How large are fiscal multipliers?
An empirical assessment for the Euro Area

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Vita

Ricardo Jorge Maia Martins da Silva was born on the 6th of December of 1987, in Vila Nova de Gaia, Portugal.

He obtained his degree in Economics from the Faculdade de Economia da Universidade do Porto – Portugal (FEP) in 2010, with a final grade of 15/20.

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To my parents,

Abstract

In the current context where the limited role for monetary policy instruments apparently endows fiscal policy with higher effectiveness, European fiscal policy authorities are rather constrained by the fact of most countries being struggling against recessions together with the need to put public finances in a sustainable path.

In this context, we assess how large are fiscal multipliers in Europe, for both aggregated and disaggregated spending and revenue variables. Moreover, we analyze how cycle phases and fiscal consolidation episodes shape the size of fiscal multipliers. We present evidence for the Euro area, relying on a VAR model with pooled annual data for the current seventeen country-members, from 1998 to 2008.

Estimation results show that, on average, public spending in the Euro area impinges negatively on impact, but the cumulative impact on output is positive while taxes, as expected, have (both impact and cumulative) negative impacts on output. On the expenditure side, transfers are the main driving force for the overall expenditure dynamics; moreover, wages exhibit negative impacts on output while positive effects are strongly driven by shocks in public investment and, to a lesser extent, by intermediate consumption. On the revenue side, all items impinge negatively on output growth. Additionally, openness reduces the effectiveness of public spending while it positively affects the size of the taxes multiplier. We have also found that the intertemporal budget constraint shapes a "more Ricardian" behavior on the European economic agents.

As regards to how the size of fiscal multipliers changes across cycle phases, our results show that public spending multiplier is positive in recessions while in expansions is smaller, inclusively, negative. Similarly, the effectiveness of the taxes multiplier is, also, higher in recessions.

Last but not the least, we have found that consolidation phases affect negatively the size of the multipliers.

Keywords: Fiscal policy, Fiscal multipliers, Fiscal shocks, Business-cycle fluctuations, Public debt, Euro area, VAR analysis.

JEL Codes: E32, E62, E65; H60.

Resumo

No contexto atual, em que o papel dos instrumentos de política monetária se encontra limitado, seria de esperar que a política orçamental tivesse uma maior eficácia. Porém, as autoridades de política estão limitadas na sua atuação pelo facto de muitos países estarem a sofrer recessões e pressão para garantir a sustentabilidade da dívida.

Neste contexto, avaliamos a magnitude dos multiplicadores orçamentais na Europa, em termos agregados e desagregados, para as variáveis da despesa e da receita. Analisamos também se as fases do ciclo e os episódios de consolidação orçamental influenciam a dimensão dos multiplicadores orçamentais. Apresentamos evidência para a área do Euro, com base num modelo VAR, com dados anuais (1998-2008) para todos os países-membros.

Os resultados das estimações mostram que, para a área Euro, a despesa pública afeta negativamente o produto no impacto mas esse efeito é positivo em termos acumulados. Os impostos, como esperado, exibem (tanto no impacto como em termos acumulados) efeitos negativos sobre o produto. Do lado da despesa, as transferências são as responsáveis pela dinâmica da despesa global; os salários apresentam efeitos negativos no produto, enquanto os efeitos positivos são fortemente impulsionados por choques no investimento público e, em menor medida, pelo consumo público intermédio. Do lado da receita, todos os instrumentos influenciam negativamente o crescimento do produto. Adicionalmente, o grau de abertura comercial reduz a eficácia da despesa pública mas aumenta o impacto da receita sobre o produto. Concluímos também que a restrição orçamental intertemporal do setor público é ativa, tornando o comportamento dos agentes europeus mais ricardiano.

Os resultados mostram ainda que o multiplicador da despesa pública é positivo em recessões, sendo menor em expansões, inclusivamente, negativo. Da mesma forma, a eficácia do multiplicador dos impostos é superior em recessões.

Finalmente, conclui-se que as fases de consolidação afetam negativamente o tamanho dos multiplicadores.

Palavras-chave: Política orçamental, Multiplicadores orçamentais, Choques de política orçamental, Ciclos económicos, Dívida pública, Área Euro, modelos VAR.

Códigos JEL: E32, E62, E65; H60.

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1. Introduction

In the sequence of the recent global financial and economic crisis - classified by the literature as the most severe crisis since the Great Depression of the 1930s -, monetary authorities of the developed countries have decided to reduce key interest rates in order to ensure not only financial stability, but also to smooth the impacts on real output and unemployment. Interest rates are now hitting the lowest levels ever and, thus, the ability of conventional monetary policy instruments to stimulate economic activity is substantially reduced.

In this context, it is important to assess the efficiency of fiscal policy to overcome scenarios of recession or of rather slow growth in most of the Euro area countries. On the one hand, a "close-to-the-lower-bound" interest rate scenario is expected to endow fiscal policy with higher effectiveness. On the other hand, however, and according to data from the ECB (2012), only five out of the seventeen Euro area countries (Estonia, Luxembourg, Slovenia, Slovakia and Finland) exhibited a debt-to-output ratio below that advocated by the Stability and Growth Pact (SGP) in 2011. Fiscal policy as a stabilizer is thus constrained by the widespread public finance disequilibria, in urgent need for a correction path.

From both empirical and theoretical literature we find that, usually, fiscal consolidation periods are associated with recessions. Moreover, while the literature is rather ambiguous on how recessions affect the size of fiscal multipliers, the Academy provides evidence of smaller impacts on output from debt-correction measures during consolidation periods, providing even evidence on non-Keynesian effects when cuts are operated through certain expenditure measures, namely public wages.

With the above-described scenario in background, this dissertation intends to assess how large are fiscal multipliers in Europe and for different fiscal policy instruments. In particular, we compute multipliers on the revenue side – covering for social security contributions, direct and indirect taxes – and on the expenditure side – public wages, intermediate consumption, transfers and investment. Moreover, we aim at contributing to the (rather sparse) literature on the size of multipliers across cycle phases or under specific periods of policy shifts, such as the fiscal consolidation episodes. Evidence is presented for the Euro area.

Among the relevant literature we found three main methodologies that can be used to assess the effectiveness of fiscal policy: (i) large structural macroeconomic models such as the dynamic stochastic general equilibrium (DSGE) models; (ii) case studies; and, (iii) Vector Autoregression (VAR) approaches. We propose to compute fiscal multipliers from estimations produced using a panel-data VAR approach. In particular, we compute the average impact and cumulative effects of fiscal policy on output for the Euro area, using annual data for the current seventeen country-members, from 1998 to 2008. We use 1998 as the starting year because, in spite of no formal monetary union, the convergence admission criteria were already established and monitored by then. The year 2008 was set as the final year of our sample as to exclude the economic and financial crisis turmoil; the inclusion of the recent years in such a small sample would certainly produce, due to outlier observations, biased results relative to regular empirical evidence.[1]

The dissertation proceeds as follows. In section 2, we provide a review of the theoretical mechanisms and empirical evidence on the size of fiscal multipliers; in particular we review the main mechanisms that shape the size of fiscal multipliers across cycle phases and during consolidation processes. After a brief description of the methodology and the data used (section 3) we provide empirical evidence for the Euro area in section 4. We compute different-instrument fiscal multipliers, accounting either for structural specificities, such as the degree of openness, the size of the debt-to-output ratio and the periods under fiscal consolidation. Multipliers are also computed for expansions and recessions. Finally, we present the concluding remarks in section 5.

[1] Results obtained by policymakers in response to the crisis were not as expected and the reliability of models used was called into question. For further details, see Ramey (2011) and Perotti (2011).

2. Theoretical mechanisms and empirical evidence on the size of fiscal multipliers – a review

There is now a substantial amount of literature exploring, both theoretically and empirically, how the size of fiscal multipliers changes according to several factors, such as the degree of openness, the alternative fiscal instruments used or other structural/institutional features governing the economies. Instead, to a rather small extent, the literature also explores how the size of the multipliers changes across cycle phases or with specific structural policy regime shifts such as fiscal consolidation processes. These latter scenarios are crucial for the analysis of the current European economic environment, where the efforts to struggle against a strong recession and to provide public support to the financial sector have had strong negative effects on public debt dynamics of most of the countries.

In what follows, we will review the literature on the main channels affecting the size of fiscal multipliers. For most of the standard results we will rely on macroeconomic manuals of general acceptance, namely on Burda and Wyplosz (2009) and Gordon (2012), as well as on previous literature reviews, namely those provided by Briotti (2005), Spilimbergo *et al.* (2009) and Hebous (2011).

2.1. General determinants of the size of multipliers

The fiscal multiplier is the most commonly used measure to assess the effectiveness of fiscal stimulus to output. Fiscal multiplier is defined as the ratio between the change in output and an exogenous change in a given fiscal variable. There are as many multipliers as the number of items composing the government budget, at different disaggregation levels – *e.g.*, tax multipliers or current government spending multipliers.

Fiscal multipliers are also computed according to different time horizons for assessing the impacts on output, usually referred as impact and cumulative multipliers. The impact multiplier measures the impact on output from a change in fiscal variables

in the period in which the impulse to government expenditure/revenue occurs. The cumulative multiplier refers to the cumulative change in output *per* unit of additional government expenditure/revenue, *i.e.*, computes contemporaneous as well as lagged effects on output produced by a shock in any fiscal variable. Cumulative multipliers are specially required in order to correct for persistent fiscal shocks.

Usually, Keynesian and New-Keynesian models predict that discretionary expansionary fiscal policies (*e.g.*, rises in government spending or cuts in taxes), by stimulating aggregate demand, produce an increase in output.[2] There is also a positive response of private consumption to government expenditures, which is explained as a result of the strong dependence of consumption on current disposable income. All these effects are, however, very different across models with different assumptions characterizing different structural behavior or institutional environments.

Using the simple Keynesian model, a static model characterized by sticky prices, slack productive capacity, fixed interest rate, and that is typically used to describe a closed (or a large, rather closed) economy in the very short-run, the value of the fiscal multiplier is positive and larger than one. The size of fiscal multiplier is larger the larger the marginal propensity to consume and the larger the sensitivity of private investment to income.

The marginal propensity to consume is higher when consumers do not take fully into account of the increase in future taxes to compensate for current debt increases, either because of finite horizon, or simple myopia, or when consumers face liquidity constraints. All these factors that potentially explain why private consumption moves alongside with current disposable income and less with net wealth.

Ceteris paribus, since the effectiveness of fiscal policy depends on the marginal propensity to consume, stimulus packages should have a higher government spending component relative to tax cuts; the first round effect on demand is immediate when expenditure increases, while under a tax cut (part of) the increase in disposable income is saved and not directly spent by individuals. Thus, expenditure-side multipliers are expected to be larger than revenue-side multipliers (see Appendix A.1. for an analytical assessment comparing both multipliers).

[2] New-Keynesian models differ from Keynesian models as the former include microeconomic foundations and rational forward-looking expectations rather than backward-looking expectations.

Also, the larger the impacts of income on investment decisions, *i.e.*, the stronger the accelerator effect is, the larger are fiscal multipliers.

In the weak Keynesian models (*e.g.*, IS-LM or IS-TR models for a closed economy and the IS-LM/TR-BP models for an open economy)[3] - those under sticky prices but with money market and international dependence in terms of goods, services and financial markets – several factors limit the size of fiscal multipliers. The value of the multiplier is smaller than in the simple Keynesian model, but still positive.

In the closed economy frameworks, the impact of fiscal multipliers on output is limited by the decline in private demand, namely in private investment, since expansionary fiscal policies put upward pressure in interest rates (crowding-out effect).[4] The degree of crowding-out is larger the larger the sensitivity of private investment to the real interest rate. Moreover, the crowding-out is larger, the larger the elasticity of money demand relative to output and/or the smaller the semi-elasticity of money demand to the interest rate (IS-LM model) or the less monetary authority reacts to economic upturns (IS-TR model).

Several studies (*e.g.*, Spilimbergo *et al.*, 2009) show that accommodative monetary conditions can increase the size of multipliers by a factor of two to three. On the contrary, under plausible assumptions the multiplier is zero if monetary policy firmly targets inflation or nominal income.

Comparatively with a closed economy (large country), in a small open economy the size of fiscal multiplier is smaller the larger is the marginal propensity to import. Expansionary fiscal policies originate short-run increases in imports and this effect is stronger the more (import) open economies are. Moreover, the external relations of a small country also shape the size of fiscal multipliers as they differ across exchange rate regimes, with the degree of capital mobility and with the level of development of monetary and financial markets.

The size of multiplier is larger if monetary conditions are accommodative. In a small open economy under a fixed exchange rate regime, fiscal expansion puts upward

[3] See, for instance, Burda and Wyplosz (2009) for a synthetic view of these models.

[4] Using, for instance, the IS-LM model (closed economy for simplification), an increase in output, resulting from and expansionary fiscal policy, leads to an increase in real money demand, pushing up interest rates. An alternative approach is the IS-TR model, in which the monetary authority, following an interest rate feedback rule on the output gap (simple version of the Taylor rule), increases the interest rates as the output gap expands.

pressure on the exchange and the interest rates.[5] As money supply increases as to defend the fixed exchange rate parity, an increase in output occurs with a smaller crowding-out effect. Hence fiscal policy under this scenario is more effective in stimulating output than for a large, rather closed, country.

In contrast, in a small open economy under a flexible exchange rate regime, fiscal policy is less effective. A fiscal expansion puts upward pressure on the interest rate; as capital flows into the economy, the demand for domestic currency increases and the domestic currency appreciates. Because prices are sticky, this nominal appreciation is mapped to a real appreciation, and consequently net exports decline. This negative effect on the trade balance limits the expansionary effect of fiscal policy, and so fiscal policy in small open economies under flexible exchange rate regimes affects output by less than in large, rather closed, economies.

Moreover, the effects of the exchange-rate channel are reinforced for higher degrees of capital mobility. Perfect mobility of capital implies that assets denominated in domestic currency and in foreign currency are perfect substitutes - as long as domestic interest rate compensates for foreign interest rate and for expected exchange rate changes, assets denominated in both currencies are hold. In this scenario, currency exchange is unlimited, costless and immediate.

So, under a fixed exchange rate regime and perfect capital mobility, capital flows are reinforced in response to interest rate differentials, offsetting them, in the sequence of a fiscal policy. Thus, no crowding-out (in) applies and fiscal policy has maximum impacts on output. On the other hand, under flexible exchange rates, exchange-rate crowding-out (in) perfectly offsets the impacts of fiscal policy on output – fiscal multiplier tends to zero.

Another factor from which the size of the fiscal multipliers depends on is the degree of financial market development. It has, however, ambiguous effects on the size of multipliers, depending on how the degree of financial development affects liquidity constraints and on the government's ability to finance its fiscal deficit.

Usually, a lower degree of financial development imposes liquidity constraints which limit the ability for consumption (and investment) smoothing. The values of the fiscal multipliers are, thus, expected to be larger (Spilimbergo *et al.*, 2009).

[5] In this dissertation we assume that an increase in exchange rate means an appreciation of the domestic currency.

Regarding government's ability to finance the fiscal deficit, the impacts of government financing on interest rates also depends on the degree of financial development. In countries with limited access to financial markets, governments can issue debt to finance the deficit only at very high interest rates, which dampens the size of multipliers. However, if in those countries governments issue bonds to "captive" domestic savers, thereby lowering the costs of financing, the size of the decrease of fiscal multipliers can be restricted.

For the sake of concreteness, collect the above-described mechanisms into the analysis of policy and "spillover" effects arising from interdependent economies. Consider, as an example of policy co-ordination, the scenario of a monetary union with high capital mobility and well developed financial markets. In this context, fiscal policy externalities may arise, although moving in opposite directions.

A fiscal stimulus will increase domestic output but it will lead to additional imports from trading partners boosting the income of the latter (trade channel). At the same time, if the country (or group of countries) where the fiscal shock occurs is large enough, the policy puts upward pressure on the union's interest rates. This, in turn, has a contractionary effect on both domestic and foreign output (interest rate channel).

Additionally, as the exchange rate of the union currency floats against the rest of the world, a fiscal expansion in a (large) member economy causes an appreciation of the common currency, worsening all member-countries' trade balances.

Cwik and Wieland (2011) find that spillovers between Euro area countries are negligible or even negative, because direct demand effects are offset by the indirect effect of the adjustment in the euro exchange rate.

In the same veil, a fiscal expansion in the Euro area, through changes in the exchange rate, boosts the non-member countries' exports and output. There is a locomotive effect between economies under flexible exchange rates, with both domestic and foreign output expansion in the sequence of a fiscal stimulus.

In contrast, under a fixed exchange rate regime, between its currencies an expansionary fiscal policy on one country requires an increase in the foreign interest rate, leading to a decrease in the output of the partner countries. Summing up, there is a negative transmission effect between economies, usually known as a beggar-thy-neighbor effect. While the output of a country increases, output of the anchored

countries decreases. This effect can be smaller or, eventually, reverted if the income feedback effect through increase of exports is strong enough.

A more recent generation of models includes dynamic models with rational expectations and infinitely-lived agents. The crucial contribution of these models is that the range of potential transmission channels for fiscal policy to aggregate demand is broader under a longer time horizon. In this scenario, agents form expectations regarding future developments in public finances and budget policies, and hence their future disposable income and wealth. The intertemporal optimization implies complex and non-linear relationships for consumption and investment, which depend, among other things, on how economic agents form their expectations. Due to wealth effects on consumption, this aggregate demand component is one of the most affected by these assumptions. Considering forward looking agents, and no liquidity constraints, the Ricardian Equivalence proposition may hold[6] - there is a precautionary behavior of economic agents that fully offset fiscal policy changes, and the value of the multiplier may converge to zero.

Dynamic Stochastic General Equilibrium (DSGE) models, as the New-Keynesian (NK) and the Real Business Cycle (RBC) ones, are examples of this type of framework. Both models predict a short-run expansion in output in the sequence of discretionary expansionary fiscal policies but a decrease in private consumption operating through a negative wealth effect attached to higher current government expenditures. The difference is that RBC models predict an increase in investment that more than compensates the fall in consumption (*e.g.*, Baxter and King, 1993) while NK models tends to exhibit investment crowding-out.

In RBC models the negative wealth effect leads to a decline in consumption whereas interest rate, saving and labor supply increase.

The rise in hours worked, in turn, causes real wages to fall whereas investment increases. This described fiscal policy transmission is in force whether the rise in government spending is permanent or persistent. The intuition behind the increase in

[6] The concept of Ricardian Equivalence was revived by Barro (1974) and means that a tax cut/expenditure increase financed by issuing government debt may fail to stimulate private consumption, because consumers discount the future tax burden required to debt service and repayment, and so increase their savings accordingly and no impact on output occurs.

investment is that a higher steady-state level of hours worked requires initially higher investment to build up additional capital stock.

In contrast, in a NK model, after a positive shock to government consumption real wages increase. This is because the resulting increase in output raises the demand for labor which, in the NK setup, offsets the increase in the labor supply due to the negative wealth effect. As regards to investment, in NK models with capital accumulation, an increase in government spending raises the interest rate and crowds-out private investment.

Increases in output result from the effects of fiscal stimulus on the supply side in RBC models, while they operate under the demand side in NK models. Additionally, both models predict only temporary output effects from fiscal stimulus. In the NK models, as time passes, prices adjust upwards and, in the medium-to-long run, fiscal shocks affect nominal but no real variables. In RBC models, only in long run permanent effects on output occur through changes in supply-side. These effects are captured by the cumulative fiscal multipliers.

2.2. Empirical evidence on the size of multipliers

In the remainder of this subsection we propose to review most of the empirical results in the literature, while comparing them with the theoretical expected outcomes described above. There is a huge amount of empirical work on the assessment of the size of fiscal multipliers. Deliberately, we will focus on those using the most standard methodology, namely the vector autoregression (VAR) framework. Moreover, as several literature reviews have been frequently produced (see, for instance, Briotti (2005), Spilimbergo *et al.* (2009) and Hebous (2011)), we will focus mainly on more recent papers.

Table 1 briefly reviews some of the most relevant papers of this strand of literature, complemented by some recent studies on the impacts on output from fiscal stimulus.

