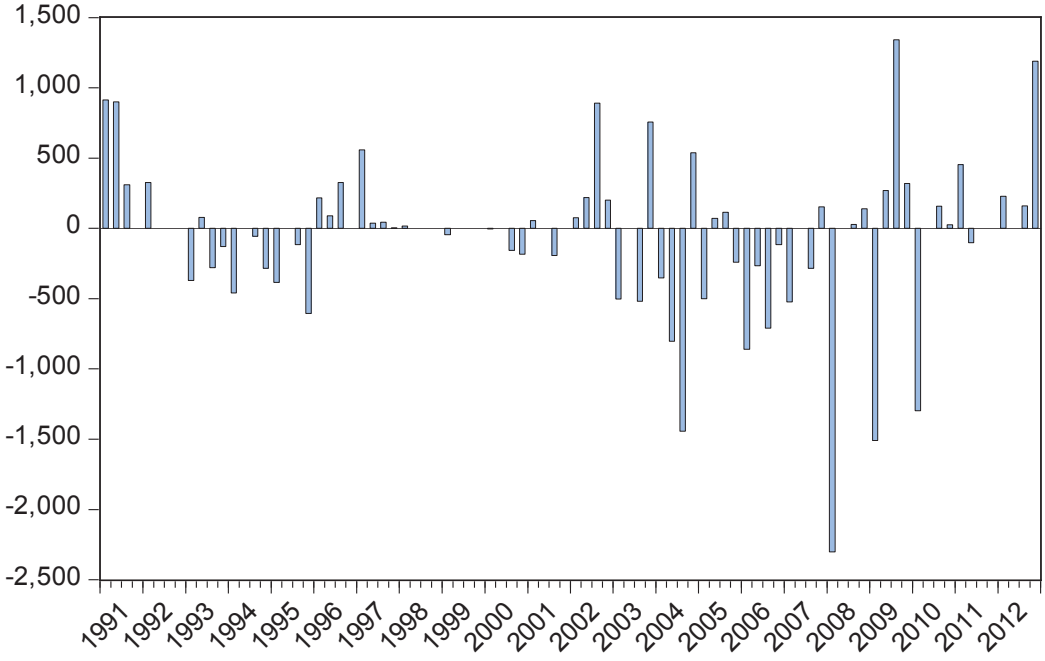
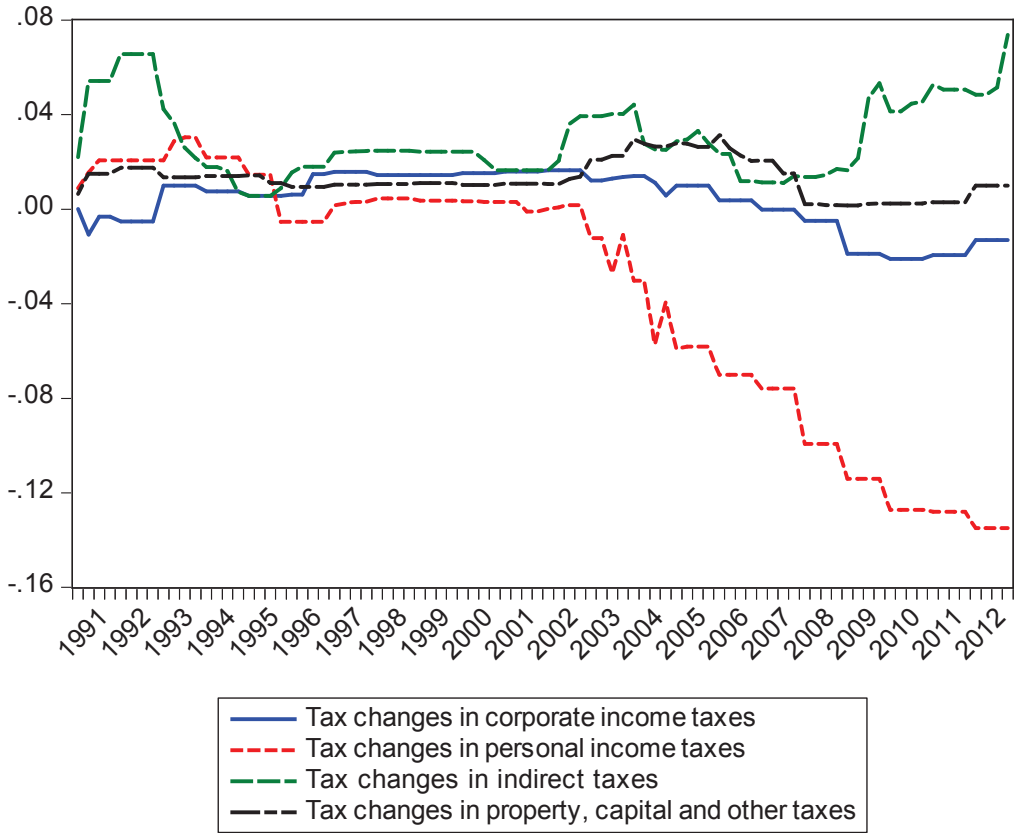


Figure 2: Cumulative tax changes in the years 1991-2012 as a share of total tax revenue[8]



4. The analytical framework

We begin by constructing a simple specification to describe the effect of legislated tax changes on tax revenue:

$$(1) \qquad \Delta T_t = a * \Delta\tau_t + \Delta T'_t = a * \Delta\tau_t + \alpha + b * \Delta X_t + \varepsilon_t$$

where ΔT_t is the change in tax revenue in period t, $\Delta\tau_t$ is the value of the tax changes that went into effect in period t and $\Delta T'_t$ is the change in tax revenue adjusted for the effect of legislated changes in that period. The change in tax revenue adjusted for legislated changes is dependent on changes in the tax bases and X_t is the vector of macroeconomic variables that affect those tax bases. ε_t represents the shocks to tax revenue that are not dependent on macroeconomic variables. The coefficient of tax changes—a—reflects the proportion of revenue actually collected as a result of the tax increase; 'a' will equal 1 if there is full realization of the static estimate.[9]

[8] For each tax type, the Figure shows the cumulative changes as a percentage of total tax revenue.

[9] Assuming that the value of the tax changes in each period constitutes a small proportion of total tax revenue, the effect of the tax changes on tax revenue through their indirect influence on macroeconomic variables will already be included in the component $b * \Delta X_t$.

We assume, for the sake of simplicity, that the tax changes in period t were legislated in period t-1, since even if the changes were legislated in an earlier period, it was still possible to modify or cancel them in t-1.[10]

Tax changes are determined as follows:

$$(2) \qquad \Delta\tau_t = d * E_{t-1}(\Delta T_t') + \omega_{t-1}$$

If policy makers have decided to implement a tax change, this may be in response to the expectations in t-1 of a change in tax revenue in t (adjusted for a change in legislation), i.e., $E_{t-1}(\Delta T_t')$. Following Equation (1), these expectations are dependent on forecasts (which are presented in period t-1) of changes in macroeconomic variables in period t.

According to this specification, the effect of changes in expected tax revenue (and in economic activity) on tax changes remains fixed from one period to the next. It is possible that the direction of the effect of forecasts for tax revenue (and economic activity) on tax changes (i.e., the sign of d), would change from one period to the next due to the changing preferences of policy makers, regarding the degree of pro-cyclicality or counter cyclicality of tax policy. However, Strawczynski (2014) showed that in Israel the degree of pro- or counter- cyclicality of tax policy varies between direct (acyclical) taxes and indirect (pro-cyclical) taxes, but remains stable over time. In Strawczynski's study, the extent of cyclicality by tax type remained stable both in assessing the tax changes in 1998–2011 and for a longer sample starting in 1970. This characteristic of tax policy in Israel makes it easier to identify the effect of tax changes on revenue, and reduces the concern of endogeneity arising from changes in policymakers' reasoning, which change the **manner** of tax policy's response to fluctuations in activity and in revenue.

Tax changes can also be the result of the shock ω_{t-1}, which is not dependent on expected tax revenue (and is the result of, for example, an ideological choice made by policy makers). Such tax changes are the exogenous changes identified by RR using the narrative method.

Combining the equations for tax revenue and tax changes and assuming that the forecast of tax revenue is formulated rationally according to the model (as described in Equation 1) yields the following equation:

$$(3) \qquad T_t = (1 + a * d) * \alpha + b * \Delta X_t + [a * d * b * E_{t-1}(\Delta X_t) + a * \omega_{t-1}] + \varepsilon_t$$

Equation (3) illustrates the risk that the estimation of Equation (1) will lead to a biased estimate of the effect of tax changes on tax revenue: if the variables that are monitored by policy makers cannot be controlled for, then some variables in the vector X_t will be included in the residual. That will lead to correlation between the tax changes and the residual, thus resulting in endogeneity.

RR deal with the problem of endogeneity by omitting any tax changes that are not exogenous. In other words, according to our notation, they only include tax changes for which d=0 and are

[10] In formulating the basic model, we essentially ignore the differences between anticipated and unanticipated tax changes. Later on, we test the effect of expected changes but only for a one-quarter-ahead horizon.

therefore only the result of ω shocks, which are not dependent on macroeconomic forecasts during the legislation period. RR explained that the choice to use the narrative method to identify exogenous changes was also based on the lack of exact forecasts that accompany the tax changes[11]:

"... it is impossible to proxy for all the information about the future output movements that policymakers may have had. The kind of numerical forecasts of what policymakers thought would happen to output in the absence of tax changes that would be ideal for this exercise, are generally not available even for recent tax changes."

We deal with the problem of endogeneity by explicitly using the quantitative forecasts of tax revenue that are presented by the Ministry of Finance in the proposed budgets, alongside the proposed tax changes. The forecasts are based on the forecasted changes in the macroeconomic variables (primarily growth in GDP) and allow controlling for the information possessed by policy makers at the time the tax change was legislated. They do not reflect the effect of proposed tax changes on economic activity or on tax revenue itself. Essentially, we explicitly include $E_{t-1}(\Delta T_t')$ in the regression and in this way deal with the correlation described above between the tax changes and the residual, and thus deal with the resulting endogeneity. The inclusion of the forecasts allows us to use all of the tax changes implemented during the sample period; not only the exogenous ones.

It might be claimed that the forecasts published by the Ministry of Finance as part of the proposed budget do not always reflect the actual forecast being considered by policy makers. According to this claim, the forecasts appearing in the proposed budget (which are used in the estimation here) may be subject to political manipulation. For example, they may be used as a tool to persuade policy makers that additional tax changes are needed. If that is indeed the situation, then the forecasts used in the estimation will not deal with the problem of endogeneity. We discuss this claim in Section 8 and show that the concern of intentional manipulation is unfounded. Specifically, in a model estimated to explain the forecast errors we did not find a significant effect for expected tax changes in the following year on forecast errors in the projection made in the current year.

In the following section, we estimate a system of equations based on Equation (1) above.

5. Direct effects of tax changes on tax revenue – controlling for economic activity

The changes in the behavior of individuals and corporations following changes in tax rates affect economic activity and therefore also tax bases and tax revenue. Furthermore, tax changes can also affect tax revenue by changing the incentive for tax evasion or tax avoidance. In this section, we

[11] In RR's model, the effect of changes in economic activity (and other shocks) on tax changes can vary from one period to the next, i.e. 'd' in our notation is d_t in theirs. Therefore, in their model the effect of economic activity on tax changes is also a cause of endogeneity, in addition to the inability to control for information possessed by policy makers. In the current model, and following the characteristics of tax policy in Israel found by Strawczynski (2014), the effect of changes in economic activity on tax changes is fixed and therefore is not a cause of endogeneity in the presented equation.

try to determine whether tax changes affect tax revenue also through channels that are not related to their effect on economic activity. This may result in a reaction of tax revenue to a tax change that is significantly different from the earlier forecast of the tax change's effect (as derived from a static calculation). Excess effects of tax changes may be an indication of their effect on the scope of tax evasion and tax avoidance.

To examine this issue, we estimate a dynamic system of equations that is based on the Bank of Israel's real tax model (Brender, 2001). It was retested in Brender and Navon (2010) and since then has been used by the Bank, with minor modifications, to forecast tax revenue. The basic model includes a dynamic system of equations based on an error-correction model for the log of quarterly tax revenue. The explanatory variables in the long run equation are the levels of GDP, wages and imports of consumer goods. The short-term equation for the log of the quarterly change in tax revenue includes as explanatory variables changes in GDP, imports of consumer goods, the average wage in the economy, the shekel value of foreign currency credit and stock prices, sales of new homes and the sale of Israeli companies to foreign investors through mergers and acquisitions.

We added the tax changes in each quarter to the Bank of Israel tax model as an explanatory variable. The inclusion of tax changes alongside the economic activity variables will make it possible to test whether tax changes have additional effects on tax revenue beyond their effect on measured economic activity. If such effects do not exist, we expect that the tax change coefficient will be equal to one, and if they do exist, the coefficient will be less than 1.

a. Specification

The effect of tax changes on tax revenue was estimated using a dynamic system of two equations within the framework of an error-correction model. The system includes a long-run equation for the relationship between tax revenue and total legislated tax changes up to that point[12] (in percent of total tax revenue) and a differences equation to test the relationship between the quarterly change in tax revenue and the quarterly change in taxation (again in percent of tax revenue). The estimation results are presented in Tables 1 and 2 below.

