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HOW DO FISCAL SHOCKS AFFECT THE MACROECONOMIC DYNAMICS IN THE SLOVENIAN ECONOMY?

Nataša Jemec, Andreja Strojan Kastelec, Aleš Delakorda[1]

ABSTRACT

This paper analyses the dynamic effects of fiscal policy on macroeconomic developments in Slovenia. Although there is a substantial volume of work examining the effects of fiscal policy internationally, there are no such estimates for Slovenia. In this study, we follow the structural VAR approach of Blanchard and Perotti (2002). It relies on institutional information about the tax and transfer systems and the timing of tax collection to identify the automatic response of taxes and spending to economic activity as well as to infer fiscal shocks.

The main finding of this paper is that positive government spending shocks in Slovenia point towards an immediate positive effect on output, private consumption and investment. The effect becomes insignificant in the period following the shock. On the other hand, positive tax shocks indicate a negative effect on GDP, private consumption and investment in the period of a shock. The effect again becomes statistically insignificant afterwards. Taking the above facts into account, one-off changes in government spending and taxes in Slovenia appear to be short-lived and can not be used to support economic activity.

POVZETEK

V raziskavi smo analizirali dinamične učinke fiskalne politike na razvoj makroekonomskih agregatov, kar je prvo tovrstno delo za Slovenijo. Izračuni so narejeni na podlagi strukturnega VAR modela, ki temelji na raziskavi Blanchard in Perotti (2002). Ta se opira na institucionalna dejstva o davčnem sistemu in sistemu transferjev ter časovnem horizontu pobiranja davkov. Omenjene informacije se potem uporabijo za identifikacijo avtomatičnih odzivov davkov in državne potrošnje na gibanje gospodarske aktivnosti in za določitev fiskalnih šokov.

Glavne ugotovitve so, da naj bi pozitivni šoki državne potrošnje pozitivno vplivali na BDP, privatno potrošnjo in investicije takoj, ko šok nastopi. Učinek postane statistično neznačilen v obdobju za tem. Pozitivni davčni šoki pa naj bi imeli v času šoka negativne učinke na BDP, privatno potrošnjo in investicije. Učinek ponovno postane statistično neznačilen v obdobju, ki sledi šoku. Iz omenjenega je možno sklepati, da imajo enkratne spremembe v državni potrošnji in davkih v Sloveniji predvidoma kratkotrajen učinek in se jih ne da uporabiti pri pospeševanju ekonomske aktivnosti na daljši rok.

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Corresponding author: natasa.jemec@bsi.si. We are very grateful to Martin Wagner, Urban Sila, Biswajit Banerjee and all the participants of the internal Bank of Slovenia seminar, of Public Finance Workshop organized by Banca d'Italia and of Economic and Business Review Conference at the Faculty of Economics, University of Ljubljana for very useful comments and suggestions. All views expressed are those of authors and do not necessarily reflect the views of the Bank of Slovenia or of the Eurosystem. All remaining errors in this paper are the sole responsibility of the authors. A preliminary version of the paper was published in Prikazi in analize 2/2011.

NETEHNIČNI POVZETEK

V primerjavi z obsežno literaturo o učinkih denarne politike na gospodarsko aktivnost, so raziskave, povezane z učinki fiskalne politike, postale bolj pogoste šele v zadnjem času. Relativno manjše število raziskav je v nasprotju s pogosto javno razpravo o pomembni vlogi fiskalne politike, še posebej v času gospodarske krize. Fiskalna politika je hkrati edini instrument, ki je na voljo posameznim državam evrskega območja za soočanje z asimetričnimi šoki. Prav tako doslej praktično ni bilo raziskav, ki bi se ukvarjale z ocenjevanjem učinkov fiskalnih šokov v Sloveniji, kar je glavni namen naše raziskave.

Oceno učinkov fiskalnih šokov smo naredili na podlagi strukturnega VAR (v nadaljevanju: SVAR) modela, ki temelji na raziskavi Blancharda in Perottija (2002). SVAR modele lahko uporabimo za analizo vpliva šokov državne potrošnje in davkov na ustrezne spremenljivke, v našem primeru na BDP, potrošnjo in investicije. Uporabili smo četrtletne podatke po metodologiji ESA95 za obdobje od prvega četrtletja 1995 do zadnjega četrtletja 2010.

Rezultati analize kažejo, da naj bi povečano trošenje države pozitivno vplivalo na BDP, zasebno potrošnjo in investicije takoj, ko nastopi povečanje. V obdobju za tem postane učinek statistično neznačilen. Višji davki naj bi takoj negativno vplivajo na BDP, zasebno potrošnjo in investicije. Učinek ponovno postane statistično neznačilen v obdobju, ki sledi šoku. Kar se tiče multiplikatorjev pa naj bi dvig državne potrošnje za 1 % BDP povzročil dvig BDP za 1,6 %, zasebne potrošnje za 1,1 % BDP in investicij za 1,6 % BDP v obdobju, ko šok nastopi. Povečanje davkov za 1 % BDP naj bi znižalo BDP za 0,4 %, privatno potrošnjo za 0,05 % BDP in investicije za 0,35 % BDP v obdobju šoka.

Naša ugotovitev, da naj bi imel pozitiven šok državne potrošnje pozitiven učinek na BDP je skladna z večino literature (na primer z Blanchardom in Perottijem (2002), De Castrom, Hernandez de Cosom (2006), Giordano in ostalimi (2006), Hepke-Falk is ostalimi (2006) ter mnogimi drugimi). Prav tako je pozitiven odziv privatne potrošnje na pozitiven šok državne potrošnje skladen z ugotovitvami npr. Blancharda in Perottija (2002), De Castrom, Hernandez de Cosom (2006), Giordano in ostalimi (2006) ter Hepke-Falk in ostalimi (2006). Povečanje investicij ob pozitivnem šoku državne potrošnje pa je primerljivo z rezultati Giordano in ostalih (2006).

Negativen učinek povišanja davkov na BDP je skladen z ugotovitvami Blancharda in Perottija (2002), Giordano in ostalih (2006) in drugih. Tudi zmanjšanje potrošnje in investicij zaradi višjih davkov je skladno z rezultati Blancharda in Perottija (2002). Naše ugotovitve so prav tako skladne s keynesiansko teorijo, ki predvideva, da bi odziv investicij na pozitiven davčni šok moral imeti obraten predznak kot njihov odziv na pozitiven šok državne potrošnje.

