Output effects of a measure of tax shocks based on changes in legislation for Portugal[*]

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Abstract

This paper develops a new measure of quarterly discretionary tax shocks for Portugal resulting from changes in legislation, following the narrative approach. A comprehensive analysis of tax policy measures in the period 1996-2012 was undertaken. The findings point to strongly negative and persistent effects of legislated tax increases on GDP and private consumption, matching the tendency of the narrative approach to yield comparatively high tax multipliers.

Keywords: fiscal policy, tax shocks, macroeconomic stabilization

JEL codes: E62, E32

1

1 Introduction

The interaction between fiscal policy and economic activity is a recurrent topic of economic research. In a period when large fiscal policy shifts have been enacted both in Europe and in the US, in the aftermath of the financial and sovereign debt crisis, this topic remains fully relevant. This is particularly so for Portugal, as the country is facing a significant fiscal tightening under the Economic and Financial Assistance Program while, at the same time, a consensus has been reached that economic growth is of paramount importance in facing the fiscal sustainability challenges ahead.

There is an open discussion about the size of tax multipliers, i.e. the impact on economic activity of each euro of shift in taxes. The difficulties in measuring these multiplier effects stem firstly from the two-folded character of the relationship between taxes and GDP, as not only changes in taxes have an impact on economic activity, but also GDP swings affect tax revenues. In addition, the two variables may be simultaneously influenced by many factors that if omitted can bias the estimates of the impact of taxation. Another issue relates to the uncertainty about the time of reaction to fiscal measures and horizons considered by economic agents.

There are two main empirical approaches for estimating the impact of fiscal shocks on output, the Structural Vector Autoregressive (SVAR) and the narrative. The SVAR approach (initiated by Blanchard and Perotti (2002)) uses fiscal - normally national accounts - data and relies on assumptions regarding their automatic contemporaneous reaction to movements in economic activity, in order to isolate the non-systematic component of fiscal policy. By contrast, the derivation of shocks in the narrative approach, followed in this paper and envisaged in Romer and Romer (2010), is more direct and intuitive, as tax policy shocks are dated and quantified according to legislation and contemporary budgetary analyses.[1] This approach does not depend on assumptions regarding the automatic response of fiscal variables

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[1]The identification of tax shocks in the narrative approach is thus fundamentally different from the standard method used to identify discretionary tax policy that consists in cyclically adjusting fiscal variables.

to GDP. Furthermore, many factors that influence GDP are less likely to systematically influence the legislated component of taxes, which limits the room for endogeneity. A possible bias arises from the willingness of government to influence economic activity, establishing a link between discretionary fiscal policy and GDP. However, the analysis of the motivation behind fiscal policy actions makes it possible to isolate and exclude this kind of measures which, as discussed in the paper, have been anyway rather infrequent in Portugal during the period considered.

Another challenge when measuring the impact of fiscal policy is posed by the fiscal data available. The narrative approach has the advantage of being independent of accounting rules (and their widely known limitations), while having the disadvantage of depending on information that partly emanates from the political process and is subject to noise. Gathering comprehensive and consistent narrative information about tax changes is very demanding and this has limited the number of studies in this vein. In fact, there are still few works in the wake of Romer and Romer (2010), Cloyne (2013), for the UK, and Hayo and Uhl (2013), for Germany, being some of the exceptions. Other papers such as Devries et al. (2011) take a related approach that considers annual data and major fiscal policy shocks only, while covering a wide range of countries. There is an older strand of narrative studies started by Ramey and Shapiro (1998) that look into the effect on economic activity of military spending shocks. Note that this method is hard to extend to other types of expenditure shocks that are more difficult to track and quantify (see European Commission (2013), Part III, for a discussion of this issue).

This paper adds to the still scarce literature that uses the narrative methodology to assess the effects of taxation on output, by providing evidence for Portugal. The benchmark response of GDP to a positive tax shock is strongly negative with a multiplier that reaches -1.3 one year out and -2.7 three years out. This response is statistically significant, but surrounded by sizeable uncertainty. The findings are robust, in particular, to the exclusion of significantly large measures from the sample and controlling for public expenditure. This

magnitude of the effects of taxation on GDP is in line with previous work for the US, Germany and the UK. However, unlike these studies which found recessionary responses both of private consumption and investment, for Portugal the impact concentrates on private consumption.

The paper is organized as follows. Section 2 describes the sources, and presents a list of tax measures implemented in Portugal between 1996 and 2012 and the type of information gathered about them. The motivation behind these actions as a potential source of endogeneity is analyzed in section 3.

Section 4 explains the implementation details in converting the tax measures into a quarterly series of tax shocks. This procedure is not straightforward and depends, for example, on the assumptions regarding economic agents' response to anticipated changes in income. We consider two alternative assumptions in deriving the series of shocks: the benchmark assumption is that agents react to changes in taxes at the time these have to be paid; alternatively, we assume that agents react at the time of approval of the measures and consider the cumulative change in tax liabilities for the future. We discuss the practical application of these assumptions to the Portuguese case: for instance, how to cope with taxes paid in specific quarters of the year, as it happens with the corporation income tax.

Section 5 uses the constructed series of shocks to measure the effects of discretionary exogenous tax policy on output. In doing this, we also distinguish between direct and indirect taxes. The GDP responses are negative for both categories of taxes, but lack statistical significance. Section 6 discusses evidence from considering alternative assumptions in the derivation of the shocks. Section 7 focuses on the response of some output components to changes in taxation. Given that this paper finds much stronger effects of taxation on GDP than in Pereira and Wemans (2013b), a previous SVAR-based study for Portugal (this has been also the case for other countries), section 8 compares the tax multipliers in the two approaches and offers some new insights for the debate about the discrepancy between them. Finally, section 9 presents the concluding remarks.

4

2 Legislated tax changes

The estimation of the impact of tax policy on economic activity presented in this paper relies on a series of shocks especially constructed for the purpose. The starting point in this work is a list of all major legislated tax changes enacted in Portugal since 1996, along with their approval and implementation dates[2], quantification and assignment to broad categories of revenue such as direct and indirect taxes and social contributions. Detailed information about tax policy measures in Portugal is very scarce as it was only recently, in the wake of the euro area sovereign debt crisis, that a systematic reporting of the expected effects of tax changes became entrenched in budgetary documents. Consequently, the series of shocks is confined to a relatively recent period, from 1996 to 2012, and even for this period its construction required gathering information from several sources. These sources primarily included budget reports, legislation documents and the annual reports of Banco de Portugal. Another important source of information about the revenue effect of tax measures was the data collected under the so-called disaggregated approach for the analysis of fiscal policy within the European System of Central Banks (see Kremer et al. (2006) for a description of the data that serve as an input to this approach). Finally, the treatment of particularly complex issues benefited from discussions with experts.

As far as quantification is concerned, conceptually we want an estimate of revenue effects holding GDP constant, that is the feedback of GDP on tax revenues should not be considered. Measures were generally quantified this way in the sources. This is particularly important for measures with a large potential influence on economic activity, such as changes in the value added tax rate, as a consideration of feedback effects would typically lead to an overestimation of the response of economic activity. Tax changes are quantified in nominal terms.

When different estimates for the magnitude of a particular tax change were available

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[2]Many of these changes were part of the State Budget, although there were several exceptions. In Portugal the State Budget for the next year is usually submitted to Parliament in October and, after approval, it comes into force in January.

in the sources, information about the implementation details in the legislation and other documents was used in deciding what figure to take. The confrontation of several sources helped cross-checking estimates in order to reduce the noise that could be introduced by the political process. At the same time, inconsistencies can arise from the use of different methods for the quantification of revenue effects in different sources (or in the same source over time), but the fact that the sample is in practice restricted to recent years helps to mitigate this issue.

The legislated tax changes considered are confined to measures with an expected effect on economic activity. This criterion led in particular to the exclusion of the securitization of tax revenues, implemented by the Portuguese government in 2003. This was a financial operation enacted in order to fulfill the budget deficit target and, although it affected tax revenues as recorded in national accounts, it did not impact the amounts actually paid by economic agents. Consequently, it is unlikely to have directly affected economic activity.

For the purpose of deriving the quarterly shocks in the next sections, it is useful to distinguish between three types of measures according to the nature of their revenue effects. Firstly, there are measures with a permanent effect on receipts and for these the annualized long-term (i.e. on-going) figure is retained.[3] Occasionally some tax changes of this type, such as in the value added tax rates, are quantified in the sources for less than a full year and taking into consideration the seasonality of the relevant macroeconomic base. Such seasonal effects must be undone in the calculation of the annualized figure. Secondly, our sample comprises measures that affect revenue only temporarily, and these are quantified on the basis of the overall variation in receipts owing to the measure. Finally, a third category consists of measures that switch revenue from one year to the other: for instance, an increase in prepayments of the corporate income tax, or in the amounts withheld at source in the personal income tax, offset by an increase in refunds or a reduction in balances due in the

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[3]Note that some of these measures may have additional temporary short-term revenue effects which have to be considered when a time of payment perspective is adopted in the compilation of shocks - see section 4.1.

following year. These measures while taking effect permanently have a yearly revenue profile akin to the one of measures with a temporary nature, in that revenue changes initially but goes back to the original level after some time.

Recent decades featured frequent modifications in tax legislation and this made it possible to compile a comprehensive list of around 70 measures with a potential effect on economic activity over the period 1996-2012. This list is summarized in Table 3 (Appendix) which includes the year of implementation, the tax concerned, a brief description of the measure, a quantification (as a percentage of nominal GDP) and whether its effects were permanent, temporary or revenue-switching. Moreover, measures are classified in accordance with the assessed motivation (see the next section).