Each equation includes an interaction between the tax changes and a dummy variable for a break period starting in 1997:Q2 and ending in 2001:Q4. This period, as mentioned in Section 2, was characterized by only a small number of minor legislated tax changes. At the same time, there were large fluctuations in total tax revenues, resulting from external outlier events (such as the Asian crisis in 1998 and the high tech bubble and its aftermath in 2000–01). In contrast to the rest of the sample period, the coefficients of legislated tax changes during this break period are either very low or very high and for the most part are not significant and have very large standard

[12] The long-run equations (in which the variables appear in terms of levels) could have included the taxation *level* (meaning the statutory tax rates) as an explanatory variable, rather than the amount of the tax changes from the beginning of the sample. However, first, it is the effect of the tax changes that is the focus of this study, and they are therefore explicitly included as a variable in the equation. Second, the level of taxation today is the sum of the initial tax level (at the beginning of the sample) and tax changes thus far. These two components are included in the specification, where the initial tax level is reflected in the regression's constant term.

deviations. This is true both in the versions that include all legislated tax changes and the regressions that test the effect of legislated tax changes on tax revenue separately for each type of tax. The inclusion of an interaction variable in the regression enables the differentiation of the period 1997:Q2 to 2001:Q4 and allows us to focus on the effect of tax changes during two periods in which the effect of the tax changes is more uniform, i.e., 1992 to 1997:Q1 and 2002 to 2012. The analysis that follows focuses on these two periods. As a test of robustness, we also estimated the model for the period 2002–12 (see Section 7) and found the results to be similar.

All the equations include quarterly dummy variables, to account for seasonality, and a dummy variable that takes the value of one for the quarters starting from 2002:Q1. The coefficient of the latter variable was found to be negative and significant which indicates a downward shift in tax revenue starting from 2002.

In estimating the two versions of the long-run equation, we used data on world trade. Although world trade does not constitute a tax base and does not directly influence tax revenue, it is one of the external variables that affect economic activity in Israel, which is a small open economy. World trade will be used here as a proxy for external influences and will appear in two forms: In the first version of the long-run equation, world trade is used (with two lags), along with the number of incoming tourists, as instrumental variables for GDP and the equation is estimated using 2SLS. Since the effect of Israeli tax revenue on world trade is negligible and world trade affects tax revenue through its effect on GDP, this estimation method minimizes possible endogeneity resulting from the simultaneity between GDP and tax revenue. The effect of tax revenue on incoming tourism is also negligible and this makes it possible to control for changes in Israel's security situation, as has been done in previous studies on the Israeli economy. In the second version of the long-run equation, we include world trade and the number of tourists as explanatory variables, alongside GDP and other local macroeconomic variables (i.e., wages and imports of consumer goods).

In the following sections, we estimate the long-run equations in which all the local macroeconomic variables are omitted, though we leave in the index of world trade and tourism. The inclusion of these exogenous variables will make it possible to more precisely identify the effect of tax changes on tax revenue and on domestic economic activity. In addition, their inclusion helps preserving the cointegrative relationship in the equations from which the local macroeconomic variables are omitted.

Many of the variables included in the long-run equation are I(1) and are non-stationary (see Appendix 2); however, in all the estimated regressions, the Engle-Granger test rejects the hypothesis that there is no cointegrative relation between the variables. For the regression estimated using 2SLS, an ADF test of the residual rejects the existence of a unit root. Apart from that regression, all of the long-run equations in the study are estimated using Static OLS (i.e., Dynamic OLS without leads and lags). In this method, the standard deviations are calculated using the Newey-West method, which corrects for autocorrelation and heteroskedasticity.

b. Estimation

We first estimate the long-run equation (Table 1). In the first version, the only domestic macroeconomic variable included in the equation is the log of GDP, and we used the log of world

trade (with two lags) and the log of the number of tourists as instrumental variables for GDP[13] in a 2SLS equation. The results show that when tax revenue forecasts are controlled for, a tax change that is expected (in a static calculation) to raise tax revenue by one percent actually increases it by 1.05 percent (Table 1).[14] The elasticity of tax revenue with respect to GDP is only slightly greater than unitary (1.03), which is similar to the result obtained from the long-run equations in Brender (2001) and Brender and Navon (2010). In the second version of the long-run equation, in addition to GDP, we added the log of the index of world trade and the log of the number of tourists, to the explanatory variables, as well as two domestic macroeconomic variables—imports of consumer goods and the average gross wage in the economy.[15] According to the estimate, a tax change made at any time in the past, which was meant to increase tax revenue by one percent indeed increases tax revenue today by one percent. In other words, when macroeconomic variables are controlled for, tax changes appear to have no additional effect on tax revenue.

The estimated coefficient of the log of GDP (with a lag of one quarter) is 0.4, which is very low relative to the expected unitary elasticity. However, in this version the coefficient of GDP is an estimate of the "domestic component" effect of GDP on tax revenue, while the coefficient of the log of the world trade index (i.e., 0.36) is an estimate of the effect of that part of GDP (and economic activity in general) determined by developments abroad.[16] The coefficient of imports of consumer goods (the residual of imports that is not correlated with GDP) was estimated to be 0.39, which is similar to the estimated coefficient in the long-run equation in Brender (2001) and in the Bank of Israel tax model. The residual of the average wage, which we added to the equation to account for the long-run relation between tax revenue and wages, positively affects tax revenue, such that an increase of one percent in the average wage leads to an increase of 0.63 percent in tax revenue.

The second equation in the dynamic system is a **differences equation** in which the dependent variable is the change in tax revenue during the current quarter relative to the previous quarter (Table 2). The residual from the long-run equation (the second version) is included here as an explanatory variable and its coefficient is -0.8, confirming the existence of an error-correction type relationship, and indicating that deviations from the long-run relationship between tax revenue and the macroeconomic variables are largely corrected within two quarters.

---

[13] We used the log of the number of tourists in the same quarter and the log of world trade with a lag of one quarter and with a lag of two quarters. These instrumental variables explain a significant portion of the volatility in GDP. (In the first stage equation, in which GDP was the dependent variable and the fixed and instrumental variables were the explanatory variables, an adjusted R^2 of 0.98 was obtained.)

[14] Wald tests did not reject the hypothesis that the coefficients of tax changes and GDP are equal to one.

[15] Changes in wages and imports of consumer goods are correlated with changes in GDP growth. In order to identify the effect of these variables, beyond the effect of GDP, we replaced them with the residual obtained from a regression of wages/imports on GDP and a constant. A similar method was used in Brender (2001) to estimate the full elasticity of tax revenue with respect to GDP, when the model also includes wages and imports of consumer goods.

[16] When estimating the version of Equation (2) in which world trade and number of tourists are omitted, a coefficient of 0.85 was obtained for GDP and a Wald test was unable to reject the hypothesis that it is equal to one.

Table 1: The long-run equation linking tax rate changes to tax revenue

Dependent Variable: Log of tax revenue	(1) Long-run equation (2SLS)	(2) Long-run equation (SOLS)
Sum of tax changes until the present	**1.049**	**0.996**
	*(3.26)***	*(4.76)***
Log of index of world trade		0.357
		*(3.28)***
Log of number of tourists		0.059
		*(2.29)**
Log of GDP (lag of one quarter)	**1.033**	0.401
	*(5.37)***	*(2.98)***
Residual of imports of consumer goods		0.391
		*(4.57)***
Residual of average wage		0.629
		*(3.26)***
Log of forecast of tax revenue	0.129	-0.009
	(0.98)	*(-0.10)*
Adjusted R-squared	0.907	0.967
Durbin-Watson statistic	0.932	1.587
Residual ADF test statistic	***-4.69	
Engle-Granger tau-statistic		***-7.17

* t-statistics appear in parentheses. The regressions include a constant term, quarterly dummy variables and dummy variables for 2002 and onward. An interaction between tax changes and a dummy variable for the period 1997:Q1 to 2001:Q4 was also included. * - indicates significance at the 10% level; ** - indicates significance at the 5% level; *** - indicates significance at the 1% level.

According to the estimation results, a tax increase that is meant to raise tax revenue by one percent and goes into effect during the current quarter will add only 0.77 percentage points to the change in tax revenue (when macroeconomic variables are controlled for). This estimate indicates that a tax change is only partially manifested in revenue during the first quarter it goes into effect. This may be due to the timing in which a tax change goes into effect during the quarter or due to possible shifting of economic activity or tax payments near that time. In any case, as noted above, the remaining gap from the long-term relationship is closed quickly. Almost all of the macroeconomic variables included in the equation had statistically significant coefficients (except for bank credit in foreign currency which, though not significant, had the expected negative sign). The change in the world trade index, growth in GDP, the increase in the average wage and imports of consumer goods, as well as the real increase in the Tel Aviv Stock Exchange index, all have a positive effect on the change in tax revenue.

Table 2: The results of the first differences equation: the short-run link between legislated tax changes and tax revenue[1]

Dependent Variable: Quarterly change in the log of tax revenue	Differences equation	Differences equation with a lead
Tax changes during the current quarter	**0.767**	**0.708**
	*(2.44)***	*(2.28)***
Tax changes in the next quarter		**0.522**
		*(1.78)**
Residual of the long-run equation	**-0.779**	**-0.768**
	*(-6.11)****	*(-6.07)****
Quarterly change in the world trade index	0.459	0.479
	*(2.51)***	*(2.65)***
Growth of GDP in the previous quarter	1.055	1.037
	*(5.41)****	*(5.42)****
Growth of GDP two quarters ago	0.241	0.247
	(1.35)	*(1.40)*
Change in the component of the average wage not correlated with GDP	0.417	0.382
	*(2.43)***	*(2.23)***
Change in the component of imports not correlated with GDP	0.341	0.336
	*(5.89)****	*(5.83)****
Change in the log of TASE index * dummy since 2004	0.120	0.110
	*(2.40)***	*(2.23)***
Change in log of foreign currency credit in the previous quarter	-0.074	-0.088
	(-1.11)	*(-1.32)*
Change in the log of the number of tourists	0.066	0.066
	*(2.28)***	*(2.27)***
Adjusted R-squared	0.938	0.942
Durbin-Watson statistic	2.195	2.247

[1]-t-statistics appear in parentheses. The regressions include a constant, quarterly seasonality variables and interactions of tax changes with the structural break period. * - indicates significance at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.

In the second version of the differences equation, we also included tax changes with a lead of one quarter. In many cases, tax changes are known about at least one quarter before they come into effect, since they are included in the budget proposal discussed by the government in the middle of the preceding year, and the legislative process is conducted in the final quarter of that preceding year. Tax changes that are expected to come into effect in the following quarter may cause a shift in activity to and from the current quarter and thus may affect tax revenue even before they go into effect. As mentioned in Section 2, there is no consensus in the literature with regard to the effect of tax change expectations on economic activity (and tax revenue). Here we are only examining the one-quarter-ahead expectations, while ignoring the exact period that has passed since the legislation was completed and until the changes go into effect.

According to the results, a tax change that is expected (using a static calculation) to raise tax revenue in the following quarter by one percent will raise tax revenue already in the current

quarter by 0.5 percent. With that, the inclusion of this variable in the equation does not materially affect the value of the other coefficients.

6. The full effect of legislated tax changes on tax revenue and on economic activity

This section tests the dynamic effect of legislated tax changes on tax revenue and attempts to estimate the actual amount that will be collected as a result of a tax change, both at the time it goes into effect and subsequently. A tax revenue forecast based only on a static calculation (multiplying the change in the tax rate by the current tax base) does not take into account the dynamic effect of a tax change on economic activity, and in turn on the size of the tax base and total tax revenue. This indirect effect is comprised not just of the effect of the tax change on GDP (as estimated in the "tax multiplier"), but also by the effect of variables such as the import of consumer goods (which are tax intensive) and wages, as well as by the possible effect on the shift of demand and activity between tax bases. Instead of explicitly estimating the tax multiplier, we directly evaluate the total effect of a tax change on tax revenue.

In this section, unlike the previous one, we differentiate in the long-run equation between three periods: the previous year, the year before that and all the changes introduced two or more years ago.[17] In the **first stage**, we estimate the equation without any domestic economic activity variables, where the presence of variables that are independent of local taxation, i.e., the world trade index and number of tourists, serves as a control for shocks that are not the result of domestic economic activity. The estimated coefficient of legislated tax changes reflects the actual effect of tax changes on tax revenue, which is the sum of the direct effect on tax revenue based on a static calculation (a positive effect) and the indirect effect on tax revenue through the effect of taxation changes on macroeconomic variables (which we generally expect to be negative). In the **second stage**, domestic economic activity variables (GDP, imports of consumer goods and the average wage) are added to the equation and we estimate the coefficient of tax changes while controlling for all macroeconomic variables. If the legislative tax changes have no additional effect beyond that on economic activity, then we expect that the coefficients of tax changes will be equal to one. The bias created in the coefficients of tax changes when local economic activity variables are left out serves as an estimate of the indirect effect of tax changes on tax revenue via domestic economic activity. However, this estimate should be treated with caution since it is obtained from the difference between coefficients in two different regressions and it is not possible to explicitly test hypotheses on it. The estimated coefficients in the two stages are presented in Table 3.

