Cyclicality of statutory tax rates

Strawczynski, Michel

Hebrew University of Jerusalem, Dept. of Economics and School of Public Policy

2 August 2013

המכון למחקר כלכלי בישראל
על-שם מוריס פאלק בע"מ (חל"צ)
The Maurice Falk Institute for
Economic Research in Israel Ltd.

Cyclicality of Statutory Tax Rates

by

Michel Strawczynski

Discussion Paper No. 13.03

July 2013

בנין פרץ נפתלי, קמפוס האוניברסיטה העברית, הר הצופים, ירושלים 91905
The Hebrew University Campus, MT. Scopus, 91905 Jerusalem, Israel
www.falk.huji.ac.il

Cyclicality of Statutory Tax Rates

By

Michel Strawczynski[1]
Department of Economics and School of Public Policy
The Hebrew University of Jerusalem

Abstract

Most studies on cyclical fiscal policy ignore statutory taxes due to a lack of data. In this paper I build on singular data on statutory tax rates in Israel, in order to study how they are changed by the government in expansions and recessions. After differentiating between ideological (exogenous) tax changes, to those that react to the cycle (endogenous) using Romer and Romer (2010) technique, I check whether endogenous statutory tax rates are a-cyclical or counter-cyclical, as recommended by theoretical models. I found that while direct taxes are a-cyclical, indirect taxes (and in particular VAT) are changed procyclically. A pseudo-panel analysis based on the different types of taxation and a panel analysis based on indirect taxation, show that the main reason for statutory tax changes is the existence of economic crises; this explanation is stronger than economic considerations like population or expenditure growth, legal considerations like the rigidity for changing statutory taxes, and income distribution considerations like the incidence on the bottom income decile.

Key Words: Cyclicality, Statutory Taxes, Crisis.
JEL Classification Numbers: H21, H60.

The Maurice Falk Institute for Economic Research in Israel Ltd.
Jerusalem, July 2013 • Discussion Paper No. 13.03

[1] This research was supported by a grant of the Falk Institute. I am thankful to Gila Weinberger and Oren Tirosh for their help on building the database on statutory tax rates, and to Dan Kaminietzki for his excellent research assistance. Thanks to Michael Weinstock and to Shlomo Yitzhaki for their very helpful remarks, to participants at the Israel Economy Seminar and the Applied Seminar of the Hebrew University of Jerusalem, to participants at the Israel Economic Association Conference, and to participants at the Bar Ilan Economics Department.Seminar for helpful comments.

1. Introduction

As a reaction to the recent crises many O.E.C.D. countries raised tax rates as a way to cope with the high budget deficit. Figure 1 shows that the main reaction was through indirect taxation, represented by the Value Added Tax (V.A.T.).

Note that this reaction is opposite to the normative prescription by economic models. It is generally agreed that during recessions fiscal policy should be countercyclical, i.e., statutory taxes should remain constant or be lowered and expenditure increased, with a higher tolerance for increasing the deficit.[2] While almost all existing studies on cyclical policy check the reaction of expenditure and deficit, almost none of them include a test for taxes, due to lack of data on statutory tax rates.

Lane (2002) shows that fiscal policy is countercyclical in OECD countries, based on total expenditure and on expenditure composition (transfers, government consumption and investment). Gavin and Perotti (1997) show that fiscal policy is procyclical in Latin American countries, based on total expenditure and on budget deficit. Also for Israel, Strawczynski and Zeira (2007) show an improvement on counter-cyclicality after 1985, based on these two variables.

With respect to taxation, while in normative terms we would expect an a-cyclical or countercyclical policy, we frequently see that in recessions, when governments are required to reduce their deficits, they tend to raise statutory taxes; i.e., a procyclical policy. Recent examples during the world crisis are Spain, Greece and Italy. Also in Israel taxes were raised in response to the crisis. This paper will investigate whether these casual observations conform a pattern, by checking the reaction of statutory tax rates to cycles in a systematic analysis, using Israel historical data.

Two papers addressed so far the issue of cyclicality of statutory tax rates. Vegh and Vuletin (2011) performed tests on cyclicality of statutory tax rates at the sub-national level for both Argentina and the US. Their finding was puzzling: while tax rates in Argentina tend to be countercyclical, they found that in the US statutory tax rates tend to be procyclical. This result is opposite to what was found at the federal level for the expenditure side, at which developed economies are usually

[2] Constant tax rates as a reaction to the cycle has been emphasized by Barro (1979); a countercyclical policy is emphasized by Spilimbergo, Symanski, Blanchard and Cotarelli (2008).

countercyclical and emerging economies are procyclical. They also found that both in Argentina and US the higher is the influence of the federal budget on sub-national budget, the more procyclical statutory tax policy is, since at good times it becomes optimal to reduce statutory tax rates. This finding hints on a possible procyclicality in the reaction of statutory tax rates at the sub-national level, an issue that has not been studied yet at the federal level. Vegh and Vuletin (2012) checked cyclicality of statutory tax rates at the central government level, in a sample of both developed and developing countries. They found an acyclical tax policy in developed economies, and a procyclical policy in developing economies. Concerning the composition of taxes in developed economies, they found some evidence of a procyclical policy for indirect taxes.

In this paper I work on a single country, Israel, allowing me to use a broader database including many different sources of taxation. For this purpose I build on a singular data base using data on statutory tax rates during the period 1960 to 2012, covering 87 percent of tax revenues. The data covers both direct sources of taxation – income tax, corporate tax, social insurance taxes and capital taxes – and indirect taxes – V.A.T., car custom duties, housing purchase taxes and excise taxes.

In Israel the concern for fiscal deficits during recessions has been repeatedly a driving force for raising statutory tax rates. While reform of income tax rates requires discussion and approval by the parliament, indirect taxes, and in particular the V.A.T., can be amended by a decision taken by the Finance Minister. This characteristic makes this source more prone to be used as a quick reaction to the cycle. Thus, our prior hypothesis is that indirect taxation is a clear candidate for procyclicality. In order to check the plausibility of a political\ institutional explanation, I build an index that considers the complexity of the process of decision for changing the different statutory tax rates.

A well-known concern for checking cyclicality of fiscal variables is the endogeneity of these variables since they have an effect on the GDP (see Ilzetsky and Vegh, 2008, for a thorough discussion of this topic). We cope with this problem by using world trade growth as an instrumental variable for GDP growth, as shown in section 4. Another concern is related to causality: do statutory tax rates affect growth or the opposite? This issue is analyzed by using Granger causality tests.

The paper is organized as follows: in section 2 I describe the data. In section 3 I present a framework for analyzing the cyclicality of statutory tax rates, and perform a time series analysis. In section 4 I proceed by showing pseudo-panel regressions in which the different tax channels are considered as cross-section units in the analysis. Finally I summarize and conclude in section 5. The three appendices at the end show the details for building exogenous and endogenous statutory tax rates (Appendix A), Granger causality tests (Appendix B) and the long-run equations (Appendix C).

2. The Data

I collect data on nine sources of taxation, which cover 87 percent of tax revenues. The sources of direct taxation are: income tax, corporate tax, national insurance (payroll) tax, capital gains tax. The sources of indirect taxation are: V.A.T. (for consumers, non-profit organizations – NPO - and financial sector), gasoline excise tax, car tax, tobacco tax, housing purchase tax. I build an aggregate index based on all sources of taxation (STAT_TOTAL), and a direct (STAT_DIR) and indirect (STAT_IND) measure, composed by the taxes mentioned above. The weights are calculated according to the proportion of each tax on total revenues in the period 1980-2009. In table 1 I show the average weights for 2008/2009.

Figures 2 and 3 show the developments of statutory tax rates over time. The shaded areas represent recession periods, using the dates according to previous research.[3] Figure 2 refers to total taxation, and Figure 3 shows the behavior of specific channels of direct and indirect taxation.

As a general pattern, indirect taxes are raised during recessions (shadowed areas) as a way to alleviate the budget deficit that arises in these periods, following the shortfall in tax revenues as a consequence of the decline in the GDP. Since some of these changes maybe exogenous (ideological) that happened to be implemented in a particular phase of the cycle, we shall first classify taxes between exogenous (ideological) and endogenous (cyclical), using the methodology introduced by Romer and Romer (2010). Then, I will check whether procyclicality is corroborated by the

[3] Unlike the U.S. where the NBER characterizes business cycles, in Israel they have been characterized by different research papers. While there are some discrepancies among different papers, recession periods are quite similar in all of them. The figures here are based on Flug and Strawczynski (2007).

econometric analysis – which controls for relevant additional variables that explain statutory tax rates. According to Romer and Romer (2010) methodology, I look at the legislative background of each one of the changes in statutory tax rates during Israeli history. After analyzing the environment of statutory tax rates decisions I aim at understanding whether they were exogenous – i.e., motivated by ideological reasons – which are independent of economic activity; or whether they were endogenous – i.e., reacted to the economic conditions. Appendix A summarizes the changes in taxation that obey to the exogenous criteria. Endogenous changes (symbolized by including the word ENDO at the name of the relevant variable) are all other changes in statutory tax rates performed during the sample period. The next stage is to use the cyclical observations to check whether the government increases (decreases) direct or indirect taxes during recessions – thus pursuing a procyclical (countercyclical) fiscal policy. One possible claim against Romer and Romer (2010) methodology is that the timing of exogenous reforms may become endogenous. If this is the case, we shall see that exogenous changes are affected by the GDP. In appendix B I show that exogenous changes in taxes Granger-cause GDP and not the opposite, while changes in GDP Granger cause endogenous changes in indirect taxation and not the other way round.

3. Statutory Changes and Cyclicality

3.1 The Framework of the Analysis

Assume that taxes finance government expenditure:

(1) $T(Y) = t(Y)Y = G$

Where t is a statutory tax function, Y is the GDP and G symbolizes government expenditure. For simplicity let us assume that:

(2) $t(Y) = tY^{\theta}$

Where t is a (linear) statutory tax rate and θ is a parameter related to the convexity of the function, implying that the elasticity of the average statutory tax rate to GDP is higher than 1.[4] After plugging back (2) into (1) it is easy to see that T'(Y) is positive, and T''(Y) is also positive. This means that the tax system is characterized by progressivity, i.e., the higher is Y the higher is the marginal aggregate average tax rate. This characterization is in line with most basic tax modeling.