Rezultati analize kažejo, da imajo enkratne spremembe državne potrošnje in davkov le kratkoročen učinek na makroekonomske spremenljivke, ne pa tudi dolgoročnih. To je skladno

s teorijo in empiričnimi ugotovitvami, ki kažejo, da kratkoročne spremembe povpraševanja nimajo dolgoročnih realnih učinkov na gospodarstvo.

Iz rezultatov analize sledita dva napotka za ekonomsko politiko. Prvič, kratkoročni učinki na gospodarsko aktivnost omogočajo fiskalni politiki, da deluje proti-ciklično. To zahteva oblikovanje zadostnih rezerv v javnofinančnem saldu v ugodnih časih, da se lahko zagotovi dodatna poraba v neugodnih gospodarskih razmerah. Drugič, trenutno nujna fiskalna konsolidacija bo verjetno negativno vplivala na gospodarsko aktivnost na kratek rok, o njenih dolgoročnih vplivih pa na podlagi naše raziskave ne moremo reči nič. Pri interpretaciji napotkov za ekonomsko politiko je potrebno biti previden, saj so naši rezultati obdani z določeno mero negotovosti zaradi majhnosti vzorca, ki v zadnjih letih vsebuje še krizo. Poleg tega se lahko SVAR model načeloma uporabi le za simulacijo učinkov začasnih šokov, medtem ko fiskalna konsolidacija zahteva uporabo trajnejših ukrepov. Poleg tega je uporabljen SVAR model zelo enostaven in, na primer, ne vključuje pričakovanj agentov, kar bi lahko močno vplivalo na rezultate. Za odgovore na takšna vprašanja bi bila bolj ustrezna uporaba strukturnega modela, vendar to presega namen in obseg naše raziskave.

NON-TECHNICAL SUMMARY

Compared to the large body of empirical evidence on the effects of monetary policy, research on fiscal policy effects has only recently received more attention. This might be due to its complexity in affecting the economy and its distributional dimension. This lack of attention contrasts with recent public debates on the role of fiscal policy, both in the euro area and worldwide, and specifically so in the period of economic crisis. Fiscal policy is indeed the sole policy instrument on the demand side, available to individual Member States of the euro area to offset shocks. There is up to now almost no research estimating the effects of fiscal policy shocks in Slovenia, which is the main purpose of this paper.

To estimate effects of fiscal shocks we use the structural VAR approach of Blanchard and Perotti (2002). With (S)VAR models we can examine the effect of shocks in government spending and net taxes on the respective variable of interest, output, consumption and investment in our case. The model is estimated using quarterly data based on the ESA95 methodology from the first quarter of 1995 until the last quarter of 2010.

The main finding of this paper is that positive government spending shocks in Slovenia appear to have an immediate positive effect on output, private consumption and investment. The effect becomes statistically insignificant in the period following the shock. In contrast, positive tax shocks tend to have a negative effect on GDP, private consumption and investment in the period of the shock and, similarly, an insignificant effect after the initial impulse. In terms of multipliers, a 1% of GDP increase in government spending seems to increase GDP by 1.6%, private consumption by 1.1% of GDP and investment by 1.6% of GDP in the period of the shock. On the other hand, a 1% of GDP increase in taxes tends to decrease BDP by 0.4%, private consumption by 0.05% of GDP and investment by 0.35% of GDP on impact.

Our finding that positive government spending shocks seem have a positive effect on output is in line with the majority of the literature (see, for instance, Blanchard and Perotti (2002), De Castro, Hernandez de Cos (2006), Giordano et al. (2006), Hepke-Falk et al. (2006) and many others). Also, a positive response of private consumption to a government spending shock is in line with the findings of Blanchard and Perotti (2002), De Castro, Hernandez de Cos (2006), Giordano et al. (2006) and Hepke-Falk et al. (2006). Finally, regarding the reaction of investment to a government spending shock, the results are comparable to those of Giordano et al. (2006).

Similarly, our finding that positive tax shocks have a negative effect on GDP is in line with the findings of Blanchard and Perotti (2002), Giordano et al. (2006), and others. The negative consumption and investment response to a positive tax shock is consistent with the results of Blanchard and Perotti (2002). Furthermore, our results are also in line with the Keynesian

theory, which predicts that the response of investment to a positive tax shock should have the opposite sign than the investment response to a positive government spending shock.

In contrast to short-term effects, the obtained results indicate that one-off changes in government spending and taxes do not have significant long-lasting effects on macroeconomic variables in Slovenia. This is in line with the theoretical prediction and empirical findings, suggesting that short-term demand shocks do not exert long-term real effects on the economy.

These findings suggest two major conclusions. First, short-term effects on economic activity may enable the fiscal policy to act counter-cyclically if appropriately geared to affect economic activity. This would require forming sufficient buffers in the fiscal balance in favourable times, to enable additional spending in the downswings of the economic cycle. Second, restrictive fiscal policy measures would most likely negatively impact the economic activity in the short-run, but there can not be much said about the longer-term perspective. These results may not have direct implications for the economic policy, since they are surrounded by a certain degree of uncertainty due to the small sample which is furthermore contaminated by the crisis and must therefore be interpreted with caution. In addition, the applied SVAR model is in principle capable of simulating the effects of temporary shocks, whereas fiscal consolidation requires the use of permanent fiscal measures. Moreover, the SVAR model used in the paper is a very simple one, where the modelling exercise does not incorporate agents' expectations, which might strongly affect the results. Such issues could, in principle, be better addressed with a structural model, which is beyond the scope of this paper.

1. Introduction

Fiscal policy is considered to have significant effects both on micro-decisions of economic agents as well as on aggregate economic activity.

Compared to the long history of estimating macroeconomic effects of monetary policy effects and large empirical evidence on this issue, research on fiscal policy effects has received more attention only recently. As the fiscal policy is to a large extent a consequence of politic- and not only economics-based decisions, it is difficult to model this field of economic policy, which by definition is very complex and has important distributional dimensions. Consequently the findings on the effects of fiscal policy have remained relatively ambiguous (e.g. Leeper, 2010). The lack of knowledge about the fiscal policy effects confronts with recent public debates on the role of fiscal policy, both in the euro area and worldwide, and specifically so in the period of economic crisis (e.g. Spilimbergo et al., 2008, Afonso et al., 2010). In that sense, researchers' views on both the short-run and long-run effects of fiscal policy remain mixed.[2] This heterogeneity rests also on the divergent theoretical underpinnings used in the analysis: purely neoclassical models state that private consumption may fall following a positive shock to government consumption via the crowding out effect, while models with (neo-) Keynesian features find the opposite (see e.g. Woodford, 2010).