Estimating the effect of taxation changes, while omitting economic activity variables, indicates that a tax change predicted (statically) to increase tax revenue by one percent will increase it by only about 60 percent of that amount during the first year after it goes into effect. In the second year, tax revenue collection reaches a low point of about 30 percent (and this proportion is not statistically significantly different from zero). After two years, tax revenue rebounds and in the long run the tax change yields about 70 percent of the static calculation's prediction. When local macroeconomic variables are controlled for, the tax change coefficients in each of the periods are

[17] Due to the lags, this version was estimated starting only from 1993:Q1.

close to one and there is no significant excess effect on tax revenue. In the long run, the coefficient of tax revenue increases even more than what is expected according to a static calculation (1.27), but the excess effect (above 1) is not statistically significant. This finding implies that there is no evidence for a negative effect of a tax rate increase on tax revenue beyond its effect on macroeconomic variables.

Table 3: The effect on tax revenue of tax changes staggered by the time they went into effect

Dependent Variable: Log of total tax revenue 1993 :Q1–2012 :Q4	(1) Excluding domestic economic variables	(2) Including all domestic economic variables
Tax changes within the last year	**0.636**	**1.067**
	*(1.78)**	*(3.79)****
Tax changes during the year before last	0.317	**1.139**
	(0.82)	*(3.24)****
Tax changes implemented more than two years ago	**0.724**	**1.270**
	*(2.06)***	*(3.48)****
Log of the index of world trade	0.654	0.372
	*(5.63)****	*(3.27)****
Log of the number of tourists	0.013	0.048
	(0.39)	*(1.69)**
Component of tax revenue forecast not dependent on tax changes in the previous years[18]	0.061	-0.067
	(0.46)	*(-0.65)*
Log of GDP		0.513
		*(2.69)****
Component of imports not correlated with GDP		0.387
		*(4.41)****
Component of the average wage not correlated with GDP		0.646
		*(2.49)***
Adjusted R-squared	0.951	0.966
Durbin-Watson statistic	1.521	1.623
Engle-Granger tau-statistic	**-6.95	***-7.31

* t-statistics appear in parentheses. The regressions include a constant, quarterly seasonality variables and a dummy variable for 2002 and onward. For each tax change variable, an interaction was included between the tax changes and a dummy variable for the period 1997:Q1 to 2001:Q4. * - indicates significance at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.

[18] The forecast of tax revenue in the following year is based on an estimate of tax revenue in the current year—an estimate that is dynamically affected by tax changes in previous years. Therefore, including the full forecast in the equation may bias the tax change coefficients included in it. As such, we included only the forecast component that is not dependent on tax changes in previous years. In other words, we included the residual of the equation in which the log of the tax forecast is the dependent variable and tax changes in the previous (calendar year) and the changes up to two years previous are the explanatory variables, alongside a constant.

Table 4 presents the calculated indirect effects of tax changes on tax revenue (i.e., the difference between the taxation coefficients) via the domestic economic activity variables.[19] During the first year following the tax increase, the negative effect on domestic economic activity offsets 0.4 percentage points from each one percent (estimated) increase in tax revenue. The indirect effect reaches a peak in the second year after the tax change goes into effect, and offsets 0.72 percentage point of tax revenue collection at that point. For tax changes that went into effect two or more years earlier, the negative effect on economic activity weakens and in the long run the offsetting effect of economic activity on tax revenue totals 0.43 percentage point of each percent of tax revenue collection.

The dynamic effect of tax changes on economic activity, whereby the effect increases in strength over a two-year period and then declines, has also been found in other studies. RR found that in the US the effect of an exogenous tax change on GDP reaches a peak after 10 quarters and declines subsequently. A similar result for the UK was obtained by Cloyne (2013). Mazar (2013) found a similar short-run effect for changes in direct taxes in Israel, and estimated the peak of their influence to occur after 18 months.[20]

Table 4: Indirect effect of tax changes (differences between the tax change coefficients)

Indirect effect of a tax increase that is intended to raise tax revenue by one percent	**The effect on tax revenue via all the domestic economic variables (percent of estimated tax revenue taking activity variables into account)**	**The effect on tax revenue via all domestic economic variables, vis-à-vis a static forecast (Coefficient=1)**
Tax increase during the last year	-0.40	-0.36
Tax increase during the year before last	-0.72	-0.68
Tax increases more than two years ago	-0.43	-0.27

We focus on the effect of tax changes on total tax revenue collection and do not attempt to estimate the tax multiplier directly, since we are examining the effect of the change not only on GDP but also via other macroeconomic variables (particularly imports and wages). Nonetheless, in order to understand the magnitude of the results, we estimated the implications of the tax multipliers in the literature for tax revenue, given the characteristics of the tax system in Israel.[21]

[19] The tax change coefficients reflect the effect of tax changes according to the average composition of tax changes during the sample period. A different composition of tax changes may yield different results. In the following sections, we examine the effect of each type of tax separately.

[20] An example of the dynamic effect of tax changes that reached a peak and then subsided can be seen in the green taxation reform on vehicles that came into effect in Israel in 2009. The reform, which raised taxes on polluting vehicles and reduced them on environmentally friendly vehicles led to a change in behavior that, at first, was characterized by a limited shift of demand to other vehicles, then led to stagnation and moderation in activity in the market in expectation for the arrival of new and more efficient less polluting vehicles, and then led to increased purchases of the new vehicles that were entitled to tax benefits as part of the reform. For more information on the reform, see Box 6.1 in the Bank of Israel Annual Report for 2013.

[21] We used the tax burden in order to calculate, in terms of percent of tax revenue collection, the size of a tax change of one percent of GDP. For a tax to GDP ratio of 27.2 percent (the average ratio during the

According to RR, the offsetting effect of a tax change on tax revenue through the effect on GDP is -0.84 (of each percent of revenue) at its peak. According to BP it ranges from -0.21 to -0.36. One can derive from Mazar (2013) that the maximum offsetting effect is -0.23 following an increase of one percent in direct taxes and -0.54 following an increase of one percent in indirect taxes. The offsetting effect we obtained is, as mentioned, -0.72 at the peak and therefore our result is closer to that obtained by RR, though it is somewhat lower (we reiterate that, the offsetting effect that we obtained takes into account other offsetting effects).

7. The effect of changes in the personal income tax, the corporate income tax and indirect taxes on tax revenue

Up to this point, we have examined the effect of tax changes without relating to the composition of the change, even though the various types of taxes may have different effects on tax revenue, both with respect to the size of the effect and its timing and with respect to the channels through which it works. The importance of differentiating between the various types of taxes is clear from the literature. Mazar (2013) found large differences in the effect on GDP between indirect and direct taxes. Mertens and Raven (2013) found differences in the dynamic effect between the personal income tax (including Social Security payments) and the corporate income tax.

In this section, we estimate three error-correction models for the income tax on salaries, the corporate income tax and indirect taxes.[22] For each type of tax, we recalculate the tax changes relative to tax revenue from that type of tax in the previous calendar year. Each estimation includes the forecast of revenue from that tax, which reflects the relevant information available to policy makers when the tax change was legislated.[23]

a. The personal income tax (on salaries)

We estimate an error-correction model for tax revenue from the personal income tax. First, a long-run equation was estimated for the relationship between tax revenue and tax changes using three versions (Table 5). The estimation of the equation without domestic economic activity variables (version 1) shows that a tax change which is intended to raise tax revenue by one percent in fact raises it by 0.76 percent during the first year, by 0.36 percent in the second year (this coefficient is not statistically significant) and by 0.65 percent in the long run (after two or

---

sample period) the change amounts to 3.68 percent of tax revenue collection. We assumed that the elasticity of tax revenue collection relative to GDP is unitary (according to the coefficients of the long-run equation above) and used it to calculate the offset effect of a change in GDP on total tax revenue. Thus, for example, RR's tax multiplier of -3.08 implies that a tax increase of 3.68 percent of tax revenue leads to an offset of 3.08 percent of tax revenue through its effect on GDP. Therefore, a tax increase of one percent of tax revenue will lead to an offset of -0.84 percent of the additional revenue.

[22] In order to preserve comparability with the previous section, we estimate the models from 1993 to 2012 and controlled for the period between 1997:Q1 and 2001:Q4.

[23] The budget includes a forecast of total revenue from the personal income tax (on salaries) and the corporate income tax combined. We used this forecast in order to calculate the residual (of the log of the forecast) that is not dependent on income tax changes in previous years, and the residual that is not dependent on corporate tax changes in previous years.

more years). Even when domestic economic activity variables are controlled for (version 2), it is clear that in the short run an increase in the income tax on salaries yields only about 80 percent of the expected amount of tax revenue (according to a static calculation). This rate may be an indication of shifting and changes in behavior, that are the result of the tax change.[24] Nonetheless, these offsetting effects are not statistically significant and they tend to disappear within two years. Thus, when controlling for the effect on economic activity, tax changes that have been in effect for two years or longer affect tax revenue according to the static calculation (i.e., the coefficient is almost equal to 1).

Among the macroeconomic variables included in the regression, we see, as expected, that the effect of the average wage on revenues from the personal income tax (i.e., 1.6) is significantly larger than its effect on total tax revenue. In addition, the effect of GDP on tax revenue is somewhat larger than unitary (1.33). These findings are consistent with the findings in other countries, which reflect the progressivity of personal income tax brackets.

The difference between the coefficients indicates that the effect of tax changes on tax revenue, through their effect on the domestic economic activity variables, is only marginal in the first year but increases in size subsequently. An increase in the personal income tax that is meant to raise tax revenue by one percent has a negative effect on economic activity and in the long run, offsets about 0.4 percent of the expected tax revenue increase (according to a static calculation).

The effect of a PIT increase on the average wage propagates through two channels:

1. The tax increase lowers GDP growth, and thus reduces the growth of the average wage in the economy. To estimate the effect through this channel we found, first, the elasticity of the average wage to GDP when controlling for PIT changes (0.47)[25]; and second, we estimated the elasticity of GDP to PIT changes within our equations framework[26]. Using both elasticities we find that a PIT increase that is meant to raise PIT revenue by one percent, reduces the average wage by 0.27 percent.
2. The incidence of the PIT falls ultimately on both employees and employers. A tax change in the PIT leads to an adjustment through a change of the (gross) average wage. To estimate the effect through this channel, we use the difference in the coefficients between Equations (2) and (3). It implies that the effect on tax revenue via the wage variable only (the component that is not correlated with GDP) is positive. Thus, a tax increase that is intended to increase tax revenue by one percent will increase the real gross average wage, after more than 2 years, by 0.34 percent.

[24] This result is supported by the microeconomic analyses of Ben-Naim (2004) and Romanov (2006) on the effect of changing the marginal tax rates of high-income earners in Israel at the beginning of the 2000s.

[25] The elasticity was estimated using an equation (not presented) where the log of average wage was the dependent variable and the explanatory variables were the same as in version (3) of the long-run equation..

[26] To calculate this elasticity we estimated a version of the long-run equation (2) that excluded only the GDP variable (not presented). The difference in the coefficients of the tax changes in the two versions is an estimate of the effect of a tax change on tax revenues through its effect on GDP. Using the estimated elasticity of PIT revenue to GDP (1.33), we derived the effect of PIT changes on GDP.

Table 5: The long-run effect of changes in the personal income tax on tax revenue

Dependent variable: Log of revenue from personal income tax 1993 :Q1–2012 :Q4	(1) Excluding domestic economic variables	(2) Including all domestic economic variables	(3) Excluding the wage variable only
Tax changes in the last year	**0.760**	**0.805**	**1.196**
	*(1.87)**	*(3.18)****	*(4.54)****
Tax changes year before last	0.355	**0.782**	**1.150**
	(0.79)	*(2.70)****	*(3.74)****
Tax changes implemented more than two years ago	**0.647**	**1.084**	**1.539**
	*(2.65)***	*(4.99)****	*(7.23)****
Log of the index of world trade	0.555	-0.016	0.009
	*(4.75)****	*(-0.14)*	*(0.07)*
Log of number of tourists	-0.118	-0.060	-0.069
	*(-1.87)**	*(-1.55)*	*(-1.61)*
Component of tax revenue forecast that is not dependent on changes in personal income tax in previous years[27]	0.354	0.048	0.120
	*(2.43)***	*(0.51)*	*(1.18)*
Log of GDP		1.331	1.683
		*(4.89)****	*(5.85)****
Component of imports not correlated with GDP		0.135	0.289
		(1.03)	*(2.06)**
Component of the average wage not correlated with GDP		1.595	
		*(4.58)****	
Adjusted R-squared	0.839	0.926	0.897
Durbin-Watson statistic	1.272	1.771	1.828
Engle-Granger tau-statistic	**-6.75	***-8.48	***-8.60

* t-statistics appear in parentheses. The regressions include a constant, and quarterly seasonality variables. For each tax change variable, an interaction is included between the tax changes and a dummy variable for the period 1997:Q1 to 2001:Q4. * - indicates significance at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.