[4] The elasticity of taxes to GDP was estimated by Brender and Navon (2010).

Assume that the production function is Cobb-Douglass:

(3) $Y = AK^{\alpha}L^{1-\alpha}$

Where K symbolizes capital and L labor.

Plugging (3) and (2) in equation (1), and taking logs derives in the following equation:

(4) $\ln(t) = \ln(G) - \theta\ln(Y) - \ln A - \alpha\ln(K) - (1-\alpha)\ln(L)$

In order to test this equation I will run cointegration equations, and I will afterwards check cyclicality in the framework of the short run regression.

Since the focus of my work is to check the cyclicality of statutory tax rates, the analysis will be performed at two dimensions: first, I check the relationship between statutory tax rates and the cycle as measured by changes in the GDP; and second, I use Romer and Romer (2010) methodology which, as explained above, separates between exogenous and endogenous statutory tax changes. This classification allows me to test whether the endogenous statutory tax changes are correlated with the cycle – and in particular, whether these reactions are counter or procyclical. In Appendix B I show Granger causality tests, which reinforce the conclusion that causality goes from the cycle to endogenous indirect taxes.[5]

It is important to stress that this research concentrates in statutory tax rates, as opposed to effective tax rates. Statutory tax rates include only the official rates, ignoring deductions or exemptions, which also affect tax collection. Ideally it would be desirable to take all taxation changes into account – since some of these exemptions or deductions may have a cyclical pattern as well. However, due to lack of data I concentrate in this research on statutory tax rates only. It is worth stressing that the changes in statutory tax rates in Israel are significantly more frequent and quantitatively significant than changes in provisions related to deductions or exemptions.

3.2 Cyclicality of Direct and Indirect Statutory Tax Rates

According to the cointegration technique the first stage is to run a long-run equation of the model, which is given in equation 4, augmented to additional variables that are

[5] In order to check the consistency of the data, I also test whether exogenous taxes affect GDP. Note, however, that a full analysis of this topic merits a separate paper.

candidates for contributing to cointegration. Since the short run equation requires lags in order check possible lagged cyclical reaction, we include a symmetric structure in the long run equation, and then compute the residuals which will be used in the short run equations. As required by cointegration, all variables are I(1) using the ADF criterium. Note that the specification requires considering separately the total factor productivity (A), which is correlated to the GDP. Since I do not aim on estimating a structural version of the production function, I run a regression using measurable variables and I only use a cointegration interpretation.[6] Note also that since the main specification includes real government expenditure, the sample starts in 1988 – since quarterly data for this variable is available only since that year.

The main long-run equations are presented in Appendix C, and they corroborate cointegration at a 5 percent level of significance, using McKinnon (1991) critical variables.

Table C.1 checks the basic framework, using capital, labor and productivity together with government expenditure. The regression shows cointegration at 10 percent, with standard production function coefficients (two-thirds for labor and one-third for capital). Note also that the coefficient of total productivity is negative as expected. The next two regressions add additional variables which show that coefficients have the expected sign and cointegration is obtained at 10 percent.

Using this information I turn back to equation (4) and try to build cointegration regressions that include cyclical variables. From now on the single purpose is obtaining a significant cointegration relationship. The lagged residual of this regression will be used at the short run regression so as to check the reaction of statutory tax rates to GDP in the short run – which is the main question asked at this research.

Results on cointegration are shown in Table C.2. The use of cyclical variables contributes significantly to the regressions, especially for endogenous indirect taxes, in which cointegration is obtained at a high level of significance. While in the specification for direct taxes cointegration is not obtained at 10 percent, I will be able to cross-check the long-run relationship by looking at the significance of the lagged

[6] Estimating the effect of taxes on a consistent framework that respects a production function is beyond the present research. For a paper that studied these effects see Lavi and Strawczynski (2002).

error term at the short run regressions, which according to the Engle-Granger hypothesis shall be significant if a cointegration relationship exists.

The short-run analysis is presented in Table 2. Error terms are significant at 5 and 1 percent, corroborating the existence of cointegration. Concerning cyclicality, note that the coefficient for endogenous direct taxes is not significant; i.e., direct taxes are a-cyclical. The cycle coefficients are significant for indirect taxes – both for total indirect taxes (at 5 percent) and in particular for endogenous indirect statutory tax rates (at 1 percent). The sign of the coefficient is negative, which means that indirect tax rates are lowered during expansions and raised during recessions – i.e., a procyclical policy.

I shall mention that the tax burden of indirect taxes is higher for poor families, since a high percentage of income is spent on consumption. Given this fact, procyclicality implies an increase in the burden on the poor at the most difficult periods. Assuming an inequality averse social utility function, this result raises serious questions on the desirability of this policy, which may be dominated by short run political considerations (this feature is further investigated in the next section). In particular, it raises a question on whether there should be political restrictions on changing tax rates during recessions, contrary to what happens in reality: indirect taxes in Israel can be changed by a decision of the Minister of Finance requiring only the advice (with no further restrictions) of the Economics Committee at the parliament. A measure of the legal flexibility for changing statutory taxes is shown in the next section.

3.3. Cyclicality of Specific Taxes: V.A.T. and Gasoline

To complete the picture I tested the cyclical behavior of the specific categories of indirect taxes. In this section I present results about V.A.T. and gasoline. As before, I start with the long run analysis.

Cointegration regressions are shown in appendix table C3; in the endogenous sources of taxation there is a cointegration relationship, as corroborated by the significant ADF statistic (at 5 and 1 percent).

The regressions on cyclicality are presented in Table 3. Note that in all regressions the error correction term is significant, corroborating the cointegration relationship. The most interesting result is related to procyclicallity: both the V.A.T.

and the gasoline statutory taxes are showing a procyclical behavior, especially when we look at the endogenous statutory tax rates.

4. Adjustment of Statutory Taxes: a Pseudo-Panel Analysis

In this section I perform a pseudo-panel analysis in which the dependent variables are the average indices of taxation, and the independent variables are formed by the characteristics of the 11 categories of taxation as shown in Table 1; the sample period is based on 52 quarters in the period I.1997 until IV.2009.[7] I learned in the previous section that endogenous direct taxes are not sensible to the cycle; as a consequence of that, running standard panel regressions with all tax sources as a dependent variable derives in a low explaining power.[8] In order to learn more about statutory tax behavior I use a pseudo-panel approach, in which the value added comes from the specific characteristics of the tax sources; these characteristics are not tested in a time series analysis because of the need of considering variation among the different types of taxes. These characteristics include the elasticity of the tax base, the number of households that pay the tax, income distribution characteristics, and additional variables as described below. I collected the following data on new variables that are candidates for explaining the adjustment of tax rates:

- Macroeconomic Variables – tax rates are usually increased in difficult times; in order to pick this phenomenon I use a macroeconomic index (see Flug and Strawczynski, 2007) that incorporates inflation, government deficits, black market premium and exchange rate dissalignement and variability.[9] This index is used in order to build a dummy variable called 'crisis', which takes the value of 1 in years in which the macroeconomic index is below a threshold. Two definitions of the variable 'crisis' will be used: a) for years in which the macroeconomic index falls for more than two consecutive quarters until it comes back to its previous level (CRISIS); b) for years in which the

[7] In this analysis I use data from the expenditure survey, which is regularly available only in this period. In appendix D I extend the analysis to the period 1960q1-2011q4.

[8] In fact, in the regular panel regressions I got a low R squared and the coefficients of dlog(gdp) were not significant. For a further explanation of this point see appendix D.

[9] The formula shown in that paper (using a principal component approach) is: macro_index= 0.334*budget surplus-0.447*inflation-0.585*black market premium-0.347*overvaluation-0.475*exchange rate variability.

macroeconomic index falls for more than two consecutive quarters (CRISIS2) until it changes direction. Figure 4 shows the direct and indirect statutory average tax rate at different recession periods in Israeli economic history; these periods are all included in the variable CRISIS and CRISIS2. In five periods (73-76, 77-79, 80-82, 87-90, 2001-04 and 2008-10) there is a clear change in policy characterized by a substantial rise in indirect statutory tax rates as a way to cope with the budget deficit created during the recession. Note that for this type of tax the maximum tax rate is higher than the one at the beginning of the period. This is particularly notable at the beginning of the seventies and at the recent crisis. Additional macroeconomic variables are the level of debt and the forecasted growth at the budget (not reported in the regressions because it was not significant).

- Economic variables – I use estimates of elasticities of the different taxes (ELAST). According to economic theory (Ramsey optimal taxation) we shall expect that taxes are inversely related to the elasticity. Thus, the question is whether governments that are forced to change tax rates put some weight on efficiency issues. I use elasticities for income tax (Gruber and Saez, 2000), for corporate tax (Wolswijk, 2007), for V.A.T. (Wolswijk, 2007), for cars (Jorgensen and Dargay, 2006), for housing (Hanushek and Quigley, 1980), for gasoline (Hughes, Mintel and Sperling, 2008) and for cigarettes (Gruber, Sen and Stabile, 2002).
- Political variables – The variable ELECT picks four quarters before election; the standard argument used in the political economy literature of a populist policy would imply reducing tax rates in election periods – i.e., a negative coefficient. GOV_TIME is the de-facto term of the governments, which is supposed to be four years but in practice it lasts frequently for a shorter period. It is difficult to analyze the sign of its coefficient ex-ante: in one hand a short period may mean a weak government which may do a populist policy, but on the other hand a sudden stop of the government may impede such a policy.
- Legal Variables (LEGAL) – I build an index that considers the simplicity of changing statutory tax rates. According to the law in Israel, changing the V.A.T. requires advice from the Economic Committee at the parliament, while changing the income tax requires approval of the parliament – implying a long process. Clearly I shall expect that a shorter process implies ex-ante that

politicians are more prone to change this type of tax. After analyzing the details included in the laws, I have chosen two categories: the V.A.T., gasoline and tobacco tax rates take a value of 2, while the income tax, car taxes and the rest of taxes mentioned in table 1 take the value of 1. In times of crisis I expect a positive coefficient for the interaction between CRISIS and LEGAL: the easier is for politicians changing the statutory tax rate, the more frequent it is expected to be adjusted in crisis periods.