Table 1: Fiscal multipliers in literature

Fiscal Instrument / Composition	Effects on output	Size-range for multipliers		Author	Methodology	Sample
		Impact	Cumulative			
Public spending (total)	**Positive**	1.68	1.21 (10 years)	Pereira and Sagalés (2011)	VAR (Cholesky decomposition)	Portugal (1980-2005)
		0.1	0.2 (5 years)	Fatás and Mihov (2001)	VAR (Cholesky decomposition)	U.S. (1960-1996)
		0.75	0.02 (5 years)	Burriel *et al.* (2010)	VAR (Structural approach)	U.S. (1981Q1-2007Q4)
		< 1		Afonso and Sousa (2012)	VAR (Bayesian structural approach)	U.S. (1970Q3-2007Q4) U.K. (1964Q2-2007Q4) Germany (1980Q3-2006Q4) Italy (1986Q2-2004Q4)
	Negative	0.65	-2.24 (5 years)	Mountford and Uhlig (2009)	Sign restrictions	U.S. (1955-2000)
	Ambiguous	0.8	-0.24 (5 years)	Blanchard and Perotti (2002)	VAR (Structural approach)	U.S. (1947Q1-1997Q4)
		0.4	-0.2 (4 years)	Agnello *et al.* (2011)	Econometric approach (2SLS)	Panel of 132

						countries (1960-2008)
Taxes (total)	**Positive**					
	Negative	0.00	-1.83 (10 years)	Pereira and Sagalés (2011)	VAR (Cholesky decomposition)	Portugal (1980-2005)
		-1.4	-0.4 (5 years)	Blanchard and Perotti (2002)	VAR (Structural approach)	U.S. (1947Q1-1997Q4)
Public Investment	**Positive**	2.44	4.69 (10 years)	Pereira and Sagalés (2011)	VAR (Cholesky decomposition)	Portugal (1980-2005)
Wage expenditure	**Negative**	0.33	-2.68 (10 years)	Pereira and Sagalés (2011)	VAR (Cholesky decomposition)	Portugal (1980-2005)
		< 0 [7]		Alesina and Ardagna (2010)	Case study	OECD countries (1970-2007)
		-0.48	-2.56 (5 years)	Alesina *et al.* (2002)	VAR (Cholesky decomposition)	OECD countries (1960-1996)
Direct taxes	**Negative**	-0.1	-2.78 (10 years)	Pereira and Sagalés (2011)	VAR (Cholesky decomposition)	Portugal (1980-2005)

Fatás and Mihov (2001) compare the dynamic impacts of fiscal policy on macroeconomic variables implied by a typical RBC model with the empirical results

[7] Alesina and Ardagna (2010) do not compute the size of fiscal multipliers, they only compare the effects of different compositions of major fiscal changes.

from an identified vector autoregression, using quarterly data from 1960Q1 to 1996Q4 for the U.S. They find strong and persistent increases in private consumption and employment in response to rises in government expenditures. This is inconsistent with theoretical benchmark of RBC models where private consumption falls in response to rises in government expenditures. Another discrepancy between the model and the empirical results is that while empirical results show a positive conditional correlation between consumption and employment, in the theoretical benchmark these variables move in opposite directions.

Overall, their results show that increases in government spending are expansionary with residential investment being the main driving force for the persistent rise in output. In a more disaggregated analysis they find that the increase in government spending is followed by a persistent rise in all components of consumption (durable goods, nondurables goods and services). Investment also increases, but only within a lag of six quarters, returning to trend after three years.

This evidence on the dynamics of investment goes against the Keynesian view and favors the classical (RBC) approach.

In contrast, Alesina *et al.* (2002), using a panel of OECD countries and covering data from 1960 to 1996, show that there is a negative effect of government expenditures on investment (crowding-out effect of fiscal policy), being this negative effect mainly associated to increases in government wages. A possible reason for this effect is that increases in wages in the public sector stimulate unions pressure for wage increases in the private sector, which have negative impact on profit margins and, consequently, on private investment.

Afonso and Sousa (2012) analyze recent empirical evidence for the U.S., the U.K., Germany, and Italy, respectively, for the periods 1970Q3-2007Q4, 1964Q2-2007Q4, 1980Q3-2006Q4, and 1986Q2-2004Q4. They use a bayesian structural vector autoregression approach with a recursive identification scheme to identify fiscal policy shocks. They conclude that government spending shocks have, in general, a small effect on GDP; they do not impact significantly on private consumption and have a negative effect on private investment (evidence for the NK approach).

Another recent paper in this domain is Pereira and Sagalés (2011) who, besides analyzing the effects of expenditure-side fiscal policies, as the previous recorded studies

do, also analyze the impacts, both at aggregate and disaggregate levels, of revenue-based fiscal policies. The authors consider four components on the spending side: current transfers, intermediate public consumption, wages and public investment; and two components on revenue side: direct and indirect tax revenues. Using the Cholesky decomposition for shock identification, the cumulative impulse-response functions are drawn for Portugal and rely on a sample covering the period from 1980 to 2005.

At the aggregate level, results show that revenue-side is more effective than spending-side fiscal policies in affecting output. By definition, an increase in taxes does not produce contemporaneous effects in output (impact multiplier is 0); although, an intertemporal accumulated effect in output is estimated in -1.83 (cumulative multiplier). In contrast, an increase in public spending produces contemporaneous effects in output (impact multiplier is of 1.68) while the cumulative multiplier is 1.21. This suggests important short-term demand effects and negligible longer-term effects. Indeed, the response of output becomes insignificant after five years. Moreover, these results go against the Keynesian theory which postulates that the tax multiplier is (in absolute value) smaller than the spending multiplier.

At a more disaggregated level, results in Pereira and Sagalés (2011) show that, among the spending-side components, public investment, wages, current transfers and intermediate public consumption exhibit, respectively, the highest through the lowest multiplier value. However, and in spite of the barely positive impact on output, wages have a negative cumulative multiplier estimated in 2.68. For the remaining expenditures, impact (and cumulative) multipliers range from 2.44 (4.69) for public investment to 0.27 (0.62) for intermediate consumption. As in the case of expenditure on wages, transfers also imply transition negative impacts on output. These results are with the Keynesian theory with exception of those observed for the compensation of employees; in this case, results go in line of those found by Alesina *et al.* (2002).

On the revenue side, direct taxes have stronger impacts on output than indirect taxes, with impact (and cumulative) multipliers of -0.1 (-2.78) and -0.06 (-0.18), respectively. The smaller effect of indirect taxes in output is explained by the large weight of consumption taxes in indirect taxes in Portugal together with consumption patterns and habits relatively price-inelastic; thus, indirect taxes have not significant effects on aggregate demand.

As for evidence on how structural or institutional factors shape the size of multipliers, we found evidence covering for the exchange rate regime, the degree of openness and the level of public debt-to-GDP ratio.

Table 2 show the results found by Ilzetzki *et al. (2011)* for government spending multiplier across different scenarios: exchange rate regimes, openness trade degree and financial fragility.

Table 2: Government spending multiplier across different scenarios

<table>
<tr><th>Fiscal Instrument</th><th>Transmission Channel</th><th colspan="2">Cumulative Multiplier</th></tr>
<tr><td rowspan="6">Public spending</td><td rowspan="2">Exchange rate regime</td><td>Fixed</td><td>Floating</td></tr>
<tr><td>1.5</td><td>0</td></tr>
<tr><td rowspan="2">Openness trade degree</td><td>“Closed” Economy (<60% GDP)</td><td>“Open Economy” (> 60% GDP)</td></tr>
<tr><td>1.2</td><td>-0.47</td></tr>
<tr><td rowspan="2">Financial fragility</td><td colspan="2">High debt (debt-to-GDP ratio > 60% GDP) for 3 (or more) consecutive years</td></tr>
<tr><td colspan="2">-2.3</td></tr>
</table>

Source: Ilzetzki *et al.* (2011).

Ilzetzki *et al.* (2011) analyze the role of the exchange rate regime in size of the fiscal multipliers. They find that the choice of the exchange rate regime is relevant to the effectiveness of fiscal policy. Using a panel VAR framework, they estimate sizeable (long-run) multipliers in countries under fixed exchange rates (1.5), while multipliers are zero in countries under floating exchange rates. This empirical evidence supports the conclusions of the Mundell-Fleming model which predicts that the effectiveness of fiscal policy increases as the exchange rate regime becomes more rigid.

In another recent study, Born *et al*. (2012) estimate a VAR that suggests a short-run multiplier of about 1.2 under fixed exchange rates and 0.75 under floating exchange rates. Hence, the multiplier differs across exchange rate regimes – but to a lesser extent

than the reported in earlier studies. However, the dynamics of the exchange rate and net exports provide little support to the fiscal transmission mechanism at the heart of the Mundell-Fleming model. In their analysis, under the assumption that government debt is riskless, a small open economy framework cannot account for cross-country spillover effects. In the presence of sovereign risk the multiplier is likely to be smaller relative to "normal" times[8] if monetary policy is constrained (Corsetti *et al.*, 2012a) as such spillovers may be sizeable, notably within monetary unions (Corsetti *et al*., 2011).

Also, the dynamics of the real exchange rate may differ systematically across currency regimes. A slightly appreciation of the real effective exchange rate followed by a depreciation over time is a behavior described by the literature after a rise in government spending; recent studies, however, document a fall in the real exchange rate after a rise in government spending in flexible exchange rate regimes. In contrast, studies focusing on fixed exchange rate regimes tend to document real appreciation in response to positive spending shocks (Corsetti *et al.*, 2012a).

Regarding the degree of openness, Ilzetzki *et al.* (2011) conclude that it is also a relevant variable for the effectiveness of fiscal policy. In line with the theoretical models, more closed economies, *i.e.*, economies with a degree of openness[9] below 60% of GDP, present higher multipliers than small open economies. They found that the government spending multiplier is larger in more closed (large) economies relative to small open economies, with an impact multiplier of 0.02 in the former and -0.19 in the latter and a long-run multiplier of 1.29 in the former and -0.47 in the latter. This difference is statistically significant on impact, but not at longer horizons.

Last but not the least, Ilzetzki *et al.* (2011) analyze how the level of public debt-to-GDP influences the multiplier. Results obtained show that for countries with a debt-to-GDP ratio above 60%, the cumulative, expenditure-side, expansionary fiscal policies have negative effects on output. They estimate a long run multiplier of -2.3. Recently, Corsetti *et al.* (2012b) found that in "good" times, fiscal balances and private consumption co-move negatively while in "bad" times[10], with high levels of public debt, the co-movement becomes positive - a set of results partially supporting non-Keynesian effects of fiscal policy.

[8] In this context "normal" times refers to a non-recession period.

[9] Ilzetzki *et al.* (2011) calculate degree of openness as $\frac{(Exports+Imports)}{GDP}$.

[10] In this context "good" times mean an expansion period and "bad" times a recession period.

2.3. Are multipliers pro or counter cyclical?

One of the main purposes of fiscal policy is to promote cyclical stabilization[11], enabling actual output dynamics closer to that of the potential output. Automatic stabilizers together with a discretionary fiscal policy are instruments to achieve this purpose. So, fiscal policy should be, essentially, countercyclical. In recessions policymakers should implement expansionary fiscal policies to stimulate the economy, and in expansions they should implement contractionary fiscal policies to avoid economic overheating and control for public deficits.

But are fiscal multipliers higher in recessions than in expansions? In what follows we will try answer this question based on both theoretical and empirical literature, although this issue still remains rather unexplored. One reason for the scarce literature on this matter is that conventional macroeconomic models are close to linear in the neighborhood of potential output. This property implies that the economy behaves similarly in recessions and in expansions. However, in the last years, a new class of models has been developed and most of them rely on non-linearity in the vicinity of the zero lower bound on nominal interest rates. In these models, the economy behaves differently during recessions when the zero lower bound is reached. However, in most of the recessions the zero lower bound does not hold and, thus, the economy behaves as in expansions.

Relying on the available literature, there are non-unambiguous effects of cycle phases on the size of fiscal multipliers. For instance, the uncertainty generated in a period of crisis probably induces to increase precautionary saving, reducing the marginal propensity to consume and the size of multipliers.

On the other hand, the deleveraging effects during recessions is likely to increase the proportion of credit constrained consumers and firms, raising the size of multipliers. In recessions prices are less flexible than in expansions and this can also increase the size of multipliers. For example, using a model with monopolistic competition, Woodford (2011) shows that the presence of either real or nominal rigidities increases multipliers. Price rigidities increase multipliers because firms respond to increases in aggregate demand not only by increasing prices but rather through increasing output.

[11] Traditional additional roles of fiscal policy are the promotion of income redistribution and the provision of public goods.

Leeper *et al.* (2011) show that the presence of price rigidities increases impact multipliers by six percentage points. This is not a very large amount, but the effect remains in the long-term (cumulative) multipliers. The presence of wage stickiness has similar effects because the real wage may remain constant, or even falls during recessions, while average labor productivity increases.

The role of "confidence" of households and firms is also very important when comparing the role of fiscal stimulus in recessions with that occurring during "normal" times[12]. While in "normal" times confidence does not react significantly to unexpected increases in government spending and spending multipliers are in the neighborhood of one, in recessions confidence reacts by more and spending multipliers are significantly larger (Barsky and Sims, 2012). This occurs because in downturns spending shocks leads to a persistent increase in the amount of government investment relative to government consumption which is, in turn, reflected in higher confidence.

Bachmann and Sims (2011) assess the importance of confidence on spending multipliers in recessions against "normal" times through estimating a VAR with and without a confidence variable in different phases of the cycle.

Table 3 shows the results found, considering two different measures for the confidence variable: "consumer confidence" for households' expectations and "CEO confidence" for businesses expectations.

[12] In this context "normal" times refers to a non-recession period.

Table 3: Government spending multiplier according to the state of economy

		State of economy			
		"normal" times		"recessions"	
		Actual	Without confidence	Actual	Without confidence
Consumer Confidence	Impact multiplier	0.684	0.765	0.388	0.260
	Max multiplier	0.759	0.770	3.08	0.260
CEO Confidence	Impact multiplier	0.967	0.990	1.019	0.835
	Max multiplier	1.223	0.991	2.498	0.835

Source: Bachmann and Sims (2011).[13]

From results shown in Table 3, the authors find evidence that confidence effects turn multipliers in recessions larger than those in expansions, especially when considering cumulative effects on output. The reverse occurs when confidence effects are absent.

Michaillat (2012) proposed a dynamic stochastic general equilibrium (DSGE) macroeconomic model that, in contrast to conventional models, is nonlinear in the range of activity seen in the data. The nonlinear behavior across cycle phases is motivated by the pressures of matching frictions in the labor market. A consequence of the nonlinearity is that the economy behaves differently in recessions and expansions and, in particular, that an increase in government consumption reduces unemployment much more in recessions than in expansions.

Simulations of the model calibrated to U.S. data indicate that the government-consumption multiplier doubles when unemployment rises from 5% to 8%. Moreover, in countries where higher portion of government consumption expenditures corresponds to compensation of public employees (*e.g.*, in the U.S. this item represents around 2/3 of

[13] The "Actual" column corresponds to the standard VAR specification, and the following "Without Confidence" column is the multiplier when the response of confidence is held fixed. The numbers have the interpretation as the dollar impact on output (either on impact – "Impact Multiplier" – or the maximum effect – "Max Multiplier" – over 16 quarters) for a one dollar increase in spending.

government consumption expenditures) the counter-cyclical behavior of multipliers is more pronounced.

Michaillat (2012) defends that fiscal policy is more effective in recessions than in expansions because an increase in government consumption stimulates aggregate employment not because it stimulates employment in the private sector, but because the government hires workers to the public sector.

In expansions, the competition to hire unemployed workers is intense. By posting vacancies, the government takes job applicants away from existing vacancies. Firms are required to post additional vacancies to attract applicants, but posting vacancies is costly so the marginal cost of labor rises and firms reduce employment significantly. Hence, the crowding out of private employment by public employment almost totally offsets the increase in public employment when unemployment is low.

In recessions, an increase in government consumption reduces unemployment effectively because public employment does not crowd out private employment as much. By posting vacancies when unemployment is high, the government brings job applicants out of unemployment, who would not find a job otherwise. Since the government does not take applicants away from existing vacancies, firms do not need to post additional vacancies, the marginal cost of labor remains the same, firms maintain the same level of employment, and there is barely any crowding out.

In a recent paper, Auerbach and Gorodnichenko (2012) also assess fiscal policy effectiveness across cycle phases. They apply the Smooth Transition VAR (STVAR) procedure to data for a large number of OECD countries and a semi-annual frequency, covering the period from 1985 to 2010.[14] They estimate the effects from an unanticipated one percent increase in government spending across cycle phases. To identify the phase of business cycle they use a direct projection method that allows the multiplier to vary smoothly with the state of the economy. They define a recession as a period when the detrended unemployment rate is particularly high, and an expansion as a period when the detrended unemployment rate is particularly low. They find that the government spending multiplier is countercyclical. On average, the government spending multiplier over 3 years is about 2.3. In recessive phases "*the response of output in the recessionary regime is robustly positive up to two years*" (Auerbach and

[14] STVAR is a specific econometric tool adequate to assess the effectiveness of fiscal policy across cycle phases.

Gorodnichenko, 2012, p.11) and the multiplier is quite large, of around 3.5. In contrast, in expansionary phases, the multiplier is much weaker, even negative at some horizons, but not significantly different from zero. The same results apply, qualitatively, to the impacts on private consumption (and investment): in recessions, the multiplier is robustly positive up to two years, of 2.5 (1.5), while, during expansions, the multiplier is negative but not statistically different from zero. As for total employment, while an increase in government spending promotes employment during recessions, it has no effect on employment during expansions.

Cogan *et al.* (2010) found that the government spending multiplier is smaller the larger the expected duration of fiscal stimulus. To an expected duration of the fiscal stimulus of 4 quarters after the end of a financial disturbance, the multiplier falls below one, while to an expected duration of 10 quarters or more the multiplier is negative. In a scenario of a permanent increase in the level of government purchases the multiplier is strongly negative (-5). This also confirms the counter cyclical nature of the multiplier.

Canzoneri *et al.* (2012), employing a variant of the Curdia-Woodford model of costly financial intermediation, also show that fiscal multipliers are strongly countercyclical, estimating that they can take values exceeding two during recessions, declining to values below one during expansions. Their sample covers quarterly data for U.S. from 1982Q3 to 2008Q4.

Finally, Tagkalakis (2008) also find that, in the presence of liquidity constraints, fiscal policy have asymmetric effects on consumption across cycle phases: fiscal policy is more effective in stimulating consumption during recessions as liquidity constrained individuals are more likely to consume all the disposable income change. This result is empirically supported for a panel of 19 OECD countries, using annual data from 1970 to 2002.

A particular case of recessive environment - the interest rate zero lower bound scenario[15]

As stated before, non-linear behavior in the workings of an economy has been recently introduced in models through mimicking the situation of a zero lower bound for interest rates.

[15] This environment is also often identified with the "liquidity trap" scenario in the relevant literature. For instance, in the IS-LM-BP framework, "liquidity trap" situations are formally represented by a horizontal LM curve.

When monetary policy is constrained by the zero lower bound on the short-term nominal interest rate the effectiveness of monetary policy is null. In this scenario, the sensitivity of money demand to interest rate is infinite, meaning that increases in money supply fail to affect nominal (and real) interest rates. In this environment fiscal policy has a strong effect on aggregate output: the nominal interest rate does not rise in response to fiscal stimulus, thus no crowding out applies, and fiscal stimulus is associated with increased inflation expectations.

Eggertsson (2011) argues for positive effects on output from temporary increases in government spending or from temporary tax cuts in the awake of a financial crisis, directly aimed at stimulating aggregate demand rather than aggregate supply, such as an investment tax credit or a cut in sale taxes. In contrast, tax cuts on wages or cuts in capital taxes have a negative effect on output. While the former generate an increase of deflationary pressures, the latter encourage people to save instead of spending.

Through using a standard new-Keynesian model calibrated to match the U.S. economy, Eggertsson (2011) calculates fiscal multipliers under two alternative environments: a zero interest rate and a positive interest rate.

Table 4 sums up his results, confirming that, with exception of payroll taxes, multipliers are larger under a "liquidity trap" scenario.

Table 4: Fiscal multipliers in zero lower bound *vs.* positive interest rate

	Positive interest rate	**Zero interest rate**
Payroll tax multiplier	-0.1612	1.0191
Capital tax multiplier	0.0013	0.1012
Government spending multiplier	0.4652	2.2793
Sales tax multiplier	-0.5139	-2.5179

Source: Eggertsson (2011).

Christiano *et al.* (2011) studied the impact of financial crisis that originates a pronounced recessionary impact on output, combined with expansionary monetary policies that result in a zero lower bound on policy rates. They found that a multiplier above 2 for government purchases is possible to be achieved at the zero lower bound, in

the context of a theoretical New Keynesian model calibrated to match a large number of features of postwar U.S. data.

Cogan *et al.* (2010) also argue that an increase in government purchases during a period in which the interest rate is zero, which is expected to last for the current quarter only - implying no change in expected future income or inflation -, has a multiplier of exactly 1. So, a value of around 2.3 for the temporary government spending obtained by Eggertsson (2011) and Cogan *et al.* (2010) means that 1.0 of this is due to the increase in government purchases during the current quarter, while the other 1.3 results from higher anticipated government purchases in the future.

More recently Christiano *et al.* (2011) and Woodford (2011) through NK models obtained similar results, confirming that multipliers are considerably larger if monetary policy is constrained by the zero lower bound.

2.4. Do multipliers change during fiscal consolidation periods?

The study of how periods of fiscal consolidation shape the size of fiscal multipliers is meaningful because such scenario represents an example of a structural policy regime shift and also because potential non-Keynesian effects may arise. Moreover, in the sequence of the recent global economic and financial crisis, most of developed countries are now struggling against unsustainable public debt paths.