Summing up the effects from the 2 channels, a PIT increase that is meant to raise PIT revenue by one percent increases the average wage by a total of 0.07 percent (after more than 2 years). Using the average quarterly PIT revenue in our sample period, and the average wage bill, we found that a burden of a PIT increase is shared (PIT is on average X% of the wage bill): on average, 65 percent falls on employees (through a decrease in net wages) and 35 percent on employers (through an increase in gross wages). This rate of the burden on employees is similar to the long-run average in non-nordic countries, as shown by the meta-analysis conducted by

[27] The forecast included in the budget is for total revenue from income tax—wages and corporate combined. The residual included in the equation is this forecast minus the effects of tax changes in personal income tax in the previous (calendar) year and prior to it (and in the next section—minus the effect of tax changes to corporate tax in the previous year and prior to it).

Gonzalez-Paramo and Melguizo (2013). Conversely, a reduction in the income tax on salaries contributes to a real drop in gross salaries, thus finding its way to the employers as well.[28]

Mertens and Ravn (2013b) find a multiplier of -2.5 for the reaction of GDP to an increase in the income tax of one percent of GDP (with the effect peaking already after three quarters). This multiplier, in the context of the Israeli economy, yields an offset coefficient of -0.34 percent. The offset coefficient derived from our estimation results is similar, reaching a peak of -0.43.

Table 6: The short-run effect of changes in the personal income tax on the change in tax revenue

Dependent variable: The change in the log of revenue from the personal income tax	(1) Differences equation	(2) First differences equation with a lead
Change in the log of the index of world trade	0.542 *(2.24)***	0.539 *(2.23)***
Change in the log of the number of tourists	-0.022 *(-0.58)*	-0.016 *(-0.43)*
Change in log of GDP	0.548 *(2.06)***	0.531 *(2.01)***
Change in the component of the average wage not correlated with GDP	1.153 *(4.45)****	1.064 *(4.07)****
Change in the component of imports not correlated with GDP	0.003 *(0.04)*	0.004 *(0.05)*
The long-run residual	-0.787 *(-7.15)****	-0.784 *(-7.07)****
Change in the personal income tax in the current quarter	**0.604** *(2.97)****	**0.686** *(3.28)****
Change in the personal income tax in the previous quarter	**0.490** *(2.30)***	**0.432** *(2.02)***
Change in the personal income tax in the coming quarter		**0.317** *(1.65)*
Adjusted R-squared Durbin-Watson statistic	0.778 2.232	0.783 2.233

* t-statistics appear in parentheses. Includes a constant, seasonality variables, and interactions of the tax changes with the structural break period. * - indicates significant at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.

Furthermore, we estimated a **differences equation** for the short-term relationship between changes in the personal income tax and changes in the revenues from this tax (Table 6). The

[28] We did not find a statistically significant difference between the coefficients of tax increases and tax reductions in the previous two years. We examined this by estimating another version of the equation (not presented) that included variables of the interaction between tax changes in the past two years and a dummy variable for an increase in tax rates during that year.

coefficient of the residual from the long-run equation (-0.8) is negative and statistically significant and supports the specification of an error-correction model in which the vast majority of deviations from the long-run relationship are corrected within two quarters. According to the estimation results, the effect of a tax change on the change in revenues from personal income tax continues for two quarters: 60 percent of the expected increase in revenue (according to a static calculation) is received in the first quarter after the change goes into effect, and an additional 49 percent in the subsequent quarter. Another version of the difference equation, which also included tax changes expected in the next quarter (2), does not show a significant effect of a future tax change on tax revenue in the preceding quarter (although the correlation is on the cusp of significance at 10 percent).

b. Corporate income tax

In the case of the corporate income tax, we estimate an equation for the long-run relationship between changes in the corporate income tax and the revenue from this tax (Table 7). An estimation of the equation without the domestic economic activity variables (1) shows that in the first year a change in the corporate income tax almost does not change the revenue from this tax. During the second year, revenue increases slightly, but is still not statistically different than zero. In the long run, a tax change implemented two or more years earlier and intended to increase revenue by one percent produces 89 percent of the expected revenue. Also, when the effect of a change in the corporate income tax on domestic economic activity is controlled for (2), it appears that in the short run corporate income tax changes cause large and significant shifts of economic activity and tax payments. Thus, there is under-collection in the first year and over-collection in the second year following the change. In the long run, and when account is taken of the domestic economic activity variables, a change in the corporate income tax yields the revenues expected according to a simple static calculation (or even slightly more than that) and there are no apparent excess effects on revenue.

The macroeconomic variables included in the estimation indicate that the elasticity of corporate income tax revenues to GDP (with a lag of one quarter[29]) is more than unitary. Also, there is a high and positive correlation between revenue and the residual of wage that is not correlated with GDP.[30] In the case of the corporate income tax, we use the log of the NASDAQ index as an exogenous proxy for economic activity (in place of the world trade index) and also include the log of the number of tourists (as a proxy for the security situation).

The difference between the coefficients indicates that the effect of changes in the corporate income tax on tax revenue, via their effect on domestic economic activity variables, reaches a peak in the second year following the change. A reduction in the corporate income tax that is

[29] In examining corporate tax revenues, we used GDP with a lag of one quarter as an explanatory variable enabling us to better take into account the timing differences in this tax revenue. The residuals of imports and wages included in the regressions were recalculated as a residual that is not correlated with GDP with a lag of one quarter.

[30] An increase in wage was supposed to negatively impact corporate profits and tax revenues, but it is possible that the increase in the component of wages that is not correlated with GDP is associated with an increase in productivity and corporate profitability, making it possible for companies to pay a higher wage to their employees, leading to a positive and strong correlation.

expected to reduce revenue by one percent stimulates domestic economic activity and thus offsets 0.73 percent of the expected reduction in the second year following the change. The positive effect on economic activity subsides following that, and in the medium to long run the cost of tax reduction is 0.27 percent.

Table 7: The long-run effect of corporate tax changes on tax revenue

Dependent variable: Revenue from corporate income tax 1993:Q1–2012 :Q4	(1) Excluding domestic economic variables	(2) Including all domestic economic variables
Tax changes in the last year	0.110	0.745
	(0.21)	*(1.07)*
Tax changes in the year before last	0.767	**1.495**
	(1.32)	*(1.88)**
Tax changes implemented more than two years ago	**0.888**	**1.154**
	*(1.80)**	*(1.80)**
Log of the NASDAQ index	0.324	0.088
	*(3.32)****	*(0.58)*
Component of forecast of income tax revenue that is not dependent on corporate tax changes in previous years	0.341	0.005
	*(2.46)***	*(0.01)*
Log of number of tourists	0.310	0.447
	(1.99)*	*(3.12)****
Log of GDP with a lag of one quarter		1.261
		*(1.96)**
Component of imports not correlated with GDP		0.773
		(1.54)
Component of the average wage not correlated with GDP		3.665
		*(3.19)****
Adjusted R-squared	0.731	0.786
Durbin-Watson statistic	1.486	1.857
Engle-Granger tau-statistic	**-6.80	***-8.36

***** t-statistics appear in parentheses. The regressions included a constant and quarterly dummies. For each tax change variable, an interaction was included between the variable and a dummy variable for the period 1997:Q1 to 2001:Q4. * - indicates significant at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.

Mertens and Ravn (2013b) find that changes in the corporate income tax affect the revenue from this tax only somewhat, as a result of the large (and negative) elasticity of the tax base with respect to tax changes. They explain that this result reflects major changes in behavior following fluctuations in corporate income tax rates. Although the response function they present indicates that after three years the tax base returns to its level prior to the tax change, the change in revenue from the corporate income tax, even at that point, is small and not significantly different from zero. This seems to contrast with our result that changes in the corporate income tax do not have a

statistically significant effect on the revenue from this tax only in the short run. However, at least part of the difference reflects the dynamics of the corporate tax rate itself in their analysis: According to their response function, following a reduction of the tax rate in the initial period, the rate gradually increases again.

Second, we estimate a **differences equation** for the short-term relation between changes in the corporate income tax and changes in revenue from it (Table 8). The negative coefficient of the residual from the long-run equation (-0.54) is statistically significant and supports the specification of an error-correction model, in which deviations from the long-run relation are for the most part corrected within two quarters. The fluctuating effect of tax changes on tax revenue is also apparent in the short-run equation. Increasing the corporate income tax does not have a statistically significant effect on revenue in the quarter in which the change goes into effect, and reduces revenue in the following quarter. Only after three quarters does the revenue from the

Table 8: The short-run effect of corporate tax changes on revenues

Dependent variable: The change in the log of corporate tax revenue	Difference equation
Change in log of GDP with a lag of one quarter	1.156
	(0.99)
Change in log of GDP with a lag of 12 quarters	2.052
	*(2.12)***
Change in the component of wages not correlated with GDP	3.819
	*(3.24)****
Change in the component of imports not correlated with GDP	0.590
	(1.66)
Change in the Tel Aviv Stock Market Index in the past year	0.166
	*(2.19)***
Change in foreign mergers and acquisitions with a lag of four quarters	0.000
	*(-2.82)****
The long-run residual	-0.536
	*(-4.28)****
Changes in the corporate tax in the current quarter	-0.708
	(-0.96)
Changes in the corporate tax in the previous quarter	**-0.667**
	*(-1.72)**
Changes in the corporate tax two quarters ago	-0.001
	(-0.00)
Changes in the corporate tax three quarters ago	**0.713**
	*(1.74)**
Changes in the corporate tax four quarters ago	**0.910**
	*(2.15)****
Adjusted R-squared	0.635
Durbin-Watson statistic	2.599

* t-statistics appear in parentheses. Includes a constant, seasonality variables and interactions between tax changes and the structural break period. * - indicates significant at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.

corporate income tax compensate for the decline and increase in a statistically significant way (by 0.71 percent of tax revenue), and it continues to rise (by close to one additional percent of tax revenue) in the corresponding quarter one year after the change. This result may indicate shifts in economic activity and tax payments between quarters as a result of corporate tax changes[31], and is also the result of the fact that a substantial portion of tax payments are in respect of past profits.

Additional evidence that corporate income tax revenue is particularly affected by past profits can be seen in the GDP and wage coefficients in the equation. The effect of a change in GDP on changes in corporate income tax revenue is not statistically significant at first, but after three years the effect is significant and large (2.05). There is a strong and statistically significant correlation between the increase in corporate tax revenue and the increase in the component of wages that is not correlated with GDP, which is apparently in contrast to the immediate negative effect of an increase in wages on corporate profits.

c. Indirect taxes

An error-correction model was used to estimate the effect of a change in indirect tax rates on total revenue from indirect taxes. We first estimated an equation for the long-run relationship (Table 9). The estimation of the equation without domestic economic variables (1) shows that a change in indirect taxes that is intended (according to a static calculation) to increase indirect tax revenue by one percent, in fact increases it by only 0.74 percent during the first year. Past changes in indirect taxes produce only about one-half of the expected revenue in the current quarter. When the effect of changes in indirect taxes on economic activity, GDP and consumer goods imports is controlled for (version 2), the revenue obtained is consistent with a static calculation of the expected effect.

The difference between the coefficients indicates that an increase in indirect taxes offsets about 30 percent of expected revenue in the first year through its effect on economic activity. This effect subsequently increases in size and offsets about one-half of the expected revenue from the tax increase (according to a static calculation).

In addition to the long-run equation, we estimated a differences equation for the short-run relationship between changes in indirect taxes and the change in revenue from indirect taxes (Table 10). The coefficient of the residual from the long-run equation (-0.98) is negative and statistically significant and supports the specification of an error-correction model, in which deviations from the long-run relationship are almost totally corrected for within a quarter. According to the estimation results, when controlling for a change in variables of economic activity, a change in indirect taxes that is intended to increase tax revenue by one percent will actually achieve the full expected revenue in the quarter in which it goes into effect.

The results for the second version of the differences equation, which includes tax changes with a lead as an explanatory variable, provide evidence of the shifting of economic activity near the time of the change in the tax rate. The estimation results indicate that a tax change in the next quarter that is intended to increase revenue from indirect taxes by one percent will increase the

[31] The estimation of a version that includes a lead variable for the tax changes in the next quarter (not presented) did not find that these changes have a statistically significant effect on tax revenue in the current quarter.

change in tax revenue already in the current quarter by 0.65 percentage points, apparently due to the bringing forward of activity in order to avoid paying the tax in the following quarter. During the quarter in which the tax change goes into effect, the change in tax revenue grows by an additional 0.85 percentage points.