- Taxation Revenue Considerations – Note that when the government adjusts a tax rate the burden is concentrated on the households that form part of the tax base. An interesting question is whether the government takes into account this kind of considerations when adjusting the statutory taxes. In order to check this issue I include as an explaining variable the number of households (HOUSE_NUM) affected by the tax rate.
- Income Distribution Variables – the variable TOP10 represents the percent of the highest decile (the highest ten percent income earners) on the tax base by using data from the expenditure survey of the Central Bureau of Statistics of Israel. Thus, f.e., for V.A.T. it represents their share in consumption; for the income tax their share on wages; and for the gasoline tax their share on gasoline consumption. The variable BOTTOM40 represents the share of the lowest 40 percent income earners on the tax base.

  Finally, I add the economic cycle as an additional explaining variable and interaction terms with CRISIS.

Tables 4, 5 and 6 show the results of the pseudo-panel analysis. These results are comparable to results shown in the literature on cyclicality of fiscal policy, since similarly to those papers I cope in this table with the endogeneity issue. For this purpose I take changes in the world trade (with one and two lags) as an instrumental variable for changes in GDP. Before starting the analysis, I performed a test for the validity of the instrumental variable, as suggested by Yitzhaki and Schechtman (2004), and it turned out that it passed the test.[10]

[10] These authors show that in order to use the instrumental variable the concentration curves of the original and instrumental variables shall not cross each other, as turned out to be the case with dlog(gdp) and dlog(wt). This result implies that the use of the instrumental variable

Note that in all tables the lagged residuals are significant which means that the panel regressions satisfy the long-run relationship, and the DW statistic is at a level that allows rejecting autocorrelation.

Table 4 is the first step for extending the time series analysis of the previous section. From this table I learn that the variable CRISIS is significant for indirect taxes in general, and for total endogenous taxes. Other variables that are significant for total statutory taxes are ELECT and GOV_TIME, both with a negative sign. These results mean that in election periods and in governments that last for long periods, there is a trend to reduce taxes. A remarkable result is that among endogenous taxes, the single source that is significant at 1 percent is endogenous indirect taxation. Thus, this analysis confirms the result I obtained in the previous section – according to which indirect endogenous taxes are raised in difficult periods and reduced in good ones.

In the next tables I use the world trade as an instrument for GDP. In table 5 I perform different kinds of sensitivity analysis for analyzing the result on indirect endogenous taxation, which is the dependent variable in all the regressions that appear in this table. In the first regression I omit the variable d(macro), to avoid a possible correlation with the variable crisis. The result of procyclicality of endogenous indirect taxes remains significant. In column 2 I analyze procyclicality only in crisis periods, by looking at the interaction between changes in GDP and CRISIS. Interestingly, the coefficient is higher than in the first regression, which means that in periods of crisis there is a remarkable procyclicality. In the third regression I check whether the reaction is with a lag, and found that procyclicality is related to a lagged response to GDP. Finally, I check sensitivity to the second definition of crisis: as explained above CRISIS2 takes the value of 1 when the macro index falls for at least two consecutive quarters, and 0 otherwise. Thus, this definition is sharper in the sense that a crisis is related to a deterioration of macroeconomic management and not to its level. The result shows that the coincident coefficient of GDP is -0.66, and in periods of crisis it rises (in the same quarter) by an additional -0.52 (with 10 percent significance).

In table 6 I check whether the changes in total endogenous taxes in periods of crisis are related to other characteristics of the different taxation channels. Regression

---

(or a transformation) is clean from possible "manipulations" on the sign of the independent variable.

1 checks whether endogenous taxes are affected by the legal difficulty of changing taxes. The positive and significant result (at 10 percent) means that in times of crisis government tends to raise taxes that are easier to change; note that the coefficient is comparable to the one of regression 4 of table 4 (0.003): two thirds of the changes made in periods of crisis are done through channels that are easier to change from a legal point of view. In the next two regressions I obtained that during crisis taxes are raised for items that are elastic and with a high number of households – which allow collecting more revenues. In the last two regressions I obtained that the revenues collected in crisis affect in a similar way the bottom 40 percent and the top 10 percent of the income distribution – i.e., changes made in times of crisis are not progressive.

5. Summary and Conclusions

This paper analyzes the cyclicality of statutory tax rates in Israel, using data that covers 87 percent of tax revenues. I found that while direct taxes are a-cyclical, indirect taxes (and in particular VAT) are changed procyclically. A pseudo-panel analysis based on the different types of taxation shows that the main reason for statutory tax changes is the existence of economic crises, as opposed to economic considerations like population or expenditure growth, legal considerations like the rigidity for changing statutory taxes, and income distribution considerations like the incidence on the bottom income decile. A panel analysis for indirect sources of taxation confirms the significance of economic crises and the economic cycle as explanatory variables for adjusting indirect taxes.

A direction for further research is to check whether the pattern that I found for Israel concerning direct and indirect sources of taxation occurs also in a cross-section sample of countries, differentiating between developed and developing economies. For this purpose there is a need of collecting statutory tax rates over time. A first attempt on this direction, using annual data, was recently performed by Vegh and Vulletin (2012).

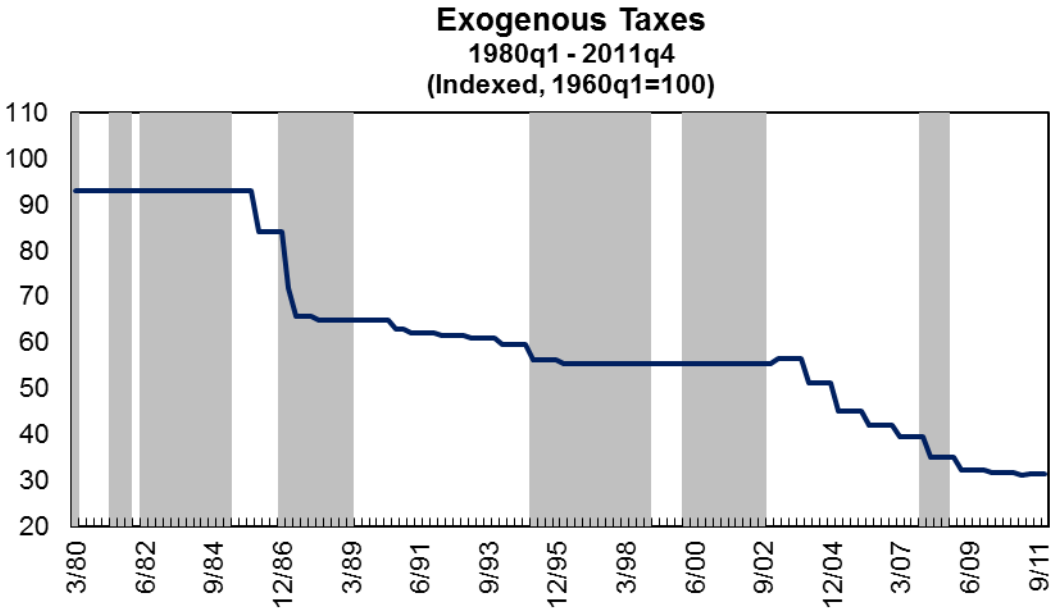
APPENDIX A – Romer and Romer Methodology

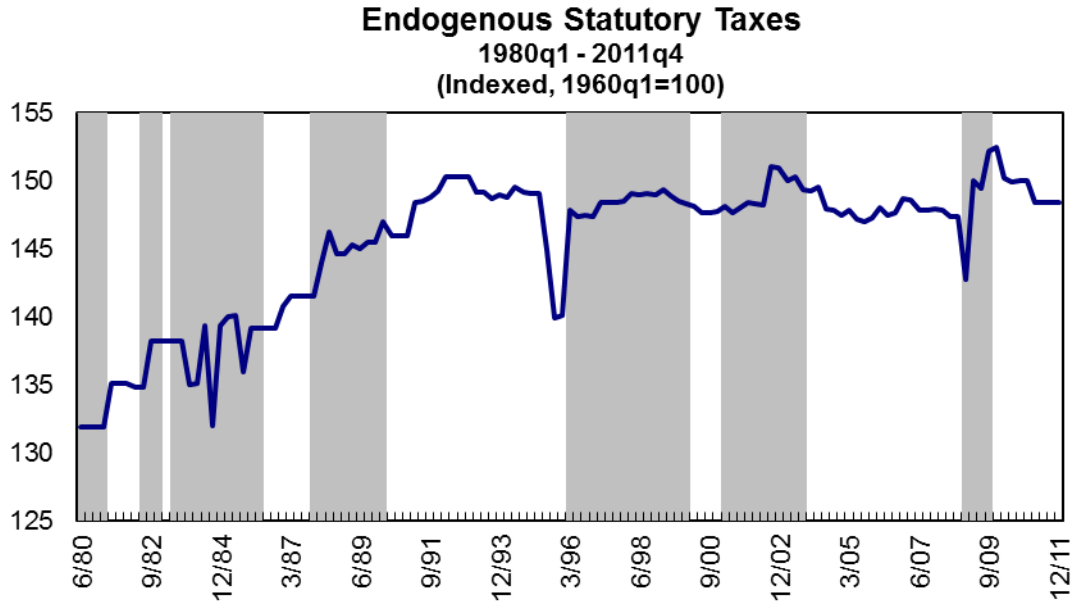
Following Romer and Romer (2010) approach, I classified the statutory tax changes into two categories: exogenous and endogenous. In order to perform this task, I analyzed the Tax Revenues Report of the Ministry of Finance and the newspapers at the time of the decision, and I looked at the explanations given by policy makers. If the change was presented as a reform or a structural change, and it was previously announced (as opposed to a decision taken close to the implemented change), the statutory change was considered as exogenous; otherwise, it is considered as endogenous.

Table A.1: Main Exogenous Tax changes in Israel

Year	Statutory Change
1964	Reduction of income taxes to low income individuals
1974	Imposition of housing purchase tax (before there existed similar taxes)
1976	Imposition of the V.A.T.
1981	Abolition of the wealth tax on housing, firms buildings, and agricultural property
1986-1988	Reduction of income and corporate taxes
1990-1994	Reduction of corporate tax
1991-1993	Reduction of car taxes
1994-1996	Reduction of income and corporate taxes, addition of a reduced tax rate for low incomes in the National Insurance contributions.
2000	Abolition of the wealth tax
2003	Imposition of the capital gains tax
2004 onwards	Reduction in income and corporate taxes
2000-2006	V.A.T. reduction
2006-2009	Reduction of car taxes
2009	Green tax reform (rise in car taxation)

The following charts show the endogenous and exogenous statutory changes in Israel. While endogenous taxes were changed in both directions, exogenous taxes were mainly reduced. From the chart it is evident that the reduction of income taxes since 2004 was exogenous. Another characteristic is that endogenous taxes were raised in the recessions (see 2001-2003 and 2009-2010).