3   Classification of motivations behind tax changes and endogeneity concerns

The adequate estimation of the effects of tax changes on GDP growth requires a series of tax shocks that does not respond to current and future economic developments, in order to avoid the well-known simultaneity bias. Previous studies using the narrative method focused on the stated motivation behind tax measures as a way to isolate exogenous actions. Tax measures deemed endogenous in Romer and Romer (2008) are taken in response to information about current or prospective economic developments and include countercyclical policy and spending-driven tax changes. In contrast, measures classified as exogenous include namely those targeted at fostering long-term growth and reducing inherited fiscal imbalances.

In the Portuguese case the vast majority of the tax measures taken during the sample period qualify as exogenous in accordance with these criteria. In fact, there is only on episode that can be considered as countercyclical policy, comprising a few measures taken around the international financial crisis of 2008. The Portuguese action plan (*Iniciativa para o Investimento e o Emprego*) within the 2009 European Economic Recovery Plan, along with

other measures already implemented in 2008 and described in the documents as having a countercyclical motivation (see, for example, Ministério das Finanças (2009), Chapter II.4), had nevertheless a rather modest size (annualized effect of around 0.1 percent of GDP). Note that the major fiscal measures enacted under this action plan were on the expenditure side. Other measures that brought down the tax burden in the same period, such as the reduction of the standard rate of the value added tax, were not part of the official documents related to the fiscal stimulus and thus cannot be classified as pursuing macroeconomic stabilization. Such a lack of importance of the countercyclical motive, unlike previous studies using the narrative approach, is also related to the sample period. Those studies are based on extended samples that start shortly after WWII, and thus include the «golden age» of fiscal policy as a tool for demand management. In fact in the studies for the US, Germany and the UK there were hardly any countercyclical tax measures after 1980 until recently.

Regarding spending-driven tax policy, there is no evidence in the documents analyzed of changes in taxes responding to measures on the expenditure side. In fact, the conduct of fiscal policy in Portugal and the approach followed in setting-up the budget may not favor such a direct link between expenditure and revenue measures. Nevertheless, some of the tax changes considered were part of fiscal consolidation packages involving simultaneously measures on the expenditure side. This may bring about a contemporaneous correlation with spending shocks (Pereira and Wemans (2013b) find this kind of evidence for Portugal) and is taken into account in the robustness exercises.

Many of the measures taken during the period analyzed, particularly in the last years, were triggered by the need to curb deficits and enhance fiscal sustainability and qualify as exogenous in the Romer and Romer (2008) typology. The remaining measures pursued a variety of objectives that are also unrelated to current macroeconomic developments, for instance, promoting long-term growth (reductions in the corporate income tax rate), creating incentives through the tax system (special tax rates for firms located in unfavored regions) and enhancing equity (different tax rates applying to married and single couples). Among

the exogenous measures, it is not always straightforward on the basis of the stated motivation to tell apart those pursuing fiscal consolidation, because that purpose may not be explicitly stated (or may appear mingled with other purposes, such as concerns about equity between taxpayers). In such cases we used the knowledge about the context in which the measure was taken, in deciding whether to categorize it into the fiscal consolidation motive. In Table 3 (Appendix) we categorize the measures into endogenous/exogenous and signal, among the latter, the ones deemed to tackle fiscal imbalances.

Table 1 presents the results of formal exogeneity tests for the overall series of exogenous shocks and for its two components derived, respectively, from the deficit reduction measures and the remaining exogenous measures. It is important to run separate tests for the consolidation-driven tax shocks because these have been noted in the literature as having less of a claim to exogeneity than other categories of exogenous shocks. In the Portuguese and the European contexts, the emphasis on a target defined by reference to the actual deficit in the Stability and Growth Pact may establish a link between downturns in economic activity and the need to implement fiscal tightening. Some literature (Cunha and Braz (2009), Agnello and Cimadomo (2009)) found evidence of discretionary procyclical fiscal policy in Portugal and other European countries. Of course many other factors besides macroeconomic developments can trigger episodes of budgetary slippage such as hikes in health- or age-related expenditure.

We test whether the shocks can be predicted by each of the variables that raise more concerns in terms of endogeneity: output and government expenditure. Furthermore we consider shocks derived in accordance with two approaches - explained in the next section - as far as timing is concerned, namely, on the basis of the time of implementation of the tax measures and on the basis of the time of approval (as an approximation to the time of announcement). This second series could be more suitable to detect a possible response of the shock to the macroeconomic variables. We employ both a standard Granger causality test and the probit test proposed by Mertens and Ravn (2011a) for the predictability of

the timing of tax changes only (i.e not of the size). The results (p-values) shown in Table 1[4] clearly speak against that output or government expenditure help predict the exogenous legislated changes in taxes, both as a whole or for its two components.

Table 1: Exogeneity tests

Shocks	Time of implementation		Time of announcement	
	Granger test	Probit test	Granger test	Probit test
All exogenous shocks				
output	0.702	0.864	0.439	0.990
government expenditure	0.970	0.508	0.989	-
Fiscal consolidation shocks				
output	0.360	0.805	0.354	0.966
government expenditure	0.941	0.766	0.996	-
Remaining exogenous shocks				
output	0.184	0.200	0.826	0.845
government expenditure	0.914	-	0.817	0.643

Notes: P-values reported. The Granger causality test is a test of joint significance of 4 lags of output growth (or government expenditure growth, as applicable) in a regression of the shock measure on those lags plus 4 own lags and a constant. The probit test is a test of joint significance of 4 lags of output growth (or government expenditure growth, as applicable) in a regression of variable τ_t on those lags and a constant, where variable τ_t is an indicator of the sign of the tax change (ΔT): $\tau_t = -1$ if $\Delta T < 0$, $\tau_t = 0$ if $\Delta T = 0$, $\tau_t = 1$ if $\Delta T > 0$.

4 Transforming the measures into a quarterly series of tax shocks

4.1 The benchmark approach: focusing on the time of payment

The construction of a quarterly series of tax shocks requires that the effect on revenue of each measure is assigned to a particular quarter (or quarters). This is far from a mechanical procedure and in many cases a deep knowledge of each measure's particularities is necessary. For instance, the way a change in personal income tax rates or deduction rules affects the behavior of economic agents may depend on whether such change modifies the amounts withheld at source or, instead, the refunds in the following year. The principle followed in

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[4]In a couple of cases, we do not present the p-values for the probit test because the estimation algorithm for the ordered probit model did not converge.

deriving the benchmark shock measure was to date tax changes in accordance with the time taxes have to be paid.

This focus on the implementation date is also adopted by Romer and Romer (2010) and Cloyne (2013) for their benchmark analysis.[5] In fact, there is strong microeconomic evidence mainly for the United States that anticipated changes in taxes influence the behavior of economic agents when they take effect (e.g. Johnston et al. (2006)), suggesting the impact on disposable income as a key channel of transmission of tax shocks to economic activity (see Jappelli and Pistaferri (2010) for a review of the literature on consumption responses to changes in income). In the Portuguese case this approach is further justified by the existence of a significant share of liquidity constrained income.[6] Moreover the importance of the implementation date may reflect other factors, such as a lack of detailed information on tax policy measures that would allow economic agents to accurately predict the change in future tax payments they entail.

The time of payment rule applies as follows (see Pereira and Wemans (2013a) (Appendix A) for a detailed explanation how several concrete measures are recorded). The most straightforward case consists of measures with permanent effects, affecting tax payments made in a continuous way, for example, concerning the value added tax rates or the personal income tax, if fully reflected on the withholding tables. Such actions are recorded once, in the quarter of implementation, by 1/4 of the annualized revenue change. Note that they represent a permanent level shift in revenues from that quarter onwards and our shock measure tries to capture *changes* in taxation. If measures of this kind are implemented step-wise, over several years, they are recorded in the quarter of implementation of each step, also by 1/4 of the annualized revenue change. In the case of measures implemented after the middle of a quarter, the change in revenue is split proportionally between the quarter of implementation

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[5] A difference relative to these studies is that for the benchmark measure of shocks we take into account the short-run revenue effects of tax measures: for example, we include in the sample measures that switch revenue from one year to the other.

[6] Castro (2006) estimates a 40 per cent share of liquidity constrained income for Portugal between the mid-nineties and 2005. In addition, this study finds a positive relationship between this share and the unemployment rate, a fact that could support an increase of liquidity constrained income in recent years.

and the next.

Some legislated tax changes affect revenue in a temporary way. These are recorded by the variation in the amounts raised in each quarter, and are cancelled by a symmetrical shock in the following quarter, reflecting the return of receipts to the original level.

A more difficult case concerns permanent measures affecting intermittent tax payments in that they occur only in specific quarters of the year. This is especially the case of payments of the corporate income tax[7] and the annual refunds of the personal income tax. On the one hand, in order to adhere strictly to the time of payment principle, shocks should be recorded in the quarter of payment and cancelled in the next (given the absence of a payment). However, such a recording would have to go on forever. On the other hand, these tax payments generally concern previous year's income or wealth, and therefore a certain smoothing behavior by agents appears plausible. In particular, corporations are typically in a good position to forecast their tax liabilities and, in addition, face less liquidity constraints than households and adopt an extended horizon in their investment decisions. Therefore, for these measures the time of payment approach is applied taking the year, instead of the quarter, as a reference. We assume that economic agents consider the change in the payments for the year as a whole owing to the measure and incorporate this information in their behavior from the first quarter (for measures coming into force in January, which is usually the case).[8] Such change is thus spread uniformly over the four quarters, and 1/4 of it is recorded in the first quarter.

Measures switching revenue from one year to the other - see section 2 - are, in the first year, recorded following the rules for permanent measures. This typically leads to assigning to the first quarter 1/4 of the change in revenue for the year as a whole. In the next year

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[7]The corporate income tax code foresees prepayments equal to between 70 and 90 per cent of the previous year's tax liability that take place in three installments in July, September and December. The settlement of the final tax liability occurs in May of the following year.

[8]In practice, for changes in the corporation income tax rates, we assume that in the first year a change takes effect (t), the only impact on revenue comes through the December prepayment, by 20 per cent of the amount, and that in $t+1$ companies pay the remainder of the tax liability of t and adapt their prepayments to the new tax rate. This intends to mimic the fact that tax changes taking effect in t translate into significant changes in revenue only from $t+1$ on.