In an environment characterized by intertemporal optimization, large fiscal imbalances and high risk premium on interest rates can make fiscal expansions to have contractionary effects: consumers' and investors' confidence decreases as fiscal expansion reinforces fiscal sustainability concerns. Similarly, a credible fiscal consolidation - that aims at lowering the public debt-to-GDP ratio in a permanent way - can lead to an improvement of agents' expectations about future fiscal policy and, thus, an improvement in expected future income. In such scenario, fiscal multipliers value are expected to be negative or close to zero.

Moreover, a fiscal consolidation scenario is an example of a negative permanent shock. Literature shows that permanent measures deliver higher multipliers than temporary measures in interventions that work through income (*e.g.*, changes in direct

taxes), while the reverse is true for interventions operating through prices (changes in indirect taxes or in investment taxes) because changes in relative intertemporal prices are more likely to affect intertemporal consumption patterns, (Spilimbergo *et al.,* 2009).

So, one should expect different size (even different sign) for multipliers in periods of fiscal consolidation relative to those when no consolidation applies. Moreover, as some different consolidation strategies impinge differently on the success of reducing debt permanently, it is expectable that the underlying fiscal multipliers differ for successful consolidation processes relative to unsuccessful ones.[16]

Based on the arguments previously reviewed, during a fiscal consolidation the size of first year multipliers is larger if the fiscal consolidation is based on government expenditures – and government investment in particular –, if the measures taken are not credible and of temporary nature, if agents are not financially constrained and if no reduction on real interest rates occurs alongside with the fiscal shock. Moreover, these effects are also larger if consolidations are implemented at the same time worldwide.

The composition of consolidation is non-neutral to long-term output, with tax-based consolidations being less supportive of long-term growth (European Commission, 2012).

Also, relying on the literature reviewed in the previous subsection, when a consolidation process delivers a recession, as automatic stabilizers represent a larger weight, multipliers for discretionary fiscal policy would turn out to be smaller during debt-correcting periods. Additionally, a recessive environment feeds-back to the debt-to-output ratio in proportion of the latter (the larger the debt, the larger the impacts of growth on the debt service); thus larger indebtedness is expected to produce smaller fiscal multipliers during consolidations. The same effect is expected if confidence breaks occur during recessions; in contrast, nominal and real rigidities and zero lower bound scenarios are expected to amplify multipliers.

[16] In the literature, there are several ways to identify periods of successful fiscal consolidation. For instance, Alesina and Ardagna (2010) define a successful fiscal consolidation episode if it brings down the debt to GDP ratio by at least 4.5% of GDP in the three years following a consolidation episode. Instead, according to the European Commission (2007), a fiscal consolidation is successful if the following condition applies: in the three years after the end of the consolidation episode the CAPB does not deteriorate by more than 0.75% of GDP in cumulative terms compared to the level recorded in the last year of the consolidation period. In other words, at least half of the overall minimum fiscal correction required to qualify as consolidation has to be safeguarded three years after.

However, fiscal adjustments have, in general, a negative, but small, impact on economic activity. Even expansionary non-Keynesian effects from expenditure cuts can emerge in the medium run as a result of anticipated effects of higher future disposable income or profitability (*e.g.*, Giavazzi and Pagano, 1990; Alesina and Ardagna, 2010).[17] This suggests that non-Keynesian responses of private consumption are more likely when changes in fiscal policy are large and persistent.

Expansionary effects of fiscal consolidations can go through both demand and supply-side channels. Demand-side channel works through positive wealth effect (expectations of an increase in lifetime disposable income, relishing liquidity constraints) or through interest rate effect (Alesina and Ardagna, 2010). The implementation of a credible consolidation program (*e.g.*, subject to supra-national rules, under the surveillance of a fiscal council or with substantial political costs), reducing risk premium on government securities, may lead to general fall in interest rates and crowding-in effects from private investment. Falling real interest rates lead to a decrease in public interest payments which can eventually lead to a decrease in future tax rates; supply-side effects may arise, contributing positively to support growth. Moreover, the responsiveness of long-term interest rates to substantial consolidation is likely to be stronger at high debt levels (OECD, 2010).

Alesina and Ardagna (2010) argue that supply-side channels entail expansionary effects of fiscal consolidations to work via labor market: tax increases and/or spending cuts impact on the individual labor supply as it affects the unions' fall-back position under imperfectly competitive labor markets - lower wage bargaining power of unions impinge positively on profits, investment and competitiveness of the private sector. Supply-side effects are expected to be larger when consolidations operate through cuts in the government wage bill, while tax-based consolidations are found to be less supportive of long-term growth, (European Commission, 2012).

Alesina and Ardagna (2010), using annual data for OECD countries from 1970 to 2007, identify episodes of expansionary effects on output after a fiscal consolidation (non-Keynesian effects of fiscal policy). Considering that an episode of fiscal

[17] Non-Keynesian effects of fiscal policy have been re-interpreted in sequence of the recent global financial crisis. Recently, several authors as Perotti (2011) concluded that this output expansion typically reflects exchange rate depreciation and a relaxation of monetary conditions rather than confidence effects *per se* arising from fiscal tightening.

adjustment is expansionary if the average growth rate of GDP, in difference from the G7 average (weighted by GDP weights), in the first period of the episode and in the two years after, is greater than the value of 75th percentile of the same variable empirical density in all episodes of fiscal adjustments, they identified 26 episodes of expansionary periods during fiscal adjustments (3.7% of the observations of the entire OECD sample).

OECD (2010) provides an analysis of the dynamics of public debt of the Member States and makes recommendations to correct this situation when countries face an unsustainable path. Results show that, for countries with no stabilized debt, policy authorities must compromise to achieve a primary fiscal surplus quantified in 0.5% of GDP. This means an improvement of the primary fiscal balance for the OECD countries quantified in 5.25% of GDP, on average, until 2025. This adjustment would allow the stabilization of the public debt-to-GDP at 110% (average of OECD countries). The OECD Global Model simulations suggest that fiscal consolidations are typically contractionary in the short run and expansionary only after two to four years. Sustainable output increases are expectable between 4 and 5 years after the beginning of the fiscal consolidation, due to a decrease of risk premium and, consequently, a decrease in average interest rates. Considering expenditure ranking, results confirm those of general literature: 2 years after the beginning of the process, multipliers between 0.9 and 1.1 are found for public investment, 0.4 to 0.7 for public transfer to households and 0.5 to 0.9 for public consumption. As for the revenue side, up to 2 years after starting consolidation, the multiplier for indirect taxes is comprised between -0.2 and -0.4 and between -0.4 and -0.7 to personal income taxes.

These results support most of empirical evidence, which suggests that consolidations based on expenditure side rather than on the revenue side tend, in general, to be more long-lasting and more growth-supporting in the medium-term, but more recessive in the short-term (Alesina *et al.*, 2012). There is a trade-off between short-run pain and long-run gain. The pain arises from the negative multiplier effects of lower spending or higher taxes, while the gain stems from the lower world interest rates and lower distortionary taxes associated with lower debt levels. The results on both pain and gain are subject to important qualifications such as the design of a fiscal package; if the tightening is well designed with favorable long-run incentives to investment and

labor supply, then the short-term pain only arises in the presence of an initial lack of credibility and only lasts for the non-credibility period. If, on the other hand, the fiscal tightening is badly designed, for example, sharply raising taxes on income or cutting essential government investment, the long run gain could be much lower or even nonexistent as higher distortions and/or productivity losses offset the gains from lower real interest rates (European Commission, 2012).

Typically, long-term growth is what matters to ensure fiscal sustainability; however, recently, financial markets are focusing in short-term growth due, for instance, to markets' beliefs that a country facing a sizeable decline in GDP is unlikely to sustain its fiscal adjustment effort over time or due to some degree of short-termism by market agents following several years of heightened market uncertainty, (European Commission, 2012). This behavior contributes to smaller fiscal multipliers.

OECD (2010) also emphasizes the importance of several features that influences the consolidation effort and, also, the size of the fiscal multipliers: privatization revenues or the implementation of structural reforms to promote economic growth in the medium-term. In fact, fiscal consolidation processes are often associated with the implementation of structural reforms (*e.g.*, enhancing competition in goods, service and labor markets that result in improvements in efficiency and competitiveness of the economy – supply-side effects). Since the purpose of structural reforms is to allow an increase in potential output, potentially leading to higher output growth rates in the medium/long-term, and given that successful consolidations may have other structural impacts on affecting interest-rate risk premium or expectations, fiscal multipliers may crucially differ (being smaller) during these episodes.

Favero *et al.* (2011) estimate a Global VAR (GVAR) for a sample of fifteen countries, using annual data from 1978 to 2009. In this paper they identify cases in which the government implements tax hikes or spending cuts (at the general government level) in order to primarily reduce the budget deficit and put public finances on a sustainable path. The strategy to identify cases in which the government implements meaningful tax hikes or spending cuts is designed by the "narrative approach" to identify the fiscal shocks. This approach identifies episodes based on fiscal policy actions motivated by deficit reduction, as described in several policy documents, irrespective of the outcomes. "Narrative shocks" are identified on the exam of intentions

and actions as described in policy documents to identify measures motivated primarily by deficit reductions. Such fiscal actions represent a response to past decisions and past economic conditions rather than to prospective conditions. This paper includes also variables, such as the initial public debt-to-GDP ratio, trade openness and spillovers which are not included in others papers. The main conclusion from their results is that there is not an unconditional fiscal multiplier. The effect of fiscal policy on output is different according these several factors, *i.e.*, during consolidations, depending on different debt dynamics, different degrees of openness, etc.

At last but not the least it is important refer the effect of consecutive consolidations. If consolidations are repeated, especially in periods where multipliers are large and persistent, in presence of continued myopic behavior of financial markets, can have counterintuitive dynamics, i.e., in this situation it is possible that the scenario consolidation-debt increase-consolidation-further debt increase takes place as long as the current multiplier is high enough to induce further short-term debt-to-GDP increases in response to consolidation (European Commission, 2012).

3. Methodology and data

Among the relevant literature we found three main methodologies that can be used to assess the effectiveness of fiscal policy: large structural macroeconomic models such as DSGE models, case studies as in Romer and Romer (2010) and Vector Autoregression (VAR) approaches.

Macroeconomic model simulations, frequently, have an underlying aggregate demand/aggregate supply structure characterized with little forward looking behavior as far as decisions by households and firms that anticipate future changes in government policies is concerned. These frameworks deliver positive impacts on output by construction in response to an increase/decrease in public spending/revenue. The multipliers obtained are small or negative only if fiscal sustainability is in question, economic agents are substantially forward looking or when monetary policy is not accommodative enough. See, for example Smets and Wouters (2003), Laxton and Pesenti (2003) and Ratto *et al.* (2009).

Case studies are based in the identification of real experiments, *e.g.*, episodes of truly exogenous fiscal expansions. Romer and Romer (2010) is one of most reputational papers using this approach, applied to study the impacts of changes in tax policy. An important feature of case studies is that the results obtained are specific to the type of fiscal measure studied and, for example, the prevailing macroeconomic conditions at the time of implementation.

Another methodology usually found in the literature for the assessment of the effectiveness of fiscal policy is, as already mentioned, the VAR approach. Such as in the case studies, the VAR methodology is based in the correct identification of exogenous movements in public expenditure or taxes. VARs give the response of the economy, taking implicitly into account the monetary policy response and thus the effects on the interest rates (whether or not interest rates are included in the VAR), to fiscal shocks. See, for example, Fatás and Mihov (2001), Blanchard and Perotti (2002) and Burriel *et al.* (2010).

In this work we intend to estimate the fiscal multipliers for the Euro area as a whole through using a VAR approach. In this context, and in what follows, we will present the model and model extensions to be estimated, after previously characterizing,

in brief, the VAR methodology. Additionally, we provide the description of all variables and as well as the respective data sources.

3.1. VAR methodology

The usual representation of a reduced VAR model takes the following form:

$$X_t = \sum_{i=1}^{k} M_i X_{t-i} + e_t \,, \qquad (3.1.1)$$

where the *n*-dimensional vector *X* includes the endogenous variables of interest (*e.g.*, public spending, output, taxes) and M_i is the *n*x*n* matrix of coefficients. The optimal number of included lags, *k*, can be determined by *a priori* evidence on the behavior of the variables or through some information criteria such as the Schwarz or Akaike *criteria*. The vector of reduced-form residuals, e_t, is *n*-dimensional with the variance-covariance matrix $\sum_e$, where $E[e_t e_t'] = 0$.

The reduced-form residuals capture three components: automatic stabilizers, discretionary fiscal policy responses (active changes in the tax rates or in public expenditure for stabilization purposes) and random discretionary fiscal policy responses. The latter is what a structural fiscal shock is meant to capture.

The structural VAR model takes the following form:

$$A_0 X_t = \sum_{i=1}^{k} A_i X_{t-i} + B v_t \qquad (3.1.2)$$

where the matrix A_0 describes the contemporaneous relationships among the variables in the vector X_t. The matrix *B* describes the relation between the reduced-form residuals e_t and the structural-form residuals v_t:

$$A_0 e_t = B v_t \qquad (3.1.3)$$

The dynamics of the variables following a one unit increase in the current value of the structural residual in the equation respecting a fiscal variable, holding all other residuals fixed (that is a "structural fiscal shock"), can be summarized in the impulse responses of the variables included in the system.

The crucial challenge is how to pin down the structural shocks. To compute the impulse responses of the variables in the system, the matrices A_0, B and the variance-covariance matrix of the structural residuals ($\sum_v$) must be estimated. However, the system can be identified only if some coefficients in the matrices $B^{-1}A_0$ are restricted to take certain values typically justified by theoretical considerations ("identifying assumptions"). Even with the assumption that the matrix B is the identity matrix, this exclusion restriction is not enough to identify the system. The diagonal matrix $\sum_v$ can be used to express $\sum_e$ as follows $A_0^{-1}\sum_v (A_0^{-1})' = \sum_e$. Still, this relation does not identify a unique solution.

As previously referred the crucial point to estimate VAR is identify structural fiscal policy shocks. In the literature there are four approaches to identify structural fiscal shocks. The recursive formulation (Cholesky decomposition) approach proposed by Sims (1980); the structural identification (SVAR) approach proposed by Blanchard and Perotti (2002); the sign restriction proposed by the approach developed by Uhlig (2005) and the narrative (or dummy variables) approach proposed by Ramey and Shapiro (1999).

According the recursive formulation approach, the first variable ordered in the system responds only to its own exogenous shock. In the simplest three dimensional VAR model used to assess fiscal policy multipliers, including spending, output and taxes, spending is ordered first, meaning that government spending is assumed not to contemporaneously react to shocks to the economy. The second variable, output, responds to the first variable (spending) and to its own shock. The third variable, taxes, reacts to its own shock and shocks to the previous two variables. Following this approach, the matrix A_0 is a triangular matrix with ones on the main diagonal, and the matrix B is the identity matrix.

$$\begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix} \begin{bmatrix} e^{spending} \\ e^{output} \\ e^{taxes} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} v^{spending} \\ v^{output} \\ v^{taxes} \end{bmatrix} \qquad (3.1.4)$$

In this context, the ordering of the variables plays a crucial role because it defines the direction of causal relationship between them. Although, there is no theoretical guide for ordering the variables, and the assumptions behind any ordering are nontrivial. For instance, positioning taxes after output excludes *a priori* contemporaneous effects of taxes on any component of output, including private consumption, which is a rather strong assumption.

According the structural identification approach, some elements of the matrix $B^{-1}A_0$ can be obtained by using information on the elasticities of output relative to spending and taxes. These elasticities correspond to certain elements in the matrix A_0. These values are exogenously imposed in the VAR model. The system takes the following form:

$$\begin{bmatrix} 1 & 0 & 0 \\ a_{21} & 1 & a_{23} \\ 0 & a_{32} & 1 \end{bmatrix} \begin{bmatrix} e^{spending} \\ e^{output} \\ e^{taxes} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ b_{31} & 0 & 1 \end{bmatrix} \begin{bmatrix} v^{spending} \\ v^{output} \\ v^{taxes} \end{bmatrix} \qquad (3.1.5)$$

where a_{21}, a_{23} and a_{32} are, respectively, the value of the elasticities of output relative to government spending and net taxes, and the elasticity net taxes relative to output.

The crucial assumption needed in this identification approach is that government spending does not react within a period time, typically assumed to be a quarter, to shocks to the economy. This is based on the idea that fiscal actions are subject to the decision lags, *e.g.*, the time needed for fiscal policy makers to respond to the status of the economy. Also, estimating b_{31}while setting b_{13}= 0 implies that spending decisions come before tax decisions.

In contrast with the two previous approaches, the sign restriction approach does not require imposing zero contemporaneous effects on some variables, but requires restrictions on the sign of the impulse responses of the fiscal variables. For example, Mountford and Uhlig (2009) identify a government spending shock as a shock that is orthogonal to monetary and business cycle shocks, and for which government revenue increases for four quarters after the shock.. Hence, they impose also sign restrictions on revenue increases to identify monetary and business cycle shocks.

The fourth and last approach to identify structural fiscal shocks is the narrative (or dummy variables) approach, which is particularly implemented in studies focusing

in the U.S. economy. Ramey and Shapiro (1999) and Ramey (2011) construct a dummy capturing dates of exogenous increases in government defense spending, according, for instance, to information in official documents. Romer and Romer (2010) apply the idea to legislated tax changes. The fiscal shock is identified by the impulse response to the date dummy. Specifically, the new reduced form VAR is:

$$X_t = \sum_{i=1}^{k} M_i X_{t-i} + \sum_{j=0}^{l} D_j \, d_{t-j} + \, e_t \qquad (3.1.6)$$

where *j* is the lag order associated with the dates dummy *d*, and *D* is the associated matrix of coefficients. The disadvantage of this approach is that other fiscal shocks of different implications might have occurred parallel to the identified episodes.

One of the main criticisms on the VAR literature, is that VAR models cannot properly account for the fact that changes in government spending and taxes can be anticipated due to legislative and implementation lags (Leeper *et al.*, 2008); in this case, the effects of the fiscal shock would appear in the economy since the moment agents anticipate government decisions. If agents are forward looking, VAR models may fail to correctly estimate fiscal shocks, thereby leading to biased estimates of their effects and, in particular, of fiscal multipliers.

This is the so-called "fiscal foresight problem". The debate on this issue is still open as Ramey (2011) finds that fiscal foresight is a relevant issue inducing a bias on estimates of fiscal multipliers, contrary to the previous findings of Perotti (2005). Bouakez *et al.* (2010) show that Ramey's results are most likely driven by the data points relative to the Korean War episode only, and thus should not be considered of a general relevance.[18]

[18] Technically, Ramey (2011) provides evidence that SVAR-based innovations in the US as identified in Blanchard and Perotti (2002) can be anticipated and Granger-caused by Ramey and Shapiro (1999) war episodes. However, Perotti (2005) finds little evidence that SVAR-based innovations are predictable. In turn, Bouakez *et al.* (2010) show that, the fiscal foresight problem is not severe enough to preclude the use of SVAR innovations as correct measures of unanticipated fiscal shocks as Ramey's results are driven by the Korean War episode.

3.2. Model specification and data

In order to make an empirical application to the Euro area, we aim, first, at estimating average fiscal multipliers, assessing overall revenue and expenditure multipliers as well as disaggregated fiscal multipliers, considering different items on both the revenue and the expenditure side.

In terms of the aggregate model, the baseline VAR definition as specified in equation (3.1.1) includes three endogenous variables in (log) first differences - government spending (DELTA_SPENDING), output (DELTA_GDP), tax revenues (DELTA_TAXES) - and an (exogenous) constant term (C). We also include an additional endogenous variable, the long term interest rate (REAL_INTEREST_RATE_10) as to control for debt service since government spending refers only to primary expenditure, as in, *e.g.*, Burriel *et al.* (2010).

We followed the recursive formulation (Cholesky decomposition) as the approach to identify structural fiscal shocks. In particular, the ordering of Cholesky decomposition is SPENDING, GDP, TAXES and REAL_INTEREST_RATE_10. This means that output responds contemporaneously to changes in public spending but public spending does not respond to changes in output. Also, output contemporaneously affects tax revenues but the converse is not true. This is because the political process implies substantial delays between the design and the implementation of changes in the tax rates which, at the margin, would affect output and to the fact that consumption and investment plans take some time to adapt to a policy even after being enacted. Last but not the least, we consider that long term real interest rate responds contemporaneously to changes in others variables but the converse is not true.

In terms of the disaggregate model, main VAR estimation contains eight endogenous variables in (log) first differences – SPENDING disaggregation into government transfers (DELTA_GTRA), government intermediate consumption (DELTA_GICO), government wages (DELTA_GWAG) and government investment (DELTA_GINV), GDP, TAXES disaggregated into social security payments (DELTA_SS), direct taxes (DELTA_TDIR) and indirect taxes (DELTA_TIND) -, the long term real interest rate and a constant term. The ordering of the Cholesky decomposition is GTRA, GICO, GWAG, GINV, OUTPUT, SS, TDIR, TIND and

REAL INTEREST_RATE_10, following the assumptions considered in the aggregate model.