Exogenous Taxes
1980q1 - 2011q4
(Indexed, 1960q1=100)
110
100
90
80
70
60
50
40
30
20
3/80
6/82
9/84
12/86
3/89
6/91
9/93
12/95
3/98
6/00
9/02
12/04
3/07
6/09
9/11


Endogenous Statutory Taxes
1980q1 - 2011q4
(Indexed, 1960q1=100)
155
150
145
140
135
130
125
6/80
9/82
12/84
3/87
6/89
9/91
12/93
3/96
6/98
9/00
12/02
3/05
6/07
9/09
12/11

Appendix B

I do not aim at testing the impact of exogenous taxes on GDP, which requires a separate research. However, I perform Granger Causality tests so as to analyze the classification of endogenous and exogenous taxes. I expect exogenous taxes to Granger-cause the GDP, and that the GDP Granger-causes endogenous taxes.

Granger Causality Tests (two lags)

Null hypothesis	Period	F-statistic	Result
Exogenous Statutory Taxes and GDP			
Statutory_Tax_FULL does not Granger Cause log(GDP_SA)	1960q1 - 2011q4	2.2	We **can not** reject the null hypothesis
log(GDP_SA) does not Granger Cause Statutory_Tax_FULL	1960q1 - 2011q4	0.9	We **can not** reject the null hypothesis
Statutory_tax_EXOG does not Granger Cause log(GDP_SA)	1960q1 - 2011q4	3.2*	We **can** reject the null hypothesis
log(GDP_SA) does not Granger Cause Statutory_tax_EXOG	1960q1 - 2011q4	0.9	We **can not** reject the null hypothesis
Endogenous Statutory Taxes and GDP			
dlog(Statutory_Tax_ENDO) does not Granger Cause dlog(GDP_SA)	1960q1 - 2011q4	0.9	We **can not** reject the null hypothesis
dlog(GDP_SA) does not Granger Cause dlog(Statutory_Tax_ENDO)	1960q1 - 2011q4	0.3	We **can not** reject the null hypothesis
dlog(Statutory_Tax_ENDO_INDIRECT) does not Granger Cause dlog(GDP_SA)	1960q1 - 2011q4	0.0	We **can not** reject the null hypothesis
dlog(GDP_SA) does not Granger Cause dlog(Statutory_Tax_ENDO_INDIRECT)	1960q1 - 2011q4	3.0	We **can** reject the null hypothesis
dlog(Statutory_Tax_ENDO_DIRECT) does not Granger Cause dlog(GDP_SA)	1960q1 - 2011q4	0.9	We **can not** reject the null hypothesis
dlog(GDP_SA) does not Granger Cause dlog(Statutory_Tax_ENDO_DIRECT)	1960q1 - 2011q4	0.1	We **can not** reject the null hypothesis

Results show GDP causes mainly endogenous indirect taxation.

Appendix C – Long Run Equations

Table C.1: Basic Framework

Period: 1987q2-2011q4	log(stat_ total)	log(stat_ total)	log(stat_ total)
	(1)	(2)	(3)
C	6.0	3.1	6.4
	(0.4)***	(0.3)***	(0.6)***
log(HP_ Government spending)	0.8		0.1
	(0.2)***		(0.2)
log (population)	-0.7		-0.1
	(0.2)***		(0.3)
log (capital stock)	-0.3		-0.1
	(0.1)***		(0.1)*
log (Productivity)	-1.2		-1.3
	(0.1)***		(0.1)***
HP_Gov. Sp. / GDP		1.9	
		(0.2)**	
Immigrants		0.5	0.9
		(0.3)*	(0.3)***
Log(Debt)		0.2	-0.1
		(0.04)***	(0.06)**
Gini		0.9	
		(0.3)***	
Log (FW)		-0.04	
		(0.02)**	
ıde_Partners_Income		0.02	0.02
		(0.005)***	(0.006)***
Gov_Time		-0.01	
		(0.001)***	
AdjR²	0.89	0.91	0.91
D.W.	0.6	0.9	0.9
ADF	-4.1*	-4.8*	-5.2**

Table C.2: Cyclicality of Statutory Tax Rates: Long Run Equation

Period	**1988q4 - 2011q4**					
	Dependent Variable					
	log(stat_ total)	log(stat_ dir)	log(stat_ ind)	log(stat_ endo_total)	log(stat_ endo_dir)	log(stat_ endo_ind)
	(1)	(2)	(3)	(4)	(5)	(6)
C	7.4 (0.5)***	9.8 (0.7)***	3.6 (0.8)***	4.5 (0.3)***	5.1 (0.4)***	2.6 (0.9)***
log(HP_ Government spending)	-1.1 (0.2)***	-1.1 (0.3)***	-1.0 (0.3)***	-0.5 (0.1)***	-0.2 (0.2)	-1.1 (0.2)***
log (population)	0.5 (0.2)**	-1.2 (0.3)***	3.1 (0.4)***	0.9 (0.1)***	-0.1 (0.2)	4.1 (0.6)***
log (capital stock)	0.5 (0.1)***	1.0 (0.1)***	-0.2 (0.1)*	0.06 (0.04)*	0.2 (0.05)***	-0.1 (0.1)
log (GDP)	-0.6 (0.1)***	-0.3 (0.2)**	-0.9 (0.2)***	-0.3 (0.1)***	-0.02 (0.1)	-1.5 (0.3)***
log (Debt)	-0.1 (0.04)**	-0.09 (0.06)	-0.1 (-0.07)*	-0.1 (0.03)***	-0.1 (0.03)**	-0.2 (0.08)**
log (Immigration)	0.02 (0.004)***	0.008 (0.005)	-0.04 (0.006)***	0.003 (0.002)	-0.01 (0.003)***	-0.04 (0.007)***
Gini	2.5 (0.3)***	3.8 (0.4)***	0.7 (0.5)	-0.005 (0.2)	-0.3 (0.2)	-0.5 (0.6)
Trade Partners Inc.	0.03 (0.004)***	0.02 (0.005)***	0.03 (0.006)***	0.008 (0.002)***	0.005 (0.003)	0.03 (0.006)***
AdjR²	0.96	0.96	0.86	0.40	0.83	0.84
D.W.	1.1	0.8	1.6	1.1	0.8	1.7
ADF	-5.9***	-4.7	-7.6***	-6.1***	-4.6	-8.2***

Table C.3: Specific Indirect Taxes: Long Run Equation

Period	**1988q1 - 2011q4**			
	Dependent Variable			
	log(vat)	log(gasoline)	log(vat_endo)	log(gasoline_endo)
	(1)	(2)	(3)	(4)
C	0.5 (0.8)	6.6 (2.4)***	1.8 (0.6)***	7.7 (2.4)***
log(HP_Government Spending)	-0.6 (0.3)*	0.7 (0.9)	-0.9 (0.3)***	1.6 (0.9)*
log (population)	2.2 (0.4)***	6.2 (1.3)***	2.9 (0.3)***	5.6 (1.3)***
log (capital stock)	0.002 (0.1)	0.5 (0.3)	-0.1 (0.08)*	0.3 (0.3)
log (GDP)	-0.9 (0.2)***	-5.5 (0.7)***	-0.8 (0.1)***	-5.7 (0.7)***
log (Debt)	-0.2 (0.1)**	-1.8 (0.2)	-0.2 (0.05)***	-1.8 (0.2)***
log (Immigrants)	0.03 (0.006)***	0.06 (0.02)***	0.03 (0.005)***	0.06 (0.02)***
Gini	1.5 (0.5)*** 0.02 (0.006)***	-3.4 (1.6)** 0.03 (0.02)*	-0.06 (0.4) 0.01 (0.005)***	-3.7 (1.6)** 0.03 (0.02)*
AdjR²	0.71	0.73	0.78	0.76
D.W.	0.8	1.4	0.9	1.4
ADF	-4.6	-7.0***	-5.2**	-7.1***

Table C4: Pseudo-Panel Analysis: Long Run Equation
(Standard Deviation in Parenthesis)

Period	**1997q1 - 2009q3**					
	Dependent Variable					
	log(stat_total)	log(stat_ dir)	log(stat_ind)	log(stat_ endo_total)	log(stat_ endo_dir)	log(stat_ endo_ind)
	(1)	(2)	(3)	(4)	(5)	(6)
C	5.529 (0.3)***	5.783 (0.4)***	5.322 (0.2)***	5.128 (0.1)***	4.591 (0.1)***	9.843 (0.2)***
Crisis	0.019 (0.0)***	0.018 (0.0)***	0.020 (0.0)***	0.008 (0.0)***	0.004 (0.0)***	0.006 (0.0)
log(debt)	0.500 (0.0)***	0.533 (0.0)***	0.400 (0.0)***	0.011 (0.0)*	-0.090 (0.0)***	0.653 (0.1)***
log(G)	-0.240 (0.0)**	-0.313 (0.0)***	-0.134 (0.0)***	-0.012 (0.0)	0.004 (0.0)	0.015 (0.0)
Elast	0.010 (0.0)	0.017 (0.0)	0.000 (0.0)	-0.001 (0.0)	-0.001 (0.0)	-0.002 (0.0)
log(house_ num)	-0.009 (0.0)*	-0.013 (0.0)*	-0.001 (0.0)	0.000 (0.0)	0.000 (0.0)	0.002 (0.0)
Legal	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)	0.000 (0.0)
macro_index	0.008 (0.0)*	0.016 (0.0)***	-0.005 (0.0)	-0.006 (0.0)***	-0.013 (0.0)***	0.048 (0.0)***
Elect	0.001 (0.0)	0.001 (0.0)	0.003 (0.0)	0.004 (0.0)***	-0.001 (0.0)	0.030 (0.0)***
top10	0.101 (0.1)	0.170 (0.1)*	-0.013 (0.0)	-0.010 (0.0)	-0.008 (0.0)	-0.029 (0.0)
bottom40	0.083 (0.0)	0.145 (0.1)*	-0.013 (0.0)	-0.009 (0.0)	-0.007 (0.0)	-0.026 (0.0)
gov_time	-0.012 (0.0)***	-0.016 (0.0)***	-0.005 (0.0)***	0.000 (0.0)**	0.001 (0.0)***	0.004 (0.0)***
log(GDP)				-0.004 (0.0)	0.054 (0.0)***	-0.401 (0.0)***
AdjR^2	0.90	0.88	0.84	0.45	0.91	0.84
D.W.	0.9	0.9	1.1	0.9	0.8	1.1

APPENDIX D – Panel Analysis of Indirect Endogenous Tax Rates

I have shown that endogenous direct and indirect tax rates behave differently against the cycle. Thus, running unconstrained panel analysis results in insignificant behavior against the cycle and in a low R squared.