Table 9: The long-run effect of changes in indirect taxes on revenues from indirect taxes

Dependent variable: log of revenue from indirect taxes	(1) Excluding domestic economic variables	(2) Including all domestic economic variables
Tax changes in the last year	**0.737**	**1.055**
	*(2.82)***	*(4.90)****
Tax changes implemented more than a year ago	**0.528**	**1.040**
	(2.32)**	(5.47)***
Component of forecast of revenue from indirect taxes that is not dependent on indirect tax changes in previous years	0.034	-0.225
	(0.27)	*(-2.44)***
Log of the index of world trade	0.351	0.125
	*(7.83)****	*(1.64)*
Log of the number of tourists	0.095	0.064
	*(4.33)****	(3.19)***
Log of GDP		0.544
		(3.60)***
Component of imports not correlated with GDP		0.489
		(5.58)***
Adjusted R-squared	0.949	0.970
Durbin-Watson statistic	1.432	1.804
Engle-Granger tau-statistic	-4.71	-8.21***
Engle-Granger z-statistic	-65.29***	-73.06***

* t-statistics appear in parentheses. The regressions include a constant term and quarterly seasonality variables. For each tax change variable, an interaction is included between the variable and a dummy variable for the period 1997:Q1 to 2001:Q4. * - indicates significant at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.

Table 10: The short-run effect of changes in indirect taxes on revenue

Dependent variable: Change in the log of revenue from indirect taxes	Difference equation	Addition of a lead
Changes in indirect taxes during the current quarter	**1.064**	**0.846**
	*(3.62)***	*(2.78)***
Changes in indirect taxes during the next quarter		**0.654**
		*(2.19)**
Residual from the long-run equation	-0.980	-0.918
	*(-7.47)***	*(-6.98)***
Change in the log of the world trade index	0.405	0.438
	*(2.04)**	*(2.24)**
Change in the log of number of tourists	0.084	0.093
	*(2.51)**	*(2.77)***
Change in the log of GDP in the previous quarter	0.568	0.503
	*(2.71)***	*(2.42)**
Change in the component of imports not correlated with GDP	0.403	0.391
	*(6.25)***	*(6.16)***
Adjusted R-squared	0.912	0.915
Durbin-Watson statistic	2.087	2.224

* t-statistics appear in parentheses. The equations include a constant, quarterly seasonality variables and interaction variables between the tax changes and a dummy variable for the structural break period. * - indicates significant at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.

d. Comparison of tax types

The results of the estimation for each tax type separately make it possible to compare the revenues derived from a change in each type of tax: In the short run (in the first year after the tax change takes effect), a change in personal income tax yields the closest revenue rate to (static) forecast revenue due to the tax change—76 percent. Revenue resulting from a change in indirect taxes reaches a similar rate—74 percent, while a change in corporate tax has almost no effect on actual revenue. Following two or more years after the change, the order changes: The change in corporate taxes yields the highest revenue rate relative to the earlier forecast—89 percent, a change in personal income tax yields 65 percent, and a change in indirect taxes yields just 53 percent of the earlier forecasted effect of the change on revenue.

Table 11: Elasticity of revenue from a change in each type of tax (change of one percent of revenue, according to static forecast)

Elasticity of revenue	**In the first year**	**Following two or more years**
Personal income tax	0.76	0.65
Corporate tax	0.11	0.89
Indirect taxes	0.74	0.53

8. Robustness tests

a. Bias in the tax revenue forecasts

Tax revenue forecasts are used in this study as a tool to deal with possible endogeneity of tax changes. In this section we examine whether the forecasts are accurate, and whether their bias is liable to reduce the benefit from including them in the regressions. First, as long as policy makers believe in the forecasts and decide on tax changes based on them, errors in the forecasts will reduce the problem of endogeneity described in Section 3. An examination of Equation 3 within the analysis we have presented shows that, to the extent that the tax revenue forecast $E_{t-1}(\Delta T_t')$, which is based on the macroeconomic forecast $E_{t-1}(\Delta X_t)$, reflects macroeconomic changes that are less correlated with their actual results (i.e., ΔX_t), there is less concern that the macroeconomic variables that affect tax revenue and are to be found in the residual will be correlated with the tax changes. Essentially, if policy makers ignore reality and decide on legislative tax changes only according to a totally random forecast, then the changes can be viewed as resulting from the exogenous shock ω_{t-1}, and the problem of endogeneity no longer exists.

Bias in tax forecasts becomes problematic when the published forecast (which is used in our estimations) does not reflect the forecasts actually used by policy makers. In this case, we would want to include private forecasts as a control variable in the regressions since it more accurately reflects the information possessed by policy makers when tax changes were legislated. The inclusion of the publicly known forecast rather than the private one makes it difficult to solve the problem of endogeneity. The motivation for intentionally publishing a biased forecast could be the desire to recruit political support for a tax change that is proposed in the budget or which has not been included in the budget (in which case the bias will either be in the direction of underestimated tax revenue if a tax increase is planned or if there is a desire to avoid a tax reduction, or in the direction of overestimated tax revenue when policy makers want to avoid raising taxes or are interested in reducing tax rates). Furthermore, since the tax revenue forecast directly affects the forecast of the deficit included in the budget, an upward bias in the tax revenue forecast can avoid (or at least delay for a limited amount of time) painful steps that need to be implemented by the government on the expenditure side (which was true at least until a fiscal rule was adopted that places a ceiling on expenditure), and perhaps conceal the scale of a fiscal crisis. Although in general a biased forecast will eventually be exposed as such, the timing of the crisis may still be of importance from a political viewpoint.

In view of the importance of the issue, we tested whether the forecasts suffer from a bias that is correlated with the tax changes. A comparison of the annual Ministry of Finance tax revenue forecasts, for the period 1992–2012, to actual tax revenues shows a small upward bias in the forecasts, of 1.8 percent on average, relative to actual tax revenues.[32] The average error in absolute value is 4.8 percent of the tax revenue.

[32] A systematic bias toward an overly optimistic forecast is found during the period prior to 2004. Following that, there was no ongoing bias in the tax revenue forecasts (see the Bank of Israel Annual Report for 2013, Chapter 6).

In order to test whether tax changes lead to a bias in the tax revenue forecast, a regression was run in which the dependent variable is forecast errors[33] and the explanatory variable is tax changes. Among the explanatory variables, we included the tax changes (in percent of tax revenue) during the year for which the forecast was made and the tax changes with lags of one and two years. In addition, we added variables to control for the (unintentional) errors in the tax revenue forecasts, i.e., the error in the IMF forecasts of world trade[34] and the deviation of the annual yield of the NASDAQ index from its multiyear average during the sample period. In order to take into account the possibility of nonlinear relationships, we also included the squares of these variables. In addition, we controlled for the change in the growth rate of GDP between the budget year and two years previous to it (the last year for which the rate of growth is fully known at the time the forecast was prepared), and for "one-off" revenues (in percent of tax revenue) whose magnitude and timing are difficult to forecast. The regression also included the previous forecast error as an explanatory variable (since the tax revenue forecast in the budget is built upon the estimated revenue in the year the forecast is made, and therefore the error in a particular year affects the error of the subsequent one).

All the variables are I(0) and the equation was estimated by OLS. The results are presented in Table 12 and show that the coefficient of tax changes, during the year for which the forecast was made, is positive and not significantly different from zero. This makes it less likely that the forecast is intentionally biased in order to persuade policy makers of the necessity of the changes (since in that case we would have expected a bias in the opposite direction of the tax changes and therefore a negative coefficient). This result is also valid for an additional version of this equation (not presented), in which we deducted the dynamic effect of the change in revenue, as we found in Section 6, from the "sum of tax changes in the current year" variable. In other words, even when taking into account the error derived from the use of a static forecast that ignores the dynamic effects of the tax change, there is still no indication of an intentional bias in the forecast.

Tax changes made in the previous year have a positive (0.30) and even statistically significant effect on forecast errors. This is evidence of the increased dynamic effect of a tax change on economic activity and tax revenue during the second year after it goes into effect. In view of the direction of the effect and the difference in timing, this does not constitute evidence of an intentional bias. Tax changes made two years earlier lead to overly pessimistic tax revenue forecasts (by 0.23 percent of tax revenue). This error is also apparently the result of ignoring the dynamic effects of a tax change. The forecast in the third year following a tax change is based on the lower tax collection during the first two years, and therefore it is revealed to be overly pessimistic when the negative dynamic effect of the tax change weakens.

---

[33] The error was calculated as the difference between the annual forecast of tax revenue and actual tax revenue. A positive value indicates that the forecast was overly optimistic while a negative value indicates that the forecast was overly pessimistic relative to actual tax revenue. Although the forecasted and actual tax revenue are annual data, there were several years (2002, 2003 and 2009) in which the forecast was changed when a new budget was passed or a special budget was introduced in mid-year. Thus, the estimation makes use of quarterly data, which for each quarter give the revenues for that year and the forecast that was valid during that quarter.

[34] The forecast error was calculated as the difference between the forecasts published by the IMF in its WEO survey in April of the year prior to the forecasted year and the actual growth in world trade. For mid-year forecasts we used the WEO forecasts made in April of that year.

The effect of the rest of the variables in the regression on the forecast errors is as expected: There is a positive (and nonlinear) correlation between the error in the IMF forecast of world trade and the error in the forecast of tax revenue, and a (non-linear) correlation between outlying increases in the NASDAQ index and (ex post) overly pessimistic forecasts of tax revenue. Changes in the growth rate of the economy and one-off revenues also lead to forecast errors.

Table 12: The effect of possible causes of errors in tax revenue forecasts

Dependent variable: Tax revenue forecast errors for the current year	(1)
Sum of tax changes in the current year	0.240
	(1.25)
Sum of tax changes in the current year minus the dynamic effect	
Sum of tax changes in the previous year	0.298
	*(1.75)**
Sum of tax changes two years ago	-0.229
	(-1.89)*
Error in the previous forecast (in a full year)	0.586
	*(8.60)****
Error in the previous forecast (in mid-year)	-0.318
	*(-3.77)****
Error in the forecast of world trade	0.027
	*(8.18)****
Squared error in the forecast of world trade	0.002
	*(4.10)****
Deviation of the rate of increase in the NASDAQ index from its multiyear average	-0.077
	*(-5.89)****
Squared deviation of the NASDAQ index	-0.080
	*(-4.20)****
The change in GDP growth between this year and two years ago	-0.218
	*(-2.25)***
One-time tax revenue	-2.328
	*(-7.14)****
Adjusted R-squared	0.862

* t-statistics appear in parentheses. Includes a constant. * - indicates significance at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.

b. Estimation for the period 2002–12

The regressions presented so far were estimated using quarterly data for 1992–2012, where the period 1997:Q2 to 2001 (inclusive) was singled out using a dummy variable. In order to test the robustness of the tax change coefficients and of the conclusions regarding actual tax revenue following a tax change, we estimated the long-run equation in the error-correction model of Section 6 for the shorter period of 2002–12 (years in which the tax forecasts did not suffer from a systematic bias). The estimation results are presented in Table 13 (right column) alongside the results for the full sample, which were presented in Table 3.

Table 13: Long-run equation of the relationship between tax changes and tax revenue—estimation for the subsample of 2002–12 and the full sample of 1993–2012

	1993 :Q1—2012 :Q4		2002:Q1—2012:Q4	
Dependent variable: Total tax revenue	(1) Excluding domestic economic activity variables	(2) Including domestic economic activity variables	(1) Excluding domestic economic activity variables	(2) Including domestic economic activity variables
Tax changes during the last year	**0.636** *(1.78)**	**1.067** *(3.79)****	**0.866** *(1.99)**	**1.291** *(5.47)****
Tax changes during the year before last	0.317 *(0.82)*	**1.139** *(3.24)****	0.419 *(1.03)*	**1.007** *(3.93)****
Tax changes implemented more than two years ago	**0.724** *(2.06)***	**1.270** *(3.48)****	**0.767** *(2.29)***	**1.174** *(3.98)****
Adjusted R-squared	0.944	0.966	0.875	0.934
Durbin-Watson statistic	1.530	1.628	1.254	1.937
Engle-Granger tau-statistic	**-6.95	**-7.31	-4.78	**-7.19

* t-statistics appear in parentheses. Version (1) also includes the log of the index of world trade, the log of the number of tourists and the log of the forecast of tax revenue. Version (2) includes the log of GDP, the component of imports not correlated with GDP and the component of wages not correlated with GDP. * - indicates significant at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.