Relying on Favero *et al.* (2011), we also control, for the aggregate data, for the effects of the degree of openness and of the debt level on fiscal multipliers. As argued before, we expect that the larger the leakages to imports, the smaller fiscal multipliers are. So, we include the degree of openness as an exogenous variable (OPENNESS_TRADE_DEGREE) as to check if the impacts on the multipliers are, indeed, as expected. Moreover, we also control for the debt-to-output ratio because policy makers have different preferences on debt-stabilization levels and horizons since they face an intertemporal budget constraint (*e.g.*, Favero and Giavazzi 2007, Leeper, 2010). Burriel *et al.* (2010) found that fiscal multipliers are larger and more persistent when fiscal stress is accounted for, meaning that sustainability concerns crucially reduce the efficiency of fiscal policy. Thus, we have also included the changes in the debt-to-output ratio (DELTA_DEBT_TO_GDP_RATIO) as an endogenous variable as to capture debt dynamics.

Data on these variables were collected on an annual basis for a panel of all the 17 member-countries of the Euro area (Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia and Spain), from 1998 to 2008.[19] Data is defined in real terms (thousands millions of Euros) and respects, in particular, to the definitions provided in AMECO – see Annex A.1., for details.

Additionally, VAR specifications, either with aggregate and disaggregated fiscal data, are to be separately estimated across cycle phases (recessions and expansions) as well as when comparing periods of sustainable fiscal consolidation with those where no such structural shift occurs. The aim is to assess how the cycle or some structural shifts affect the size of multipliers.

As regards to the identification of cycle phases, we followed the deviations approach and computed the output gap by detrending the GDP series by parsimoniously

[19] Quarterly data on fiscal variables is not available for all the Euro area countries. Even studies using Euro area data on a quarterly basis (*e.g.*, Burriel *et al.*, 2010) rely on a "constructed" intra-annual interpolation due to Paredes *et al.* (2009). Thus, for all the Euro area countries, the only data available is annual. We use 1998 as a starting year because the convergence admission criteria have already been established by then. The year 2008 was set as a final year of our sample as to exclude the economic and financial crises; the inclusion of the recent years in such a small sample would certainly produce biased results, counterproductive relative to regular empirical evidence.

using the Hoddrick-Prescott filter provided in the *Eviews 7.1* toolbox. The sample is, accordingly, split into two: one subsample including the observations in which the output gap is positive (expansions) and the other comprising periods of negative output gap (recessions). Data on the identification of expansionary and recessive periods is provided in Annex A.2., using AMECO.

A strategy similar to that followed to control for openness was used to evaluate the impacts on the size of fiscal multipliers from fiscal consolidation efforts: the VAR is augmented with a dummy binary variable that assumes the value of 1 if the period belongs to a fiscal consolidation process, and 0 otherwise. In the literature, there are several ways to identify periods of fiscal consolidation. For instance, Alesina and Ardagna (2010) define a fiscal consolidation episode as a year when occurs an improvement of the cyclically-adjusted primary budget (CAPB) of at least 1.5% of GDP. Alternatively, the OECD defines the start of a fiscal consolidation episode as an improvement in the CAPB by at least one percentage point of potential GDP in one year or, in two consecutive years, with at least a 50 basis points improvement occurring in the first of the two years. The fiscal consolidation continues as long as the CAPB improves. An interruption is allowed without terminating the episode as long as the deterioration of the CAPB does not exceed 30 basis points of GDP and is more than offset in the following year (by an improvement of at least 50 basis points of GDP). The consolidation episode stops if the CAPB stops increasing or if the CAPB improves by less than 20 basis points of GDP in one year and then deteriorates.

Since our application is to the Euro area, to identify fiscal consolidation episodes we followed a third approach - the European Commission (2007) criterion. According to this criterion, a fiscal consolidation episode is identified with an improvement of the CAPB of at least 1.5% of GDP which is either achieved (i) in one single year or (ii) over a period of three years where in each single year the improvement of the CAPB is less than 1.5% of GDP and the CAPB does not deteriorate by more than 0.5% of GDP compared to the previous year. Data on the identification of consolidation periods is provided in Annex A.3., using AMECO.

Before providing and analyzing the estimation results, a few preliminary tests on the model specification are in order. First of all, VAR methodology requires variables to

be stationary. We proceed with the ADF - unit root test on the above mentioned variables, using *Eviews* built-in tools.

For the core specification, Table 5 shows that long-term real interest rate and taxes are stationary in levels, while public spending and output are stationary in first differences of log-levels.

Table 5: Unit-root tests on core variables of the model - aggregate fiscal variables, full sample

	Level (p-value)	**1st differences (p-value)**
Log(Spending)	0.9971	0.0000
Log(GDP)	0.1605	0.0006
Log(Taxes)	0.0032	0.0181
Real Interest Rate 10 years	0.0000	0.0000
Delta Debt to GDP ratio	0.0002	0.0000

A second step to model specification is choosing the optimal number of lags to apply in the VAR. Using the Schwarz criterion we confirm that the number of lags that minimize the statistic test is one (see Table 6, below), as expected.

Table 6: Optimal number of lags - aggregate fiscal variables, full sample

Number of lags	**Schwarz**
1	-8.885986
2	-8.769394
3	-8.694972
4	-7.970372
8	-7.449543

So, all the endogenous variables in the VAR also appear lagged once. Finally, we also perform the VAR stability test. A VAR model must satisfy the stability condition, that is, all the roots of the characteristic polynomial should be less than one in modulus.

Table 7 exhibits the test performed using the 5 endogenous variable VAR model.

Table 7: VAR stability test - aggregate fiscal variables, full sample

Roots of Characteristic Polynomial

Endogenous variables: DELTA_SPENDING DELTA_GDP DELTA_TAXES REAL_INTEREST_RATE_10

Exogenous variables: C

Lag specification: 1 1

Date: 09/23/12 Time: 10:00

Root	Modulus
0.669530	0.669530
0.295140	0.295140
0.200786 - 0.053218i	0.207719
0.200786 + 0.053218i	0.207719

No root lies outside the unit circle.

VAR satisfies the stability condition.

From Table 7, we conclude that the VAR specification satisfies the stability conditions. Stability tests were also performed for the VAR model using disaggregated fiscal variables, holding similar (not reported) results.[20]

[20] All non reported results are available upon request.

4. Estimation results

In this section we compute fiscal multipliers resulting from VAR estimations under the specifications with both aggregated and disaggregated fiscal variables. Multipliers are computed using all observation in the sample and also considering subsample: recession *vs.* expansion. Moreover, we control, to aggregated and disaggregated fiscal variables, for the effect of fiscal consolidation and, to aggregated fiscal variables, for the effect of the degree of openness and the debt dynamics on the size of fiscal multipliers. Results are critically analyzed by comparing them with those predicted by the literature reviewed in section 2, above.

4.1. Global Analysis

Results from VAR estimation using aggregated fiscal variables are reported in Table 8, below.

Table 8: Estimation results - aggregated fiscal variables, full sample.

Vector Autoregression Estimates
Date: 09/23/12 Time: 05:40
Sample: 1998 2008
Included observations: 175
Standard errors in ( ) & t-statistics in [ ]

	DELTA_SPE...	DELTA_GDP	DELTA_TAXES	REAL_INTE...
DELTA_SPENDING(-1)	0.261238	0.054573	-0.108603	-16.36830
	(0.07839)	(0.05754)	(0.10374)	(6.57191)
	[3.33249]	[0.94840]	[-1.04689]	[-2.49064]
DELTA_GDP(-1)	0.093668	0.551661	0.079493	-32.86690
	(0.12398)	(0.09101)	(0.16407)	(10.3936)
	[0.75552]	[6.06186]	[0.48452]	[-3.16222]
DELTA_TAXES(-1)	0.209572	-0.036962	0.321586	6.613347
	(0.07969)	(0.05849)	(0.10545)	(6.68048)
	[2.62997]	[-0.63189]	[3.04956]	[0.98995]
REAL_INTEREST_RAT...	-0.003730	-0.000341	-0.001720	0.231757
	(0.00090)	(0.00066)	(0.00120)	(0.07582)
	[-4.12488]	[-0.51420]	[-1.43683]	[3.05681]
C	0.023291	0.012869	0.025044	2.862741
	(0.00487)	(0.00357)	(0.00644)	(0.40789)
	[4.78705]	[3.60340]	[3.88965]	[7.01839]
R-squared	0.226293	0.264803	0.087845	0.195847
Adj. R-squared	0.208088	0.247505	0.066383	0.176926
Sum sq. resids	0.137438	0.074055	0.240691	965.9515
S.E. equation	0.028433	0.020871	0.037627	2.383709
F-statistic	12.43035	15.30766	4.092974	10.35063
Log likelihood	377.2556	431.3625	328.2258	-397.7929
Akaike AIC	-4.254349	-4.872714	-3.694009	4.603348
Schwarz SC	-4.163927	-4.782291	-3.603586	4.693770
Mean dependent	0.035217	0.032095	0.032885	1.913868
S.D. dependent	0.031951	0.024060	0.038942	2.627445

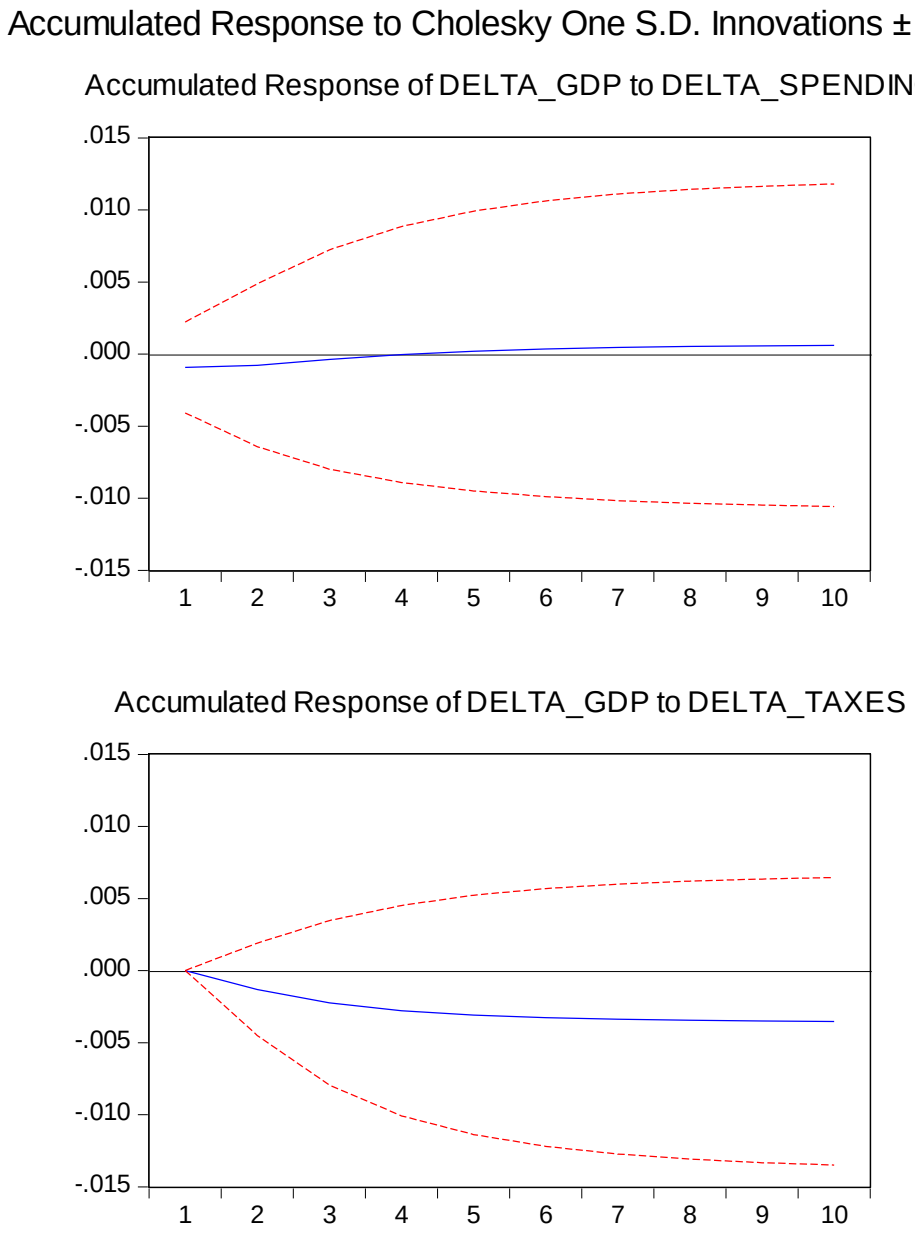
Determinant resid covariance (dof adj.)	1.01E-09
Determinant resid covariance	9.01E-10
Log likelihood	829.1717
Akaike information criterion	-9.247676
Schwarz criterion	-8.885986

At a 5% significance level, all variables are globally significant for all the four equations. Specifically, F-statistic > F critical value (4,175) = 2.423.[21] In VAR models, interpretation of the estimated coefficients is not trivial because each endogenous variable is explained by other lagged variables that result from other equations of the model. Indeed, the most appealing interpretation is given through the analysis of the impulse response functions.

Figure 1 shows the accumulated impacts on DELTA_GDP to shocks in DELTA_SPENDING and DELTA_TAXES, respectively.

[21] F critical value was computed by using the function = @qfdist(0.95, 4,175) in *Eviews 7.1* software.

Figure 1: Accumulated impulse response functions of DELTA_GDP to shocks in DELTA_SPENDING (left-hand side) and DELTA_TAXES (right-hand side), full sample.



Public spending, overall (excluding debt service expenditure) impinges negatively on impact, but the cumulative impact on output is positive. Taxes, as expected, have (both impact and cumulative) negative impacts on output.

By normalizing the impulse response functions considering a one percentage point shock to public spending and taxes, we compute the accumulated fiscal multipliers on aggregate fiscal variables. In particular, multipliers are computed by dividing the

accumulated responses of GDP to a 1 standard deviation shock in public spending (or taxes) by the impact response of public spending (or taxes) to its own shock – this gives the elasticity of output relative to public spending (or taxes). Thus, public spending (or taxes) multiplier results from dividing the corresponding elasticity by the average weight of public spending (or taxes) on output.

Table 9 shows the results and they respect to the changes in output induced by a euro unit shock in the fiscal instrument.[22]

Table 9: Cumulative fiscal multipliers, full sample - public spending *vs.* taxes.

Period	Public Spending	Taxes
1	-0.077 [23]	0
2	-0.065	-0.108
3	-0.031	-0.185
4	-0.003	-0.3
5	0.017	-0.255
6	0.03	-0.269
7	0.038	-0.279
8	0.044	-0.285
9	0.048	-0.289
10	0.05	-0.291

Source: own calculations

Table 10 shows the estimation results for the VAR using disaggregated fiscal variables.

[22] Throughout the text, similar computations were made for different disaggregation of fiscal instruments or for different periods of analysis.

[23] *E.g.*, $-0.077 = \frac{-0.00093}{0.02843}/0.42507$. IRF values of output and public spending to a 1 standard deviation shock in public spending are available upon request.

Table 10: Estimation results - disaggregated fiscal variables, full sample.

Vector Autoregression Estimates
Date: 09/23/12 Time: 00:43
Sample: 1998 2008
Included observations: 175
Standard errors in ( ) & t-statistics in [ ]

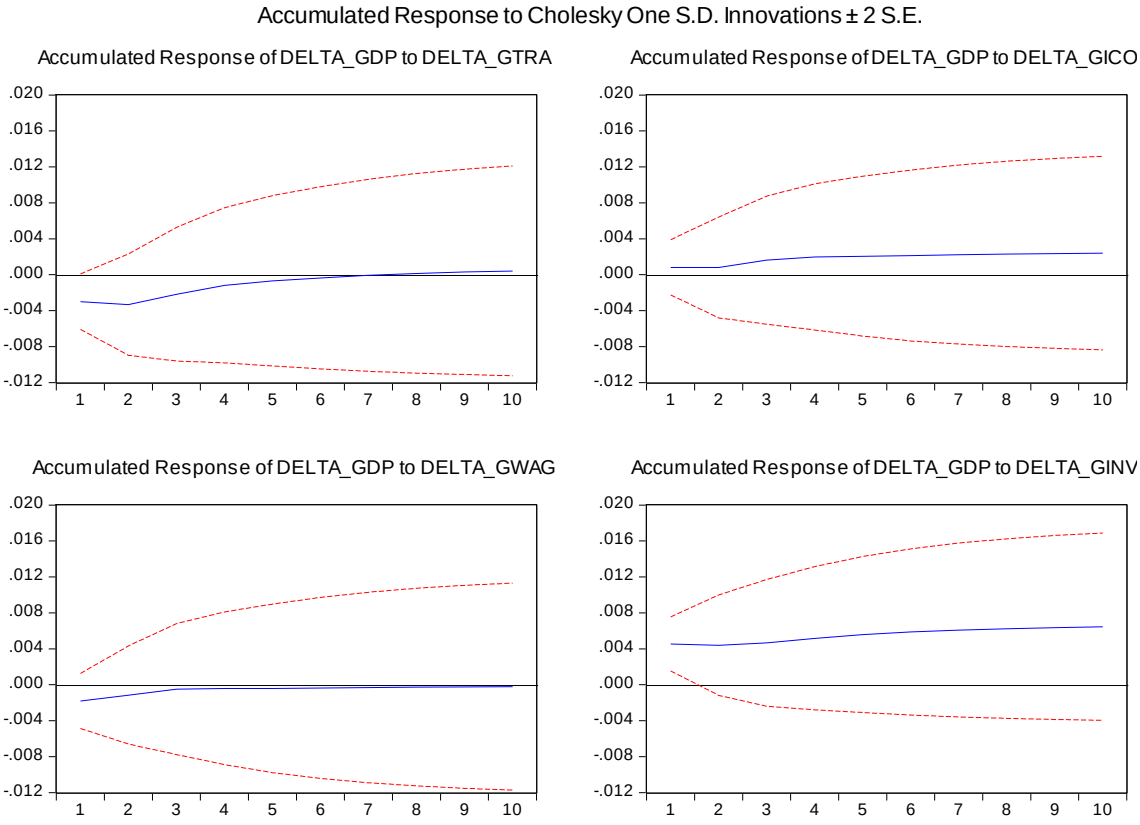
	DELTA_GTRA	DELTA_GICO	DELTA_GWAG	DELTA_GINV	DELTA_GDP	DELTA_SS	DELTA_TDIR	DELTA_TIND	REAL_INTE...
DELTA_GTRA(-1)	0.045697	0.004239	0.070391	-0.268612	0.017409	-0.244909	-0.576906	-0.242088	-20.30862
	(0.08208)	(0.15586)	(0.08090)	(0.27052)	(0.04867)	(0.08075)	(0.16359)	(0.12522)	(5.56997)
	[0.55672]	[0.02720]	[0.87006]	[-0.99296]	[0.35769]	[-3.03290]	[-3.52661]	[-1.93331]	[-3.64609]
DELTA_GICO(-1)	0.049374	-0.140305	0.095276	0.221210	-0.016703	-0.022609	-0.035155	0.035877	-0.159849
	(0.04044)	(0.07679)	(0.03986)	(0.13328)	(0.02398)	(0.03978)	(0.08060)	(0.06169)	(2.74421)
	[1.22092]	[-1.82712]	[2.39029]	[1.65977]	[-0.69657]	[-0.56830]	[-0.43619]	[0.58154]	[-0.05825]
DELTA_GWAG(-1)	0.193064	-0.278501	0.171106	0.254988	0.118989	0.356778	-0.012988	0.453259	4.758882
	(0.09119)	(0.17315)	(0.08988)	(0.30052)	(0.05407)	(0.08971)	(0.18173)	(0.13911)	(6.18776)
	[2.11725]	[-1.60844]	[1.90378]	[0.84849]	[2.20068]	[3.97713]	[-0.07147]	[3.25833]	[0.76908]
DELTA_GINV(-1)	0.005790	0.128352	0.029111	-0.154397	-0.025267	0.018605	-0.053905	-0.059201	-1.329045
	(0.02325)	(0.04416)	(0.02292)	(0.07664)	(0.01379)	(0.02288)	(0.04635)	(0.03548)	(1.57801)
	[0.24900]	[2.90672]	[1.27008]	[-2.01460]	[-1.83242]	[0.81326]	[-1.16312]	[-1.66879]	[-0.84223]
DELTA_GDP(-1)	0.073521	-0.488946	0.195729	0.043815	0.603587	0.164080	-0.014813	0.000961	-35.21780
	(0.15835)	(0.30069)	(0.15608)	(0.52188)	(0.09390)	(0.15578)	(0.31559)	(0.24157)	(10.7456)
	[0.46429]	[-1.62608]	[1.25404]	[0.08396]	[6.42828]	[1.05325]	[-0.04694]	[0.00398]	[-3.27742]
DELTA_SS(-1)	0.120473	0.298439	0.195449	0.305205	-0.049038	0.157737	0.365656	-0.162136	5.020863
	(0.08968)	(0.17030)	(0.08840)	(0.29557)	(0.05318)	(0.08823)	(0.17874)	(0.13682)	(6.08579)
	[1.34331]	[1.75246]	[2.21106]	[1.03261]	[-0.92214]	[1.78782]	[2.04579]	[-1.18507]	[0.82501]
DELTA_TDIR(-1)	0.032481	0.225748	0.076018	0.019988	-0.044059	-0.012156	0.169248	-0.053044	2.523688
	(0.03979)	(0.07555)	(0.03922)	(0.13113)	(0.02359)	(0.03914)	(0.07929)	(0.06070)	(2.69990)
	[0.81636]	[2.98805]	[1.93845]	[0.15244]	[-1.86753]	[-0.31057]	[2.13443]	[-0.87391]	[0.93473]
DELTA_TIND(-1)	-0.038245	0.168724	-0.074709	0.746577	0.023773	0.123041	0.407263	0.256156	0.884566
	(0.06202)	(0.11776)	(0.06113)	(0.20439)	(0.03677)	(0.06101)	(0.12360)	(0.09461)	(4.20846)
	[-0.61667]	[1.43273]	[-1.22218]	[3.65269]	[0.64646]	[2.01666]	[3.29502]	[2.70747]	[0.21019]
REAL_INTEREST_RAT...	-0.004856	-0.003874	-0.003395	-0.005329	-0.000305	-0.004560	-0.003257	-0.000254	0.191948
	(0.00113)	(0.00215)	(0.00111)	(0.00372)	(0.00067)	(0.00111)	(0.00225)	(0.00172)	(0.07669)
	[-4.29692]	[-1.80509]	[-3.04771]	[-1.43067]	[-0.45585]	[-4.10080]	[-1.44598]	[-0.14752]	[2.50277]
C	0.035358	0.043133	0.011472	-0.003560	0.011106	0.024923	0.030717	0.027842	3.098393
	(0.00628)	(0.01192)	(0.00619)	(0.02069)	(0.00372)	(0.00618)	(0.01251)	(0.00958)	(0.42610)
	[5.63082]	[3.61750]	[1.85357]	[-0.17200]	[2.98287]	[4.03444]	[2.45451]	[2.90647]	[7.27146]
R-squared	0.194563	0.132843	0.286019	0.136878	0.308700	0.281242	0.160490	0.119447	0.240778
Adj. R-squared	0.150630	0.085543	0.247075	0.089798	0.270993	0.242037	0.114699	0.071416	0.199366
Sum sq. resids	0.198052	0.714109	0.192404	2.151119	0.069633	0.191679	0.786637	0.460917	911.9804
S.E. equation	0.034646	0.065787	0.034148	0.114180	0.020543	0.034084	0.069047	0.052853	2.350990
F-statistic	4.428644	2.808550	7.344293	2.907382	8.186766	7.173627	3.504805	2.486908	5.814185
Log likelihood	345.2869	233.0675	347.8184	136.5806	436.7494	348.1489	224.6035	271.3766	-392.7621
Akaike AIC	-3.831850	-2.549343	-3.860782	-1.446635	-4.877136	-3.864559	-2.452611	-2.987161	4.602995
Schwarz SC	-3.651005	-2.368498	-3.679937	-1.265790	-4.696291	-3.683714	-2.271767	-2.806316	4.783840
Mean dependent	0.039699	0.034763	0.028523	0.029368	0.032095	0.031029	0.035042	0.033995	1.913868
S.D. dependent	0.037592	0.068795	0.039354	0.119680	0.024060	0.039149	0.073384	0.054848	2.627445