Thus, in this appendix I build a panel analysis that is based only on endogenous indirect tax rates; i.e., the dependent variable is formed by the seven categories of indirect taxation as shown in Table 1. Note that in a panel analysis taxation sources are not independent, and thus a correction for the cointegration framework is needed, along the lines of Pesaran (2006). In order to enrich the historical analysis I choose all possible independent variables that go back to 1961q1.

I then run a long run panel equation, first assuming that taxes are independent (see equation 1), and then correcting for dependence using the methodology suggested by Pesaran (2006) – see equation 2. This correction requires adding the average values of the dependent variable and independent variables, as explained by Eberhardt and Bond (2009).

After obtaining the long run relationships I run short run equations that include the change in the same variables, including 2 lags, and the residual with one lag.

Table D.1 shows the long-run regressions with the Im, Pesaran and Shin (IPS) W statistic, which turned to be significant at 1 percent.

Table D.2 shows the short run regressions. The lagged residual is significant. Note also that the crisis dummy is significant at 1 percent, and that the coefficient that testifies about procyclical policy continues to be significant in this analysis.

Table D.1: Panel Analysis for Endogenous Indirect Taxes – Long Run Equation

Period	**1961q2 - 2011q4**		**1827 Observations**	
	Dependent Variable			
	log(endo-genous indirect)	log(endo-genous indirect)	log(endo-genous indirect)	log(endo-genous indirect)
	(1)	(2)	(3)	(4)
C	2.1 (0.2)***	2.1 (0.04)***	2.1 (0.2)***	2.1 (0.04)***
Crisis	-0.1 (0.004)***	0.0 (0.0)		
Crisis2			-0.04 (0.004)***	0.004 (0.001)***
log (Debt)	0.08 (0.009)***	-0.03 (0.004)***	-0.1 (0.009)***	-0.03 (0.004)***
Macro Index	0.002 (0.002)	-0.03 (0.004)***	-0.005 (0.002)*	-0.03 (0.004)***
log (GDP)	0.3 (0.03)***	-0.03 (0.008)***	0.3 (0.03)***	-0.02 (0.004)***
log (world Trade)	-0.04 (0.02)*	-0.02 (0.004)***	-0.05 (0.02)**	-0.02 (0.004)***
Trade Partners Income	-0.02 (0.003)***	0.02 (0.03)***	-0.01 (0.003)***	0.02 (0.03)***
War	0.007 (0.008)	--0.03 (0.003)***	0.02 (0.008)***	--0.03 (0.003)***
Average Independent		0.5 (0.002)***		0.6 (0.002)***
Average Dependent		0.4 (0.06)***		0.4 (0.06)***
AdjR²	0.85	0.99	0.85	0.99
D.W.	0.1	0.1	0.1	0.1
W Statistic (IPS)	-3.8***	-5.1***	-3.8***	-5.5***

Table D.2: Panel Analysis for Endogenous Indirect Taxes – Short Run Equation (1)

Period	**1962q1 - 2011q4**		**1800 Observations**	
	Dependent Variable			
	dlog(endogenous indirect)	dlog(endogenous indirect)	dlog(endogenous indirect)	dlog(endogenous indirect)
	(1)	(2)	(3)	(4)
C	0.002	0.002	0.006	0.006
	(0.001)	(0.001)	(0.1)***	(0.1)***
Crisis	0.01	0.01		
	(0.001)***	(0.001)***		
Crisis2			0.003	0.003
			(0.0016)**	(0.0016)*
dlog (Debt)	-0.09	-0.04	-0.06	0.002
	(0.03)***	(0.03)	(0.003)**	(0.03)
d(Macro Index)	-0.005	-0.006	-0.005	-0.008
	(0.003)*	(0.003)**	(0.003)*	(0.003)***
dlog (GDP)	-0.07	-0.06	-0.08	-0.08
	(0.03)**	(0.03)**	(0.03)***	(0.03)***
dlog (world Trade)	-0.06	-0.06	-0.07	-0.07
	(0.03)*	(0.03)*	(0.03)**	(0.03)**
d(Trade Partners Income)	-0.0004	-0.0001	0.0008	0.0005
	(0.0)	(0.0)	(0.0009)	(0.001)
War	-0.01	-0.01	-0.01	-0.01
	(0.003)***	(0.003)***	(0.003)***	(0.003)***
War(-1)	0.01	0.01	0.01	0.02
	(0.003)***	(0.003)***	(0.003)***	(0.003)***
Residual(-1)	-0.02	-0.1	-0.03	-0.2
	(0.007)***	(0.005)***	(0.006)***	(0.05)***
AdjR²	0.06	0.06	0.05	0.04
D.W.	1.9	1.9	1.9	1.9

(1) All the regressions includes one and two lags of dlog(gdp), dlog(world trade) and d(trade partners income).

References

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

Bender, A. and G. Navon (2010), "Predicting Government Tax Revenues and Analyzing Forecast Uncertainty", *Israel Economic Review*, vol. 7 No 2, 81-111.

Eberhardt, M. and S. Bond (2009), "Cross-section dependence in nonstationary panel models: a novel estimator", Nordic Econometric Conference, Lund (available at the internet).

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

Flug K. and M. Strawczynski (2007), "Macroeconomic Policy and Growth accelerations in Israel", Bank of Israel Economic Review (Hebrew).

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

Gavin M. and R. Perotti (1997), "Fiscal policy in Latin America", *NBER Macroeconomics Annual*, vol. 12, 11-71.

Gruber, J. and E. Saez (2000), "The elasticity of taxable income: evidence and implications", NBER Working Paper No. 7512.

Gruber J., A. Sen and M. Stabile (2002), "Estimating price elasticities when there is smuggling: the sensitivity of smoking to price in Canada", NBER Working Paper No 8962.

Hanushek E. and J. Quigley (1980), "What is the price elasticity of housing demand?", The Review of Economics and Statistics, vol. 62, No. 3, 449-454.

Hughes, J. E., C.P. Knittel and D. Sperling (2008), "Evidence of a shift in the short run price elasticity of gasoline demand", manuscript.

Ilzetzki E. and C. Vegh (2008), "Procyclical Fiscal Policy in Developing Countrues: truth or fiction", manuscript, University of Maryland, June 20.

Jorgensen F. and J. Dargay (2006), "Inferring price elasticities of car use and moral costs of driving without a licence", Oxford University Centre for the environment, Working Paper No. 1019.

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

Lavi Y. and M. Strawczynski (2002): "Policy variables and growth: evidence from Israel", *Applied Economics Letters*, 9:2, 81-86.

MacKinnon, J. G. (1991), "Critical values for cointegration tests," Chapter 13 in Long-Run Economic Relationships: Readings in Cointegration, ed. R. F. Engle and C. W. J. Granger. Oxford, Oxford University Press.

Pesaran, H. (2006), "Estimation and Inference in Large Heterogeneous Panels with a Multifactor Error Structure", *Econometrica* 74 (4), 967-1012.

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

Smets F. and R. Wouters (2007), "Shocks and frictions in US business cycles: a Bayesian DSGE approach", *American Economic Review*, vol. 97 (3), 586-606.

Spilimbergo, Symansky, Blanchard and Cottarelli (2008), "Fiscal Policy for the crisis", IMF Staff Position Note, December.

Strawczynski and Zeira (2007), "Cyclicality of fiscal policy in Israel", Israel Economic Review.

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

Vegh, C. and G. Vuletin (2011), "How do federal transfers systems affect fiscal policy cyclicality at the sub-national level?", manuscript.

Vegh, C. and G. Vuletin (2012), "How is tax policy conducted over the business cycle?", NBER Discussion Paper.

Wolswijk G. (2007), "Short and long-run tax elasticities: the case of Netherlands", European Central Bank Working Paper No. 763.

Yitzhaki, S. and E. Schechtman (2004), "The Gini Instrumental Variable, or the "double instrumental variable" estimator", *International Journal of Statistics*, Vol. LXII, no 3, 287-313.

Figure 1: Number of OECD Countries That Changed Statutory Tax Rates During the Crisis (between 2008 and 2012)

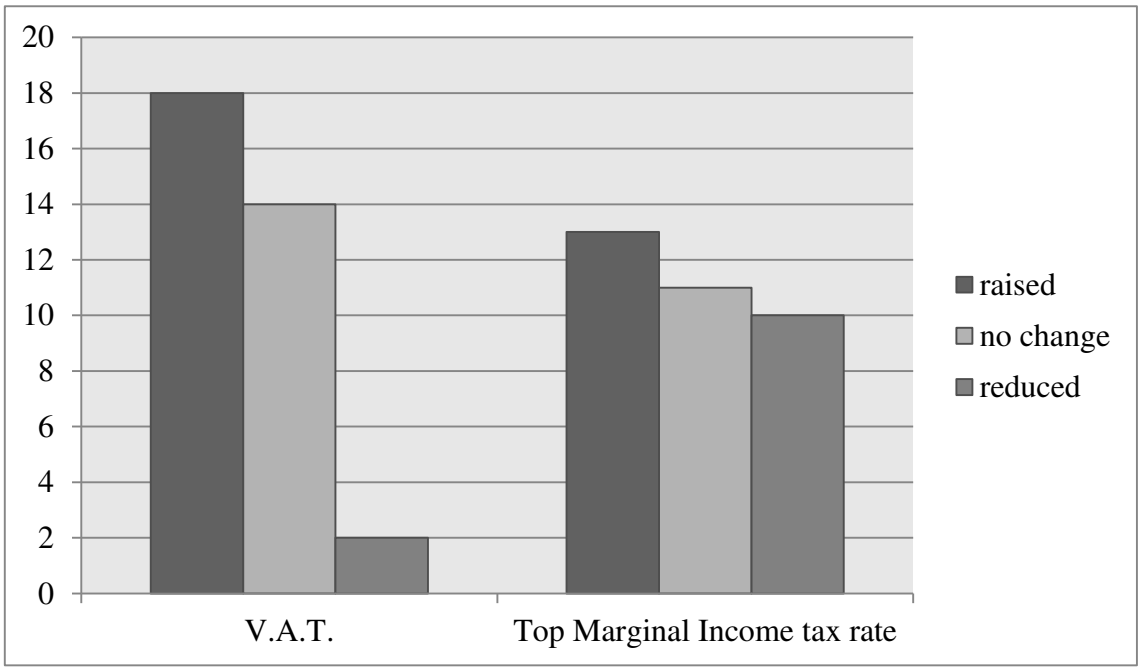


Figure 2: Average Statutory Tax Rate and Business Cycles (Shadowed Areas Represent Recessions)