The effect of tax changes that went into effect two or more years ago is similar for both samples, for each of the versions of the regression (i.e., with and without domestic economic activity variables). For both periods and when domestic economic activity is controlled for, the effect of tax changes on tax revenue in the long run is not statistically different from that expected according to a static calculation. There is an observed difference between the coefficients for tax changes during the first year after they go into effect. After 2002, a tax change that was intended to reduce tax revenue by one percent according to a static calculation in fact reduces it by 0.87 percent, in contrast to 0.64 for the full sample. Also, when controlling for domestic economic activity, after 2002 revenue collection following a tax reduction declines more than in the full sample—by 1.29 percent. Nevertheless, the differences between the coefficients in the two sample periods narrow significantly in the second year after the tax change, and almost disappear subsequently.

c. Controlling for government expenditure

Tax changes are often correlated with changes in government expenditure. The correlation can be negative when the government adopts a procyclical policy (e.g., it raises taxes and cuts expenditure) or a countercyclical policy (e.g., it reduces taxes and increases expenditure). The correlation can be positive when the government raises taxes in order to finance an increase in expenditure without increasing the deficit. Although the size of a planned increase in expenditure is known to policy makers at the time of the decision to implement a tax change and therefore the

effect of the expenditure on tax revenue should be reflected in the tax revenue forecast, there is still justification for testing whether the correlation between legislated tax changes and changes in expenditure may lead to biased estimates of the effect of tax changes.

Table 14 presents the estimates of the equations in Table 3 with the addition of the log of government expenditure in the current quarter as an explanatory variable. According to the estimation results of the long-run equation, a reduction of one percent in government expenditure is correlated with an increase of 0.15 percent in tax revenue and the correlation is statistically significant. Nevertheless, controlling for the level of government expenditure leaves the estimated effect of tax changes on tax revenue virtually unchanged, and the coefficients in the two versions are similar.

Table 14: Long-run relationship between tax changes and tax revenue, controlling for government expenditure

	Including government expenditure		Base	
	(1) Excluding domestic activity variables	(2) Including domestic activity variables	(1) Excluding domestic activity variables	(2) Including domestic activity variables
Sum of tax changes in the last year	**0.724** *(2.00)***	**1.119** *(4.08)****	**0.636** *(1.78)**	**1.067** *(3.79)****
Sum of tax changes in the year before last	0.293 *(0.76)*	**1.191** *(3.48)****	0.317 *(0.82)*	**1.139** *(3.24)****
Sum of tax changes implemented two or more years ago	**0.652** *(1.84)**	**1.333** *(3.75)****	**0.724** *(2.06)***	**1.270** *(3.48)****
Log of government expenditure	-0.156 *(-1.50)*	**-0.155** *(-1.84)**		
Adjusted R-squared	0.945	0.967	0.944	0.966
Durbin-Watson statistic	1.354	1.540	1.530	1.628
Engle-Granger tau-statistic	**-6.35	**-6.98	**-6.95	***-7.31

* t-statistics appear in parentheses. Both versions also include the log of the index of world trade, the log of the number of tourists and the component of the tax revenue forecast that is not dependent on tax changes until the end of the previous year. Version (2) includes, in addition, the log of GDP, the component of imports not correlated with GDP and the component of wages not correlated with GDP. * - indicates significance at the 10% level; ** - significance at the 5% level; *** - significance at the 1% level.

9. Conclusion

We have tested the effect of tax changes on tax revenue collection in Israel during the period 1992–2012, using a comprehensive database of the tax changes implemented by the government during that period. In order to deal with the problem of endogeneity, we used the tax revenue forecasts that were presented by the Ministry of Finance with the annual budget proposals—documents that also included proposed tax changes. The forecasts essentially reflect all the

information policy makers had when they decided on the tax changes for the coming fiscal year. The use of these forecasts is novel and makes it possible to use all of the tax changes implemented, rather than only exogenous ones (i.e., not just tax changes that are claimed to have ideological motivations, rather than being influenced by economic activity or the volume of revenue derived from it). We find that there is no negative connection between errors in tax revenue forecasts and the proposed tax changes, alleviating concerns regarding a systematic bias in the forecasts in order to politically justify changes in tax rates.

Furthermore, the availability of static estimations of the effect of changes on revenue—estimations that were used in the State budget until 2012—also made it easier to identify the effect of tax changes. Stability in the (pro-cyclical) response of tax policy in Israel to fluctuations in activity and in revenue also helps in dealing with the problem of endogeneity and in identifying the effect of tax changes.

Separate error-correction models were estimated for total tax revenue, revenue from the personal income tax, revenue from the corporate income tax and revenue from indirect taxes. In all cases, a cointegrative relationship was found over the long run between the level of tax revenue and the explanatory variables, and deviations of short-run tax revenue from the long-run relationship are almost always corrected for within two quarters or less.

It was found that a significant portion of the effect of statutory tax changes on tax revenue is offset through their dynamic effect on economic activity and that this effect peaks during the second year after the tax change goes into effect. As a result of the offset, a tax increase during the sample period resulted in only about 60 percent of the expected change (according to the static forecast) during the first year it goes into effect, about one-third of the expected amount during the second year, and from the third year onward the additional revenue was about 70 percent of the expected addition. A lack of awareness of these dynamic effects and their timing increased the error in the tax forecasts used in the State budget.

In the long run, all the indirect effects of a tax change on tax revenue are the result of its effect on (measured) economic activity. Apart from the effect through this channel, we did not find evidence that tax changes affect the scope of tax planning or tax evasion. The estimated amount of offset of revenue derived from the effect of tax changes on all activity variables is higher than the estimated offset derived from the tax multipliers (i.e. the effect via GDP only) found by Blanchard and Perotti (2002) for the US, and by Mazar (2013) for Israel, and is closer to the offset revenue derived from the tax multiplier found by Romer and Romer (2010).

Despite the significant offsetting effect, we found that in Israel during the last two decades a tax reduction led to a drop in tax revenue and that a tax increase raised tax revenue. The "magic" that is claimed to exist on the "wrong" side of the Laffer curve, whereby a tax rate reduction raises tax revenue, does not appear to be relevant in Israel. This conclusion is valid both for aggregate taxes and for each type of tax that we tested.

In analyzing each type of tax separately, we found that over time a change in the corporate income tax generates the highest revenue relative to the earlier static forecast—about 90 percent. A change in personal income tax leads to meeting about 65 percent of the forecast effect on revenue, and a change in indirect taxes has an effect on revenue of only about 53 percent of the static forecast for this effect.

In addition, we found that a reduction in the personal income tax has a negative effect on the real average gross wage (and that a tax increase has a positive effect. We did not find asymmetry between reductions and increases). A tax reduction that is intended to reduce tax revenue by one percent reduces the portion of the average wage not correlated with GDP by about one-third of a percent in the long run. Even when accounting for the positive effect of the tax reduction on GDP, and through it on the wage component that is correlated with GDP, the overall effect on the average wage remains negative, with the wage declining by 0.11 percent in the long run. Thus, workers and employers essentially share in the benefit from a tax reduction, since a worker's net wage increases by 54 percent of the amount while the wage costs of employers are reduced by the rest of it.

There is no consensus in the literature as to the unique effect of anticipated tax changes as compared to unanticipated ones. We examined only the possible effect of a tax change with a one-quarter-ahead horizon (assuming that for such a short horizon it is reasonable that most of the tax changes are known). We found that a tax increase in the next quarter has a positive and statistically significant effect on tax revenue already in the current quarter. This effect was also found in the separate estimation for indirect taxes. The effect of expected tax changes in Israel is worthy of continued investigation, including the cases in which there is a long delay between the approval of a legislated tax change and when it goes into effect. This is particularly relevant with regard to the program to reduce direct taxes in Israel during the last decade, which was discontinued at the end of 2011. The discontinuation of the program raised questions about the potential effect of cancelling expected (pre-legislated) tax reductions that have not yet gone into effect.

References

Allingham, Michael G. and Sandmo, Agnar (1972), "Income tax evasion: A theoretical analysis", *Journal of Public Economics*, 1972, 1(3/4) pp. 323-38.

Ben Naim, Galit (2004), "The effect of raising the tax rates for the rich on tax revenue: theory vs. reality", *Israel Tax Quarterly*, volume 126. (Hebrew).

Blanchard, Olivier, and Perotti, Roberto (2002), "An empirical characterization of the dynamic effects of changes in government spending and taxes on output", T*he Quarterly Journal of Economics* 117.4 (2002): 1329-1368.

Brender, Adi (2001), "Estimates of the tax revenue function in Israel", Bank of Israel Discussion Paper 2001.02 (Hebrew).

Brender, Adi and Navon, Guy (2010), "Predicting government tax revenue and analyzing forecast uncertainty", *Israel Economic Review* Vol. 7, No. 2 (2010), 81-111.

Cloyne, James (2013), "Discretionary tax changes and the macroeconomy: New narrative evidence from the United Kingdom", *American Economic Review* 103.4 (2013): 1507-28.

Favero, Carlo, and Giavazzi, Francesco (2012), "Measuring tax multipliers: The narrative method in fiscal VARs", *American Economic Journal: Economic Policy* 4.2 (2012): 69-94.

Gonzalez-Paramo, Jose Manuel, and Melguizo, Angel (2013), "Who bears labour taxes and social contributions? A meta-analysis approach", *SERIEs* 4:247-271

Mazar, Yuval (2013), "Fiscal policy and its effect on GDP and its components", Bank of Israel Review 87, pp. 31 – 68 (Hebrew).

Mertens, Karel, and Ravn, Morten O. (2010), "Empirical evidence on the aggregate effects of anticipated and unanticipated US tax policy shocks", National Bureau of Economic Research, Working Paper No. w16289.

Mertens, Karel, and Ravn, Morten O. (2013a), "A reconciliation of SVAR and narrative estimates of tax multipliers", *Journal of Monetary Economics*.

Mertens, Karel, and Ravn, Morten O. (2013b), "The Dynamic Effects of Personal and Corporate Income Tax Changes in the United States." *American Economic Review*, 103(4): 1212-47.

Mountford, Andrew, and Uhlig, Harald (2009), "What are the effects of fiscal policy shocks?", *Journal of Applied Econometrics* 24.6 (2009): 960-992.

Perotti, Roberto (2012), "The Effects of Tax Shocks on Output: Not So Large, but Not Small Either", *American Economic Journal: Economic Policy*, 4(2): 214-37.

Romanov, Dmitri (2006), "The corporation as a tax shelter: Evidence from recent Israeli tax changes", *Journal of Public Economics* 90 (2006), 1939-1954

Romer, Christina D., and Romer, David H. (2010), "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks", *American Economic Review*, 100(3): 763-801.

Slemrod, Joel and Yitzhaki, Shlomo (2002), "Tax avoidance, evasion, and administration", Chapter 22 in *Handbook of Public Economics*, Volume 3, Edited by A.J. Auerbach and M. Feldstein.

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

Yitzhaki, Shlomo (1974), "A note on income tax evasion: A theoretical analysis", *Journal of Public Economics*, 1974, 3(2) pp. 201-02.

Appendix 1 – Quarterly tax changes

Taxes are classified as direct and indirect taxes and fees, where direct taxes are classed in three groups: personal, corporate and other (which includes capital gains taxes, proper (real estate) taxes, and other direct taxes).

Quarter	Classification of change	Tax Change	Quarterly effect (NIS million, current prices)
1991:Q1	Indirect	Increase in VAT from 16% to 18%	150
	Indirect	Continued effect of the increase in tax on tobacco	24
	Indirect	Reduction of purchase tax	10
	Indirect	Reduction of the foreign exchange allocation levy	-10
	Personal	Imposition of a 5% immigrants absorption levy	70
	Other	Effect of the increase in VAT on non-profits and financial institutions	50
1991:Q2	Indirect	Continued effect of increase in VAT from 16% to 18%	150
	Indirect	Increase of excise on fuel	65
	Indirect	Continued effect of the reduction in purchase tax	12
	Indirect	Imposition of protective tariffs on imports from third countries in place of administrative restrictions	27.5
	Personal	Continued effect of the immigrants absorption levy	73
	Personal	Effect of accelerated depreciation on self-employed	-20
	Corporate	Imposition of tax on real interest from bonds (for corporates)	7.5
	Corporate	Reduction of the Corporate Income Tax from 42% to 41%	-17.5
	Corporate	Effect of accelerated depreciation on companies	-75
	Other	Continued effect of increase in VAT on non-profits and financial institutions	55
	Other	Purchase tax on "Build your own home" and combination transactions	2.5
	Other	Betterment tax on luxury homes	10
1991:Q3			
1991:Q4			
1992:Q1	Indirect	Increase in excise on fuels to 52% (December 1991)	50
	Indirect	Reduction of purchase tax by agreements	-20
	Indirect	Increase in purchase tax on soft drinks	25
	Indirect	Increase in tariffs as part of exposure to third countries	20
	Indirect	"Other changes"	40
	Corporate	Reduction in CIT	-20
	Fees	Broadcast frequency usage fees	17.5
1992:Q2			
1992:Q3			
1992:Q4			