Determinant resid covariance (dof adj.)	3.78E-22
Determinant resid covariance	2.22E-22
Log likelihood	2127.723
Akaike information criterion	-23.28826
Schwarz criterion	-21.66066

At a 5% significance level, all variables are globally significant for all the nine equations. Specifically, F-statistic > F critical value (9,175) = 1.934.[24]

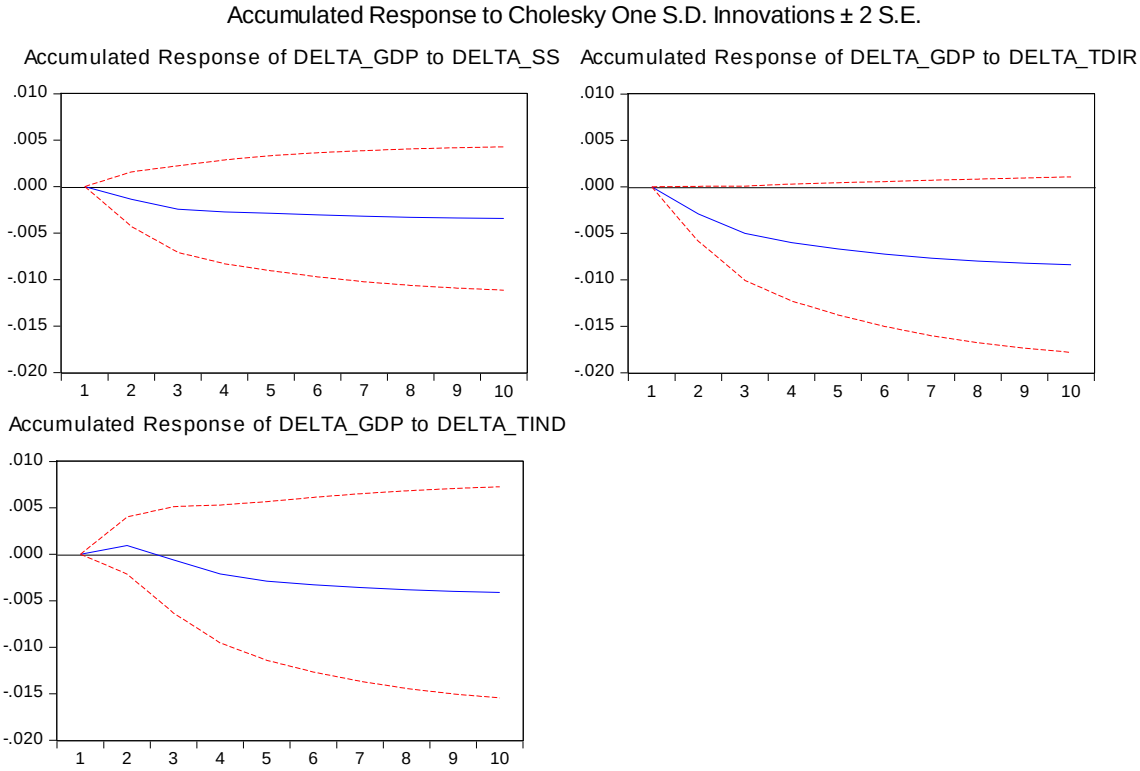
Figure 2 and Figure 3 show the cumulative responses of GDP growth to shocks in the growth rate of different items of public spending and revenue, respectively.

Figure 2: Accumulated impulse response functions of DELTA_GDP to shocks in disaggregated items of DELTA_SPENDING, full sample.



[24] F critical value was computed by using the function = @qfdist(0.95, 9,175) in *Eviews 7.1* software.

Figure 3: Accumulated impulse response functions of DELTA_GDP to shocks in disaggregated items of DELTA_TAXES, full sample.



On the expenditure side, transfers are the main driving force for the overall expenditure dynamics (*cf.* responses to DELTA_GTRA with those to DELTA_SPENDING, above in Figure 1). Moreover, wages exhibit negative impacts on output while, positive effects are driven by shocks in public investment and intermediate consumption. On the revenue side, all items impinge negatively on output growth.

Table 11 shows the computed multipliers for different spending and revenue items. Values refer to cumulative multipliers per period.

Table 11: Cumulative fiscal multipliers, full sample - disaggregated public spending *vs.* disaggregated taxes.

Period	Public Spending				Taxes		
	GTRA	**GICO**	**GWAG**	**GINV**	**SS**	**TDIR**	**TIND**
1	-0.353	0.25	-0.6	1.62	0	0	0
2	-0.391	0.245	-0.382	1.579	-0.313	-0.369	0.171
3	-0.256	0.499	-0.163	1.663	-0.56	-0.636	-0.108
4	-0.14	0.609	-0.137	1.845	-0.628	-0.762	-0.383
5	-0.081	0.632	-0.136	1.993	-0.66	-0.849	-0.522
6	-0.042	0.657	-0.121	2.095	-0.7	-0.92	-0.595
7	-0.009	0.686	-0.103	2.171	-0.735	-0.975	-0.648
8	0.016	0.709	-0.089	2.228	-0.76	-1.014	-0.689
9	0.035	0.726	-0.079	2.272	-0.778	-1.043	-0.72
10	0.049	0.739	-0.072	2.304	-0.792	-1.065	-0.742

Source: own calculations.

As previously referred, the literature frequently points that government spending multiplier is higher than tax multiplier and that an increase in GDP can be obtained through an increase in government spending or a decrease in taxes. Our results, using aggregated fiscal data, do not satisfy the first stylized fact. Tax cumulative multiplier is higher than government spending cumulative multiplier (in modulus 0.291 *vs.* 0.05); the same applies to impact multipliers with values (in modulus) of 0.108 and 0.077, respectively. The second stylized fact is only partially supported by the results. While, on impact and cumulative terms, an increase in GDP can be obtained by a decrease in taxes, as far as government spending multiplier is concerned, an increase in total public spending produces positive impacts on output only in cumulative terms, on impact the effects are negative. Theoretical literature and empirical evidence, *ceteris paribus*, do not support this last result, especially, because many government spending packages are directed to agents that face liquidity constraints and so, use this increase in disposable income to smooth consumption or pay debts.

It is also important to refer that the values of the multipliers are low comparatively with others obtained through similar methodology (see Table 1, section 2). However, the analysis regarding the effects of disaggregated expenditure and revenue on output provides some insights to previous results.

As far as government spending multiplier is concerned, the component with the highest positive effect on output is public investment (GINV), delivering impact and cumulative multipliers of 1.62 and 2.304, respectively. Public investment is, frequently,

directed to infrastructures or to the qualification of human resources that bring positive effects, not only at the time when these measures are implemented but, also, in the longer run, either directly or indirectly, by increasing the productivity of private inputs.[25] Intermediate consumption (GICO) also has a positive effect on GDP at all-time horizons, exhibiting multipliers of 0.25 on impact and of 0.739 in cumulative terms. On the other hand, results obtained relative to compensation of public employees (GWAG) and transfers (GTRA) have negative effects on output, at least on impact. According to the literature, while in the long run increases in government wages can lead to distortions in the labor market between public and private sector with negative impact on employment, and thus on output (confirming the negative cumulative multiplier of 0.072), the negative value obtained for the impact multiplier is counterintuitive because an increase in wages leads to increases in disposable income of beneficiaries and through smoothing consumption behavior we should expect this value to be positive. Negative impact values could result if households acknowledge such expenditures as spurious and to be fully financed, in the very near future, with taxes.

Results on transfer multipliers are also counterintuitive: GTRA exhibit a negative impact multiplier (-0.353), but positive contributions arise during the third year after the shock (note that the multiplier starts increasing in period 3, Table 11).

Using quarterly data, Burriel *et al.* (2010) also finds similar evidence for the Euro area: an initial positive impact on output is reversed after some quarters and net positive impacts arise only within 30 to 40 quarters, in accordance to the dynamics in Table 11. An increase in government transfers has, frequently, the same effects of a decrease in direct taxes: transfers increase the level of real disposable income, and hence of consumption. One explanation is that transfers work as automatic stabilizers and, in the very short run may exhibit a strong negative correlation with output (reverse causality); the stabilization role of transfers becomes less pronounced as time passes.

The effects of these latter instruments differ, however, if transfers include pension payments and other transfers that are taxable and, hence, some of the increase in incomes is absorbed through an increase in tax payments. According to the literature, a 1% of nominal GDP cut in transfers has a smaller multiplier effect than a 1% of

[25] There is an extensive literature on the productivity of public capital, basically following the seminal work of Aschauer (1989).

nominal GDP increase in direct taxes. The same applies, at least in cumulative terms, in our case.

As far as taxes are concerned, it is important to distinguish the mechanisms operating through the social security contributions/direct taxes multipliers and those operating through indirect taxes multiplier. While in first case an increase in SS/TDIR taxes induces a reduction in the level of real disposable income and, thus, in consumption, an increase in TIND induces a rise in the price level, erodes the real value of wealth and this may also reduce current consumption. The relative importance in each country of real wealth and real disposable income to consumption decisions will influence the relative size of the two tax multipliers. So, in countries with higher degree of consumption smoothing (smaller liquidity constraints), it is expected that the dynamic effects from wealth are more important and, consequently, that the size of indirect tax multiplier is larger relative to the direct tax multiplier. Moreover, indirect tax rates have a more effective role as a stabilizer. Our results show that SS and TDIR multipliers are higher than TIND multiplier (impact multipliers of -0.313 and -0.369, respectively, against a positive multiplier of 0.171 and cumulative multipliers of -0.792 and -1.065, respectively, against -0.742). This suggest that there is not a significant degree of consumption smoothing (due, for instance, to higher liquidity constraints) in these countries.

In what follows, we complement the global analysis with the assessment on how the degree of openness and debt dynamics influences the size of the fiscal multipliers. We restrict our analysis to the case of VARs using aggregated fiscal variables only.

Openness degree and the size of fiscal multipliers in the Euro area

In order to assess how the openness degree affects the size of the multipliers we have included in the VAR, as an exogenous variable, the ratio of total exports plus total imports (of goods and services) relative to GDP. The assumption is that the trade integration is a structural characteristic of the economy and that, at least in the short-run is not influenced either by GDP growth or by changes in fiscal instruments. Instead, as referred before, it shapes the magnitude of fiscal shocks on output. Estimation results are shown in Table 12, below.

Table 12: Estimation results controlling for openness degree - aggregated fiscal variables.

Vector Autoregression Estimates
Date: 09/26/12 Time: 04:06
Sample: 1998 2008
Included observations: 175
Standard errors in ( ) & t-statistics in [ ]

	DELTA_SPE...	DELTA_GDP	DELTA_TAXES	REAL_INTE...
DELTA_SPENDING(-1)	0.264465	0.047681	-0.108071	-15.86257
	(0.07873)	(0.05733)	(0.10429)	(6.58268)
	[3.35929]	[0.83164]	[-1.03625]	[-2.40974]
DELTA_GDP(-1)	0.115221	0.505625	0.083046	-29.48927
	(0.12937)	(0.09421)	(0.17137)	(10.8168)
	[0.89066]	[5.36693]	[0.48459]	[-2.72625]
DELTA_TAXES(-1)	0.207721	-0.033008	0.321281	6.323246
	(0.07990)	(0.05819)	(0.10584)	(6.68064)
	[2.59983]	[-0.56727]	[3.03545]	[0.94650]
REAL_INTEREST_RAT...	-0.003802	-0.000188	-0.001731	0.220490
	(0.00091)	(0.00067)	(0.00121)	(0.07643)
	[-4.15974]	[-0.28208]	[-1.42989]	[2.88489]
C	0.025244	0.008698	0.025366	3.168761
	(0.00587)	(0.00428)	(0.00778)	(0.49103)
	[4.29862]	[2.03389]	[3.26065]	[6.45331]
OPENNESS_TRADE_D...	-0.002349	0.005017	-0.000387	-0.368071
	(0.00394)	(0.00287)	(0.00522)	(0.32934)
	[-0.59630]	[1.74892]	[-0.07421]	[-1.11760]
R-squared	0.227917	0.277873	0.087875	0.201747
Adj. R-squared	0.205075	0.256508	0.060889	0.178130
Sum sq. resids	0.137149	0.072738	0.240683	958.8649
S.E. equation	0.028487	0.020746	0.037738	2.381965
F-statistic	9.977694	13.00618	3.256326	8.542441
Log likelihood	377.4395	432.9320	328.2286	-397.1486
Akaike AIC	-4.245022	-4.879222	-3.682613	4.607413
Schwarz SC	-4.136515	-4.770715	-3.574106	4.715920
Mean dependent	0.035217	0.032095	0.032885	1.913868
S.D. dependent	0.031951	0.024060	0.038942	2.627445

Determinant resid covariance (dof adj.)	1.01E-09
Determinant resid covariance	8.76E-10
Log likelihood	831.5828
Akaike information criterion	-9.229518
Schwarz criterion	-8.795490

Table 13 presents the fiscal multipliers comparing the estimated results from the baseline model (VAR without the OPENNESS_TRADE_DEGREE variable) with those obtained when trade openness is considered.

Table 13: Cumulative fiscal multipliers, controlling for openness degree – public spending *vs.* taxes.

Period	Public Spending		Taxes	
	With trade openness	Without trade openness	With trade openness	Without trade openness
1	-0.067	-0.077	0.000	0
2	-0.040	-0.065	-0.091	-0.108
3	-0.003	-0.031	-0.149	-0.185
4	0.023	-0.003	-0.179	-0.3
5	0.040	0.017	-0.194	-0.255
6	0.050	0.03	-0.202	-0.269
7	0.057	0.038	-0.206	-0.279
8	0.060	0.044	-0.209	-0.285
9	0.063	0.048	-0.210	-0.289
10	0.064	0.05	-0.211	-0.291

Source: own calculations.

The multipliers after controlling for openness cannot be interpreted as multipliers under openness; rather they refer to the remaining effects on the multipliers after having "isolating" the impacts on output resulting from changes in trade integration.[26] Accordingly, public spending multipliers, both on impact as well as in cumulative terms, are larger in the new specification relative to baseline – this means that openness has a negative impact on the size of multipliers, as when we control for its effects on output multipliers are larger. This goes for the literature since the larger the leakage to imports, the smaller the multiplier. However, in the case of taxes, the reverse occurs. This may be due to the negative impacts of the tax burden on external competitiveness: the more open the economy is, the larger the impacts on net exports from cost increases due to tax hikes.[27]

[26] See Burriel *et al.* (2010) on this interpretation when a variable capturing financial stress is included, as exogenous, in the model.

[27] We have computed estimations controlling, instead, for the openness degree as measured by the imports-to-output ratio. Conclusions are virtually the same with the leakage on imports having stronger effects on the spending multiplier (while having smaller impacts on the tax multiplier) compared with the model controlling for overall (exports+imports) openness degree. Results are available on request.

Debt dynamics and the size of fiscal multipliers in the Euro area

As for assessing the impacts arising from including debt dynamics, we have re-estimated the baseline VAR allowing for the change in public debt as percentage of GDP (DELTA_DEBT_TO_GDP_RATIO) as an endogenous variable. Unlike openness, the dynamics of this variable both determines and is determined by the remaining endogenous variables in the model. On the one hand, policymakers follow different underlying behavior towards debt stabilization when setting fiscal policy; moreover, debt influences output as the need to satisfy intertemporal government budget constraint puts pressure on future taxes and thus, shapes current consumption and saving decisions. On the other hand, real interest rates and output growth feedback on debt stabilization, and the same happen, by definition, with shocks in fiscal instruments.

Estimation results for the augmented VAR are displayed in Table 14. As can be seen from the table, specific Cholesky decomposition considers the changes in the debt-to-output ratio as the last variable: changes in debt respond contemporaneously to changes in all the other variables, but the converse does not hold.

Table 14: Estimation results controlling for debt dynamics - aggregated fiscal variables.

Vector Autoregression Estimates
Date: 09/23/12 Time: 08:45
Sample: 1998 2008
Included observations: 175
Standard errors in ( ) & t-statistics in [ ]

	DELTA_SPE...	DELTA_GDP	DELTA_TAXES	REAL_INTE...	DELTA_DEB...
DELTA_SPENDING(-1)	0.275809	0.059924	-0.134736	-16.87605	17.44611
	(0.08117)	(0.05965)	(0.10729)	(6.81325)	(9.41258)
	[3.39788]	[1.00461]	[-1.25587]	[-2.47695]	[1.85349]
DELTA_GDP(-1)	0.062420	0.540187	0.135533	-31.77804	-0.107705
	(0.13180)	(0.09686)	(0.17421)	(11.0632)	(15.2839)
	[0.47359]	[5.57719]	[0.77800]	[-2.87242]	[-0.00705]
DELTA_TAXES(-1)	0.211089	-0.036405	0.318866	6.560499	-9.354834
	(0.07983)	(0.05867)	(0.10552)	(6.70094)	(9.25741)
	[2.64414]	[-0.62054]	[3.02196]	[0.97904]	[-1.01052]
REAL_INTEREST_RAT...	-0.003855	-0.000387	-0.001496	0.236109	0.070463
	(0.00092)	(0.00068)	(0.00122)	(0.07746)	(0.10701)
	[-4.17786]	[-0.57099]	[-1.22627]	[3.04831]	[0.65849]
DELTA_DEBT_TO_GDP...	-0.000507	-0.000186	0.000910	0.017681	0.453194
	(0.00072)	(0.00053)	(0.00095)	(0.06028)	(0.08328)
	[-0.70650]	[-0.35303]	[0.95865]	[0.29330]	[5.44185]
C	0.023675	0.013010	0.024356	2.849360	-0.275823
	(0.00490)	(0.00360)	(0.00648)	(0.41153)	(0.56853)
	[4.82885]	[3.61109]	[3.75848]	[6.92384]	[-0.48515]
R-squared	0.228571	0.265345	0.092779	0.196256	0.211011
Adj. R-squared	0.205748	0.243610	0.065938	0.172477	0.187669
Sum sq. resids	0.137033	0.074000	0.239389	965.4601	1842.649
S.E. equation	0.028475	0.020925	0.037636	2.390143	3.302007
F-statistic	10.01481	12.20800	3.456620	8.253192	9.039654
Log likelihood	377.5136	431.4270	328.7003	-397.7484	-454.3044
Akaike AIC	-4.245870	-4.862022	-3.688003	4.614267	5.260622
Schwarz SC	-4.137363	-4.753515	-3.579496	4.722774	5.369129
Mean dependent	0.035217	0.032095	0.032885	1.913868	-0.312515
S.D. dependent	0.031951	0.024060	0.038942	2.627445	3.663628

Determinant resid covariance (dof adj.)	8.91E-09
Determinant resid covariance	7.48E-09
Log likelihood	395.6194
Akaike information criterion	-4.178508
Schwarz criterion	-3.635973

Table 15 presents the fiscal multipliers corresponding to the above model specification (with debt) compared with those from baseline model (without debt).