(first quarter) there is a symmetrical cancellation recording, given the return of revenues to the original level.

We also consider a slight variation of the benchmark approach, featuring a strict time of payment recording of the measures that concern intermittent tax payments. In this alternative, the changes in those payments are assigned to the exact quarters in which they occur[9], recorded for the actual amounts, and cancelled in the following quarter. By convention, the recording of a measure stops when the quarterly profile of its revenue effect remains unchanged from one year to the other. This approach has the obvious shortcoming that permanent measures affecting intermittently paid taxes are treated similarly to measures with temporary effects, but it is useful to cross-check the impacts of intermittent tax payments vis-a-vis the benchmark shock measure.

4.2 An alternative approach: focusing on approval dates and cumulative liabilities

The idea behind the construction of the benchmark series of shocks is that the relevant moment for measuring the macroeconomic effects of taxation is when agents have to pay their taxes. However if the behavior of consumers was primarily influenced by their permanent income expectations, the relevant moment would instead be when they learned that their future disposable income would change. In this case, they would modify their behavior at the time of credible announcement of the measure. Similarly, firms may adopt a multi-year horizon for some of their investment decisions, particularly large scale ones[10], the relevant piece of information being in this case the long-run change in tax liabilities.

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[9]In doing this, besides the assumption concerning the prepayments of the corporate income tax described in the last footnote, it is further assumed that tax refunds of the personal income tax concentrate in the third quarter. This has mostly been the case, notwithstanding some changes in the procedures since 1996. Regarding the tax on real estate, we assumed that it has been paid fully in the second quarter, at the time of the first installment, ignoring the possibility of paying it in two installments in certain cases.

[10]In contrast, the recording of the tax shock taking as a reference the amount to be paid over the one-year horizon, in the time of payment approach, may provide a better basis for assessing the effects of taxes on small-scale investment decisions (such as acquisition of transportation equipment).

This approach brings the timing of the shock closer to the moment of announcement of the underlying measure, and in this sense is also more adequate to capture possible impacts on economic activity through the expectations channel (for instance, a positive impact of measures that enhance the soundness of the fiscal stance). The time of credible announcement of a measure is approximated by the date of approval of the respective legislation[11] (the exact date considered was that of publication in the *Diário da República*). In calculating the cumulative change in liabilities, short-term revenue effects related to pre-payments or refunds do not matter.

Table 2 compares the quarterly recording of shocks under the cumulative liabilities and the time of payment approaches. For permanent (one-step) measures affecting continuous tax payments, the two approaches differ only to the extent that there is a lag between approval and implementation. Note that, in this case, there are no short-run revenue effects that originate a difference vis-a-vis the long-run figure. Whenever legislation is approved in the second half of a quarter, the shock is fully assigned to the following quarter.[12]

In the cumulative liabilities approach measures enacted step-wise are recorded only once, also at the time of approval, by 1/4 of the sum of all single (annualized) tax changes. In addition measures that affect taxes paid intermittently are recorded once, by 1/4 of the annualized long-run revenue change. For measures affecting receipts temporarily, the shock is assigned to the quarter the respective legislative change was approved, by the overall change in revenue, and cancelled in the following one. Finally, measures switching revenue from one year to the other are disregarded, as it is assumed that economic agents realize that these have no effect on their net tax liabilities. It is worth noting that this measure of shocks is constructed along similar lines as the Romer and Romer (2010) present-value

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[11]It is very difficult to construct a shock measure that goes beyond this in terms of capturing fiscal foresight. Agents usually learn about a measure before approval, but the moment this happens is hard to establish. At the same time, many measures are dropped or strongly modified in the course of the legislative procedure, and one would need an assessment about the probability agents attach to the approval of each proposal.

[12]This deviates from the rule followed in the time of payment approach as the spreading by two quarters makes no sense in a liabilities-focused analysis. We thus adopted this more simplified assumption borrowed from Romer and Romer (2010).

shock measure.[13]

Table 2: Summary of recording of tax measures with permanent effects

Type of measure	Approach	Time of recording	Amount
Continuous tax payments, one-step	time of payment	quarter payment begins[1]	1/4 change in annualized revenue
	cumulative liabilities	quarter of approval[2]	1/4 change in annualized revenue
Continuous tax payments, multi-step	time of payment	quarter payment begins at each step	1/4 change in annualized revenue at each step
	cumulative liabilities	quarter of approval	1/4 sum of changes in annualized revenue at every step
Intermittent tax payments	time of payment	1st quarter of year payment begins and, while applicable, of following years[3]	1/4 change in actual revenue during the year
	cumulative liabilities	quarter of approval	1/4 change in annualized long-run revenue

Notes: (1) Measures implemented in the second half of the quarter are proportionally split between the quarter of implementation and the next. (2) Measures approved in the second half of the quarter are recorded in the next. (3) If the measure is passed already in the course of the year, the shock is assigned to the first quarter of the period thereafter.

4.3   An overview of the series of tax shocks

The series obtained in the time of payment approach are illustrated in Figure 1 for shocks to direct taxes (including social security contributions), and in Figure 2 for shocks to indirect taxes. The shaded areas signal the periods when GDP contracted for at least two consecutive quarters.

In the case of direct taxes, there is a first major negative shock in the initial quarter of 2001, resulting from the combination of a reduction in the corporate income tax rate and the reform of the personal income tax coming into force in 2001 (the shock measure also reflects the cancellation of the temporary effect of the increase in the corporate income tax prepayments in 2000). The special scheme for the payment of tax arrears («perdão fiscal»), in the last quarter of 2002, gave rise to a particularly noticeable shock affecting both direct

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[13]Note, however, that the Romers disregard the tax changes with temporary effects in this instance. This recording would indeed follow from a strict cumulation of the changes in liabilities. Nevertheless, we have included such tax changes, in order to distiguish them from those that merely switch revenue between time periods.

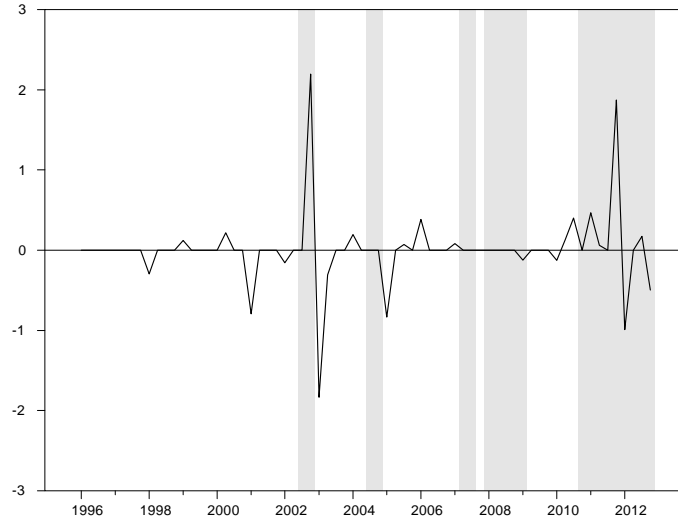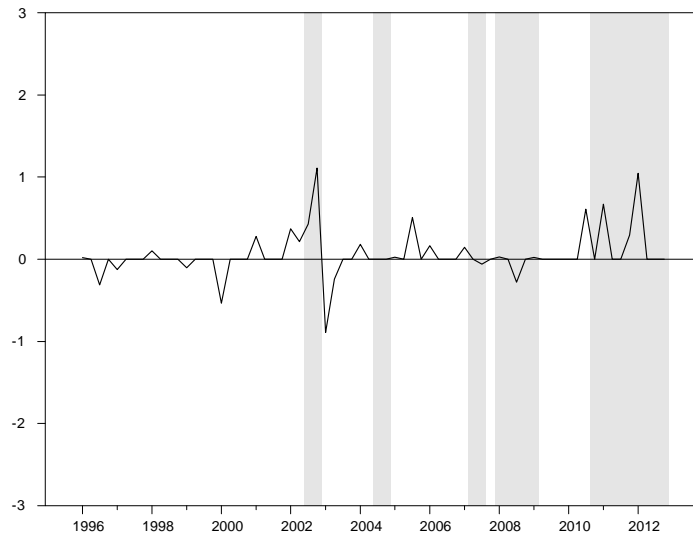Figure 1: Shocks to direct taxes (as a percentage of quarterly GDP)

Figure 2: Shocks to indirect taxes (as a percentage of quarterly GDP)

and indirect taxes, matched by a negative one in the following quarter. This program allowed tax arrears with a legal collection date until 31 December 2002 to be settled without paying interest or fines.[14] After that, there is a significant negative shock in 2005 that reflects the lagged effects of the corporate income tax rate reduction of 2004. In the later sample years, several measures led to a series of positive shocks to direct taxes, the largest one being the 2011 personal income tax surcharge, impacting chiefly the last quarter of that year and, given its temporary nature, originating a cancellation in the subsequent quarter.

Regarding indirect taxes, besides the special scheme for the payment of tax arrears, already mentioned, several increases in the value added tax rates translated into significant positive shocks. The change in the average rate of the tax on oil products in 2000 was the most significant tax reduction in the sample period. More recently, in 2012, there is another large positive shock, brought about by the application of the standard value added tax rate to goods previously subject to the reduced or intermediate rates.

To conclude, the special scheme for the payment of taxes in 2002 clearly stands out as the most significant shock in the sample. Moreover, the measures taken in the period before and in the course of the Economic and Financial Assistance Program also give rise to a prominent sequence of shocks. Note further that there is a positive contemporaneous correlation between direct and indirect tax shocks (the correlation coefficient is about 0.45). This mirrors the fact that many tax policy measures were aimed at fiscal tightening, and were not, in particular, shifts between different types of taxation. This is in contrast with the evidence in Princen et al. (2013), who analyze discretionary tax measures between 2001 and 2012 in several EU countries and find evidence of increases in indirect taxes, matched by cuts in direct taxes, targeting a shift to growth-friendlier tax bases.