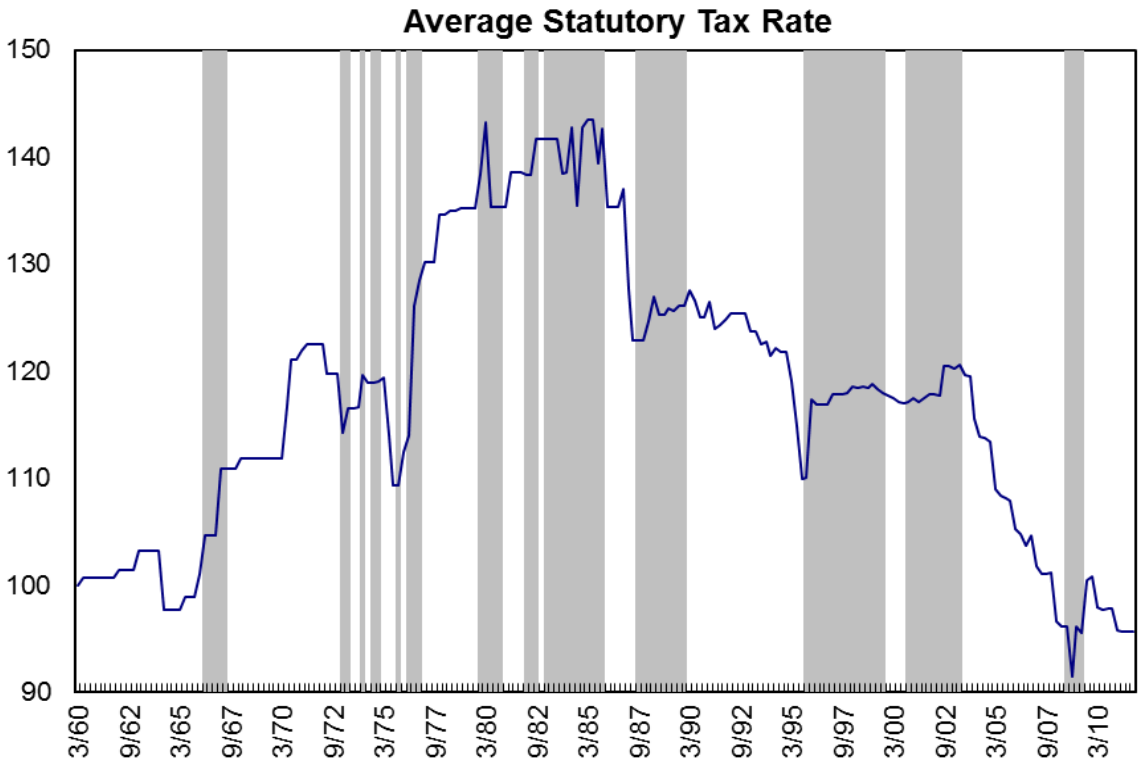
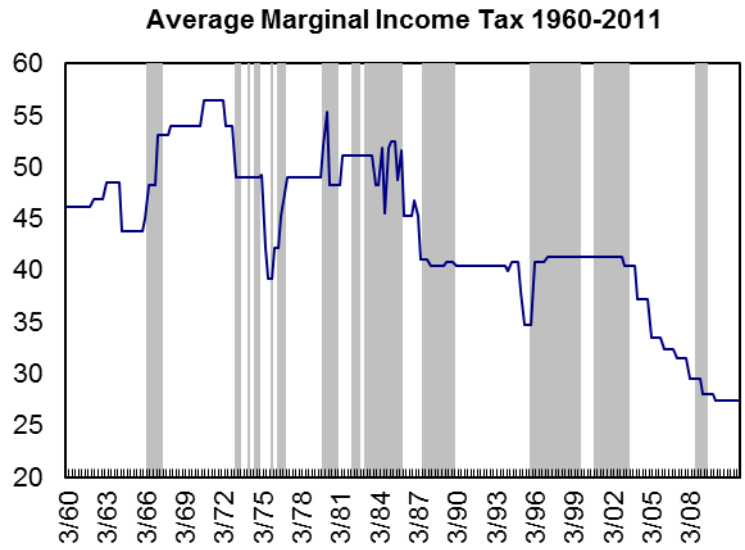
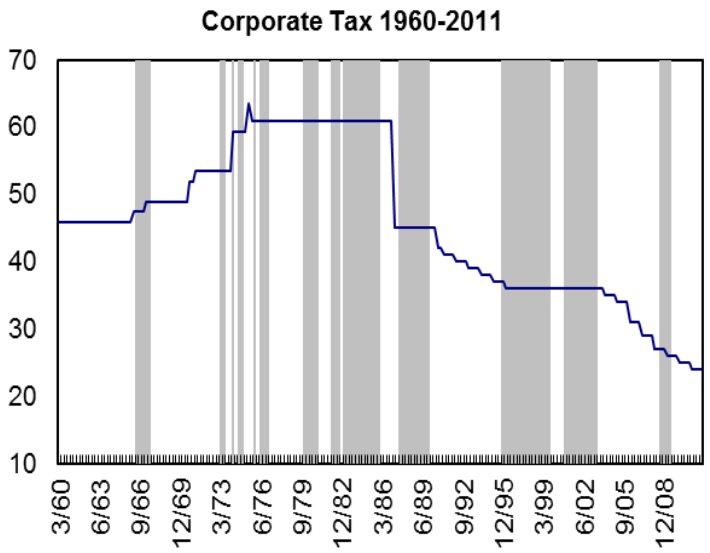
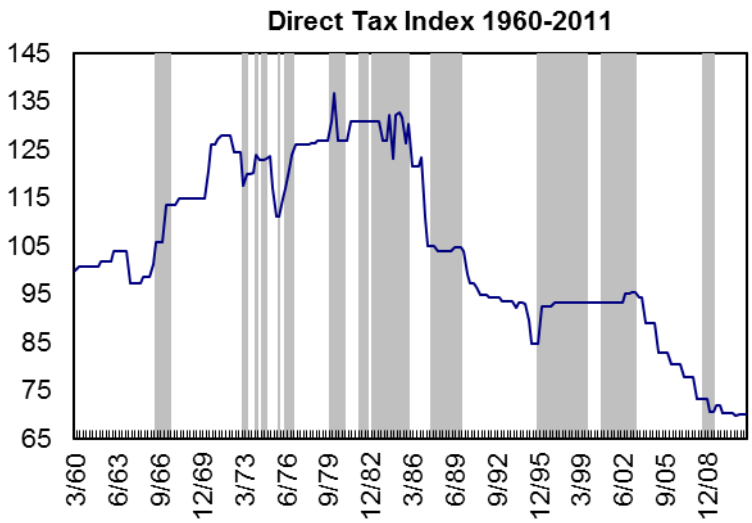
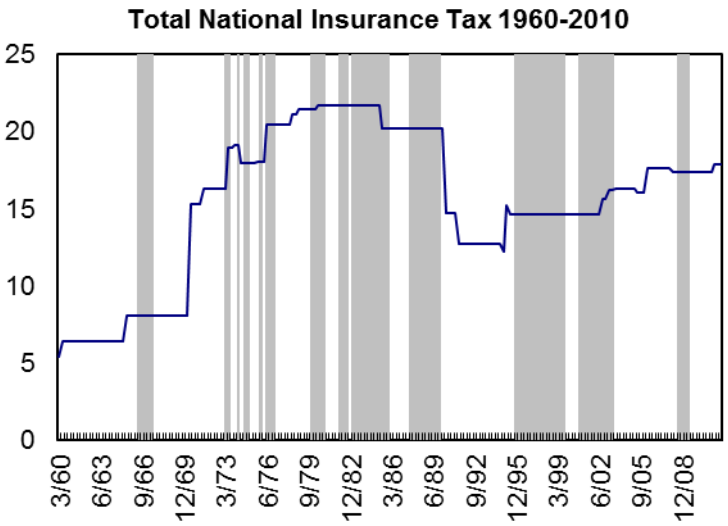


Figure 3: Specific Statutory Tax Rates and Business Cycles
(Shadowed Areas Represent Recessions)