Table 15: Cumulative fiscal multipliers, controlling for debt dynamics – public spending *vs.* taxes.

Period	Public Spending		Taxes	
	With debt	Without debt	With debt	Without debt
1	-0.08	-0.077	0.000	0
2	-0.072	-0.065	-0.107	-0.108
3	-0.053	-0.031	-0.176	-0.185
4	-0.044	-0.003	-0.209	-0.3
5	-0.043	0.017	-0.226	-0.255
6	-0.043	0.03	-0.235	-0.269
7	-0.045	0.038	-0.240	-0.279
8	-0.046	0.044	-0.244	-0.285
9	-0.046	0.048	-0.246	-0.289
10	-0.047	0.05	-0.247	-0.291

Source: own calculations.

From Table 15: we can see that both expenditure-side and revenue-side multipliers are smaller with debt: an unit-euro increase in public consumption increases, in cumulative terms, output by 0.05 euros after 10 years while considering the negative impact on the budget constraint it reflects, instead, in a fall in output of 0.047 euros. The same occurs with taxes: a tax decrease impinges negatively on debt accumulation and, thus, output expands by less compared with the no-debt-feedback scenario. The results prove the role of the intertemporal budget constraint on shaping a "more Ricardian" behavior on economic agents. Favero *et al.* (2011) have also found similar results: for an initial fiscal retrenchment of 1% of GDP, the model without feedback produces a larger output retrenchment than the one obtained with the debt-feedback model.

4.2. Multipliers across cycle phases

After concluding on the different size of Euro area fiscal multipliers depending on the different fiscal instruments, we propose now to assess how the cycle phases shape the size of fiscal multipliers, *i.e.*, if fiscal policy is expected to be more efficient during recessions than during expansions, as the literature generally argues.

Table 16 and Table 17 show the estimation results for aggregate fiscal variables for the subsamples of expansionary and recessive periods, respectively. Corresponding accumulated impulse response functions of output are plotted in Figure 4 and Figure 5

and cumulative fiscal multipliers comparing expansions with recessions are presented in Table 18.

Table 16: Estimation results - aggregated fiscal variables, expansions.

Vector Autoregression Estimates
Date: 09/23/12 Time: 00:57
Sample: 1998 2008 IF OUTPUT_GAP>0
Included observations: 106
Standard errors in ( ) & t-statistics in [ ]

	DELTA_SPE...	DELTA_GDP	DELTA_TAXES	REAL_INTE...
DELTA_SPENDING(-1)	0.361356	0.048654	-0.099933	-18.01378
	(0.09578)	(0.07804)	(0.14012)	(7.67318)
	[3.77266]	[0.62344]	[-0.71318]	[-2.34763]
DELTA_GDP(-1)	-0.019665	0.527726	-0.058390	-40.51020
	(0.16009)	(0.13044)	(0.23420)	(12.8247)
	[-0.12284]	[4.04585]	[-0.24932]	[-3.15875]
DELTA_TAXES(-1)	0.207835	-0.025052	0.278416	-0.107584
	(0.09537)	(0.07771)	(0.13952)	(7.64038)
	[2.17917]	[-0.32239]	[1.99547]	[-0.01408]
REAL_INTEREST_RAT...	-0.006426	-0.000379	-0.002873	0.172343
	(0.00116)	(0.00094)	(0.00169)	(0.09261)
	[-5.55808]	[-0.40259]	[-1.69873]	[1.86088]
C	0.027188	0.012559	0.032228	3.617217
	(0.00640)	(0.00521)	(0.00936)	(0.51249)
	[4.24990]	[2.40955]	[3.44359]	[7.05813]
R-squared	0.354026	0.227084	0.066593	0.270828
Adj. R-squared	0.328443	0.196473	0.029627	0.241950
Sum sq. resids	0.071615	0.047543	0.153268	459.6014
S.E. equation	0.026628	0.021696	0.038955	2.133192
F-statistic	13.83824	7.418474	1.801445	9.378300
Log likelihood	236.4864	258.1996	196.1600	-228.1543
Akaike AIC	-4.367667	-4.777350	-3.606793	4.399137
Schwarz SC	-4.242033	-4.651717	-3.481159	4.524771
Mean dependent	0.037206	0.033563	0.033631	1.663423
S.D. dependent	0.032494	0.024204	0.039545	2.450084

Determinant resid covariance (dof adj.)	7.80E-10
Determinant resid covariance	6.43E-10
Log likelihood	520.1225
Akaike information criterion	-9.436274
Schwarz criterion	-8.933738

Table 17: Estimation results - aggregated fiscal variables, recessions.

Vector Autoregression Estimates
Date: 09/23/12 Time: 01:04
Sample: 1998 2008 IF OUTPUT_GAP<0
Included observations: 69
Standard errors in ( ) & t-statistics in [ ]

	DELTA_SPE...	DELTA_GDP	DELTA_TAXES	REAL_INTE...
DELTA_SPENDING(-1)	0.194570	0.069335	-0.052505	-8.972508
	(0.13437)	(0.09115)	(0.16239)	(12.2684)
	[1.44798]	[0.76070]	[-0.32333]	[-0.73135]
DELTA_GDP(-1)	0.165850	0.602630	0.236377	-26.10285
	(0.19664)	(0.13338)	(0.23764)	(17.9535)
	[0.84341]	[4.51805]	[0.99468]	[-1.45392]
DELTA_TAXES(-1)	0.133465	-0.034319	0.357329	11.20750
	(0.14339)	(0.09726)	(0.17328)	(13.0913)
	[0.93080]	[-0.35286]	[2.06212]	[0.85610]
REAL_INTEREST_RAT...	-0.000413	-0.000781	-0.001401	0.270658
	(0.00164)	(0.00111)	(0.00198)	(0.14983)
	[-0.25169]	[-0.70145]	[-0.70662]	[1.80648]
C	0.017626	0.013804	0.018760	2.093937
	(0.00791)	(0.00537)	(0.00956)	(0.72242)
	[2.22762]	[2.57188]	[1.96182]	[2.89850]
R-squared	0.139941	0.327050	0.170656	0.149729
Adj. R-squared	0.086187	0.284990	0.118822	0.096588
Sum sq. resids	0.056513	0.026001	0.082535	471.0801
S.E. equation	0.029716	0.020156	0.035911	2.713048
F-statistic	2.603367	7.775905	3.292355	2.817539
Log likelihood	147.2981	174.0812	134.2313	-164.1786
Akaike AIC	-4.124584	-4.900903	-3.745833	4.903726
Schwarz SC	-3.962692	-4.739011	-3.583942	5.065618
Mean dependent	0.032163	0.029840	0.031739	2.298609
S.D. dependent	0.031085	0.023837	0.038256	2.854397

Determinant resid covariance (dof adj.)	8.10E-10
Determinant resid covariance	5.99E-10
Log likelihood	340.9802
Akaike information criterion	-9.303775
Schwarz criterion	-8.656208

Figure 4: Accumulated impulse response functions of DELTA_GDP to shocks in DELTA_SPENDING (left-hand side) and DELTA_TAXES (right-hand side), expansions.

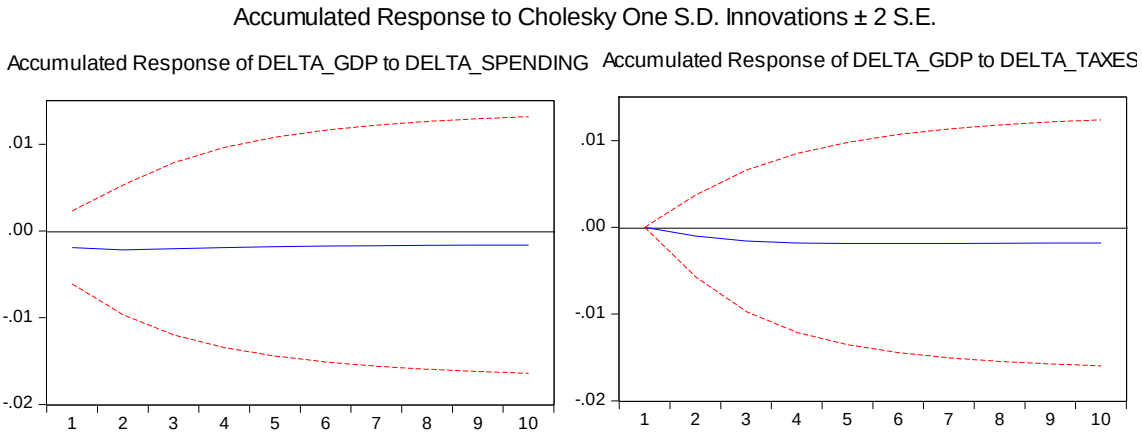


Figure 5: Accumulated impulse response functions of DELTA_GDP to shocks in DELTA_SPENDING (left-hand side) and DELTA_TAXES (right-hand side), recessions.

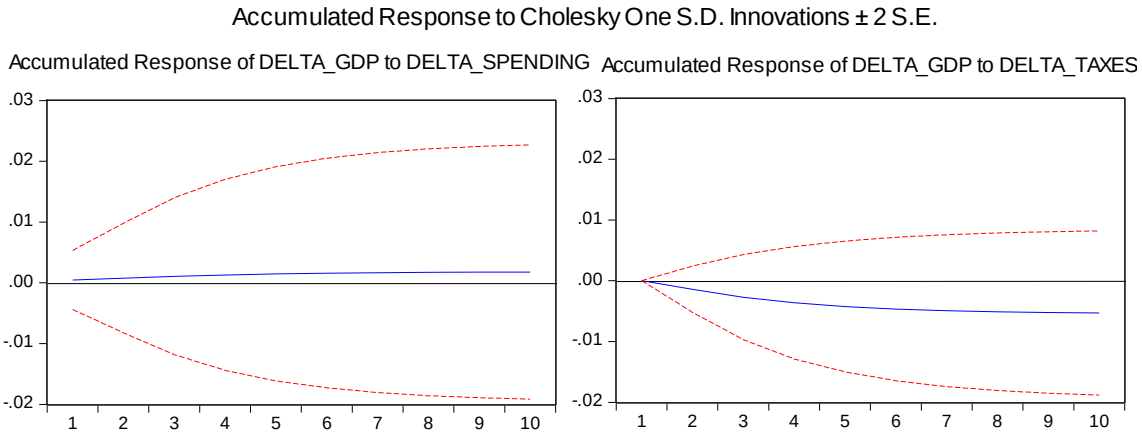


Table 18: Cumulative fiscal multipliers, expansions *vs.* recessions - public spending *vs.* taxes.

Period	Public spending		Taxes	
	Expansions	**Recessions**	**Expansions**	**Recessions**
1	-0.167	0.037	0	0
2	-0.192	0.062	-0.076	-0.15
3	-0.18	0.085	-0.121	-0.285
4	-0.167	0.104	-0.139	-0.382
5	-0.158	0.117	-0.144	-0.447
6	-0.152	0.127	-0.144	-0.49
7	-0.148	0.133	-0.143	-0.52
8	-0.146	0.138	-0.141	-0.538
9	-0.144	0.14	-0.14	-0.55
10	-0.142	0.142	-0.138	-0.56

Source: own calculations.

Taking into account the two subsamples to distinguish between cycle phases, estimation results show that in recessions government spending multiplier is positive while in expansions is smaller, inclusively, negative (impact multipliers of 0.037 and -0.167, respectively; cumulative multipliers of 0.142 and -0.142, respectively). This smaller value in expansions is in line with theoretical literature and empirical evidence. Relatively to tax multiplier, the effectiveness of this instrument is, also, higher in recessions: in both cumulative terms and on impact (impact multipliers are -0.15 in recessions, against -0.076 in expansions; cumulative multipliers are, respectively, of -0.56 and -0.138). Apparently, in the Euro area as a whole, the larger values for fiscal multipliers during recessions suggest that fiscal policy purely targeted to stabilization concerns would, on average, produce a fiscal surplus bias.

As expected, the same conclusions can also be drawn using disaggregate fiscal variables. Table 19 and Table 20 show estimation results and Figure 6 and Figure 7 show the corresponding accumulated responses of output in expansions and recessions, respectively, considering disaggregated fiscal data.

Table 19: Estimation results - disaggregated fiscal variables, expansions.

Vector Autoregression Estimates
Date: 09/23/12 Time: 01:11
Sample: 1998 2008 IF OUTPUT_GAP>0
Included observations: 106
Standard errors in ( ) & t-statistics in [ ]

	DELTA_GTRA	DELTA_GICO	DELTA_GWAG	DELTA_GINV	DELTA_GDP	DELTA_SS	DELTA_TDIR	DELTA_TIND	REAL_INTE...
DELTA_GTRA(-1)	0.059873	0.123069	0.027115	-0.181849	0.075759	-0.301018	-0.149361	-0.139416	-25.32056
	(0.10118)	(0.19068)	(0.10753)	(0.35425)	(0.06983)	(0.09819)	(0.19285)	(0.17079)	(6.69457)
	[0.59174]	[0.64543]	[0.25216]	[-0.51334]	[1.08485]	[-3.06557]	[-0.77451]	[-0.81628]	[-3.78225]
DELTA_GICO(-1)	0.026938	-0.406988	0.050710	0.036813	-0.017549	-0.078008	0.044451	0.040884	-4.658415
	(0.05317)	(0.10020)	(0.05651)	(0.18616)	(0.03670)	(0.05160)	(0.10134)	(0.08976)	(3.51812)
	[0.50660]	[-4.06158]	[0.89739]	[0.19774]	[-0.47820]	[-1.51171]	[0.43862]	[0.45550]	[-1.32412]
DELTA_GWAG(-1)	0.387692	-0.030649	0.271939	0.081352	0.059983	0.285072	0.093945	0.369705	7.331806
	(0.11575)	(0.21812)	(0.12301)	(0.40524)	(0.07989)	(0.11233)	(0.22061)	(0.19538)	(7.65825)
	[3.34947]	[-0.14051]	[2.21077]	[0.20075]	[0.75086]	[2.53785]	[0.42585]	[1.89224]	[0.95737]
DELTA_GINV(-1)	0.005913	0.088885	0.023126	0.046461	-0.016965	0.035152	-0.173997	-0.092448	-2.187192
	(0.03054)	(0.05755)	(0.03246)	(0.10692)	(0.02108)	(0.02964)	(0.05821)	(0.05155)	(2.02063)
	[0.19363]	[1.54444]	[0.71255]	[0.43453]	[-0.80486]	[1.18606]	[-2.98930]	[-1.79333]	[-1.08243]
DELTA_GDP(-1)	0.200539	-0.745140	0.117010	-0.411228	0.562852	0.261805	-0.414175	0.090444	-38.51730
	(0.20087)	(0.37853)	(0.21346)	(0.70325)	(0.13863)	(0.19493)	(0.38284)	(0.33906)	(13.2900)
	[0.99837]	[-1.96851]	[0.54815]	[-0.58476]	[4.06002]	[1.34306]	[-1.08186]	[0.26675]	[-2.89821]
DELTA_SS(-1)	0.027447	0.204026	0.264950	0.726196	-0.104589	0.126016	0.030360	-0.250852	11.54925
	(0.10904)	(0.20549)	(0.11588)	(0.38176)	(0.07526)	(0.10582)	(0.20782)	(0.18406)	(7.21450)
	[0.25171]	[0.99290]	[2.28643]	[1.90224]	[-1.38976]	[1.19085]	[0.14609]	[-1.36289]	[1.60084]
DELTA_TDIR(-1)	0.024644	0.046989	0.080438	0.206577	-0.037938	0.014300	0.002796	-0.160963	-1.715143
	(0.05419)	(0.10212)	(0.05759)	(0.18973)	(0.03740)	(0.05259)	(0.10328)	(0.09147)	(3.58545)
	[0.45477]	[0.46013]	[1.39675]	[1.08882]	[-1.01436]	[0.27192]	[0.02707]	[-1.75968]	[-0.47836]
DELTA_TIND(-1)	-0.138787	0.460195	-0.049152	0.430943	0.051847	0.123270	0.638817	0.362818	-3.505379
	(0.08238)	(0.15524)	(0.08755)	(0.28841)	(0.05686)	(0.07995)	(0.15701)	(0.13905)	(5.45046)
	[-1.68474]	[2.96438]	[-0.56145]	[1.49419]	[0.91190]	[1.54193]	[4.06871]	[2.60919]	[-0.64314]
REAL_INTEREST_RAT...	-0.006495	-0.006191	-0.006052	-0.009048	-0.000271	-0.004569	-0.004709	-0.000293	0.180643
	(0.00138)	(0.00260)	(0.00147)	(0.00483)	(0.00095)	(0.00134)	(0.00263)	(0.00233)	(0.09122)
	[-4.71097]	[-2.38281]	[-4.13058]	[-1.87463]	[-0.28453]	[-3.41491]	[-1.79223]	[-0.12580]	[1.98037]
C	0.032345	0.054133	0.014056	0.007165	0.011596	0.025448	0.045858	0.022241	3.721081
	(0.00800)	(0.01508)	(0.00851)	(0.02802)	(0.00552)	(0.00777)	(0.01526)	(0.01351)	(0.52957)
	[4.04105]	[3.58891]	[1.65253]	[0.25567]	[2.09915]	[3.27618]	[3.00606]	[1.64618]	[7.02656]
R-squared	0.355802	0.303963	0.356981	0.124706	0.269952	0.341128	0.218199	0.128914	0.345260
Adj. R-squared	0.295409	0.238710	0.296698	0.042647	0.201510	0.279359	0.144905	0.047250	0.283878
Sum sq. resids	0.094272	0.334788	0.106468	1.155538	0.044906	0.088785	0.342447	0.268609	412.6864
S.E. equation	0.031337	0.059054	0.033302	0.109713	0.021628	0.030411	0.059726	0.052896	2.073359
F-statistic	5.891400	4.658194	5.921741	1.519715	3.944238	5.522625	2.977040	1.578591	5.624781
Log likelihood	221.9182	154.7504	215.4701	89.09278	261.2238	225.0965	153.5516	166.4232	-222.4477
Akaike AIC	-3.998456	-2.731140	-3.876794	-1.492317	-4.740071	-4.058424	-2.708521	-2.951381	4.385805
Schwarz SC	-3.747188	-2.479872	-3.625526	-1.241049	-4.488803	-3.807156	-2.457253	-2.700113	4.637073
Mean dependent	0.041094	0.036416	0.031347	0.027310	0.033563	0.034445	0.041756	0.026819	1.663423
S.D. dependent	0.037332	0.067682	0.039710	0.112130	0.024204	0.035824	0.064588	0.054192	2.450084

Determinant resid covariance (dof adj.)	5.69E-23
Determinant resid covariance	2.33E-23
Log likelihood	1408.278
Akaike information criterion	-24.87318
Schwarz criterion	-22.61177

Table 20: Estimation results - disaggregated fiscal variables, recessions.