Fiscal policy represents the only policy instrument, which individual Member States of the euro area may use to offset adverse asymmetric shocks on the demand side. Fiscal shocks in an economic union, especially those in big countries, may cause important spill-over effects (e.g. Guiliodori and Beetsma, 2004). It is also important to keep in mind that fiscal policy has important supply side effects e.g. through infrastructure expenditures, spending aimed at human capital enhancement, and taxes that directly affect the returns to labour and capital. Notwithstanding the relatively rich volume of work that examines the effects of fiscal policy internationally, almost no investigation has been directed to estimate these effects for Slovenia.

This paper analyses the dynamic effects of fiscal policy on macroeconomic developments in Slovenia, both from the expenditure as well as from the revenue side. The main issue in the estimation of fiscal policy effects is the identification of a fiscal shock, where approaches range from using simple VARs to structural models. In this paper, we follow the approach of Blanchard and Perotti (2002), where a structural VAR is used. It relies on institutional information about the tax and transfer systems and the timing of tax collection to identify the automatic response of taxes and spending to activity as well as to determine the structural fiscal shocks. The empirical investigation of the role of fiscal policy in Slovenia shows that in the period examined, positive government spending shocks appear to have a positive effect on

[2] This paper only deals with the effects of fiscal policy on output and does not include an analysis of fiscal policy price effects. For an overview of studies on price effects and an assessment of empirical results one may refer e.g. to Henry et al. (2004).

output, private consumption and investment on impact. The effect becomes insignificant afterwards. The results indicate that positive tax shocks have a negative immediate effect on output, private consumption and investment. The effect again becomes insignificant in the period following the shock. To sum up, one-off changes in government spending and taxes in Slovenia appear to be short-lived and can not be used for long-lasting purposes. The size of the effects is similar to those in other studies. After a 1% of GDP increase in government spending, GDP contemporaneously seems to rise by approximately 1.6%, while it appears to decrease by close to 0.4% after a 1% of GDP increase in taxes.

The remainder of the paper is organized as follows. A literature review is provided in section 2. Section 3 describes fiscal policy in Slovenia. The empirical approach is presented in section 4. Section 5 includes a detailed description of the data. The effects of fiscal policy on GDP, private consumption and investment are presented in section 6. Section 7 presents robustness checks. Section 8 concludes.

2. Literature review

Various methodologies have been applied to study the effects of fiscal policy shocks. Aside from structural models, discussed and evaluated in Coenen et al. (2010) or in Cogan et al. (2009), four major strands of research stand out. First, transforming a seminal approach of Romer and Romer (1989) for identifying monetary policy shocks into a fiscal policy experiment, by the same authors (2007), one can trace the effects of fiscal policy using dummy variables to detect fiscal episodes, such as presidential speeches, wars or well-documented fiscal expansions in a so-called "event-study".

The second approach by Canova and Pappa (2003) and by Mountford and Uhlig (2009) consists of identifying fiscal shocks by sign and near-zero restrictions of impulse responses in a VAR. This approach also follows a methodology originally applied to monetary policy (see Uhlig (1999)). The restrictions imposed come from orthogonalising fiscal variables to both "generic" business cycle shock (shock which jointly moves output, consumption, non-residential investment and government revenue in the same direction) and monetary policy shock as well as from sign restrictions. The revenue shock is defined by allowing that tax revenues increase while government spending does not. Identifying restrictions are also applied so that the fiscal variables do not respond for a certain time period. On the other hand, no sign restrictions are imposed on the response of GDP to fiscal shocks.

The third approach to investigate the effects of fiscal policy shocks by Fatas and Mihov (2001) or by Favero (2002) relies on the Choleski ordering to identify fiscal shocks in a VAR. In the paper by Fatas and Mihov (2001), government spending is ordered first, assuming that all the contemporaneous elasticities of fiscal variables to the rest of the variables are zero,

while in the paper by Favero (2002), fiscal variables are ordered last, mimicking the fiscal policy reaction function.

Finally, Blanchard and Perotti (2002) apply a methodology which combines institutional information and SVAR analysis. This is also the approach we take in this paper and is discussed further in the following sections.

In line with the divergences in theoretical and methodological approaches, the existing empirical evidence on the effects of fiscal policy is also rather heterogeneous. Spilimbergo et al. (2009) and Hemming et al. (2002) provide an overview of studies dealing with the effects of fiscal policy on economic activity. As these overviews point out, the size (and even the sign) of fiscal multipliers varies across countries, time, and depends on many factors and circumstances in which fiscal policy is applied, among others also on the current stance of the monetary policy (e.g. Eggertsson, 2009) and its response to changes in fiscal policy (e.g. Woodford, 2010). The findings of Ilzetzki et al. (2010) support the view of an effective fiscal policy in closed economies and only negligible effects of fiscal policy in open economies, especially in those with a flexible exchange rate. Contrary to that, Dellas et al. (2005) find no significant relationship between the exchange rate regime and the effects of fiscal policy. The study by Ilzetzki et al. (2010) also reveals that government consumption has smaller short-run and less persistent effects in developing than in high-income countries. According to this study, the size of the impact multiplier amounts to 0.2 in the case of high-income countries, while it is negative at -0.2 in developing countries. Although the cumulative multiplier in the long-run becomes positive at 0.4 in the latter group of countries, it is less than a half of the value of the cumulative multiplier in high-income countries, which is 0.9.