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[14]This shock has a specific nature in that it does not concern taxes to be paid but instead taxes that ought to have been paid. Consequently, a strict liabilities analysis will disregard this measure. Still, it captures a unique episode of a very large change in the amount of tax payments mostly concentrated in one quarter. Moreover, some of the debts had a very low probability of being paid if it was not for this scheme. Therefore it was considered in the estimation, but the robustness section shows how results change when this episode is excluded.

5 Effects of discretionary exogenous tax policy on output

5.1 Benchmark results

The macroeconomic impacts of the tax shocks derived in the previous section can be assessed on the basis of reduced-form specifications, under the assumption that shocks do not respond to contemporaneous or prospective changes in economic activity. Accordingly, in the remainder of the paper we drop the endogenous legislated tax changes, i.e. those with a countercyclical motivation.

The basic specification we use regresses output growth $(\Delta \ln y_t)$ on the contemporaneous value and on 4 lags of the shock measure in percentage of GDP (ΔT_{t-i}) and 4 own lags:

$$\Delta \ln y_t = \alpha + \sum_{i=0}^{4} \beta_i \Delta T_{t-i} + \sum_{i=1}^{4} \gamma_i \Delta \ln y_{t-i} + e_t. \tag{1}$$

This specification is in first differences because the shock measure captures changes in taxation. It controls for lagged output which is likely to be the single most important control variable in this context (see Romer and Romer (2010)). Note that it accounts in particular for a possible lagged pro-cyclical response of some legislated changes in taxes, induced by the functioning of the Stability and Growth Pact (see section 3), although the econometric evidence presented there strongly suggests that this is not needed.[15] In a robustness section below we address possible biases in using a specification like (1), namely stemming from the correlation of the legislated tax shocks with shocks on the expenditure side, as well as from omitting exogenous changes in taxes not resulting from legislation (see Perotti (2012)).

The shock series starts in 1996:1. Given that 4 lags of the variables are included, the estimation, by OLS, is based on a sample starting in 1997:1 and ending in 2012:4. GDP and

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[15]Studies such as Mertens and Ravn (2011b) and Cloyne (2013) have plugged narrative shock measures into a reduced-form VAR including other macroeconomic variables, besides output. This is less suitable here owing to the lack of degrees of freedom. In a related paper, Favero and Giavazzi (2012) suggest measuring the effects of the narrative tax shocks inside a fiscal SVAR.

all the other macroeconomic variables considered are seasonally adjusted prior to estimation. As it is plausible that some components of GDP, notably private investment, react to tax shocks with a lag greater than 1 year, we also report the results considering 8 lags of the shock measure. The effect of the shocks is determined as a cumulative dynamic multiplier.

Figure 3 presents the effects on output of an increase in taxes of 1 percentage point of GDP and one-standard-deviation confidence bands[16] for the benchmark tax shock measure. The response of GDP is negative and builds up steadily, attaining -1.3 percent after 1 year, and -2.7 percent after 3 years. In the subsequent period it strengthens a bit further, to around -3.0 percent, and remains thereafter at this level, being thus highly persistent. This effect on output is statistically significant, although the confidence bands are wide. These findings indicate that legislated tax increases (decreases) have a powerful recessive (expansionary) impact on economic activity. When the lag length of the shock measure is increased to 8 in equation (1), the trajectory of output deviates only slightly from that presented in Figure 3, decreasing by 1.2 percent 1 year out and 2.9 percent 3 years out.

Comparing with previous studies using the narrative approach, Romer and Romer (2010), Cloyne (2013) and Hayo and Uhl (2013) report negative impacts on output which take between 2 to 3 years to build up and reach maxima around -2.5 percent of GDP. Moreover, the first of these studies also finds a rather persistent output response. Such magnitudes for the impact of taxes are much in line with the ones for Portugal.[17]

Figure 4 presents separately the output responses for the abovementioned two categories of exogenous shocks, namely, those derived from consolidation measures and from the remaining exogenous measures. The point responses for the first category are very much in line with the ones for the shock series as a whole, reaching -1.4 percent one year out, and around

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[16]The bands for this and the other dynamic multipliers throughout the paper were obtained by a standard Monte-Carlo procedure, drawing 1000 vectors of coefficients from a multivariate normal with mean and variance-covariance given by the least squares point estimates. An output response for each draw was computed; the standard deviation across all responses is presented.

[17]Cloyne notes that the similarity of the results for the UK and for the US is surprising, given the very different tax systems in the two countries, as well as sources used and procedures followed to obtain the shock series. It is interesting to note that we have reached the same type of findings for Portugal.

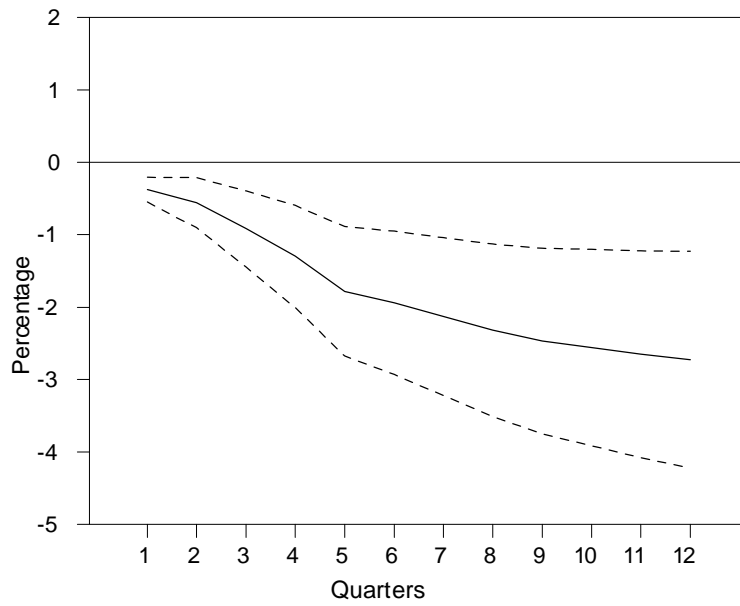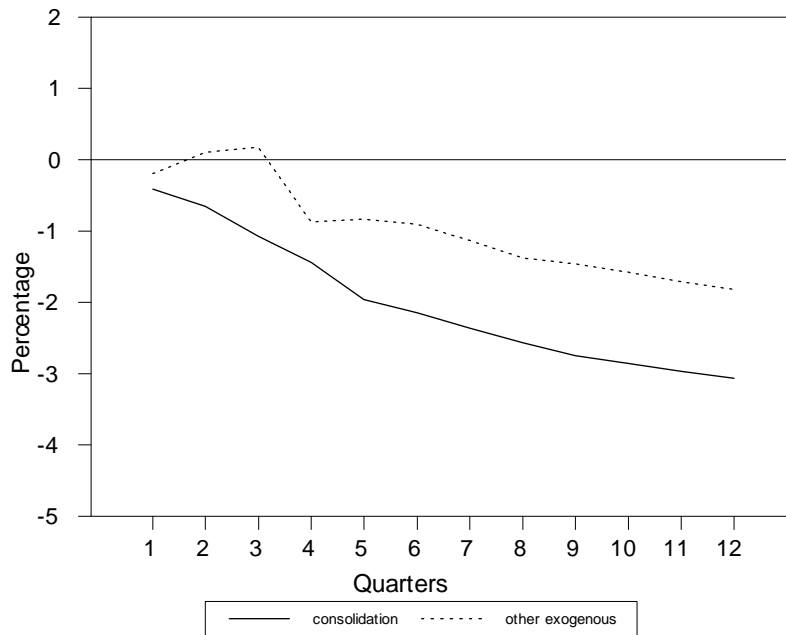Figure 3: Output response to discretionary tax policy (1% of GDP shocks)

Figure 4: Output response for the two categories of exogenous tax shocks (1% of GDP)

-3.1 percent three years out. The response for second category is initially nil; it becomes negative four quarters after the shock only, and reaches -1.8 percent after three years. The confidence bands (not shown) indicate, however, that while the output response to fiscal consolidation shocks is statistically significant throughout, the one for the other exogenous shocks has no statistical significance (this may be due to the smaller number of shocks in the context of a short estimation period). Thus in the Portuguese case there is no evidence of consolidation tax measures being relatively less harmful for growth. Other narrative studies are quite heterogeneous in this respect: for instance, Hayo and Uhl (2013) find that consolidation shocks have a more depressing impact than other exogenous shocks, while Romer and Romer (2010) report the opposite, with consolidation shocks having a *positive* (albeit non-significant) effect on GDP.

Regression (1) above embodies the most relevant experiment in this context: a permanent change in taxes. Nevertheless it may be also interesting to estimate an alternative specification in the form of a bivariate VAR including the shock measure and output growth. The impulse-responses yield the trajectory of GDP following a *typical* legislated tax shock during the sample period in that the shock is allowed to decay over time through the inclusion of its own lags in the respective equation. Similarly to regression (1) above, the lag length is set to 4 and GDP is allowed to respond contemporaneously to taxes, meaning that it is ordered in the second place after the shock series. The GDP response that results from this exercise (not shown) has a profile similar to the one in Figure 3, but the impact is now a bit smaller: around -1 percent after 1 year and -2 percent after 3 years, and the maximum stands at -2.4 percent. Such result is caused by a reversion in the second quarter after impact of slightly more than 20 percent of the shock, which remains at this level thereafter. A separate analysis of direct and indirect taxes shows that the partial decay of the shock happens only for the former, matching a larger share of legislated changes affecting direct taxes with a temporary effect on revenues. In comparison to the regression-based analysis, this tends to weaken the GDP response.