Vector Autoregression Estimates
Date: 09/23/12 Time: 01:18
Sample: 1998 2008 IF OUTPUT_GAP<0
Included observations: 69
Standard errors in ( ) & t-statistics in [ ]

	DELTA_GTRA	DELTA_GICO	DELTA_GWAG	DELTA_GINV	DELTA_GDP	DELTA_SS	DELTA_TDIR	DELTA_TIND	REAL_INTE...
DELTA_GTRA(-1)	0.096759	-0.284031	0.194642	-0.420342	-0.049258	-0.093557	-1.120051	-0.488302	-14.42278
	(0.15178)	(0.24755)	(0.13214)	(0.46542)	(0.07515)	(0.15364)	(0.28914)	(0.20037)	(10.7737)
	[0.63748]	[-1.14735]	[1.47304]	[-0.90315]	[-0.65547]	[-0.60894]	[-3.87373]	[-2.43695]	[-1.33871]
DELTA_GICO(-1)	0.084860	0.132876	0.147041	0.387801	-0.007292	0.053448	-0.078843	-0.018928	2.599978
	(0.06659)	(0.10860)	(0.05797)	(0.20418)	(0.03297)	(0.06740)	(0.12684)	(0.08790)	(4.72638)
	[1.27442]	[1.22352]	[2.53660]	[1.89934]	[-0.22119]	[0.79298]	[-0.62157]	[-0.21533]	[0.55010]
DELTA_GWAG(-1)	-0.031268	-0.617495	-0.004790	0.346844	0.179149	0.356879	-0.083529	0.658112	1.463448
	(0.15280)	(0.24921)	(0.13302)	(0.46854)	(0.07565)	(0.15467)	(0.29108)	(0.20172)	(10.8459)
	[-0.20463]	[-2.47776]	[-0.03601]	[0.74027]	[2.36803]	[2.30734]	[-0.28696]	[3.26253]	[0.13493]
DELTA_GINV(-1)	0.018253	0.140395	0.056927	-0.320220	-0.036337	0.009763	0.049304	-0.040040	-0.342543
	(0.03756)	(0.06126)	(0.03270)	(0.11517)	(0.01860)	(0.03802)	(0.07155)	(0.04958)	(2.66600)
	[0.48596]	[2.29184]	[1.74099]	[-2.78041]	[-1.95401]	[0.25679]	[0.68909]	[-0.80753]	[-0.12849]
DELTA_GDP(-1)	-0.003461	-0.221306	0.378505	0.592288	0.597756	0.071765	0.128662	-0.161588	-26.56480
	(0.26545)	(0.43294)	(0.23109)	(0.81396)	(0.13143)	(0.26870)	(0.50567)	(0.35043)	(18.8419)
	[-0.01304]	[-0.51117]	[1.63791]	[0.72766]	[4.54820]	[0.26708]	[0.25444]	[-0.46111]	[-1.40988]
DELTA_SS(-1)	0.199253	0.337202	0.020475	-0.146891	0.045949	0.305862	0.499438	-0.112974	-2.702953
	(0.16261)	(0.26521)	(0.14156)	(0.49862)	(0.08051)	(0.16460)	(0.30977)	(0.21467)	(11.5422)
	[1.22533]	[1.27144]	[0.14463]	[-0.29460]	[0.57073]	[1.85822]	[1.61231]	[-0.52627]	[-0.23418]
DELTA_TDIR(-1)	0.033992	0.300797	0.013181	-0.065786	-0.040954	-0.083162	0.260643	0.119458	4.947052
	(0.07017)	(0.11444)	(0.06108)	(0.21515)	(0.03474)	(0.07102)	(0.13366)	(0.09263)	(4.98042)
	[0.48445]	[2.62846]	[0.21578]	[-0.30576]	[-1.17889]	[-1.17090]	[1.95001]	[1.28965]	[0.99330]
DELTA_TIND(-1)	0.014837	-0.080658	-0.163747	0.901474	0.014250	0.100686	0.337386	0.235985	5.456478
	(0.09955)	(0.16236)	(0.08666)	(0.30524)	(0.04929)	(0.10076)	(0.18963)	(0.13142)	(7.06591)
	[0.14904]	[-0.49679]	[-1.88949]	[2.95329]	[0.28912]	[0.99922]	[1.77916]	[1.79571]	[0.77223]
REAL_INTEREST_RAT...	-0.002630	-0.001275	0.002603	-0.001405	-0.001708	-0.004006	-0.002893	-0.004932	0.241777
	(0.00237)	(0.00387)	(0.00207)	(0.00728)	(0.00118)	(0.00240)	(0.00452)	(0.00314)	(0.16857)
	[-1.10735]	[-0.32929]	[1.25925]	[-0.19301]	[-1.45223]	[-1.66628]	[-0.63958]	[-1.57305]	[1.43431]
C	0.032065	0.047920	-0.002045	-0.018814	0.014957	0.016391	0.038554	0.057334	2.402972
	(0.01179)	(0.01923)	(0.01026)	(0.03615)	(0.00584)	(0.01193)	(0.02246)	(0.01556)	(0.83685)
	[2.71973]	[2.49206]	[-0.19925]	[-0.52043]	[2.56235]	[1.37345]	[1.71664]	[3.68370]	[2.87145]
R-squared	0.099551	0.305979	0.335891	0.283980	0.434270	0.290581	0.335377	0.227746	0.189101
Adj. R-squared	-0.037806	0.200112	0.234587	0.174757	0.347972	0.182365	0.233993	0.109944	0.065404
Sum sq. resids	0.089172	0.237202	0.067581	0.838418	0.021859	0.091367	0.323589	0.155404	449.2669
S.E. equation	0.038877	0.063406	0.033844	0.119208	0.019248	0.039352	0.074058	0.051322	2.759473
F-statistic	0.724761	2.890207	3.315653	2.599993	5.032223	2.685183	3.308009	1.933298	1.528750
Log likelihood	131.5630	97.81000	141.1278	54.25013	180.0688	130.7241	87.09559	112.3995	-162.5429
Akaike AIC	-3.523564	-2.545217	-3.800807	-1.282612	-4.929530	-3.499250	-2.234655	-2.968103	5.001243
Schwarz SC	-3.199781	-2.221434	-3.477023	-0.958829	-4.605746	-3.175466	-1.910871	-2.644319	5.325026
Mean dependent	0.037555	0.032225	0.024185	0.032529	0.029840	0.025782	0.024727	0.045019	2.298609
S.D. dependent	0.038162	0.070895	0.038685	0.131224	0.023837	0.043520	0.084616	0.054400	2.854397

Determinant resid covariance (dof adj.)	3.11E-22
Determinant resid covariance	7.60E-23
Log likelihood	875.9914
Akaike information criterion	-22.78236
Schwarz criterion	-19.86831

Figure 6: Accumulated impulse response functions of DELTA_GDP to shocks in disaggregated items of DELTA_SPENDING and DELTA_TAXES, expansions.

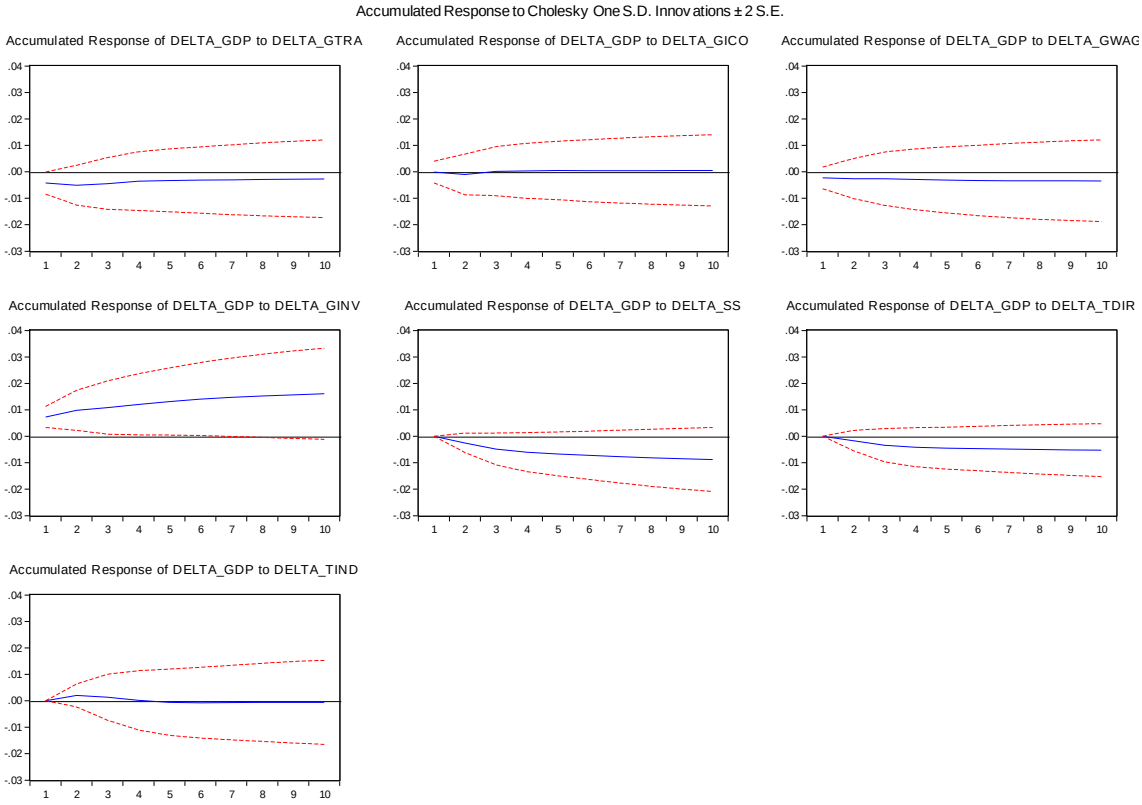


Figure 7: Accumulated impulse response functions of DELTA_GDP to shocks in disaggregated items of DELTA_SPENDING and DELTA_TAXES, recessions.

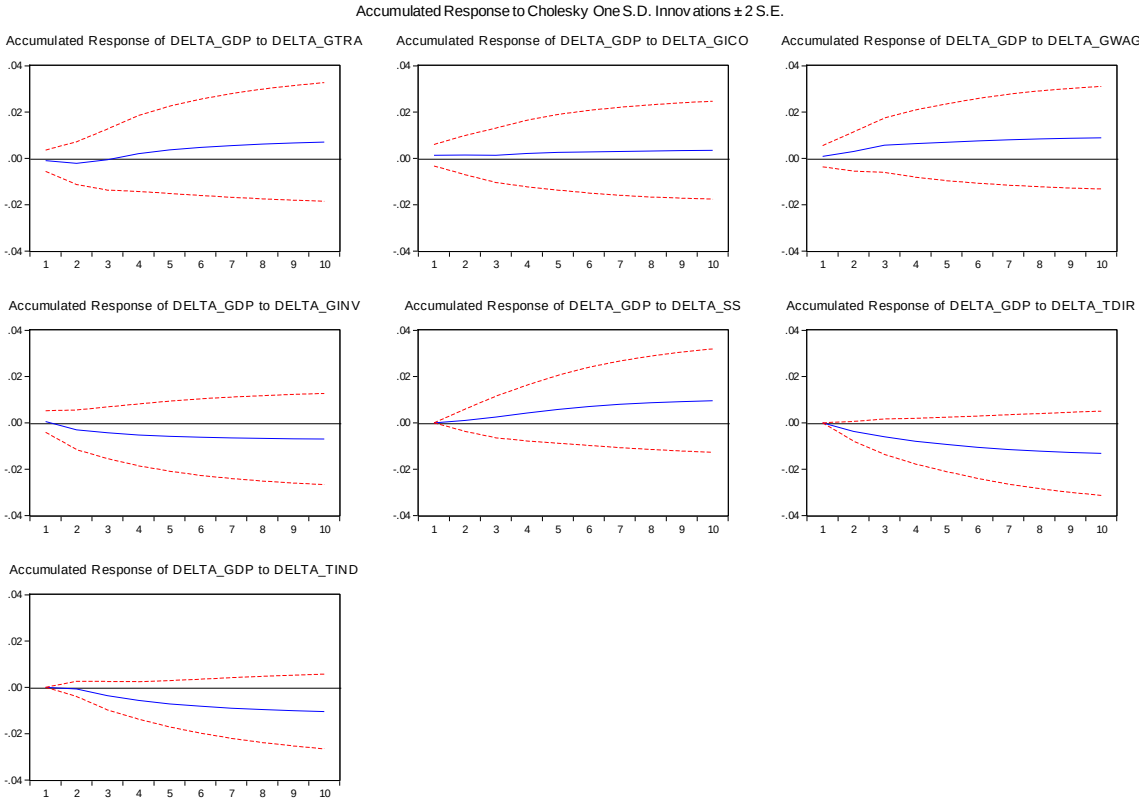


Table 21 and Table 22 compare, respectively, disaggregated expenditure and revenue multipliers, under expansions and recessions.

Table 21: Cumulative fiscal multipliers, expansions *vs.* recessions - disaggregated public spending.

Period	Expansions				Recessions			
	GTRA	GICO	GWAG	GINV	GTRA	GICO	GWAG	GINV
1	-0.561	-0.04	-0.767	2.554	-0.118	0.43	0.317	0.232
2	-0.669	-0.348	-0.869	3.435	-0.243	0.465	1.047	-1.199
3	-0.586	0.072	-0.876	3.792	-0.063	0.426	1.984	-1.697
4	-0.472	0.119	-0.969	4.223	0.241	0.679	2.235	-2.055
5	-0.429	0.164	-1.047	4.601	0.428	0.834	2.433	-2.287
6	-0.409	0.138	-1.105	4.929	0.548	0.917	2.636	-2.442
7	-0.396	0.146	-1.128	5.17	0.643	0.981	2.813	-2.562
8	-0.38	0.158	-1.14	5.36	0.72	1.04	2.945	-2.65
9	-0.364	0.172	-1.146	5.507	0.779	1.09	3.039	-2.716
10	-0.352	0.182	-1.153	5.63	0.822	1.125	3.112	-2.766

Source: own calculations.

Table 22: Cumulative fiscal multipliers, expansions *vs.* recessions - disaggregated taxes.

Period	Expansions			Recessions		
	SS	**TDIR**	**TIND**	**SS**	**TDIR**	**TIND**
1	0	0	0	0	0	0
2	-0.688	-0.258	0.391	0.238	-0.479	-0.081
3	-1.316	-0.519	0.261	0.548	-0.775	-0.453
4	-1.637	-0.64	0.028	0.918	-1.029	-0.709
5	-1.823	-0.689	-0.119	1.268	-1.209	-0.896
6	-1.967	-0.712	-0.147	1.541	-1.366	-1.026
7	-2.101	-0.738	-0.135	1.738	-1.493	-1.126
8	-2.219	-0.765	-0.122	1.885	-1.586	-1.206
9	-2.314	-0.787	-0.119	2	-1.655	-1.266
10	-2.389	-0.804	-0.119	2.088	-1.708	-1.311

Source: own calculations.

In disaggregated terms, as far as spending side is concerned, most of the multipliers are in line to what happens in aggregated terms. A single counterintuitive result emerges regarding the GINV multiplier: in expansions, the value of the multiplier is larger than in recessions, reaching 5.63 in the positive phases of the cycle while being even negative in downturns (-2.766). Apparently, during recessions, public investment policies fail to stimulate output, possibly because they are of less productive nature, or even harmful.

On the revenue it is important to notice that, in cumulative terms, in recessions, the GDP response to a change in direct taxes is approximately the double than that occurring in expansions (-1.708 *vs.* -0.804) being this effect even larger in the case of indirect taxes which values are of -1.311 in recessions *vs.* -0.119 in expansions. However, evidence shows that changes in social security contributions work strongly pro-cyclically: in recessions, multipliers range from 0.238 to 2.088 while, under expansions, a 1 euro rise in SS leads to a decrease in output of 2.389 euros in cumulative terms. One possible explanation for the stronger negative impact during expansions may be the non-linear behavior of labor supply, exhibiting higher wage elasticity in low-unemployment times.

4.3. Multipliers during debt-consolidation periods

A last empirical question that we aim to answer is how structural breaks, such as fiscal consolidation efforts, are meaningful for the effectiveness of fiscal policy. In this regard, we have proceeded in a similar way as with the control for openness. We have included in the VAR a dummy variable, as exogenous. The dummy takes the value of 1 if the period is considered as one under the effort of a fiscal consolidation process, and is recorded zero otherwise. The assumption is that consolidation is a particular structural environment that may affect, relying on literature, the multipliers. Classification of periods as of consolidation draws on the European Commission (2007) criteria as described in section 3, above.

Table 23 shows the estimation results for the VAR using aggregate fiscal data and controlling for consolidation periods. Corresponding fiscal multipliers are presented in Table 24.

Table 23: Estimation results controlling for consolidation periods- aggregated fiscal variables.

Vector Autoregression Estimates
Date: 09/24/12 Time: 19:26
Sample: 1998 2008
Included observations: 175
Standard errors in ( ) & t-statistics in [ ]

	DELTA_SPE...	DELTA_GDP	DELTA_TAXES	REAL_INTE...
DELTA_SPENDING(-1)	0.233588	0.060563	-0.079399	-16.92467
	(0.07637)	(0.05786)	(0.10237)	(6.61460)
	[3.05869]	[1.04673]	[-0.77563]	[-2.55868]
DELTA_GDP(-1)	0.012895	0.569159	0.164808	-34.49220
	(0.12235)	(0.09269)	(0.16400)	(10.5971)
	[0.10540]	[6.14014]	[1.00494]	[-3.25488]
DELTA_TAXES(-1)	0.239654	-0.043478	0.289813	7.218657
	(0.07769)	(0.05886)	(0.10414)	(6.72918)
	[3.08470]	[-0.73865]	[2.78293]	[1.07274]
REAL_INTEREST_RAT...	-0.003932	-0.000298	-0.001507	0.227706
	(0.00088)	(0.00067)	(0.00118)	(0.07606)
	[-4.47730]	[-0.44750]	[-1.28020]	[2.99377]
C	0.030735	0.011257	0.017182	3.012529
	(0.00518)	(0.00392)	(0.00694)	(0.44845)
	[5.93623]	[2.86966]	[2.47570]	[6.71767]
DCONS_EC	-0.017017	0.003686	0.017974	-0.342424
	(0.00489)	(0.00371)	(0.00656)	(0.42394)
	[-3.47683]	[0.99411]	[2.73970]	[-0.80773]
R-squared	0.277941	0.269078	0.126635	0.198939
Adj. R-squared	0.256578	0.247453	0.100796	0.175239
Sum sq. resids	0.128263	0.073624	0.230455	962.2369
S.E. equation	0.027549	0.020872	0.036928	2.386149
F-statistic	13.01058	12.44294	4.900880	8.394059
Log likelihood	383.3006	431.8726	332.0281	-397.4558
Akaike AIC	-4.312007	-4.867116	-3.726036	4.610923
Schwarz SC	-4.203500	-4.758609	-3.617529	4.719430
Mean dependent	0.035217	0.032095	0.032885	1.913868
S.D. dependent	0.031951	0.024060	0.038942	2.627445

Determinant resid covariance (dof adj.)	8.62E-10
Determinant resid covariance	7.49E-10
Log likelihood	845.2656
Akaike information criterion	-9.385892
Schwarz criterion	-8.951865

Table 24: Cumulative fiscal multipliers, controlling for consolidation – public spending *vs.* taxes.

Period	Public Spending		Taxes	
	With dummy for consolidation	Baseline	With dummy for consolidation	Baseline
1	-0.046	-0.077	0	0
2	-0.016	-0.065	-0.122	-0.108
3	0.024	-0.031	-0.203	-0.185
4	0.055	-0.003	-0.248	-0.3
5	0.077	0.017	-0.273	-0.255
6	0.091	0.03	-0.288	-0.269
7	0.100	0.038	-0.297	-0.279
8	0.107	0.044	-0.303	-0.285
9	0.111	0.048	-0.307	-0.289
10	0.114	0.05	-0.310	-0.291

Source: own calculations

Using aggregate fiscal data, Table 24 shows that when controlling for consolidation periods, spending multipliers (both on impact and in cumulative terms) and revenue-side multipliers (at least in cumulative terms, from the 4th year onwards) are higher than in the baseline model. These results show that consolidation periods produce negative impacts on the size of multipliers, as expected – a one-euro cut in public spending or a one-euro increase in taxes, has less impacts on reducing output during a consolidation than otherwise. Moreover, cuts in spending appear to be the most adequate instrument for achieving a fiscal consolidation with smaller impacts on output – cumulative spending multiplier almost doubles when we control for consolidation.

Table 25 shows the estimation output for disaggregated variables and the corresponding multipliers are compared to those in the baseline model in Table 26 and Table 27.

Table 25: Estimation results controlling for consolidation periods – disaggregated fiscal variables.