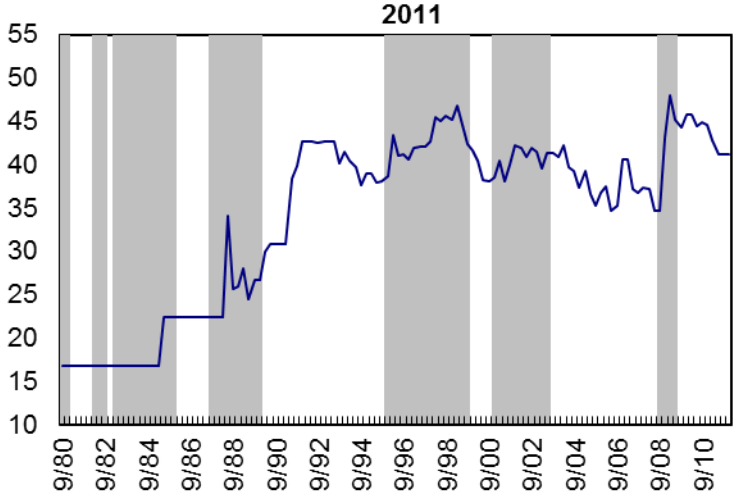




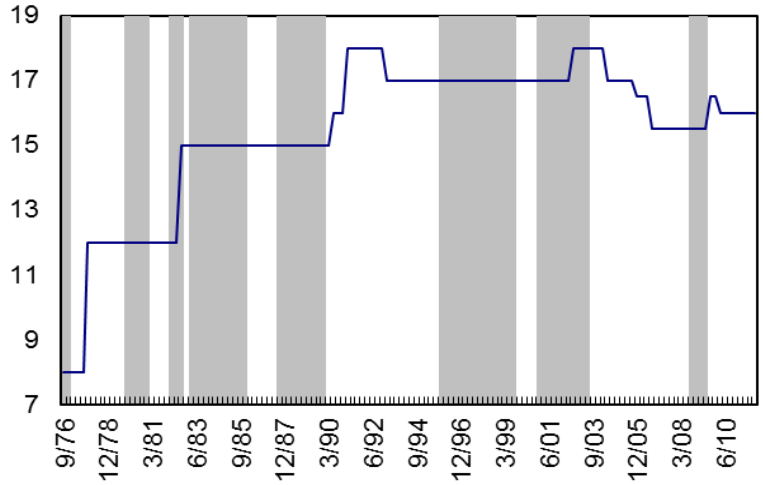




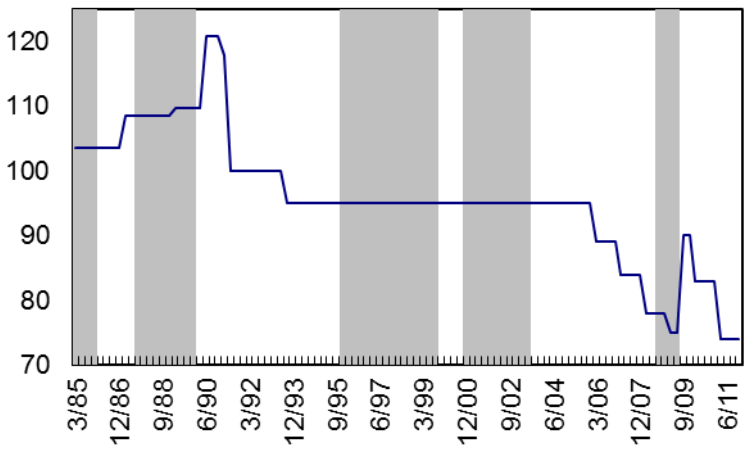
Weighted tax rate of gasoline and diesel 1980-2011



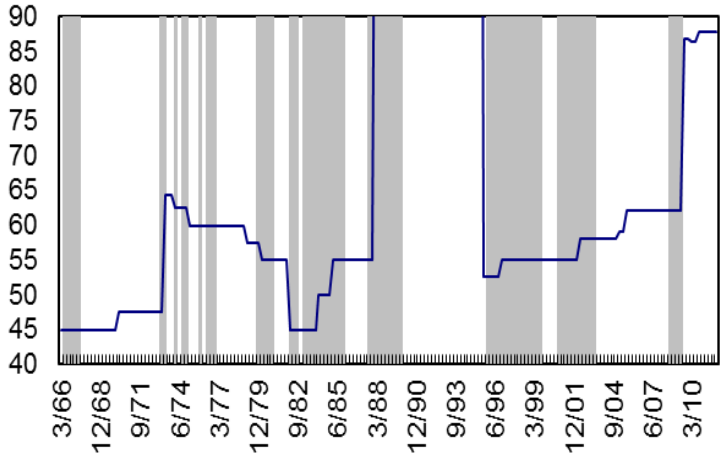
V.A.T. tax rate 1976-2011



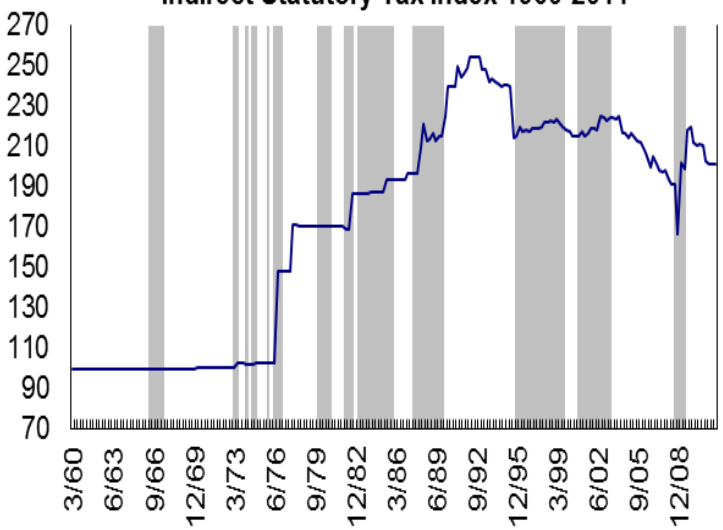
Car Tax 1985-2011



Tax on Tobacco 1966-2011



Indirect Statutory Tax Index 1960-2011



Housing Taxes 1960-2011

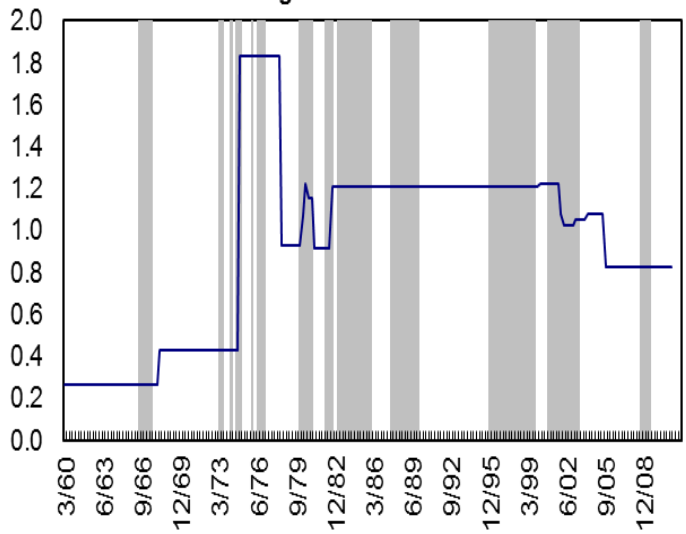


Figure 4: The Reaction of Statutory Taxes During Recessions

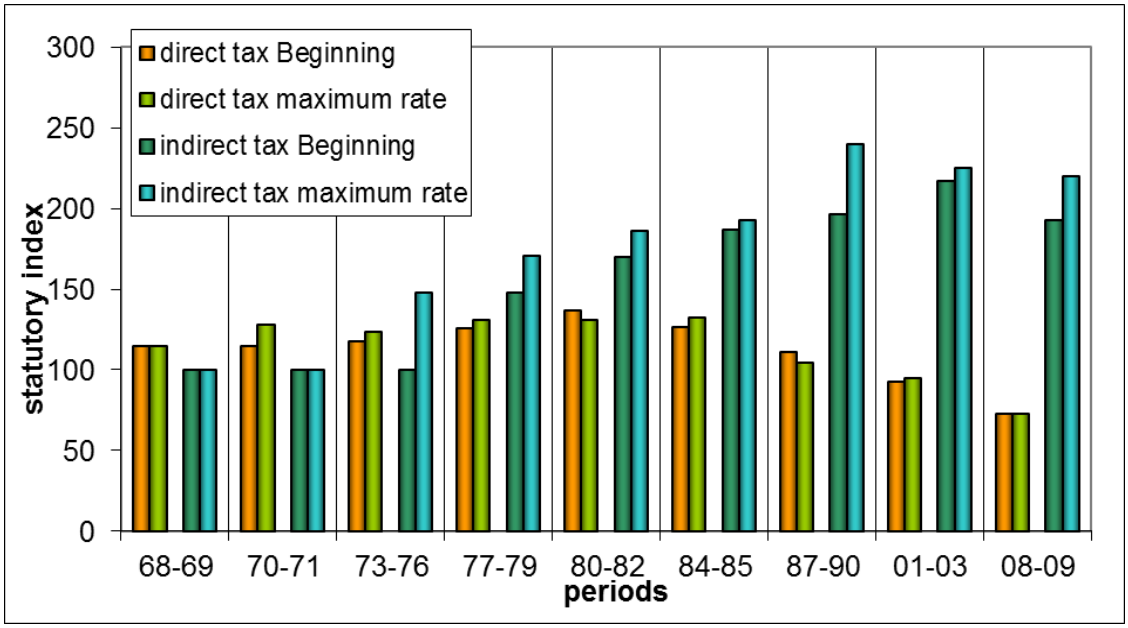


Table 1: The Weights of the Different Taxes

	Tax Revenues (% of GDP)	**Weight (%)**
Total Direct Taxes	**14.95**	**59.79**
Income tax	6.00	28.35
Corporate tax	3.25	12.98
National Insurance	5.4	17.18
Capital gains	0.3	1.27
Total Indirect Taxes	**12.76**	**40.21**
V.A.T. for consumers	8.00	25.66
V.A.T. for Non Profit Organizations	0.98	2.89
V.A.T. for financial institutions	0.28	0.87
Gasoline Tax	2.04	4.85
Car Tax	0.96	3.59
Tobacco Tax	0.1	0.65
Housing Taxes	0.4	1.71
Total	**27.71**	**100**