It is generally accepted that the effects of fiscal policy depend to a large extent on the instrument used. In general, multipliers associated with changes in spending, and within that in targeted transfers, are higher than those related to tax cuts, as found by Coenen et al. (2010). As a rule of thumb, Spilimbergo et al. (2009) suggest that the effect of fiscal policy when acting on the revenue side is about half of the spending multipliers. On the other hand, Mountford and Uhlig (2009), emphasize that the multipliers associated with tax cuts are much higher than spending multipliers. Their analysis, however, also includes assumptions on how the expansionary fiscal actions are financed. The size of the tax multiplier for the United States in Blanchard and Perotti (2002) is estimated at around 1 in the first year, where the effect of a shock peaks in the second year, while the spending multiplier is about half of the size of the tax multiplier after four quarters and peaks in the fourth year in their VAR with a deterministic trend. Perotti (2005) finds smaller multipliers for European countries[3] than for the US, a finding which is similar to the findings of structural models as presented in ECB (2010) or in Coenen et al. (2010). According to Coenen et al. (2010), the short-term impact of

[3] Some other examples include e.g. Afonso and Sousa (2009) for Portugal, Benetrix and Lane (2009) for Ireland, de Castro Fernandez and Hernandez de Cos (2006) for Spain, Giordano (2006) for Italy and Heppke-Falk et al. (2006) for Germany.

a fiscal stimulus on GDP is roughly by one half to one third larger in the United States than in Europe. The majority of estimates of fiscal multipliers with monetary accommodation vary around 1 in the case of Europe and between 1 and 1.5 in the United States. According to this study, the smaller effects in Europe in comparison to the United States could be mainly attributed to the larger openness to trade, stronger role of automatic stabilisers and to the higher degree of nominal rigidities in Europe. In the evidence provided by Blanchard and Perotti (2002) and by Galí, López-Salido and Vallés (2005), private consumption rises significantly after a positive government spending shock. Cogan et al. (2009) find that private consumption reacts similar to investment. Finally, Fatas and Mihov (2001) find that increases in government consumption are always expansionary, while increases in public investment do not affect output significantly. According to the same study, increases in government employment (wage spending) are assessed to have the largest effect on the economy.

Some empirical studies find a negative relationship between fiscal spending and aggregate economic activity. The most notable studies with negative multipliers are found in the literature on expansionary fiscal contractions initiated by Giavazzi and Pagano (1990). Following that, Perotti (1999) finds evidence of a negative co-movement of household consumption and government spending during episodes of fiscal consolidation (and hence large spending cuts) in circumstances of "fiscal stress" (defined by unusually high debt to GDP ratios), but the opposite sign in "normal" times, a finding similar to Galí et al. (2007). In the same vein, a study by Guidice et al. (2003) confirms the expansionary effect of fiscal tightening on economic activity for roughly half of the consolidation episodes studied. Their simulations show that consolidations may be expansionary in the short to medium-run, provided that they are obtained through expenditure cuts rather than revenue increases. Although these positive "non-Keynesian" effects on private demand are not always strong enough to offset the negative impact of the fiscal consolidation on GDP in the period of a shock, they begin to dominate in consecutive years.

The sizes and signs of fiscal multipliers from the reviewed literature are summarized in Table 1.

Table 1: Estimates of fiscal multipliers in different countries

Country	Multiplier	Instruments applied[1]	Methodology	Sample period	Study
range of countries					
high-income countries	ST: 0.2*, LT: 0.9*[c]	gov.spending (+)	SVAR	1996-2007	Ilzetzki at al. (2010)
low-income countries	ST: -0.2*, LT: 0.4[c]	gov.spending (+)	SVAR	1996-2007	Ilzetzki at al. (2010)
open economies	ST: negative*, LT: 0	gov.spending (+)	event study	1996-2008	Ilzetzki at al. (2010)
closed economies	ST: 0.1[n], LT: 1.6[n, c]	gov.spending (+)	event study	1996-2009	Ilzetzki at al. (2010)
euro area					
euro area	ST: positive*, LT: negative / ST: negative*, LT: zero	gov.spending (+) / taxes (+)	SVAR	1981-2007	Burriel et al. (2009)
euro area	ST: ~0.8-1.2[n], LT: ~0.0-0.5[n] / ST: ~0-0.5[n], LT: ~ -0.1 - 0.1[n]	gov.spending (+) / taxes (-)	structural models	NA	Coenen et al. (2010)
euro area[2]	ST: positive*, LT: -negative[c]	gov.spending (+)	VAR	1982-2004	Dellas (2010)
Germany	ST: positive*, LT: positive / ST & LT: positive	gov.spending (+) / taxes (+)	SVAR	1974-2004	Heppke-Falk et al. (2006)
West Germany	ST: 0.4*, LT: -0.8*[c] / ST: -0.1, LT: -0.1*[c]	gov.spending (+) / taxes (-)	SVAR	1960-2001	Perotti (2005)
Ireland	ST: positive*, LT: negative*	gov.spending (+)	SVAR	1970-2006	Benetrix and Lane (2009)
Italy	ST: 0.1*, LT: negative* / ST: negative*, LT: negative	gov.spending (+) / taxes (+)	SVAR	1982-2003	Giordano et al. (2006)
Portugal	ST: 0*, LT: negative* / ST: 0*, LT: negative*	gov.spending (+) / taxes (+)	B-SVAR	1979-2007	Afonso and Sousa (2009)
Spain	ST: positive*, LT: negative* / ST: ~0*, LT: negative*	gov.spending (+) / taxes (+)	SVAR	1980-2004	de Castro, Hernandez de Cos (2006)
US					
	ST: 0.9*, LT: 0.8* / ST: -0.7*, LT: -0.7*	gov.spending (+) / taxes (+)	SVAR	1947-1997	Blanchard and Perotti (2002)[3]
	ST: positive*, LT: zero / ST: zero, LT: negative	gov.spending (+) / taxes (+)	SVAR	1981-2007	Burriel et al. (2009)
	ST: positive*; LT: positive* ST: negative; LT: zero	gov.spending (+) / taxes (+)	range of methods	1955-2006	Caldara, Kamps (2008)
	ST: ~1.0-1.5[n], LT: ~0.0-0.6[n] / ST: ~0-0.5[n], LT: ~0[n]	gov.spending (+) / taxes (-)	structural models	NA	Coenen et al. (2010)
	ST: positive*, LT: positive[c]	gov.spending (+)	VAR	1982-2004	Dellas (2010)
	ST: positive, LT: positive*	gov.spending (+)	VAR	1960-1996	Fatas and Mihov (2001)
	ST: ~0.7*, LT: ~1.3*[c]	gov.spending (+)	structural model	1954-1998	Gali et al. (2005)
	ST: positive*, LT: negative[c] / ST: negative*, LT: negative[c]	gov.spending (+) / taxes (+)	VAR	1955-2000	Mountford and Uhlig (2009)
	ST: 0.7*, LT: 1.9*[c] / ST: 0.1, LT: 0.3*[c]	gov.spending (+) / taxes (-)	SVAR	1960-2001	Perotti (2005)
	ST: ~ -0.2*, LT: ~ -3[c]	taxes (+)	event study	1947-2006	Romer and Romer (2007)
	ambigious (depends on monetary policy reaction)	gov.spending (+)	structural model	NA	Woodford (2010)

Notes:

The table includes both the estimates of fiscal multipliers, explicitly provided in the related studies, as well as their approximated (~) values in case they were presented in graphs only; in case the definition of a multiplier does not correspond to the one used in our paper, qualitative indicator is provided. ST: short-term (on impact), LT: long-term (more than 3 years, if applicable). * the value 0 is outside the region between the one-standard error bands; "n": the statistical significance of values is not presented in the respective analysis; no "*" or "n": the value 0 is inside the one-standard error bands . "c" cumulative multipliers, which are not directly comparable to the results presented in our paper.