Vector Autoregression Estimates
Date: 09/26/12 Time: 04:01
Sample: 1998 2008
Included observations: 175
Standard errors in ( ) & t-statistics in [ ]

	DELTA_GTRA	DELTA_GICO	DELTA_GWAG	DELTA_GINV	DELTA_GDP	DELTA_SS	DELTA_TDIR	DELTA_TIND	REAL_INTE...
DELTA_GTRA(-1)	0.025424	-0.064179	0.054422	-0.373235	0.019444	-0.253569	-0.517788	-0.226292	-20.95608
	(0.08219)	(0.15243)	(0.08132)	(0.26664)	(0.04923)	(0.08155)	(0.16179)	(0.12636)	(5.62316)
	[0.30934]	[-0.42104]	[0.66925]	[-1.39978]	[0.39492]	[-3.10936]	[-3.20033]	[-1.79081]	[-3.72674]
DELTA_GICO(-1)	0.041813	-0.165822	0.089320	0.182189	-0.015944	-0.025839	-0.013106	0.041769	-0.401330
	(0.04034)	(0.07482)	(0.03991)	(0.13088)	(0.02417)	(0.04003)	(0.07941)	(0.06202)	(2.76010)
	[1.03649]	[-2.21630]	[2.23777]	[1.39206]	[-0.65976]	[-0.64551]	[-0.16504]	[0.67342]	[-0.14540]
DELTA_GWAG(-1)	0.216485	-0.199458	0.189555	0.375858	0.116638	0.366782	-0.081286	0.435010	5.506886
	(0.09137)	(0.16946)	(0.09040)	(0.29642)	(0.05473)	(0.09066)	(0.17986)	(0.14048)	(6.25128)
	[2.36939]	[-1.17705]	[2.09681]	[1.26799]	[2.13098]	[4.04571]	[-0.45193]	[3.09664]	[0.88092]
DELTA_GINV(-1)	3.79E-05	0.108938	0.024580	-0.184084	-0.024689	0.016148	-0.037131	-0.054719	-1.512764
	(0.02328)	(0.04319)	(0.02304)	(0.07554)	(0.01395)	(0.02310)	(0.04584)	(0.03580)	(1.59313)
	[0.00163]	[2.52256]	[1.06689]	[-2.43683]	[-1.76998]	[0.69892]	[-0.81004]	[-1.52844]	[-0.94956]
DELTA_GDP(-1)	0.021679	-0.663904	0.154892	-0.223727	0.608791	0.141936	0.136362	0.041355	-36.87348
	(0.15960)	(0.29600)	(0.15791)	(0.51777)	(0.09561)	(0.15836)	(0.31418)	(0.24538)	(10.9194)
	[0.13584]	[-2.24293]	[0.98090]	[-0.43209]	[6.36761]	[0.89629]	[0.43403]	[0.16854]	[-3.37687]
DELTA_SS(-1)	0.125533	0.315515	0.199434	0.331317	-0.049546	0.159899	0.350901	-0.166078	5.182458
	(0.08905)	(0.16517)	(0.08811)	(0.28892)	(0.05335)	(0.08836)	(0.17531)	(0.13692)	(6.09301)
	[1.40962]	[1.91029]	[2.26340]	[1.14676]	[-0.92872]	[1.80954]	[2.00160]	[-1.21295]	[0.85056]
DELTA_TDIR(-1)	0.028918	0.213726	0.073212	0.001605	-0.043701	-0.013678	0.179636	-0.050268	2.409920
	(0.03954)	(0.07333)	(0.03912)	(0.12826)	(0.02368)	(0.03923)	(0.07783)	(0.06079)	(2.70499)
	[0.73145]	[2.91475]	[1.87158]	[0.01251]	[-1.84516]	[-0.34867]	[2.30808]	[-0.82696]	[0.89092]
DELTA_TIND(-1)	-0.020245	0.229470	-0.060531	0.839468	0.021966	0.130729	0.354775	0.242131	1.459424
	(0.06230)	(0.11555)	(0.06164)	(0.20213)	(0.03732)	(0.06182)	(0.12265)	(0.09579)	(4.26271)
	[-0.32495]	[1.98587]	[-0.98193]	[4.15316]	[0.58854]	[2.11467]	[2.89261]	[2.52770]	[0.34237]
REAL_INTEREST_RAT...	-0.005044	-0.004505	-0.003542	-0.006295	-0.000287	-0.004640	-0.002711	-0.000109	0.185971
	(0.00113)	(0.00209)	(0.00111)	(0.00365)	(0.00067)	(0.00112)	(0.00222)	(0.00173)	(0.07705)
	[-4.47832]	[-2.15702]	[-3.17909]	[-1.72282]	[-0.42496]	[-4.15174]	[-1.22292]	[-0.06268]	[2.41350]
C	0.040355	0.059998	0.015408	0.022229	0.010605	0.027057	0.016145	0.023948	3.257987
	(0.00678)	(0.01258)	(0.00671)	(0.02200)	(0.00406)	(0.00673)	(0.01335)	(0.01043)	(0.46398)
	[5.95081]	[4.77036]	[2.29643]	[1.01039]	[2.61039]	[4.02106]	[1.20937]	[2.29689]	[7.02190]
DCONS_EC	-0.011699	-0.039483	-0.009216	-0.060377	0.001174	-0.004997	0.034116	0.009116	-0.373641
	(0.00626)	(0.01161)	(0.00619)	(0.02030)	(0.00375)	(0.00621)	(0.01232)	(0.00962)	(0.42817)
	[-1.86949]	[-3.40181]	[-1.48835]	[-2.97382]	[0.31326]	[-0.80476]	[2.76928]	[0.94742]	[-0.87265]
R-squared	0.211370	0.189999	0.295535	0.181040	0.309114	0.284069	0.197993	0.124240	0.244287
Adj. R-squared	0.163282	0.140609	0.252579	0.131103	0.266987	0.240415	0.149090	0.070840	0.198207
Sum sq. resids	0.193919	0.667041	0.189840	2.041055	0.069592	0.190925	0.751496	0.458408	907.7653
S.E. equation	0.034387	0.063776	0.034023	0.111559	0.020599	0.034120	0.067693	0.052869	2.352691
F-statistic	4.395547	3.846885	6.880063	3.625395	7.337630	6.507242	4.048708	2.326589	5.301355
Log likelihood	347.1320	239.0337	348.9924	141.1762	436.8017	348.4938	228.6024	271.8542	-392.3567
Akaike AIC	-3.841509	-2.606099	-3.862770	-1.487728	-4.866305	-3.857072	-2.486884	-2.981191	4.609791
Schwarz SC	-3.642579	-2.407170	-3.663841	-1.288798	-4.667376	-3.658142	-2.287955	-2.782262	4.808721
Mean dependent	0.039699	0.034763	0.028523	0.029368	0.032095	0.031029	0.035042	0.033995	1.913868
S.D. dependent	0.037592	0.068795	0.039354	0.119680	0.024060	0.039149	0.073384	0.054848	2.627445

Determinant resid covariance (dof adj.)	3.16E-22
Determinant resid covariance	1.76E-22
Log likelihood	2148.055
Akaike information criterion	-23.41777
Schwarz criterion	-21.62740

Table 26: Cumulative fiscal multipliers, controlling for consolidation – disaggregated public spending.

Period	With dummy for consolidation				Baseline			
	GTRA	GICO	GWAG	GINV	GTRA	GICO	GWAG	GINV
1	-0.352	0.274	-0.606	1.736	-0.353	0.25	-0.6	1.62
2	-0.384	0.278	-0.409	1.727	-0.391	0.245	-0.382	1.579
3	-0.258	0.485	-0.198	1.808	-0.256	0.499	-0.163	1.663
4	-0.152	0.549	-0.144	1.935	-0.14	0.609	-0.137	1.845
5	-0.097	0.558	-0.115	2.049	-0.081	0.632	-0.136	1.993
6	-0.059	0.573	-0.086	2.136	-0.042	0.657	-0.121	2.095
7	-0.028	0.591	-0.060	2.201	-0.009	0.686	-0.103	2.171
8	-0.005	0.607	-0.040	2.249	0.016	0.709	-0.089	2.228
9	0.012	0.619	-0.024	2.285	0.035	0.726	-0.079	2.272
10	0.024	0.627	-0.012	2.311	0.049	0.739	-0.072	2.304

Source: own calculations.

Table 27: Cumulative fiscal multipliers, controlling for consolidation – disaggregated taxes.

Period	With dummy for consolidation			Baseline		
	SS	TDIR	TIND	SS	TDIR	TIND
1	0.000	0.000	0.000	0	0	0
2	-0.310	-0.369	0.215	-0.313	-0.369	0.171
3	-0.552	-0.626	-0.169	-0.56	-0.636	-0.108
4	-0.618	-0.752	-0.512	-0.628	-0.762	-0.383
5	-0.652	-0.839	-0.688	-0.66	-0.849	-0.522
6	-0.690	-0.908	-0.785	-0.7	-0.92	-0.595
7	-0.722	-0.960	-0.852	-0.735	-0.975	-0.648
8	-0.746	-0.998	-0.902	-0.76	-1.014	-0.689
9	-0.763	-1.025	-0.939	-0.778	-1.043	-0.72
10	-0.776	-1.046	-0.966	-0.792	-1.065	-0.742

Source: own calculations.

Looking at disaggregated fiscal variables, results seem also of interest for policy making: apparently, and among the several sources of revenues, a reduction in indirect taxes is the most recommended. For all the remaining revenue items, the impact on output is estimated to be higher during consolidations.

On the spending side, reducing transfers and intermediate consumption has stronger impacts on output during consolidations, while reducing public investment or wages has lower impacts on output during consolidation processes. Reducing public wages exhibits even stronger non-Keynesian effects during consolidation periods. This

last result is clearly supported by the theoretical literature on non-Keynesian effects of fiscal policy.[28]

[28] See, for example, Alesina *et al.* (2002) and Ardagna (2007).

5. Conclusions

In the current context where the limited role for monetary policy instruments apparently endows fiscal policy with higher effectiveness, European fiscal policy authorities are rather constrained by the fact of most countries being struggling against recessions together with the need to put public finances in a sustainable path. In this context, we aimed at assessing how large are fiscal multipliers in Europe and for different fiscal policy instruments. Moreover, we intended to contribute to the (rather sparse) literature on the size of multipliers across cycle phases and under fiscal consolidation episodes.

After a literature review on the mechanisms through which fiscal policy affects output, evidence is presented for the Euro area, relying on a VAR model with pooled annual data for the current seventeen country-members, from 1998 to 2008.

Estimation results show that, on average, public spending in the Euro area impinges negatively on impact, but the cumulative impact on output is positive, while taxes, as expected, have (both on impact and cumulative) negative impacts on output. However, both multipliers obtained are smaller comparatively to those recorded in the theoretical and empirical literature. One possible explanation may be related to the non-accommodative monetary policy from the ECB, reflecting price stability concerns.

On the expenditure side, transfers are the main driving force for the overall expenditure dynamics; moreover, wages exhibit negative impacts on output while positive effects are strongly driven by shocks in public investment and, to a lesser extent, by intermediate consumption. On the revenue side, all items impinge negatively on output growth. Additionally, our results support that the openness degree reduces the effectiveness of public spending while it positively affects the size of the taxes multiplier. The latter result may reflect the negative impacts of the tax burden on external competitiveness. We have also found that, when the VAR is augmented by an endogenous variable capturing debt dynamics, both revenue- and expenditure-side multipliers are smaller; this proves the role of the intertemporal budget constraint on shaping a "more Ricardian" behavior on the European economic agents.

To assess how the size of fiscal multipliers changes across cycle phases, the sample was divided in two subsamples: one subsample including the observations in

which the output gap is positive (expansions) and the other comprising periods of negative output gap (recessions). Estimation results show that public spending multiplier is positive in recessions while in expansions is smaller, inclusively, negative. Similarly, the effectiveness of the taxes multiplier is, also, higher in recessions.

Last but not the least, controlling for consolidation periods, the size of overall public spending and taxes multipliers is higher than in baseline scenario – consolidation phases affect negatively the size of the multipliers. Moreover, cuts in spending appear to be the most adequate instrument for achieving a fiscal consolidation with substantially smaller impacts on output than in times of no-consolidation. Looking at disaggregated fiscal variables, a reduction in indirect taxes should be the measure most recommended to policymakers, on the revenue side. For all the remaining revenue items, the impact on output is estimated to be higher during consolidations. On the spending side, reducing transfers and intermediate consumption has stronger impacts on output during consolidations, while reducing public investment or wages has lower impacts on output during consolidation processes. Reducing public wages exhibits even stronger non-Keynesian effects during consolidation periods.

We are aware, however, that these results should be carefully interpreted because of both technical and theoretical limitations of the analysis. On the one hand, we have chosen a parsimonious VAR model with recursive formulation to identify structural shocks; the other strategies, in spite of being more appealing, would have been substantially more time-consuming and would, in certain cases, further reduce the already small number of observations in the sample. Moreover, regime-switching VAR models that allow for smooth transitions across states would probably be more suitable for computing multipliers in recessions and expansions (*e.g.*, Auerbach and Gorodnichenko, 2012). From a theoretical point of view, analyzing fiscal shocks in the context of an international panel entails several drawbacks. Formally, fiscal policy in the Euro area is country-specific; thus, fiscal policy mechanisms operate with different intensity in different countries, fiscal policy authorities have different preferences on fiscal policy mixes, on debt stabilization relative to cycle stabilization and policy responses are not immune to international policy spillovers. For instance, Favero *et al.* (2011) found that a fiscal consolidation has different impacts whether it is implemented by a single country or contemporaneously by a set of highly integrated countries. The

analysis of fiscal multipliers is probably more useful for policy makers if it relies only on observations for a specific country, although of difficult implementation for all the European countries, due to sparse data since the Euro involvement.

Appendix

Keynesian spending and tax multipliers (closed economy)

$Y^{eq} = E_p$

$E_p = C + G + I_P \Leftrightarrow$

$\Leftrightarrow E_p = \bar{C} + \mathrm{c}.Y_d + \bar{I_p} + \bar{G} \Leftrightarrow$

$\Leftrightarrow E_p = \bar{C} + \mathrm{c}.(Y - T + R) + \bar{I_p} + \bar{G} \Leftrightarrow$

$\Leftrightarrow E_p = \bar{C} + \mathrm{c}.[(Y - (\bar{T} + t.Y) + \bar{R}) + \bar{I_p} + \bar{G} \Leftrightarrow$

$\Leftrightarrow E_p = \bar{C} + \mathrm{c}.(1 - \mathrm{t}).Y^{eq} - \mathrm{c}.\bar{T} + \mathrm{c}.\bar{R} + \bar{I_p} + \bar{G} \Leftrightarrow$

$\Leftrightarrow E_p = [c.(1-t)].Y^{eq} + A_p$

$Y^{eq} = [c.(1-t)].Y^{eq} + A_p \Leftrightarrow$

$\Leftrightarrow Y^{eq}.[1 - c.(1-t)] = A_p \Leftrightarrow$

$\Leftrightarrow Y^{eq} = \frac{1}{[1-c.(1-t)]} . A_p$

$\Delta Y^{eq} = \frac{1}{[1-c.(1-t)]} . \Delta A_p = \alpha.\Delta A_p$

Spending Multiplier

$\Delta\bar{\mathrm{G}} => \Delta \mathrm{A_p} = \Delta\bar{\mathrm{G}} => \Delta \mathrm{Y_g^{eq}} = \alpha.\Delta \mathrm{A_p} = \alpha.\Delta\bar{\mathrm{G}} = \frac{1}{[1-c.(1-t)]}\Delta\bar{\mathrm{G}}$

Tax Multiplier

$\Delta\bar{\mathrm{T}} => \Delta \mathrm{A_p} = -c.\Delta\bar{\mathrm{T}} => \Delta \mathrm{Y_t^{eq}} = -\mathrm{c}.\alpha.\Delta \mathrm{A_p} = -c.\alpha.\Delta\bar{\mathrm{T}} = \frac{-c}{[1-c.(1-t)]}\Delta\bar{\mathrm{T}}$

If $\Delta\bar{\mathrm{G}} = \Delta\bar{\mathrm{T}}$, in modulus, Spending Multiplier > Tax Multiplier, since 0<c<1,

$$\left|\frac{1}{[1-c.(1-t_1)]}\right| > \left|\frac{-c}{[1-c.(1-t_1)]}\right| \text{ c.q.d.}$$

where $Y =$ Gross Domestic Product;

$E_p =$ Planned Expenditure;

$A_p =$ Autonomous Aggregate Expenditure;

$C =$ Private Consumption;

$G =$ Government Spending;

$I_p =$ Planned Private Investment;

$c =$ Marginal Propensity to Consume;

T = Income Taxes;

t = Income Tax Rate;

R = Transfers from Government to private sector.

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Annexes

A.1. List of variables used in estimations[29]

Variable	Description
REAL_ INTEREST_ RATE_10	$= ILN - [\left(\frac{PVGD_t}{PVGD_{t-1}} - 1\right) * 100]$ **ILN** - Nominal long-term interest rates (national data weighted with current GDP in ECU/EUR) **PVGD** - Price deflator gross domestic product at market prices (average of national growth rates weighted with current values in ECU/EUR)
GROSS DOMESTIC PRODUCT (GDP)	**OVGD** - Gross Domestic Product at constant market prices (average of national growth rates weighted with current values in ECU/EUR)
SPENDING	$= GTRA + GICO + GWAG + GINV$
GOVERNMENT TRANSFERS (GTRA)	$=$ **UYTGH** $+$ **UYTGM** $+$ **UYVG** $+$ **UUOG** **UYTGH** - Social benefits other than social transfers in kind (National currency) **UYTGM** - Social transfers in kind supplied to households via market producers: general government (National currency) **UYVG** - Subsidies: general government (National currency) **UUOG** - Other current expenditure: general government (National currency)
GOVERNMENT INTERMEDIATE CONSUMPTION (GICO)	**UCTGI** - Intermediate consumption: general government (National currency)
GOVERNMENT WAGES (GWAG)	**UWCG** - Compensation of employees: general government (National currency)

[29] These variables can have been used directly in estimations or indirectly, that is, used to calculate variables used in estimations.

GOVERNMENT INVESTMENT (GINV)	**UIGGO** - Gross fixed capital formation: general government (National currency)
TAXES	$= \boldsymbol{SS + TDIR + TIND}$
SOCIAL SECURITY PAYMENTS (SS)	**UTSG** - Social contributions received: general government (National currency)
INDIRECT TAXES (TIND)	**UTVG** - Taxes linked to imports and production (indirect taxes): general government (National currency)
DIRECT TAXES (TDIR)	**UTYG** - Current taxes on income and wealth (direct taxes): general government (National currency)
DELTA_DEBT_TO_GDP_RATIO	$= \boldsymbol{UDGG_t - UDGG_{t-1}}$ **UDGG** - General Government Consolidated Gross Debt (Percentage of GDP at market prices – excessive deficit procedure)
OPENNESS_TRADE_DEGREE	$= \frac{(\boldsymbol{OXGS + OMGS})}{\boldsymbol{OVGD}}$ **OXGS** - Exports of goods and services at constant prices **OMGS** - Imports of goods and services at constant prices **OVGD** - Gross Domestic Product at constant market prices (average of national growth rates weighted with current values in ECU/EUR)

A.2. Identification of cycle phases – Euro area countries

	Years	
Country	**Expansions**	**Recessions**
Austria	1999; 2000; 2001; 2006; 2007; 2008.	1998; 2002; 2003; 2004; 2005.
Belgium	1999; 2000; 2001; 2004; 2005; 2006; 2007; 2008.	1998; 2002; 2003.
Cyprus	2000; 2001; 2006; 2007; 2008.	1998; 1999; 2002; 2003; 2004; 2005.
Estonia	2005; 2006; 2007; 2008.	1998; 1999; 2000; 2001; 2002; 2003; 2004.
France	1999; 2000; 2001; 2002; 2004; 2005; 2006; 2007; 2008.	1998; 2003.
Finland	1998; 1999; 2000; 2001; 2002; 2004; 2005; 2006; 2007; 2008.	2003.
Germany	2000; 2001; 2002; 2006; 2007; 2008.	1998; 1999; 2003; 2004; 2005.
Greece	2003; 2004; 2005; 2006; 2007; 2008.	1998; 1999; 2000; 2001; 2002.
Ireland	1999; 2000; 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008.	1998.
Italy	2000; 2001; 2002; 2004; 2005; 2006; 2007; 2008.	1998; 1999; 2003.
Luxembourg	2000; 2001; 2002; 2005; 2006; 2007; 2008.	1998; 1999; 2003; 2004.
Malta	1998; 1999; 2000; 2001; 2002; 2007; 2008.	2003; 2004; 2005; 2006.
Netherlands	1998; 1999; 2000; 2001; 2002; 2006; 2007; 2008.	2003; 2004; 2005.
Portugal	1998; 1999; 2000; 2001; 2002; 2007; 2008.	2003; 2004; 2005; 2006.
Slovakia	1998; 2006; 2007; 2008.	1999; 2000; 2001; 2002; 2003; 2004; 2005.
Slovenia	1999; 2000; 2005; 2006; 2007; 2008.	1998; 2001; 2002; 2003; 2004.
Spain	2000; 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008.	1998; 1999.

A.3. Identification of consolidation periods – Euro area countries

Country	Number of fiscal consolidation episodes	Years of fiscal consolidation episodes
Austria	2	2001; 2005.
Belgium	2	1998; 2006.
Cyprus	5	2000; 2004; 2005; 2006; 2007.
Estonia	1	2000.
France	1	1998.
Finland	3	1998; 1999; 2000.
Germany	5	1998; 1999; 2000; 2005; 2007.
Greece	1	2005.
Ireland	4	2003; 2004; 2005; 2006.
Italy	2	2007; 2008.
Luxembourg	4	2005; 2006; 2007; 2008.
Malta	6	1999; 2000; 2001; 2002; 2004; 2005.
Netherlands	4	2003; 2004; 2005; 2006.
Portugal	3	2002; 2004; 2006.
Slovakia	3	1999; 2001; 2003.
Slovenia	0	-
Spain	2	1998; 2006.