5.2 Robustness exercises

5.2.1 Outliers and sample period

As seen in section 4.3 a number of tax policy actions stand out for their size, notably the special scheme for the payment of tax arrears in 2002 («perdão fiscal») and several measures taken during the recent period of fiscal consolidation, from 2010 to 2012. Such large tax changes are legitimate observations to consider. Nevertheless one may ask whether they are driving the large negative effects of taxation on GDP documented above, given that our sample is small and the mentioned tax increases - albeit partly temporary - coincided with periods of contraction in economic activity (see Figures 1 and 2). In order to address this issue, we (i) dropped the amounts related to the special scheme for the payment of tax arrears from the shock series, and (ii) considered a sample ending in the 2010:2. Note that this last exercise implies the loss of about 1/5 of the degrees of freedom available. The GDP responses are shown, respectively, in Figures 5 and 6 (the benchmark response from Figure 3 is also shown - dashed line - for comparison). As far as the point estimates are concerned, the impact on GDP remains virtually unchanged when the special scheme for the payment of tax arrears is dropped, and weakens but only to a small extent when the last two and a half years are excluded from the sample. The most visible change consists in the widening of the confidence bands, particularly in the second case, which is not surprising given the reduction in the number of degrees of freedom. Overall these robustness exercises indicate that the benchmark results are not being driven by particular episodes of legislated increases in taxes, although they also underline the great uncertainty surrounding a precise quantification of the impact they have on output.

5.2.2 Controlling for expenditure and other revenue shocks

Some of the changes in taxation showing up in our shock series were part of consolidation packages including, at the same time, measures on the expenditure side. Therefore there

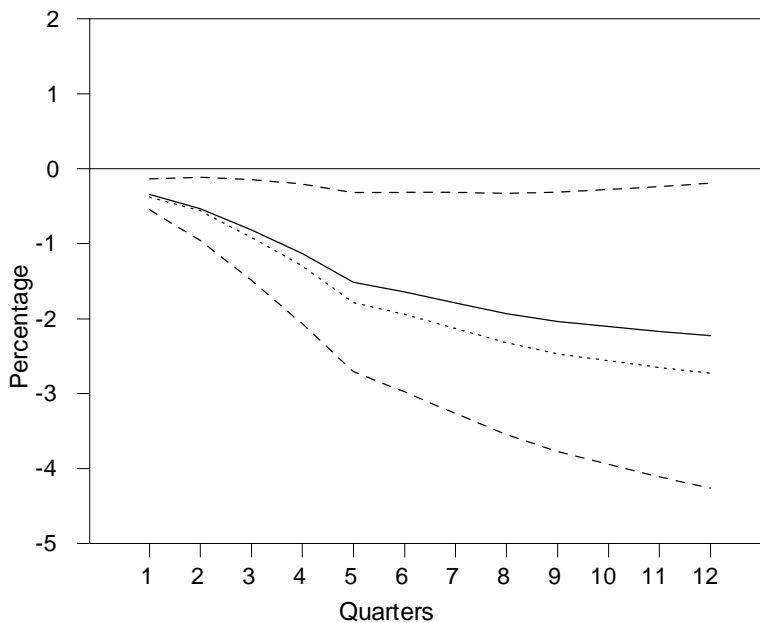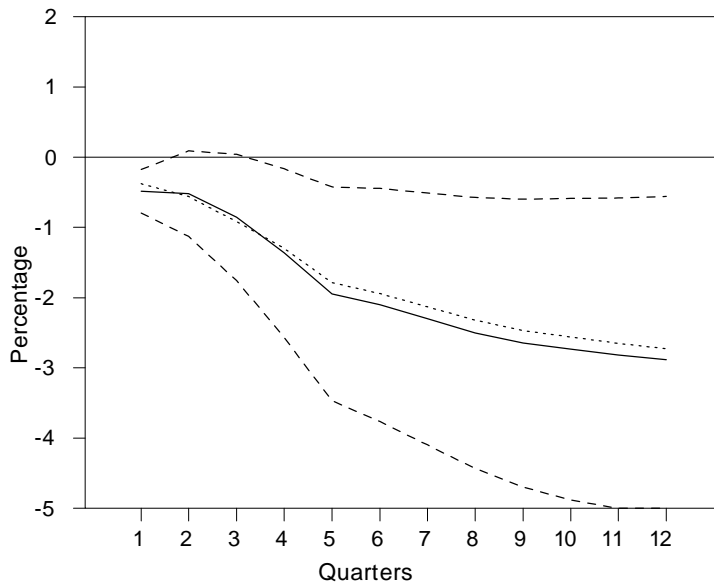Figure 5: Output response to discretionary tax policy (1% of GDP shocks) dropping the «perdão fiscal»

Figure 6: Output response to discretionary tax policy (1% of GDP shocks), sample ending in 2010:Q2

23

is room for (negative) correlation between tax shocks and contemporaneous expenditure shocks - and indeed Pereira and Wemans (2013b) found evidence of this kind for Portugal. Assuming a conventional depressing effect on GDP of government expenditure reductions, such correlation would tend to overstate the measured negative impact of tax increases on output. A possible way to assess whether this is causing a substantial bias is to include government expenditure and its lags in equation (1) above.

The response of output to changes in taxes controlling for spending[18] (not shown) is indeed less negative than the benchmark response, but without making much of a difference (they almost coincide for the first four quarters and three years out the fall in GDP is now 2.3 instead of 2.7 percent). It is worth noting that the inclusion of expenditure in equation (1) allows controlling for shocks to this variable but has the unwanted consequence of holding fixed the trajectory of the variable following tax shocks (expenditure may react to them both directly or indirectly, following the GDP response). This may exaggerate the reduction in the recessive effect of tax shocks when expenditure is taken on board, given the pro-cyclical behavior of important expenditure categories (see Pereira and Wemans (2013b)) which is likely to override the countercyclical response of some others, like unemployment benefits. In any case, our findings clearly indicate that the inclusion of expenditure is relatively unimportant for the measured effects of discretionary exogenous taxation on GDP.

Perotti (2012) raises the possibility of a bias in using a specification like (1) for measuring the effects of the narrative shocks on GDP. If GDP (y_t) responds to changes in exogenous taxation not resulting from legislation (and its lags), $\mu_t, \mu_{t-1}, ...,$ given that these are omitted in equation (1), they will be part of the residual variable (e_t). Given that y_{t-i} responds to μ_{t-i} and lags, e_t will not be orthogonal to y_{t-i}, leading to biased estimates. Perotti (2012) suggests an instrumental variable approach to overcome such a bias. Specifically one can estimate the following equation[19] by instrumental variables:

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[18]Government expenditure is defined as the sum of government consumption and investment plus social transfers. Moreover, like GDP, it enters the equation in growth rates.

[19]The specification suggested by Perotti (2012) imposes $\eta_2 = 1$ but, as noted by Cloyne (2013), this is not appropriate because ΔT_t is defined as a percentage of GDP, not in growth rates.

$$\Delta s_t = \eta_1 \Delta y_t + \eta_2 \Delta T_t + \mu_t, \tag{2}$$

where Δs_t is the log change in tax revenues and ΔT_t is the narrative shock measure. This equation can be estimated using Δy_{t-1} and ΔT_{t-1} (and lags) as instruments for Δy_t. The residuals, $\widehat{\mu}_t$, provide an estimate of the changes in taxation that are not legislated actions nor an endogenous reaction to GDP, and can be used as an additional regressor in (1) to eliminate the mentioned bias. We did this by including the current value and four lags of $\widehat{\mu}_t$ in equation (1): the impact is, however, very small: the point response of GDP is now -1.0 one year out, and -2.5 three years out, thus very close to the benchmark response.

5.3 Separating the effects of direct and indirect taxes

This section distinguishes between the effects of direct and indirect taxes on output (note that our listing contains a reasonable number of measures for each category). In doing so, it is necessary to take into account that shocks to the two types of taxes are contemporaneously correlated (see section 4) and thus each series has to be included in the equation used to measure the other's effect on output. Otherwise the measured response of output, say to direct tax shocks, would reflect to some extent the effects of shocks to indirect taxes, and vice-versa. The specification now used is:

$$\Delta \ln y_t = \alpha + \sum_{i=0}^{4} \beta_i \Delta DT_{t-i} + \sum_{i=0}^{4} \varphi_i \Delta IT_{t-i} + \sum_{i=1}^{4} \gamma_i \Delta \ln y_{t-i} + e_t, \tag{3}$$

where, as before, $\Delta \ln y_t$ is the growth rate of output and ΔDT_t and ΔIT_t are, respectively, the shocks to direct and indirect taxes. The point estimates indicate a fall in output by 0.6 percent after one year and 2.1 percent after three years, following a 1 percent of GDP change in direct taxes (Figure 7), and by, respectively, 2.3 and 3.1 percent, following an identical change in indirect taxes (Figure 8).