[1] Instruments applied as shocks. (+) and (-) signs represent the direction of the shock to respective instruments.

[2] Averages of the results for 8 euro area countries presented in the analysis.

[3] Average response of models with stochastic and deterministic trend.

3. Fiscal policy in Slovenia in the period 1995-2010

The fiscal situation in Slovenia is characterised by deficits throughout the period 1995-2010. Even in good times no surplus was achieved, and the smallest deficit was achieved in 2007 (0.1% of GDP). Structural deficits[4] have been present throughout the period, as can be seen from Figure 1. However, government indebtedness has been relatively low with a government debt ratio below 20% of GDP in 1995, increasing to 38% of GDP by 2010, still well below the 60% reference value, which is specified in the Maastricht criterion for participation in the Economic and Monetary Union.

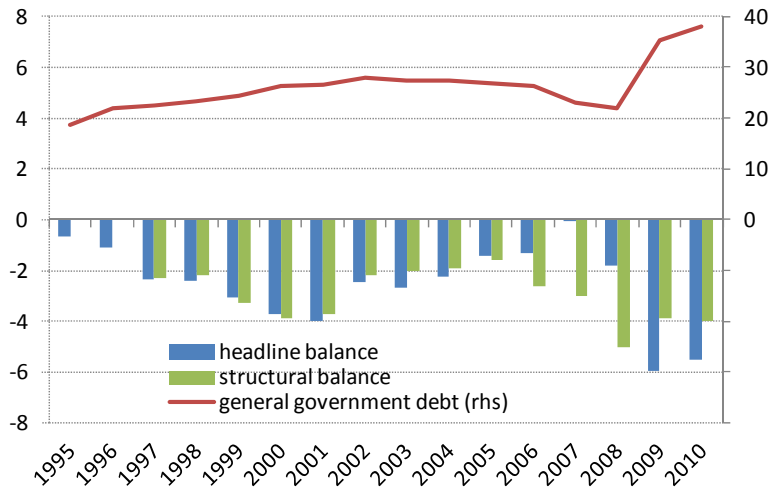
After gaining independence in 1991 the goal of fiscal policy in Slovenia was to prevent further economic destabilisation. Debt was kept at low levels. Headline deficit was increasing at the end of the 90s and exceeded 3 % in 2000 and 2001. Prior to the EU accession and euro adoption the main aim of the fiscal policy has been to reduce the deficit and to secure the fulfilment of the Maastricht fiscal criteria in order to support the adoption of the euro as soon as possible.

The main consolidation occurred in the period from 2002 to 2005, i.e. prior to the EU accession and euro adoption. The main consolidation measures included an increase in the VAT rates in 2002 (additional revenue of around 0.4 % of GDP) and an expenditure restraint. The structural deficit increased substantially in the period 2006-2008, mainly as a consequence of the tax reform, e.g. a gradual reduction of the payroll and corporate income tax rates. Lowering of the payroll tax has reduced the revenue by around 0.6 % of GDP in both 2008 and 2009. However, in 2009 it was more than compensated by an increase in excise duties (0.9 % of GDP)[5]. During the recent economic and financial crisis the headline deficit increased substantially due to the working of automatic stabilisers. Fiscal consolidation is needed now and an excessive deficit should be corrected by 2013 at the latest as required under the EU excessive deficit procedure.

[4] The structural balance is an indicator of the underlying position of the budget balance. It is calculated by substracting the cyclical component, which denotes the part of the fiscal position that is explained by the current cyclical position, from the actual budget balance. The European Commission excludes from the actual budget balance also one-off and other temporary measures.

[5] Additional information on the main budgetary measures can be found in Convergence and Stability Programmes (http://www.mf.gov.si/en/areas_of_work/public_finances/stability_and_convergence_programmes/) and/or in the European Commission assessments of the Stability Programmes (http://ec.europa.eu/economy_finance/economic_governance/sgp/convergence/index_en.htm).

Figure 1: Main fiscal ratios, Slovenia 1995-2010, in % of GDP



Source: Statistical Office of the Republic of Slovenia, European Commission.

4. Structural VAR model

Our identification of fiscal policy shocks is based on the methodology originally proposed by Blanchard and Perotti (2002), a seminal paper on fiscal policy SVAR analysis. Previously this approach was used to study the effects of monetary policy. However, authors argue that it is even better suited for fiscal policy. Reasons for that are the following. First, in contrast to monetary policy, fiscal variables move for many reasons and output stabilization is rarely the main one. In other words, with respect to output, fiscal shocks are exogenous. Second, contrary to monetary policy, it takes policymakers more than a quarter to learn about a GDP shock and to react to it. This virtually eliminates the possibility of discretionary adjustment of fiscal policy in response to unexpected movements in GDP. Therefore, to obtain identification one can rely on the knowledge about the tax and transfer systems, to construct the automatic response of fiscal policy to unexpected movements in activity, which implies that one can identify estimates of fiscal policy shocks. With the identification of these shocks, one can check their effect on GDP and its components (Blanchard, Perotti, 1999).

4.1 Specification

The reduced form VAR model is:

$$Y_t = C(L)Y_{t-1} + U_t \tag{1}$$

where $Y_t = [T_t \;\; g_t \;\; y_t]'$ with real net taxes, T_t, real government spending, g_t, and real GDP, y_t. All variables are log-transformed. $C(L)$ is an autoregressive lag polynomial and U_t is the vector of reduced form errors. We use quarterly data, because this is essential for

identification of the fiscal shocks. Our benchmark specification also includes a constant, a linear time trend and a dummy[6] variable for the crisis, which we omit from the notation for convenience. The number of lags for the VAR is chosen to be four as suggested by the Akaike information criterion (AIC).[7] The residuals of the 4-lag VAR model appear to be serially uncorrelated, further supporting this lag length choice.