Table 2: Cyclicality of Statutory Tax Rates

Period	**1988q1 - 2011q4**					
	Dependent Variable					
	dlog (stat_ total)	dlog(stat_ dir))	dlog(stat_ ind))	dlog (stat_ endo_total)	Dlog (stat_ endo_ dir)	dlog (stat_ endo_ ind))
	(1)	(2)	(3)	(4)	(5)	(6)
C	-0.0	-0.0	-0.01	-0.0	0.0	-0.0
	(0.0)	(0.0)	(0.01)	(0.0)	(0.0)	(0.0)
dlog (HP_Gov.Sp.)	-0.7	-0.7	-0.2	-0.8	-0.6	-1.2
	(0.8)	(1.0)	(1.5)	(0.5)	(0.6)	(1.5)
dlog (population)	1.0	-0.9	4.3	1.0	-0.4	4.0
	(0.8)	(0.9)	(1.4)***	(0.5)**	(0.5)	(1.4)***
dlog (capital stock)	0.5	0.8	-0.3	0.1	0.3	-0.1
	(0.3)	(0.4)**	(0.6)	(0.2)	(0.2)	(0.6)
dlog (GDP))	-0.2	-0.04	-0.5	-0.1	-0.0	-0.7
	(0.1)*	(0.1)	(0.2)**	(0.07)*	(0.0)	(0.2)***
d (Debt)	0.002	0.0005	0.004	-0.00	-0.0	0.0
	(0.002)	(0.002)	(0.003)	(0.0)	(0.0)	(0.0)
dlog (Immigr.)	0.01	0.005	0.02	0.0	-0.0	0.02
	(0.004)	(0.006)	(0.008)*	(0.0)	(0.0)*	(0.008)**
d(Gini)	1.4	2.1	-0.04	0.8	0.8	0.7
	(1.0)	(1.2)*	(1.8)	(0.6)	(0.7)	(1.9)
d(Trade_Par-tners_Income)	0.01	0.01	0.02	0.006	0.002	0.01
	(0.003)***	(0.004)*	(0.01)***	(0.002)***	(0.002)	(0.006)***
Residuals (-1)	-0.4	-0.3	-0.7	-0.5	-0.4	-0.7
	(0.1)***	(0.1)***	(0.1)***	(0.1)***	(0.1)***	(0.1)***
AdjR²	0.26	0.15	0.37	0.28	0.16	0.23
D.W.	1.9	1.8	2.1	1.9	1.8	2.2

Table 3: Cyclicality of Specific Indirect Taxes

Period	**1988q1 - 2011q4**			
	Dependent Variable			
	dlog(vat))	dlog(gasoline))	dlog(vat_endog))	dlog(gasoline_endog))
	(1)	(2)	(3)	(4)
C	-0.0	-0.0	-0.0	-0.0
	(0.0)	(0.0)	(0.0)	(0.0)
dlog(HP_Gov. Sp.)	-0.3	-0.9	1.1	0.0
	(1.0)	(0.9)	(2.6)	(2.8)
dlog (population)	2.9	3.3	3.4	2.3
	(1.0)***	(0.9)***	(2.6)	(2.7)
dlog (capital stock)	0.03	-0.2	-0.3	0.2
	(0.4)	(0.4)	(1.1)	(1.2)
dlog (GDP))	-0.3	-0.4	-1.0	-0.8
	(0.1)**	(0.1)***	(0.5)**	(0.5)*
d (Debt)	0.0	-0.0	-0.0	-0.0
	(0.0)	(0.0)	(0.0)	(0.0)
dlog (Immigrants)	0.0	0.0	0.0	-0.0
	(0.0)	(0.0)	(0.0)	(0.0)
d(Gini)	0.4	-0.2	0.0	4.8
	(1.2)	(1.1)	(0.0)	(3.4)
d(Trade Partners Income)	0.0	0.0	0.0	0.0
	(0.0)	(0.0)	(0.0)	(0.0)
Residuals (-1)	-0.3	-0.4	-0.3	-0.3
	(0.1)***	(0.1)***	(0.1)***	(0.1)***
AdjR²	0.25	0.32	0.16	0.18
D.W.	2.1	2.0	2.0	1.9

Table 4: Cyclicality of Statutory Tax Rates: Panel Analysis (1)
(Standard Deviation in Parenthesis)

Period	**1997q3 - 2009q3**					
	Dependent Variable					
	dlog(stat_ total)	dlog(stat_ dir)	dlog(stat_ ind)	dlog(stat_ endo_total)	dlog(stat_ endo_dir)	dlog(stat_ endo_ind)
	(1)	(2)	(3)	(4)	(5)	(6)
C	0.017	0.021	0.008	0.001	-0.001	0.007
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Crisis	0.000	-0.007	0.008	0.003	0.002	0.005
	(0.0)	(0.0)**	(0.0)***	(0.0)***	(0.0)*	(0.0)*
dlog(debt)	0.142	0.241	0.023	-0.065	-0.079	0.024
	(0.1)*	(0.1)**	(0.1)	(0.0)**	(0.0)***	(0.0)
dlog(G)	-0.049	-0.004	-0.116	-0.031	-0.019	-0.080
	(0.0)***	(0.0)	(0.0)***	(0.0)***	(0.0)***	(0.0)***
dlog(house_ num)	-0.015	-0.022	0.023	0.013	0.018	-0.038
	(0.1)	(0.1)	(0.1)	(0.0)	(0.0)	(0.1)
d(macro_ index)	0.022	0.030	0.060	-0.007	-0.008	0.000
	(0.0)***	(0.0)***	(0.0)	(0.0)***	(0.0)***	(0.0)
Elect	-0.009	-0.010	-0.007	0.003	0.001	0.011
	(0.0)***	(0.0)**	(0.0)*	(0.0)**	(0.0)	(0.0)***
gov_time	-0.001	-0.001	0.000	0.000	0.000	0.000
	(0.0)***	(0.0)***	(0.0)	(0.0)	(0.0)	(0.0)
Residuals (-1)	-0.199	-0.149	-0.388	-0.327	-0.098	-0.295
	(0.0)***	(0.0)***	(0.1)***	(0.0)***	(0.0)***	(0.0)***
dlog(GDP)	-0.243	-0.245	-0.205	-0.035	0.029	-0.265
	(0.1)***	(0.1)**	(0.1)*	(0.0)	(0.0)	(0.1)***
AdjR²	0.17	0.18	0.22	0.28	0.24	0.25
D.W.	1.8	2.1	1.6	1.7	1.9	2.1

1) The regression includes the variables ELAST, LEGAL, TOP10 and BOTTOM40, which were not significant and are not reported for space considerations.

Table 5: Endogenous Indirect Taxes During Crisis (1)
(Standard Deviation in Parenthesis)

Period	**1997q2 - 2009q3**			
	Dependent Variable			
	d(log(stat_ endo_ind))	d(log(stat_ endo_ind))	d(log(stat_ endo_ind))	d(log(stat_ endo_ind))
	(1)	(2)	(3)	(4)
C	0.014 (0.0)	-0.003 (0.0)	-0.018 (0.0)	0.006 (0.0)
Crisis	-0.002 (0.0)	0.008 (0.0)**	0.008 (0.0)	
crisis2				-0.002 (0.0)
dlog(debt)	0.157 (0.1)	0.182 (0.2)	0.663 (0.3)*	0.208 (0.1)*
dlog(G)	-0.125 (0.0)***	-0.128 (0.0)***	-0.175 (0.0)***	-0.127 (0.0)***
dlog(house_num)	-0.005 (0.1)	-0.065 (0.1)	-0.082 (0.1)	-0.004 (0.1)
Elect	0.007 (0.0)*	0.012 (0.0)***	0.017 (0.0)***	0.009 (0.0)*
top10	-0.016 (0.0)	-0.007 (0.0)	-0.010 (0.0)	-0.015 (0.0)
bottom40	-0.016 (0.0)	-0.009 (0.0)	-0.011 (0.0)	-0.013 (0.0)
gov_time	0.000 (0.0)	0.000 (0.0)	0.001 (0.0)	0.000 (0.0)
Residuals (-1)	-0.268 (0.0)***	-0.281 (0.0)***	-0.402 (0.1)***	-0.329 (0.1)***
dlog(GDP)	-0.756 (0.2)***		-0.266 (0.2)	-0.661 (0.2)***
dlog(GDP)*(crisis)		-0.822 (0.3)**	-0.672 (0.7)	
dlog(GDP(-1))			0.778 (0.2)***	0.149 (0.1)
dlog(GDP(-1)* (crisis(-1))			-0.952 (0.3)***	
dlog(GDP)*(crisis2)				-0.521* (0.3)
dlog(GDP(-1)* (crisis2(-1))				0.152 (0.3)
AdjR²	0.18	0.16	0.11	0.20
D.W.	2.2	2.3	2.1	2.1

(1) Using the world trade with one and two lags as an instrumental variable for the GDP and past values (with two lags) as instrumental variables for the debt and for government spending ; the regression includes the variables ELAST and LEGAL, which were not significant and are not reported for space considerations.

Table 6: Legal, Economic and Income Distribution Considerations During Crisis (1)
(Standard Deviation in Parenthesis)

Period	**1997q2 - 2009q3**				
	Dependent Variable				
	dlog(stat_endo_total))	dlog(stat_endo_total)	dlog(stat_endo_total)	dlog(stat_endo_total)	dlog(stat_endo_total)
	(1)	(2)	(3)	(4)	(5)
C	0.004 (0.0)	0.004 (0.0)	0.007 (0.0)	0.005 (0.0)	0.006 (0.0)
dlog(DEBT)	-0.020 (0.0)	-0.065 (0.0)**	-0.069 (0.0)**	-0.005 (0.0)*	-0.060 (0.0)**
dlog(G)	-0.037 (0.0)***	-0.038 (0.0)***	-0.037 (0.0)***	-0.037 (0.0)***	-0.038 (0.0)***
d(macro_index)	-0.006 (0.0)**	-0.006 (0.0)***	-0.007 (0.0)***	-0.006 (0.0)***	-0.006 (0.0)***
Elect	0.000 (0.0)	0.006 (0.0)	0.001 (0.0)	0.001 (0.0)	0.001 (0.0)
Residuals (-1)	-0.040 (0.0)***	-0.043 (0.0)***	-0.004 (0.0)***	-0.041 (0.0)***	-0.043 (0.0)***
dlog(GDP)	-0.101 (0.0)***	-0.089 (0.0)***	-0.087 (0.0)***	-0.092 (0.0)***	-0.090 (0.0)***
crisis*legal	0.002 (0.0)*				
crisis*elast		0.004 (0.0)***			
crisis*house_num			0.000 (0.0)***		
crisis*bottom40				0.011 (0.0)***	
crisis*top10					0.010 (0.0)***
AdjR²	0.21	0.23	0.24	0.22	0.23
D.W.	2.1	2.1	2.1	2.1	2.1

(1) Using the world trade with one and two lags as an instrumental variable for the GDP, and past values (with two lags) as instrumental variables for the debt and for government spending; the regression includes the variables ELAST, LEGAL, dlog(HOUSE_NUM), GOV_TIME, TOP10 and BOTTOM40, which were not significant and are not reported for space considerations.