Figure 7: Output responses to discretionary changes in direct taxes (1% of GDP shocks)
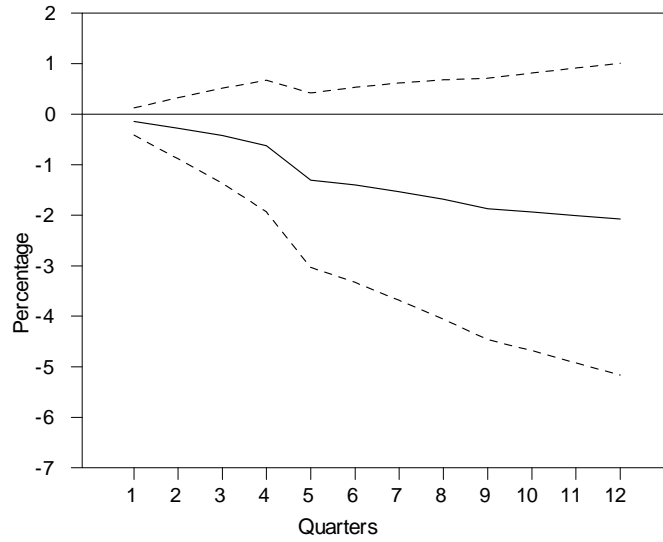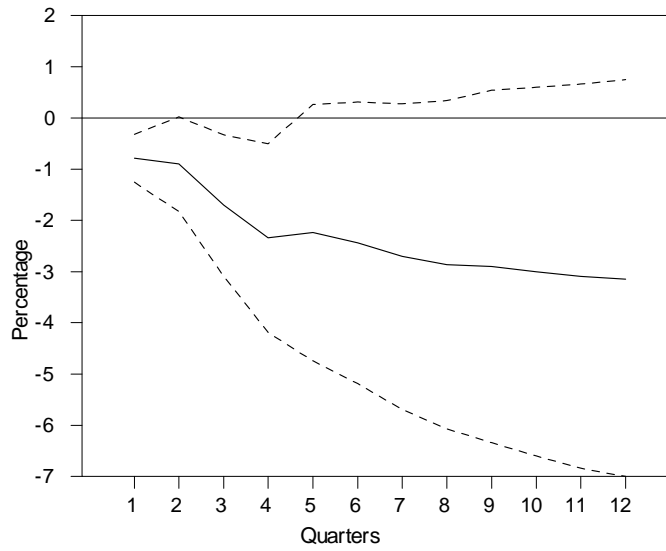

Figure 8: Output responses to discretionary changes in indirect taxes (1% of GDP shocks)

Therefore, as far as point estimates are concerned, a sizeable negative impact on economic activity is observed for both categories of taxes. However the confidence bands widen noticeably in comparison to total taxes and, albeit still clearly indicating a negative sign, encompass a zero response. This added uncertainty possibly reflects the lower density of shocks when each tax category is taken separately, and the smaller number of degrees of freedom in regression (3). In fact the bands largely overlap in Figures 7 and 8, so that it is not possible to come to a conclusion as to different effects of direct and indirect taxation. These results are in contrast with the evidence in Pereira and Wemans (2013b) who found a stronger effect of direct taxes on output (see section 8).[20]

6   Output response in the cumulative liabilities approach

The benchmark results are based on a shock measure derived assuming that the time of payment is the correct timing for the transmission of discretionary fiscal policy to economic activity. This emphasis on the implementation date is justified by the evidence that consumers respond to changes in current disposable income. Nevertheless, alternative assumptions cannot be ruled out, in particular, that economic agents modify their behavior at the time a given measure is passed and consider at once the cumulative change in liabilities for the future. The approach put forward in section 4.2 brings the shock measure closer to these assumptions.

As it turns out, the output response for the cumulative liabilities series comes rather close to the one for the time of payment series, both in terms of level and profile (Figure 9). The same holds as regards statistical significance (not shown). This is likely to stem from an important correlation between the shocks in the two approaches. In particular, these coincide for most permanent measures affecting revenues collected continuously over the year. Furthermore, in Portugal the approval of tax changes often does not take place much before implementation, and there are almost no examples of important multi-year tax

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[20]Previous studies for other countries using the narrative approach did not present evidence on this issue.

Figure 9: Output response to discretionary tax shocks for different shock measures (1% of GDP)
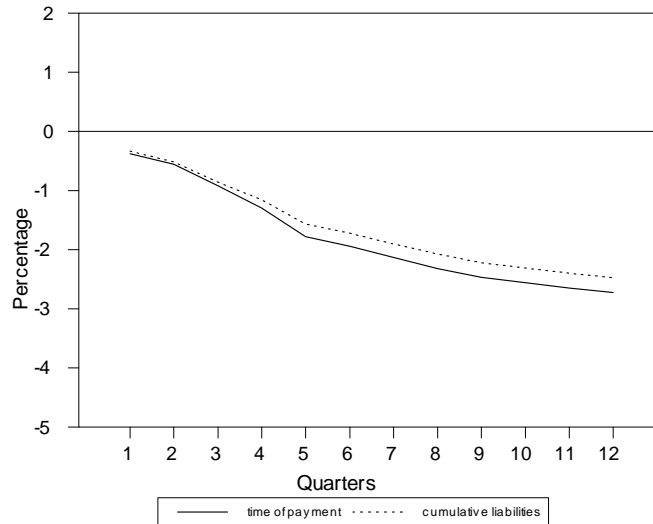
plans, factors that could amplify the differences between the shocks in the two approaches. Lastly, owing to the inclusion of a number of lags of the shock measure in equation (1), this specification may in some cases still capture the effect of shocks on economic activity reasonably well, as a lagged impact, even if the right timing is missed.

Given the limited variability in terms of characteristics of tax measures in our dataset, a more interesting experiment is to consider the GDP response in a regression where one includes the two alternative measures at the same time. This regression captures *only* the effects on economic activity of those parts of the shocks which do not overlap (as the other shock measure is held constant in the regression). Figure 10 presents the GDP response in each one of the approaches, controlling for the other. The respective confidence bands (not shown) become rather wide, in such a way that they comprise a zero response in both cases. This is likely to reflect the fact that one is now looking at the effects of portions of the full shocks. Taking into account such lack of statistical significance, the conclusions that follow must be essentially read as hints.
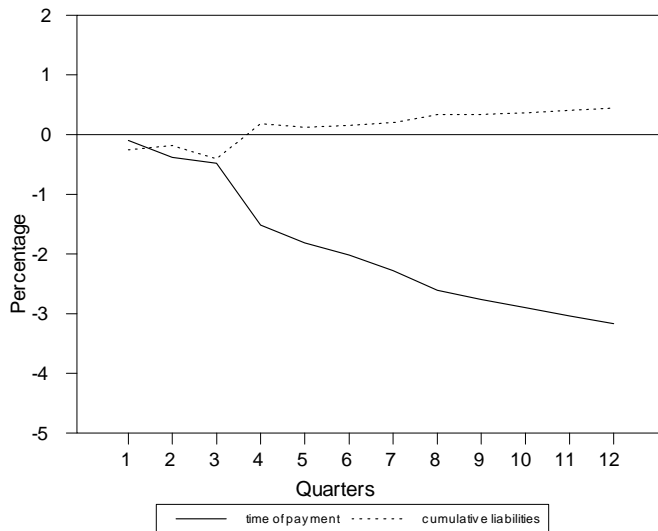
The trajectory of output following shocks dated in accordance to the time of payment, controlling for the cumulative liabilities series, comes close to the one observed for the shock

measure as a whole. This provides support to the assumption that output responds to tax changes at the time of implementation. The response of output for the cumulative liabilities measure, holding constant the time of payment series, is initially nil and after about one year it becomes *positive* albeit small. As said the cumulative liabilities approach is comparatively more suitable for measuring the effects on the economy operating through expectations. Such evidence goes thus against the permanent income theory, but it would be compatible, among other hypotheses, with a positive impact on the confidence of economic agents of tax increases reflecting a prospective improvement in the fiscal stance. Romer and Romer (2010) also document a positive - statistically non-significant - relationship with economic activity for their present-value measure (which bears similarity to our cumulative liabilities measure) when controlling for their benchmark series. Consistently Mertens and Ravn (2011b) find that the tax changes in the Romer and Romer (2010) dataset that could be anticipated (in the sense that were announced at least one quarter prior to implementation) have *before implementation* a positive relationship with output (reversed after implementation).[21]

As an additional experiment, we have assessed the effects on output of a third shock measure in which all tax changes are dated on a strict time of payment basis (see the end of section 4.1). The distinctive feature of this third measure is to capture, in particular, the possibility that refunds of the personal income tax have an impact on output concentrated in the quarter they occur - say, because some consumers face strong liquidity constraints. In a regression including both this modified measure and the benchmark one, the responses of output were negative and equal three years out, respectively, to -0.6 percent and -2.3 percent (non-significant in both cases). Bearing in mind that one is looking at the effects of those portions of the shocks which do not overlap, a larger impact of the benchmark shock measure may indicate that a smoothing behavior by consumers in face of tax refunds predominates.

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[21]Note however that the experiment in Mertens and Ravn is not fully comparable with what is done in our study and Romer and Romer. In fact Mertens and Ravn take the Romers' benchmark series and split it into two subsets: anticipated and non-anticipated shocks. But note that the Romers' benchmark measure differs from their present-value measure not only as regards timing but also the amounts recorded (similarly to the two alternative shock measures in our study).

Figure 10: Output response to discretionary tax policy controlling for the alternative shock measure (1% of GDP shocks)

7 Response of output components to tax shocks

This section studies the trajectory of some GDP components, namely private consumption and private investment, following legislated tax changes, for the benchmark shock measure. The specification used in doing so is similar to (1), but replacing GDP by the relevant demand component. Following a rise of 1 percent of GDP in taxes private consumption falls by about 2.0 percent after one year, and 3.6 percent after three years (Figure 11). This is slightly more than the fall in GDP, but overall the responses of the two variables are very much in line with each other. The responses of consumption of non-durables and durables (Figure 12) differ, as expected, by showing a much more pronounced fall for the latter, which stands at 8.3 and 10.7 percent, respectively, one and three years out. In contrast, the corresponding reductions in the consumption of non-durables are 1.2 and 2.8 percent. The confidence bands (not shown) indicate that both responses are statistically significant.