4.2 Identification

We follow the identification strategy proposed by Blanchard and Perotti (2002), where the reduced from residuals U_t are written as linear combinations of the underlying "structural" shocks V_t:

$$AU_t = BV_t \tag{2}$$

where the structural innovations V_t are assumed to be orthonormal, i.e. the covariance matrix is assumed to be an identity matrix $E(V_t V_t') = I$. The matrices A and B describe the instantaneous relations between the reduced form errors and the structural shocks.

From the reduced form representation and from the relationship between the reduced form residuals and the structural shocks, we can obtain the structural form of the VAR by pre-multiplying (1) by the matrix A:

$$AY_t = AC(L)Y_{t-1} + AU_t = AC(L)Y_{t-1} + BV_t \tag{3}$$

A and B matrices are not identified without constraints and therefore we follow the four step approach of Giordano et al. (2005) to identify the fiscal shocks.

In the first step the reduced form VAR is estimated, from where we obtain the reduced form residuals[8] $U_t = \left[u_t^T \;\; u_t^g \;\; u_t^y\right]'$. We can express the reduced form residuals of net taxes, u_t^T, and government spending, u_t^g, as linear combinations of the underlying structural fiscal shocks v_t^T, v_t^g and of the reduced form residuals of GDP, u_t^y:

$$u_t^T = \alpha_y^T u_t^y + \beta_g^T v_t^g + v_t^T \tag{4}$$

$$u_t^g = \alpha_y^g u_t^y + \beta_T^g v_t^T + v_t^g \tag{5}$$

[6] The dummy takes a value of 1 from/including the fourth quarter of 2008 and 0 before that.

[7] Also other information criteria confirm at most four lags, for example, Final prediction error, Hannan-Quinn information criterion, Schwarz information criterion etc.

[8] Once the model is estimated, we obtain estimates of reduced form errors, which are the residuals of the estimation and could also be referred to as $\widehat{U}_t$. However, for notational convenience we use the same notation, U_t, for reduced form errors and reduced form residuals throughout the paper.

where the coefficients α_y^T and α_y^g capture both the automatic response of economic activity to net taxes and government spending under existing policy rules and any discretionary adjustment of fiscal policy in response to unexpected movements in output. The coefficients β_g^T and β_T^g measure how the structural shock to government spending or net taxes affects net taxes or spending on impact (but not over other horizons), respectively.

The main interest of this paper is the identification of structural shocks v_t^T and v_t^g, and the study of the response of real GDP to these shocks. To identify these two structural shocks we need to impose further restrictions on the system above. Here we use the observation made by Blanchard and Perotti (2002) that it takes policymakers and legislatures more than a quarter to react to a GDP shock. This virtually eliminates the possibility of discretionary adjustment of fiscal policy in response to unexpected movements in GDP. As a consequence, with the use of quarterly data, the coefficients α_y^T and α_y^g capture only the automatic elasticity of the government spending and net taxes to real GDP.

Due to the correlation of reduced form residuals, u_t^j, with structural shocks, v_t^i, it is not possible to estimate the α_i^j's by OLS. Thus, we use exogenous elasticities α_j^i in order to identify the shocks. Derivation of both elasticities is described in the next section. The use of exogenous contemporaneous elasticities allows us to compute cyclically adjusted reduced-form residuals for net taxes, $u_t^{T,CA}$, and for government spending, $u_t^{g,CA}$. This represents the second step of our identification procedure:

$$u_t^{T,CA} = u_t^T - \alpha_y^T u_t^y = \beta_g^T v_t^g + v_t^T \quad (6)$$

$$u_t^{g,CA} = u_t^g - \alpha_y^g u_t^y = \beta_T^g v_t^T + v_t^g \quad (7)$$

To be able to identify the system we need to make a decision about the ordering of the fiscal variables, which represents our third step. If we want to impose the restriction that tax decisions come first, we need to set β_g^T=0, whereas if we want spending decisions to come first we set β_T^g=0. In our benchmark case, we assume that tax decisions come first. The reverse ordering, which may in certain periods even better represent the actual fiscal policy decisions[9], makes little difference to the impulse response of output. Since tax decisions come first under our assumption, cyclically adjusted residuals of taxes equal the tax shock. Spending decisions in that case come second and can therefore be adjusted for the decision on taxes. This allows us to estimate β_T^g by an OLS regression of cyclically adjusted residuals of spending on the estimate of the tax shock:

[9] While it is easier for the government to adjust expenditure during the economic cycle than the revenue, there have been both examples in Slovenia in the recent years. On the one hand, the government has cut discretionary expenditure items like investment to compensate for lower revenue due to unfavourable macroeconomic developments. On the other hand, it has also substantially increased excise taxes, in particular on mineral oil. This implies that a mixed evidence exists on the reaction of government to economic cycle.

$$u_t^{T,CA} = v_t^T \quad (8)$$

$$u_t^{g,CA} = \beta_T^g v_t^T + v_t^g \quad (9)$$

Finally, we can estimate the remaining coefficients in the equation for the reduced form residual of real GDP. To do that we need to use instrumental variables to take into account the correlation between the regressors and the error term. Following Blanchard and Perotti (2002), we use cyclically adjusted reduced-form residuals as instruments for the fiscal variables. Those may still be correlated with each other, but are no longer correlated with v_t^y:

$$u_t^y = \alpha_T^y u_t^T + \alpha_g^y u_t^g + v_t^y \quad (10)$$

With the above mentioned four steps, we obtain all the coefficients, needed to construct the estimates of A and B matrices, which we use to compute the impulse responses to fiscal shocks[10]:

$$\begin{bmatrix} 1 & 0 & -\alpha_y^T \\ 0 & 1 & -\alpha_y^g \\ -\alpha_T^y & -\alpha_g^y & 1 \end{bmatrix} \begin{bmatrix} u_t^T \\ u_t^g \\ u_t^y \end{bmatrix} = \begin{bmatrix} \sigma^T & 0 & 0 \\ \beta_T^g & \sigma^g & 0 \\ 0 & 0 & \sigma^y \end{bmatrix} \begin{bmatrix} v_t^T \\ v_t^g \\ v_t^y \end{bmatrix}$$

The elements on the main diagonal of the B matrix are the standard deviations of the structural shocks.