1993:Q1	Indirect	Reduction of VAT from 18% to 17%	-180
	Indirect	Tariff reductions	-7.5
	Indirect	Reductions of import purchase tax	-50
	Indirect	Cancellation of travel tax and levy on imported services	-80
	Indirect	"Other changes"	-7.5
	Corporate	Effect of accelerated depreciation	247.5
	Corporate	Reduction of CIT to 39%	-35
	Other	Miscellaneous	-57.5
1993:Q2	Indirect	Continued effect of VAT reduction from the first quarter	-60
	Indirect	Cancellation of the purchase tax on soft drinks	-20
	Personal	Erosion of tax credit point value	115
1993:Q3	Indirect	Reduction of purchase tax on various products	-10
	Indirect	Cancellation of the 2% general import levy	-140
	Personal	Continued effect of the erosion of the tax credit point value	22.5
1994:Q4	Indirect	Continued effect of the reduction in purchase tax	-10
	Indirect	Continued effect of the cancellation of the general import levy	-50
1994:Q1	Indirect	Reduction of purchase tax	-20
	Indirect	Reduction of tariffs	-15
	Indirect	Reduction of import purchase tax	-22.5
	Personal	Reduction of Personal Income Tax for 1994-5. Stage 1: Cancellation of the absorption levy and the credits system that accompanied it	-125
	Corporate	Reduction of CIT	-35
	Fees	Broadcast frequency usage fees	7.5
1994:Q2			
1994:Q3	Indirect	Reduction of excise on diesel and oil	-25
1994:Q4	Indirect	Effect of the reduction of purchase tax	-130
1995:Q1	Indirect	Reduction of tariffs (exposure, trade agreement with the US)	-30
	Personal	Planned continuation of the reduction of PIT	-135
	Corporate	Effect of the reduction of employers' portion of National Insurance fees	30
	Corporate	Accelerated depreciation	-30
	Corporate	Reduction of CIT to 37%	-37.5
1995:Q2			
1995:Q3	Other	Effect of purchase tax reductions	-60
1995:Q4	Indirect	Increase in tax on cigarettes	60
	Personal	Increase in income tax ceilings	-370
1996:Q1	Indirect	Increase in tax rates on gasoline by 0.35 agorot per liter	150
	Indirect	Tariff reductions – exposure	-7.5
	Corporate	Effects of accelerated depreciation in previous years	55
	Corporate	Reduction of CIT from 37% to 36%	-42.5
	Other	Expansion of purchase tax bracket by 0.5%	-32.5

1996:Q2	Indirect	Continued effect of the increased tax on gasoline	50
1996:Q3	Corporate	Effect of reduction of employers' portion of National Insurance fees	185
1996:Q4			
1997:Q1	Indirect	Increase of excise on gasoline and reduction of excise on oil	82.5
	Indirect	Increase in tax on cigarettes	37.5
	Indirect	Purchase tax on air conditioners for vehicles	30
	Indirect	Cancellation of the input tax deduction for commercial vehicles	17.5
	Indirect	Tariff reduction – exposure	-12.5
	Personal	Increased credit to residents of the north in 1996-98	-7.5
	Personal	Non-update of tax brackets in 1997	205
	Personal	Reduction of the deduction for National Insurance payments (self-employed)	17.5
	Personal	Expanded benefit for advanced study funds for self-employed	-25
	Corporate	Cancellation of the income tax exemption for the Ports Authority and the Airports Authority	22.5
	Other	Cancellation of the purchase tax benefit for residential building at the State's initiative	15
	Fees	Increase in fines for traffic violations	25
1997:Q2	Indirect	Prohibtion of input tax deduction on ATVs and minivans	6
	Personal	Increase in the use value of commercial vehicles	20
1997:Q3	Indirect	Continued effect of the prohibition of input tax deduction on ATVs and minivans	10
	Personal	Continued effect of the increase in use value of commercial vehicles	20
1997:Q4	Indirect	Continued effect of the prohibition of input tax deduction on ATVs and minivans	2
1998:Q1	Indirect	Reduction of the exemption ceiling on air bags	15
	Indirect	Tariff reduction – exposure	-12.5
	Personal	Continued effect of not updating the tax brackets in 1997 (including self-employed)	67.5
	Personal	Expansion of advanced study funds for self-employed	-27.5
	Corporate	Increased depreciation for computers	-10
	Corporate	Effect on companies of increased value use for commercial vehicles (April 1997)	-27.5
	Fees	Increase in broadcast frequency fees	7.5
1998:Q2			
1998:Q3			
1998:Q4			
1999:Q1	Indirect	Tax reduction – exposure	-15
	Personal	Expansion of Advanced Study Fund benefit to self-employed	-27.5
1999:Q2			

1999:Q3			
1999:Q4			
2000:Q1	Personal	Reduction of the tax benefit for deductions to provident funds	12.5
	Personal	Credit point for discharged soldiers	-12.5
	Personal	15% credit for residents of Acco	-7.5
	Corporate	Effect of real estate tax reform	25
	Other	Real estate tax reform: cancellation of property tax (-1000), increase of purchase tax (450), imposition of sales tax (350), effect of betterment tax (100)	-25
	Other	Increase of the water levy	5
2000:Q2			
2000:Q3	Indirect	Reduction of purchase taxes	-109
	Personal	Continued effect of the 15% credit for residents of Acre	-10
2000:Q4	Indirect	Continued effect of purchase tax reduction	-141
2001:Q1		Taxation of controlling owners on capital gains on the stock market (amendment to the Adjustment for Inflation Conditions Law). Mainly affected companies	25
	Other	Increase of the water levy	17.5
2001:Q2			
2001:Q3	Personal	Negev Law: Credit of 5–25% for residents of the Negev from July 2001	-150
2001:Q4			
2002:Q1	Personal	Reduction of credit rates for residents of development areas	25
	Personal	0.5% levy on high-income earners	37.5
	Personal	Income tax relief for low-income earners	-20
	Corporate	Continued effect of taxation of controlling owners on capital gains in the stock market	25
	Other	Changes in real estate taxation	-75
	Fees	Traffic fine debt collection campaign	70
2002:Q2	Indirect	Increase in excise on diesel	100
	Indirect	Increase in purchase tax on cigarettes (imported and domestically manufactured)	56
	Personal	Taxation on the benefit value for cellphones	24
2002:Q3	Indirect	Increase in VAT from 17% to 18%	462
	Indirect	Continued effect of the increase in excise on diesel	100
	Indirect	Continued effect of the increase in purchase tax on cigarettes	47
	Personal	Continued effect of taxation on the benefit value of cellphones	39
	Other	Increase in VAT on non-profits and financial institutions	85
2002:Q4	Indirect	Continued effect of VAT increase	126
	Other	Continued effect of increase in VAT on non-profits and financial institutions	40

2003:Q1	Personal	Decrease in credit rates for residents of development areas	37.5
	Personal	Cancellation of the 0.5% levy on high-income earners	-37.5
	Personal	Cancellation of the tax relief for low-income earners	20
	Personal	Cancellation of the credit for a disabled parent	37.5
	Personal	First stage of PIT reduction (Rabinovich Committee)	-575
	Corporate	Effect of cancellation of the National Insurance payment ceiling and increase of employer's payments by 1%	-160
	Other	Tax on income from interest, capital gains on the stock market and income from abroad	325
	Fees	End of the traffic fine debt collection campaign	-70
	Other	Increase in the water levy	7.5
2003:Q2			
2003:Q3	Indirect	Increase in excise on oil	32
	Personal	Bringing forward the second stage of the reform in PIT from January 2004 to July 2003	-250
	Personal	Applying the second stage of the PIT reduction retroactively from January 2003	-500
	Personal	Reducing the tax exemption for the temporarily disabled	30
	Personal	Reducing the list of development communities entitled to credits	170
	Corporate	8% levy on employing foreign workers	30
	Other	25% tax on gambling and prize winnings	60
2003:Q4	Indirect	Continued effect of increase in the excise on oil	6
	Personal	End of the one-time effect of the retroactive reduction in PIT	500
	Personal	Continued effect of the reduced tax exemption for the temporarily disabled	20
	Personal	Continued effect of the reduction of the list of development communities entitled to credits	80
	Corporate	Continued effect of the 8% levy on employing foreign workers	20
2004:Q1	Personal	Income tax reduction as part of the accelerated depreciation outline	-700
	Personal	Increase of retirement age entitled to deduction	20
	Personal	Separate calculation for spouses	-90
	Corporate	Effect on income tax of the increase in excise on diesel	-25
	Corporate	Effect on income tax of cancellation of the National Insurance payment ceiling	40
	Indirect	Reduction of purchase tax on durable goods	-45
	Indirect	Cancellation of tariffs on selected food items	-7.5
	Indirect	Cancellation of stamp tax on nonconvertible bonds	-12.5
	Indirect	VAT reduction from 18% to 17%	-100
	Indirect	Increase of excise on diesel	305
	Other	Continued effect of capital gains tax	100
	Other	Effect of VAT reduction on non-profits and financial companies	-15
	Other	Mekorot water production levy	170
2004:Q2	Indirect	Continued effect of the VAT reduction	-500

	Indirect	Continued effect of the reduction of purchase tax on durable goods	-50
	Indirect	Cancellation of purchase tax on ceramic tiles, baths and iron	-50
	Other	Effect of VAT reduction on non-profits and financial companies	-70
2004:Q3	Personal	Reduction of PIT on low and middle-income earners	-325
	Personal	Retroactive application of PIT reduction from January	-650
	Corporate	Reduction of CIT from 36% to 35%	-100
	Indirect	Reduction of excise on diesel for half a year (from July)	-90
	Other	Continued effect of the VAT reduction on non-profits and financial institutions	-40
2004:Q4	Personal	Continued effect of PIT reduction (retroactive offset)	650
	Corporate	Reduction of CIT – effect of retroactive application	-200
2005:Q1	Indirect	Return of excise on diesel to NIS 0.68	90
	Indirect	Increase of purchase tax on cigarettes	95
	Indirect	Increase of tax on commercial ATVs (4x4 vehicles)	15
	Indirect	Cancellation of purchase tax on trucks	-7.5
	Indirect	Reduction of indirect taxation benefits for immigrants and returning residents	12.5
	Indirect	Reduction of stamp tax	-75
	Personal	PIT reform	-950
	Personal	Freeze in the value of credit points	75
	Personal	Cancellation of credit for spouse who is not working	112.5
	Personal	Increase in the use value of company vehicles	7.5
	Corporate	Effect on income tax of the increase in excise on diesel	-25
	Corporate	Reduction of CIT from 35% to 34%	-100
	Corporate	Effect on corporate tax of reduction in National Insurance payments	85
	Corporate	End of effect of the retroactive CIT reduction from the previous quarter	200
	Other	Continued effect of capital market tax increase	100
	Other	Imposition of salary tax on financial institutions in respect to employer contributions	62.5
	Other	Reduction of tax exemption ceiling on lottery winnings	50
	Other	Interruption of recording revenue from Mekorot water levy	-170
	Other	Increase in levy on water from private producers	20
2005:Q2	Indirect	Continued effect of the increase in tax on commercial ATVs	30
	Indirect	Continued effect of the increase in the value use of company cars	30
2005:Q3	Indirect	Increase in excise on diesel as part of the diesel arrangement	70
	Indirect	Cancellation of the input tax deduction on commercial vehicles	75
2005:Q4	Indirect	Reduction of VAT from 17% to 16.5%	-300
	Indirect	Continued effect of increase in excise on diesel	100

	Other	Cancellation of purchase tax to a ceiling of NIS 550,000 for a single home	-50
2006:Q1	Indirect	Cancellation of stamp tax	-175
	Indirect	Reduction of purchase tax on vehicles (as part of an outline)	-12.5
	Personal	Freeze in the value of credit points	75
	Personal	Reduction of PIT	-550
	Personal	Half credit point for those completing a degree	-15
	Corporate	Effect on corporate tax of increase in excise on diesel	-25
	Corporate	Effect on corporate tax of the cancellation of stamp tax	25
	Corporate	Effect on corporate tax of the reduction of National Insurance contributions	70
	Corporate	Reduction of CIT from 34% to 31%	-337.5
	Corporate	Limiting the credit for employers in Eilat	12.5
	Other	Increase in tax on the capital market – one-time revenue from theoretical sales	225
	Other	Net effect of tax changes on income from abroad	-25
2006:Q2	Other	End of one-time revenue from the capital market	-225
2006:Q3	Indirect	VAT reduction from 16.5% to 15.5%	-550
	Indirect	Increase in excise on diesel from NIS 1 to NIS 1.3, according to the diesel arrangement	70
	Other	VAT reduction on nonprofits and financial institutions	-125
2006:Q4	Indirect	Continued effect of the VAT reduction	-100
	Indirect	Continued effect of the increase in excise on diesel	100
	Other	Continued effect of the VAT reduction on nonprofits and financial institutions	-100
2007:Q1	Indirect	Reduction of purchase tax on vehicles (as part of the outline)	-25
	Personal	Reduction of income tax	-250
	Personal	Granting of credit points to those completing degrees	-7.5
	Corporate	Reduction of CIT from 31% to 29%	-225
	Corporate	Effect on income tax of increase in the excise on diesel	-25
	Corporate	Effect on income tax of the reduction in employer's National Insurance contributions	80
	Other	Effect of change in capital gains tax and tax on income from abroad	25
	Other	Change in method of charging water levy	-21.25
2007:Q3	Indirect	Increase in excise on diesel from NIS 1.35 to NIS 1.64, according to the diesel arrangement	90
	Indirect	Cancellation of purchase tax on household appliances and others	-100
	Fees	Reduction in additional licensing fee for diesel vehicles	-40.75
2007:Q4	Indirect	Continued effect of the increase in excise on fuel	130
			0
2008:Q1	Indirect	Reduction of purchase tax on vehicles	-25
	Personal	Reduction of PIT	-1150
	Personal	Update of the value of a credit point	-100