Tax policy may have distinct impacts on corporate investment depending on the transmission channel. While the traditional interest rate channel implies a rise in investment following a tax increase, negative effects are also possible, e.g. indirectly through the re-

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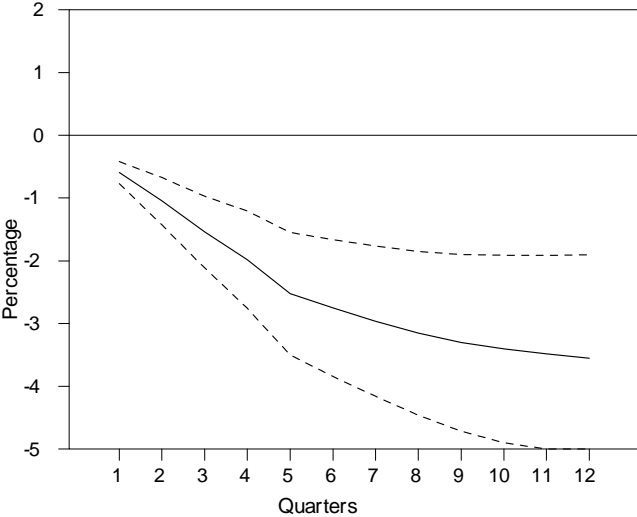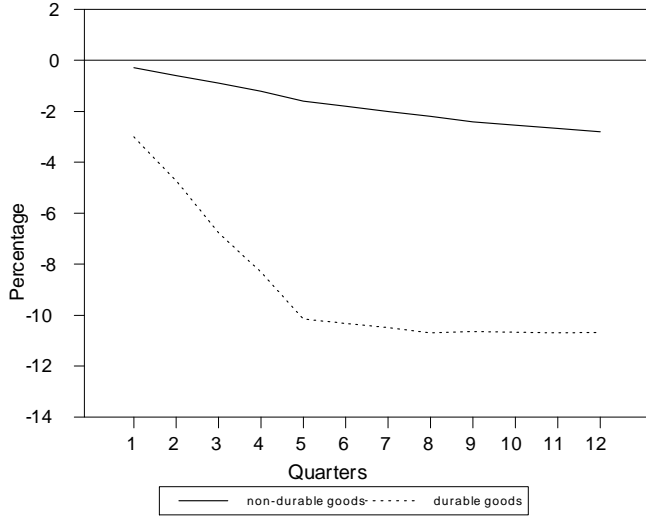Figure 11: Private consumption response to discretionary tax policy (1% of GDP shocks)

Figure 12: Consumption of durables and non-durables response to discretionary tax policy (1% of GDP shocks)

cessionary impact on output or, in the case of the corporation income tax, the reduction in prospective profitability. Unfortunately the response of private investment to the measure of tax shocks developed in this paper does not shed light on this issue for Portugal. In fact, except for the quarter of impact, in which the response (not shown) is positive, from the second quarter on the confidence bands are approximately symmetrical around a zero response. We increased the number of lags of the shock series to 8, and used the shock measure based on cumulative liabilities, which could be more adequate in this context, but without coming to very different conclusions. When investment is broken down by investment of households and corporations, the responses remain statistically non-significant. For the latter variable, there is a sign change from positive to negative after about two years but, given the degree of uncertainty, it is difficult to assess whether this is meaningful in any way.

While for Portugal the depressing effect of tax shocks appears essentially linked to private consumption, the abovementioned studies for the US and the UK also report a strong recessionary impact on private investment.

8 A comparison with SVAR results

The narrative approach has most commonly led to larger tax multipliers than the SVAR approach. For example, the multiplier estimated for the US post-war economy by Romer and Romer (2010) reaches -3, while SVARs multipliers for the US usually do not come much beyond -1. The findings of Cloyne (2013) and Hayo and Uhl (2013) indicate a GDP response similar to the one in Romer and Romer (2010), associating the narrative approach with large negative tax multipliers[22]. Such a tendency is corroborated by our results for Portugal: the effects of tax shocks presented above are much stronger than the ones estimated in Pereira and Wemans (2013b) using an SVAR.

Figure 13 presents the GDP response to tax shocks in an SVAR including taxes, social

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[22]Although studies such as Favero and Giavazzi (2012) have questioned these magnitudes by using alternative specifications to measure the impact of the shocks.

Figure 13: GDP response to tax shocks (1% of GDP): narrative (full line) and SVAR (dashed line) results
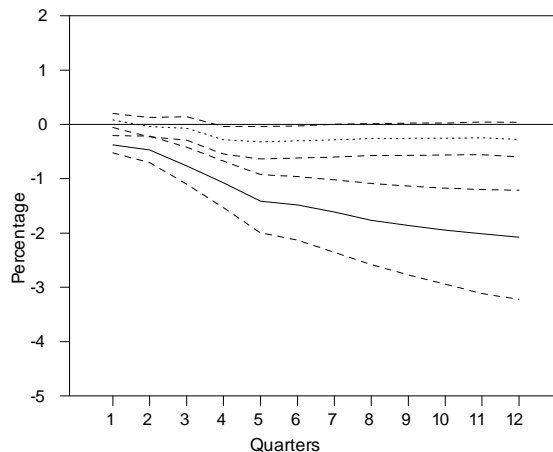
benefits, public consumption, inflation and output (see Pereira and Wemans (2013b) for the details, but with the sample ending in the last quarter of 2012)[23]. Figure 13 also presents the GDP response for the narrative shock, when this is allowed to be non-permanent (see the end of Section 5.1) which is more in line with the SVARs setting. Although both methodologies yield negative effects on GDP, the difference between magnitudes is statistically significant, with the GDP response in the SVAR reaching a maximum of -0.3 percent against -2.4 percent in this study. When taxes are broken down, the point GDP responses differ both for direct and indirect tax shocks. However, more so in the second case as the response hovers around zero in the SVAR, while the point estimates are always strongly negative in the narrative approach (though also lacking statistical significance).

We now go through a number of possible reasons for the different findings in the two methodologies, some of which have been addressed in the literature. The first one is fiscal foresight. Ramey (2011), focusing on the impact of military spending on GDP and private consumption, has blamed the failure of SVARs to capture the anticipation of fiscal policy measures by economic agents for the differences vis-a-vis the narrative approach. Leeper et al. (2008) make similar considerations for taxes. SVARs date tax shocks when revenue is

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[23]Note that the results presented here are very similar to the ones obtained in the original paper with a sample ending in the last quarter of 2011.

affected. While the narrative approach has more flexibility in this respect, the benchmark analyses under this approach have followed (for the reasons given at the beginning of Section 4.1) the time of payment rule that does not take into account fiscal foresight either. Therefore, notwithstanding the potential relevance of the issue, it does not play a role in explaining the gap in GDP responses to tax shocks presented under each methodology. Moreover, as seen in section 6 our alternative shock series derived on the basis of the time of announcement of tax measures (that may capture fiscal foresight to some extent) triggers a GDP response that hardly differs from the benchmark one, as shown in the next section. Similarly when Mertens and Ravn (2011b) split the Romers' benchmark shock series into two subsets: anticipated and non-anticipated shocks, they do not find important differences in the respective GDP responses *after implementation.*

A second source of differences between the two methodologies concerns the elasticity of taxes to GDP calibrated into the SVAR model in order to isolate the automatic contemporaneous movements in taxation. Mertens and Ravn (2013) develop an alternative identification methodology that does not require imposing a contemporaneous elasticity. Using this methodology they estimate a value for that parameter about 50 percent above the benchmark figure computed in accordance with the Blanchard and Perotti procedure and argue that the consideration of this larger elasticity is enough to reconcile the SVAR evidence with the large multipliers of the narrative approach. Previous studies (Caldara and Kamps (2008)) had already stressed the sensitivity of the SVAR results for the US to changes in calibrated elasticities. For Portugal, however, existing evidence is not supportive of such a conclusion: Pereira and Wemans (2013b) carry out a robustness exercise in which they experiment with elasticities that are up to two and a half the benchmark figure. The tax multiplier gets larger when larger elasticities are imposed, but remains well below the impacts presented in this paper.

As a third reason for the gap in the evidence derived under the two methodologies for Portugal, we now focus on the content of the shocks. SVAR shocks capture all deviations

from systematic policy, while the narrative approach concentrates on discretionary legislated policy (not responding to economic activity), i.e. usually large and clearly acknowledged actions. Thus SVAR shocks have a broader scope and include many other changes in revenue that may not be perceived as changes in taxation by economic agents, or at least be perceived as relatively less important ones, such as improvements in the efficiency of tax collection. Moreover, the dating of the shocks in the SVAR approach will depend on accounting rules that can deviate from the date taxes have to be paid, relevant for the narrative approach. This can happen especially in the case of the value added tax as there are important timing differences between the moment consumers pay the tax and when companies pass on the amounts collected to the tax authorities. Furthermore, fluctuations in refunds of this tax bring about an important variation in revenues that is irrelevant for consumers. This could help justify the particularly big discrepancy in the findings for the indirect tax multiplier.

The quantitative importance of changes in tax revenues not explained by the business cycle nor legislative actions can be large. Kremer et al. (2006) estimate that for Portugal in the period 1998-2004 such changes, in absolute average and annual terms, stood at 0.4 percent of GDP, above the figure for the legislated changes (0.3 percent). This phenomenon is likely to be even more pronounced when quarterly data are used as they are more affected by short-run volatility in revenues. In order to explore this issue more formally we extracted the part of the structural (SVAR) tax shock not stemming from legislative changes, as the residual of a least squares regression of the SVAR shock on the narrative shock. We plug this «non-legislative» component into a reduced-form VAR including the same variables (taxes, social benefits, public consumption, inflation and real GDP) and the same number of lags as the original SVAR (note that when the full SVAR tax shock is plugged into this specification, one gets almost exactly the response in Figure 13). The resulting output response (not shown) has a trajectory similar to the one for the overall SVAR shock, only slightly more subdued (the impact three years ahead is -0.2 instead of -0.3; the degree of precision of the estimate is also similar). The measured impact on output (using the same system) for the

linear projection component is commensurate with the one for the narrative shock (albeit more imprecisely estimated) - this is understandable given that the linear projection is just a scaling of the latter shock. Such an evidence is consistent with a differentiated and stronger impact on output of the legislated component of the SVAR shock.

9   Concluding remarks

This study develops a quarterly series of discretionary tax policy shocks for Portugal, based on the legislation and contemporary budgetary analyses. It covers the period from 1996 to 2012. Moreover the sample period is characterized by a high density of measures that have been mostly exogenous, in the sense that they were independent from current and prospective macroeconomic conditions. The benchmark analysis is based on the assumption that economic agents respond to changes in taxes when their current income is affected.