After the VAR is estimated and identified we can compute impulse responses to evaluate the dynamic effects of structural shocks to taxes and spending. Solving equation (3) for Y_t gives the structural moving average representation, whose coefficients represent the structural impulse response functions:

$$Y_t = [I - C(L)]^{-1} A^{-1} B V_t \quad (11)$$

5. Data

5.1 Data sources and description

We use quarterly data based on the ESA95 methodology from 1995:1 to 2010:4. It is crucial for our approach to use quarterly data for two reasons. The first one is the fact that the available dataset is short and the second one is our assumption, required by the chosen approach, that discretionary fiscal policy actions are not taken within one time period. In

[10] To be theoretically precise, we can say that it is estimated reduced form errors, or in other words, reduced form residuals that are related via an AB-model to the structural shocks, of which estimates are obtained based on estimated U_t and estimates (partly with exogenously fixed parameters) of the matrices A and B.

Slovenia, quarterly national accounts data on general government are available only for the period from 1999 onwards, while annual data exists from 1995. For the period 1995-1999 we have therefore constructed quarterly profiles of the relevant series, based on the cash data.[11] The final sample is still relatively short compared to datasets used in other studies.[12] Using cash data would enlarge somewhat the sample (from 1992 on), but we decided to use ESA95 data due to their more frequent use.

The basic VAR includes three variables: net taxes, government spending and GDP. We define revenue and expenditure variables in line with Blanchard and Perotti (2002). The revenue variable is defined as total revenue (including tax and non-tax revenue) minus transfers[13] and interest payments (also referred to as taxes or net taxes in the rest of the paper). The expenditure variable is called government spending (also referred to as spending in the rest of the paper) and consists of government consumption (mainly compensation of employees and intermediate consumption) and government investment. The difference between the two variables is the primary deficit.

All the variables are seasonally adjusted using TRAMO-SEATS[14]. They are expressed in real terms, which we obtained by using the GDP deflator[15] and they are used in logarithms. All three variables are presented in Figure 2.

All variables used in our basic VAR model show an upward trend, with GDP and taxes declining during the crisis. This was the period in which (primary) deficit (the difference between taxes and spending) increased the most.

[11] There is no unique best way to perform the interpolation. We have made the interpolation on the basis of quarterly growth rates from the cash data in a way that ensures that quarterly values sum up to the published annual figures. Additionally we have taken out from the 1995 figure two specific transactions, which were booked as capital transfers (restitution in cash of private property nationalised after the Second World War and due to financial improvement of banks), which contributed to the deficit in that year in the amount of around 7.7% of GDP.

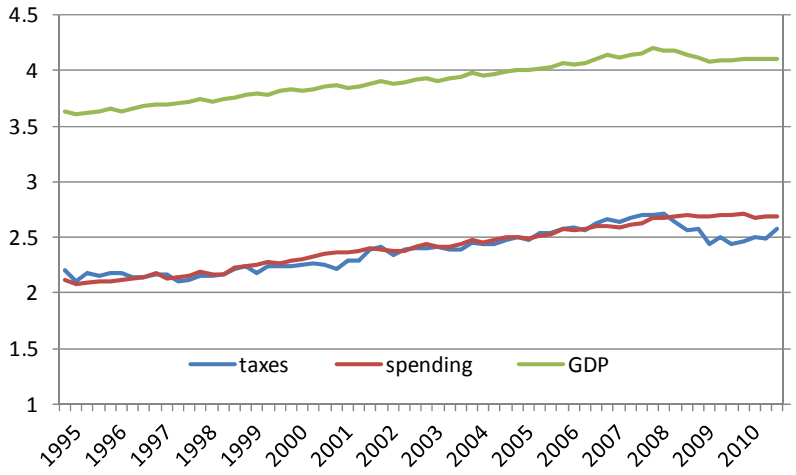
[12] In the paper of Blanchard and Perotti (2002) the dataset covers around 50 years (1947-1997 period). Some other studies use the sample which covers around 25 years (for example Burriel et al. (2009), de Castro Fernandez and Hernandez de Cos (2006)) or 30 years (Heppke-Falk et al. (2006)).

[13] Transfers include all expenditure items except public consumption, public investment and interest payments.

[14] It should be pointed out that data transformations described above, e.g. the interpolation of the data until 1995 and the seasonal adjustment may present some problems. While interpolation of data until 1995 was positive in a sense that the time series has been extended, both procedures do break the quarterly frequency structure of the data, which is important for identification. Regarding seasonal adjustment issue we do robustness test, where we check for seasonal adjustment with quarterly dummies and our results remain very similar (see section 7.2).

[15] The index is set at 100 in 2000.

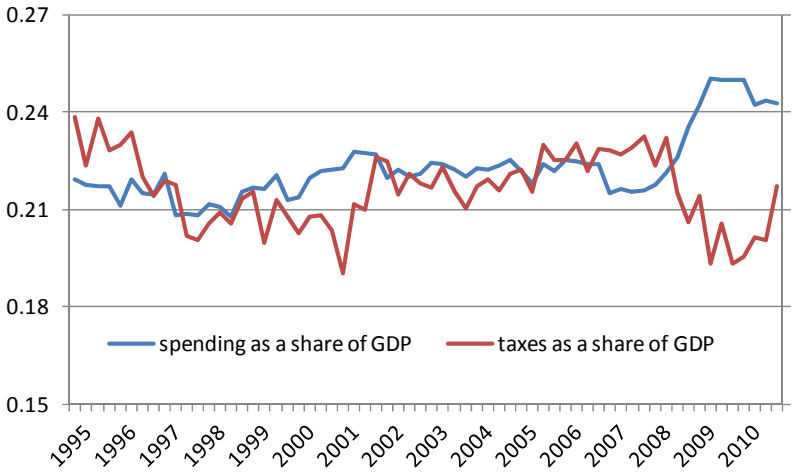
Figure 2: Log-transformed taxes, spending and GDP



Source: Statistical Office of the Republic of Slovenia and authors' calculations.

The series expressed as a share of GDP are plotted in Figure 3. The tax to GDP ratio exhibits a downward trend up to 2001, and is later on an upward trend until the middle of 2008. The spending to GDP ratio has been relatively stable in the period up to mid 2008, fluctuating at around or below 22% of GDP, with the exception of 1997 and 1998. At the end of 2008 the economic and financial crisis resulted in a reduction of the tax to GDP ratio and in an increase in the spending to GDP ratio.

Figure 3: Taxes and spending as shares of GDP



Source: Statistical Office of the Republic of Slovenia and authors' calculations.