	Personal	Additional half credit point for those obtaining a Bachelor's degree	-12.5
	Personal	Increase in the use value of a company car	157.5
	Corporate	Reduction of CIT from 29% to 27%	-250
	Corporate	Effect on income tax of the reduction in National Insurance payments	50
	Corporate	Effect on income tax of excise on diesel	-25
	Other	Charging of the reduction due to the Iscar deal (reduction of goodwill)	-75
	Other	Cancellation of the employer's payroll tax at public institutions	-350
	Other	Cancellation of sales tax (from August 1, 2007)	-105
	Other	Increase in the purchase tax exemption ceiling (from August 1, 2007)	-87.5
2008:Q3	Indirect	Increase in excise on diesel from NIS 1.64 to NIS 2.06, according to the diesel arrangement	40
	Fees	Cancellation of the additional licensing fee for diesel vehicles	-16.25
2008:Q4	Indirect	Continued effect of the increase in excise on fuel	120
2009:Q1	Indirect	Reduction of purchase tax on vehicles according to the outline	-25
	Personal	Reduction of PIT	-775
	Personal	Continued effect of the credit point for those completing a degree	-12.5
	Personal	Increase in the use value of a company car	125
	Personal	Effect of Earned Income Tax Credit	-7.5
	Personal	Loss in respect of compulsory pensions	-35
	Corporate	Reduction of CIT from 27% to 26%	-137.5
	Corporate	Effect of increase in excise on diesel	-25
	Corporate	Continued effect of reduction of the employer's National Insurance contribution	25
	Corporate	Application of accelerated depreciation until May 2009	-175
	Corporate	Cancellation of the Inflationary Adjustments Law	100
	Corporate	Recognition of payroll tax payments in calculated income tax at financial institutions	-25
	Corporate	Reduction of tax on dividends from foreign companies	-25
	Corporate	Change in the Capital Investment Encouragement Law	400
2009:Q2	Indirect	Increase in tax on cigarettes	150
	Indirect	Increase in excise on fuel by NIS 0.30	100
2009:Q3	Indirect	Increase in VAT from 15.5% to 16.5%	740
	Indirect	Continued effect of increase in excise on fuel	150
	Indirect	Increase in excise on diesel from NIS 2.06 to NIS 2.44, according to the diesel arrangement	100
	Indirect	Continued effect of the tax increase on cigarettes	25
	Indirect	Green taxation reform on vehicles	70
	Indirect	Drought levy	125
	Other	Increase in VAT on financial companies	32
2009:Q4	Indirect	Continued effect of VAT	120

	Indirect	Continued effect of the increase in excise on diesel	150
	Indirect	Continued effect of green taxation and vehicle taxation	30
	Indirect	Reduction of purchase tax on vehicles and cancellation of the ABS grant	-10
	Other	Continued effect of VAT on financial companies	6
2010:Q1	Indirect	Reduction of VAT from 16.5% to 16%	-450
	Indirect	Reduction of the tariff exemption on cigarettes at duty free	50
	Indirect	Continued effect of reduction in purchase tax on cars and cancellation of the ABS grant	-15
	Indirect	Cancellation of the drought levy	-125
	Personal	Reduction on income tax	-775
	Personal	Increase in the use value of company cars	165
	Personal	Increase in the use value of cell phones	50
	Personal	Effect of Earned Income Tax Credit	-12.5
	Personal	Reduction of credit for those completing a Bachelor's degree	12.5
	Personal	Effect of compulsory pension arrangement	-35
	Personal	Cancellation of half a credit point for women	125
	Personal	Increase of credit for child care	-125
	Corporate	Reduction of corporate tax from 26% to 25%	-150
	Corporate	Continued effect of the cancellation of the Inflationary Adjustments Law	25
	Corporate	Effect of the increase in excise on diesel	-25
	Corporate	Effect of the reduction in the employer's National Insurance contribution	25
	Corporate	Cancellation of the benefit on dividends from foreign companies	25
2010:Q2			
2010:Q3	Indirect	Increase in purchase tax on cigarettes	150
2010:Q4	Indirect	Continued effect of the increase in tax on cigarettes	25
2011:Q1	Indirect	Imposition of VAT on the land for purchase groups	25
	Indirect	Increase in excise on gasoline by NIS 0.20	190
	Indirect	Increase in excise on diesel by NIS 0.20	135
	Indirect	Reduction of excise on gasoline on February 13, 2011	-90
	Indirect	Increase in carbon tax	110
	Personal	Reduction in PIT	-187.5
	Personal	Widening of the 10% PIT bracket	-35
	Personal	Increase in the use value of cell phones	50
	Personal	Increase in the use value of company cars	175
	Personal	Increase in the exempt portion of pensions	-20
	Personal	Cancellation of the recognition of lodging (travel) expenses	15
	Personal	Continued effect of compulsory pensions	-35
	Corporate	Reduction of CIT from 25% to 24%	-175
	Corporate	Effect of accelerated depreciation until May 2009	250
	Corporate	Effect of increase in excise on diesel	-12.5

	Corporate	Continued effect of the cancellation of the Inflationary Adjustments Law	25
	Other	Imposition of purchase tax on real estate purchase groups	25
2011:Q2	Indirect	Continued effect of reduction of excise on gasoline	-100
2011:Q3			
2011:Q4			
2012:Q1	Indirect	Reduction of the purchase tax grant (for polluting vehicles)	80
	Indirect	Reduction of tariffs and purchase taxes (The Trajtenberg Committee)	-187.5
	Personal	Increase in the PIT rate for the highest bracket from 44% to 48%	200
	Personal	Granting a tax credit point to fathers of children aged 0–3	-300
	Personal	Reduction of PIT for income between NIS 8,000 and NIS 14,000	-200
	Personal	Additional tax credit point for mothers of children aged 0–5	-75
	Corporate	Increase in CIT from 24% to 25%	175
	Corporate	One-time CIT refunds	-2200
	Corporate	Effect of accelerated depreciation until May 2009	150
	Corporate	Effect of the increased excise on diesel	-12.5
	Corporate	Continued effect of the cancellation of the Inflationary Adjustments Law	25
	Other	Increase of capital gains tax from 20% to 25%	325
	Other	One-time addition due to the distribution of dividends at the end of 2011, before the capital gains tax increase	3500
	Other	Reduction of the tax exemption on lottery winnings	50
2012:Q2	Corproate	Amendment to one-time corporate tax refunds	2200
	Other	Amendment to the one-time revenue from dividends	-3500
	Other	Loss due to bringing dividends forward	-600
2012:Q3	Indirect	Increase of purchase tax on cigarettes and alcohol	160
2012:Q4	Indirect	Continued effect of increase in purchase tax on cigarettes and alcohol	90
	Indirect	Increase in VAT from 16% to 17%	1100

One-off tax revenue changes

The changes are classified by the tax base that they affect

Quarter	Classification	One-time revenue (current prices)	Notes
2006:Q1	Corporate	1500	"Outlier amounts from large companies"
2006:Q2	Corporate	1500	"Outlier revenue from the banking industries" (resulting from the Bachar Committee)
2006:Q3	Corporate	3700	Iscar deal
2006:Q1	Corporate	660	Completion of the privatization of Oil Refineries Ltd.
2007:Q1	Corporate	2000	Bachar Reform transactions and outlier real estate transaction
2007:Q2	Corporate	-250	
2008:Q1	Indirect	400	Delay of refunds due to labor sanctions
2008:Q2	Indirect	-400	Realization of refunds delayed due to labor sanctions
2009:Q2	Corporate	1500	"Large purchase transaction"

Appendix 2 - The variables used in the study

All variables are of quarterly duration, unless otherwise noted. All variables denominated in shekels are stated in constant 2000 prices (in CPI terms).

ADF tests were conducted with a constant and a number of lags selected by the Schwartz Information Criterion with a maximum of 8 lags.

Tax variables – tax changes, revenues and forecasts

The source for all original variables is the Ministry of Finance and the State Revenue Administration within the ministry.

Variable	Description	Integration level	
		ADF estimate of the variable	ADF estimate of the change in the variable
Tax revenue	Total tax revenue, net of one-time income (from exceptional M&A deals and events)	-1.57	-3.88***
PIT revenue	Personal Income Tax revenue, net of one-time income	-1.76	-3.00**
CIT revenue	Corporate Income Tax revenue, net of one-time income	-1.05	-12.37***
Indirect tax revenue	Indirect tax revenue, net of one-time income	-0.40	-8.42***
Tax changes	Quarterly tax changes, as percent of the revenue in the previous calendar year	-9.81***	
Annual tax changes	Total tax changes in the current calendar year, accounting for the timing of the change. As percent of the revenue in the previous calendar year	-5.14***	
Total tax changes until now	Cumulative amount of quarterly tax changes as a percentage of total revenue from 1991:Q1 to the current quarter,	-0.73	-9.81***
PIT changes	Cumulative amount of the quarterly PIT changes as a percentage of PIT revenue in the previous calendar year	-3.92***	
CIT changes	Cumulative amount of the quarterly CIT changes as a percentage of CIT revenue in the previous calendar year	-9.20***	
Indirect tax changes	Quarterly changes in indirect taxes, as percentage of indirect tax revenue in the previous calendar year	-6.45***	

Tax revenue forecast	Forecast for total tax revenue in the current calendar year, as presented in the latest budget proposal for the current year. The forecast does not include the effect of tax changes on revenue or on activity.	-0.87	-9.29***
Income tax revenue forecast	Forecast for revenue from personal and corporate income tax in the current year, as presented in the last budget proposal. The forecast does not include the effect of tax changes on revenue or on activity.	-0.66	-9.55***
Indirect taxes revenue forecast	Forecast for the revenues from indirect taxes in the current calendar year, as presented in the latest budget proposal for the current year. The forecast does not include the effect of tax changes on revenue or on activity.	1.28	-9.55***
Tax forecast error	Errors in the annual tax revenue forecast compared to actual revenue, as a percentage of the forecast. (A negative sign indicates a forecast that was too pessimistic and a positive sign indicates a forecast that was too optimistic.)	-7.31***	
One-time tax revenue	Tax revenue in the current year that has been defined by the Ministry of Finance as “one-time”, as a percentage of revenue in the previous calendar year, from exceptional M&A deals and events	-3.06**	

Activity variables:

Variable Name	Description	Integration level		Source
		ADF estimate of the variable	ADF estimate of the change in the variable	
World Trade Index	International Monetary Fund (IMF) World Trade Index	-0.23	-5.61***	IMF
Error in world trade forecast	Forecast error in the IMF forecast for the change in the World Trade Index. The forecast error is calculated as the difference between the forecasts published by the IMF in its WEO survey in April of the previous year and the actual change in world trade in the current year. In cases when an additional tax forecast was made in Israel in mid-year, we used the WEO forecasts made in April of that year.	-3.06***		IMF
NASDAQ index	NASDAQ-100 Stock index	-1.71	-6.76***	
Number of Tourists	Number of tourists arriving in Israel	-1.11	-9.87***	CBS
GDP	Gross Domestic Product, in millions of shekels, original figure	0.30	-4.14***	CBS
Government expenditures	Expenditures by the central government	-1.98	-16.33***	BOI
Imports of consumer goods	Total Imports of consumer goods to Israel, in millions of shekels	-1.54	-4.99***	CBS
Imports of consumer goods residual	Residual of a regression in which the dependent variable is the log of consumer goods imports, and the explanatory variables are a constant and the (simultaneous) GDP. This is essentially the component of consumer goods imports that is not correlated with GDP.	-3.31**		BOI
Average Wage	Gross average wage per employee post	-2.04	-3.78***	CBS

Average wage residual	Residual of a regression in which the dependent variable is the log of the average wage, and the explanatory variables are a constant and the (simultaneous) GDP. This is essentially the component of the average wage that is not correlated with GDP.	-2.30	-3.38**	BOI
TASE Index	Tel Aviv Stock Exchange general stock index in points, quarterly average, divided by the CPI.	-1.53	-7.03***	TASE
Credit in foreign currency	Free credit in foreign currency or indexed to foreign currency (in dollar terms), multiplied by the shekel-dollar exchange rate, divided by the CPI.	-1.52	-5.80***	BOI
Foreign mergers and issuances	Mergers and issuances of Israeli firms with parties at interest abroad (hundreds of millions of shekels)	-9.49***		BOI