The estimated multiplier effects of tax shocks on economic activity are negative and high, in line with the results of other studies belonging to the same strand of the literature. Legislated tax changes of 1 percent of GDP reduce output by 1.3 percent one year out, and 2.7 percent three years out. These estimates are statistically significant, although surrounded by a reasonable degree of uncertainty, and are robust to a number of variations in the specification used to measure the impacts and to the exclusion of abnormally large measures. The evidence thus suggests that legislated increases (decreases) in taxes have considerable recessionary (expansionary) effects. A shock of the same magnitude has an effect on consumption of around -2.0 percent after one year, and -3.5 percent after three years. Consumption of durables responds particularly strongly to changes in taxation.

This paper also considers an alternative shock measure better suited for capturing a possible role of expectations in the transmission of fiscal policy. Note that the conduct and implementation of tax policy in Portugal does not provide a good setting for studying the issue, as most measures affect income close to the date of approval. With this caveat, there

is a hint of a positive relationship between the expectations component of tax changes and economic activity. This could theoretically stem from beneficial effects on economic growth coming from prospective fiscal consolidation.

The estimated impact of changes in taxation on economic activity for Portugal is much stronger in this paper than in previous work using the SVAR methodology, as it has been the case for other countries. While there are many differences between the two methodologies, in the Portuguese case that gap can be ascribed in particular to the content of the shock. Narrative shocks come strictly from discretionary exogenous government policy; SVAR shocks reflect many other factors to which economic agents may respond differently.

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10   Appendix

Table 3: Tax policy measures implemented in Portugal from 1996 to 2012 (continues)

Year	Tax	Brief Description	Assessed motiv.	Quantification (% GDP)
1996	IVA	Introduction of an intermediate rate (12%) in July (p.e.)	exog.(O)	-0.32
1996	ISP	Change in the average tax rate (p.e.)	exog.(O)	0.02
1997	IRC	Tax rate reduction from 36 to 34% (p.e.)	exog.(O)	-0.17
1997	ISP	Change in the average tax rate (p.e.)	exog.(O)	-0.12
1998	ISP	Change in the average tax rate (p.e.)	exog.(O)	0.10
1999	ISP	Change in the average tax rate (p.e.)	exog.(O)	-0.10
2000	IRC	Increase in the prepayment rate from 75 to 85% for high-profit firms (r.s.e.)	exog.(O)	0 (+/-0.26)
2000	IRC	Introduction of lower rates for companies located on inland regions and for small companies plus a reduction in the tax rate from 34 to 32% (p.e.)	exog.(O)	-0.22
2000	ISP	Change in the average tax rate (p.e.)	exog.(O)	-0.52
2001	IRS	Reductions on the tax rates and inclusion of an additional bracket (p.e.)	exog.(O)	-0.24
2001	ISP	Change in the average tax rate (p.e.)	exog.(O)	0.27
2002	IRS	Especially strong update of bracket limits of withholding tables (r.s.e.)	exog.(O)	0 (-/+0.25)
2002	IRS	Special scheme for the payment of tax arrears (t.e.)	exog.(C)	0.17
2002	IRC	Special scheme for the payment of tax arrears (t.e.)	exog.(C)	0.33
2002	IRC	Tax rate reduction from 32 to 30% (p.e.)	exog.(O)	-0.14
2002	IVA	Standard tax rate increase from 17 to 19% in June (p.e.)	exog.(C)	0.64
2002	IVA	Special scheme for the payment of tax arrears (t.e.)	exog.(C)	0.23
2002	ISP	Change in the average tax rate (p.e.)	exog.(O)	0.37
2002	Other Ind.	Special scheme for the payment of tax arrears (t.e.)	exog.(C)	0.11
2002	Social cont.	Special scheme for the payment of tax arrears (t.e.)	exog.(C)	0.13
2003	IRC	Increase in the special prepayment rate (p.e.)	exog.(O)	0.10
2003	ISP	Change in the average tax rate (p.e.)	exog.(O)	-0.03
2004	IRC	Tax rate reduction from 30 to 25% (p.e.)	exog.(O)	-0.45
2004	ISP	Change in the average tax rate (p.e.)	exog.(O)	0.18
2005	IRS	Decline in tax rates compensated by a reduction of tax deductions (r.s.e.)	exog.(O)	0 (-/+0.12)
2005	IVA	Standard tax rate increase from 19 to 21% in July (p.e.)	exog.(C)	0.51
2005	ISP	Change in the average tax rate (p.e.)	exog.(O)	0.03
2005	Social cont.	Increase of self employed social contributions in July (p.e.)	exog.(C)	0.07
2006	IRS	Reintroduction of tax credits (p.e.)	exog.(O)	-0.08
2006	IRS	Introduction of a new top bracket (p.e.)	exog.(C)	0.02
2006	IRS	Gradual increase in the taxation of income from pensions (p.e.)	exog.(C)	0.04
2006	ISP	Rise in the tax rate (p.e.)	exog.(C)	0.13
2006	IT	Multi-year increase of the unitary tax component (p.e.)	exog.(C)	0.09
2007	IRS	Elimination of the different treatment of married and single taxpayers (p.e.)	exog.(O)	-0.02
2007	IRC	Changes in the taxation of dividends (p.e.)	exog.(C)	0.02
2007	ISP	Rise in the tax rate (p.e.)	exog.(C)	0.12
2007	Other ind.	Reform of the taxation of vehicles in July (p.e.)	exog.(O)	-0.04
2007	Social cont.	Increase of the public employees and pensioners contribution to their health system (p.e.)	exog.(C)	0.06
2008	IRS	Increase in tax credits (p.e.)	end.	-0.04

Table 3: Tax policy measures implemented in Portugal from 1996 to 2012 (continued)

Year	Tax	Brief Description	Assessed motiv.	Quantification (% GDP)
2008	IRC	Introduction of tax benefits (p.e.)	exog. (O)	-0.01
2008	IRC	Change in the calculation of taxable income (p.e.)	exog. (O)	0.04
2008	IMI	Reduction in top tax rates by mid-year (p.e.)	end.	-0.04
2008	IVA	Decline in the standard tax rate from 21 to 20% in July (p.e.)	exog. (O)	-0.28
2009	IRS	Raise in tax benefits to people with disabilities (p.e.)	exog. (O)	-0.02
2009	IRC	Rate cut from 25 to 12.5% applied to low values of taxable income (p.e.)	end.	-0.1
2009	IRC	Changes in the rules for prepayments (r.s.e.)	end.	0 (+/-0.03)
2009	IRC	Reduction in the special prepayment limit (p.e.)	end.	-0.03
2009	IT	Increase in the tax rate - ad valorem and unitary components (p.e.)	exog.(O)	0.01
2010	IRS	Special surcharge on the income from pensions and labour of 1% for the 3rd and 4th income brackets and 1.5% for the higher brackets in July (p.e.)	exog.(C)	0.39
2010	IRS	Increase of withholding rates on capital income in July (p.e.)	exog.(C)	0.02
2010	IRS	Introduction of a new bracket with a marginal rate of 45% to be applied to taxable income exceeding 150.000 euros (p.e.)	exog.(C)	0.01
2010	IRC	Increase of 2.5 p.p. in the rate applied to high taxable profits	exog. (C)	0.12
2010	Other dir.	Special taxation scheme for undeclared income from capital held abroad (t.e.)	exog. (C)	0.05
2010	IVA	Increase in all rates by 1 p.p. in July (p.e.)	exog. (C)	0.61
2011	IRS	New ceilings for tax benefits; higher taxation of capital gains and reduction of the deduction applicable to pensions' income above 22.500 euros (p.e.)	exog.(C)	0.11
2011	IRS	Extraordinary surcharge of 3.5% on 2011's taxable income (t.e.)	exog.(C)	0.58
2011	IRC	Introduction of a ceiling to tax benefits (p.e.)	exog. (C)	0.06
2011	Other dir.	Effect of the introduction of a new tax on the banking sector (p.e.)	exog. (C)	0.09
2011	IVA	Increase in the standard rate from 21 to 23% (p.e.)	exog. (C)	0.60
2011	IVA	Increase of the rate applied to electricity and natural gas in October (p.e.)	exog. (C)	0.29
2011	ISP	Reduction of tax benefits (p.e.)	exog.(C)	0.08
2011	Social cont.	Entry into force of the new contributory code; increase in the contributory rate for public employees from 10 to 11% (p.e.)	exog.(C)	0.16
2012	IRS	Reduction of tax benefits (p.e.)	exog.(C)	0.37
2012	IRS	Increase in the taxation of pensions (p.e.)	exog.(C)	0.07
2012	IRS	Solidarity surcharge on highest pensions (p.e.)	exog.(C)	0.01
2012	IRS	Increase of the taxation on capital income (p.e.)	exog.(C)	0.00
2012	IRC	Surcharge initiated in 2010 extended to profits exceeding 1.5 million euros plus introduction of a surcharge on profits exceeding 10 million euros (p.e.)	exog. (C)	0.11
2012	IMI	Increase of top and bottom tax rates and elimination of exemptions (p.e.)	exog. (C)	0.03
2012	Other dir.	Special taxation scheme for undeclared income from capital held abroad (t.e.)	exog. (C)	0.16
2012	IVA	Changes in the lists of goods and services subject to reduced rates (p.e.)	exog. (C)	0.99
2012	IT | IABA	Increase in excise taxes (p.e.)	exog.(C)	0.06
2012	ISV	Update of the tax (p.e.)	exog.(C)	0.01

Note: IVA-Value Added Tax; ISP-Tax on Oil Products; IRC-Corporate Income Tax; IRS-Personal Income Tax; IT-Tax on Tobacco; IABA-Tax on Alcohol and Alcoholic Beverages; ISV-Tax on Vehicle Sales; IMI-Municipal Tax on Real Estate; p.e.-permanent eff.; t.e.-temporary eff.; r.s.e.-revenue switching eff.; end. - endogenous meas.; exog.(C) - exogenous meas. - consolidation; exog. (O) exogenous meas. - other.