5.2 Exogenous elasticities

For the identification of structural shocks exogenous elasticities are required. The elasticity α_y^T represents the elasticity of net taxes to output. For the calculation of the output elasticity we follow the OECD methodology as proposed in Giorno et al. (1995). On the revenue side the calculation takes into account four different tax categories, i.e. the personal income tax, the corporate income tax, indirect taxes and social security contributions, while on the expenditure side the elasticity of transfers is considered separately. The output elasticity is a weighted average of the elasticities of different net tax components, including transfers. It is computed on the basis of information on institutional arrangements, like tax rates. The contemporaneous output elasticity of net taxes has been calculated as:

$$\alpha_y^T = \sum_i \varepsilon_{\tilde{T}_i,B_i} \varepsilon_{B_i,y} \frac{\tilde{T}_i}{\tilde{T}} \tag{12}$$

where $\varepsilon_{\tilde{T}_i,B_i}$ is the elasticity of the ith category of net taxes to its own tax base and $\varepsilon_{B_i,y}$ is the GDP elasticity of the tax base of the ith category of net taxes. The $\tilde{T}_i$'s are positive in the case of taxes and negative in the case of transfers.

Table 4: Comparison of output elasticities of net taxes in Slovenia with EMU and Spain

	Slovenia	EMU	Spain
$\varepsilon_{tdirh,y}$	0.09	0.90	0.17
$\varepsilon_{ss,y}$	0.09	0.64	0.17
$\varepsilon_{tdirc,y}$	1.53	1.08	1.04
$\varepsilon_{tind,y}$	0.72	0.97	0.30
$\varepsilon_{transf,y}$	-0.2	-0.2	-0.2
$\boldsymbol{\alpha_y^T}$	**0.87**	**1.54**	**0.62**

Sources: Slovenia: Authors' calculations, EMU: Burriel et al. (2009), Spain: de Castro Fernandez and Hernandez de Cos (2006).

According to our estimation, the output elasticity of net taxes stands at 0.87 in Slovenia (see also appendix)[16]. This is similar to the elasticity estimated for Germany at 0.95 (Heppke-Falk et al., 2006). However, different SVAR studies in different countries give very different estimates of the output elasticity of net taxes, as can also be seen from Table 4. For example, the output elasticity of net taxes (α_y^T) is estimated to be 0.62 for Spain, while it is estimated as

[16] Elasticities vary over time due to changes in tax legislation and due to changes in the composition of net taxes. For that reason, constant elasticities reflect at best, the "average" response of net taxes over a sample period. The response of tax bases to changes in activity may depend on the nature of economic shock(s) that produced the boom or the recession (Van den Noord, 2000).

1.54 in the case of EMU. We use those two values for the robustness check also because their authors apply the same estimation procedure as we do.

Regarding government spending we assume, following Heppke-Falk et al. (2006), that it does not respond to real GDP within a quarter, as expenditure is planned on an annual basis within the budgetary process and is therefore rather inflexible in the short-run. Also Blanchard and Perotti (2002) state that they could not identify any automatic feedback from economic activity to government purchases of goods and services. In other words, we set elasticity of government spending to output, α_y^g, to 0.

6. Fiscal policy effects on macroeconomic variables

We present the impulse responses for 12 quarters (i.e. 3 years) ahead. When displaying the impulse response functions we show the point estimate and the 95% bootstrapped confidence intervals based on 5000 replications. Similarly to Blanchard and Perotti (2002), we report the responses of output, consumption and investment in % of GDP that have the interpretation of multipliers. In other words, we report responses measured in % of GDP of responding variable due to a fiscal shock of size 1% of GDP.[17]

6.1 Benchmark results

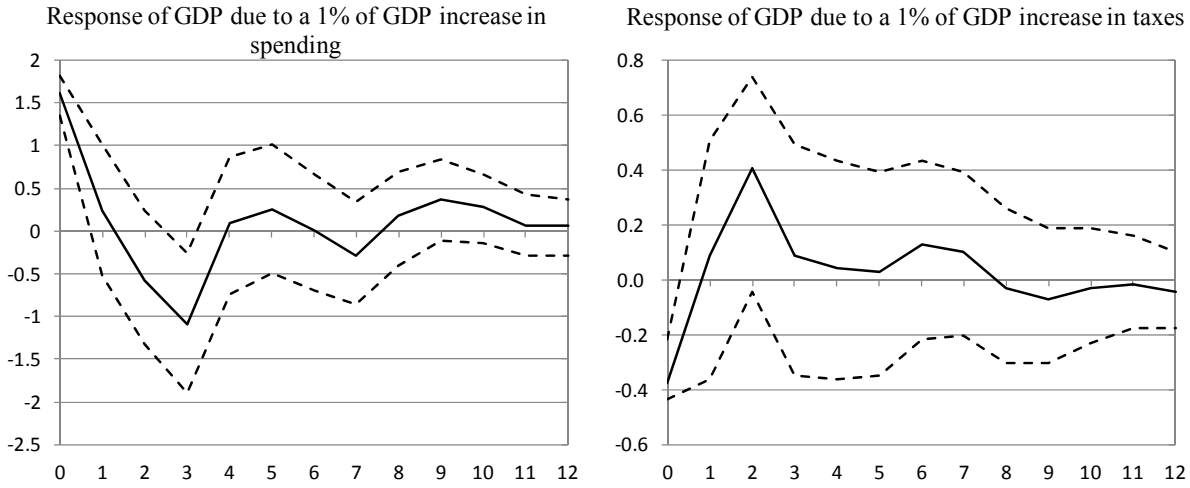
In Figure 4, we show the responses of GDP to a 1% of GDP increase in spending and taxes. We can see that higher government expenditure tends to raise real GDP on impact (when a shock occurs), namely a 1% of GDP increase in government expenditure appears to raise real GDP by 1.61%, which is also the highest point it reaches. The impact multiplier seems to be therefore higher than 1. The reaction of GDP remains positive also in the first period after the shock, but becomes insignificant. The insignificance can be gauged from the widening of the confidence intervals.

Regarding the taxes we can see that a 1% of GDP increase in taxes appears to decrease real GDP at a time of a shock by 0.38%, which is also the lowest point it reaches. The impact multiplier tends to be this time smaller than 1 and is also smaller than the spending multiplier,

[17] We calculate this by first dividing the original impulse response of the responding variables by the impact response of fiscal variables. This result is then divided by the ratio of respective fiscal variable and the responding variable. The ratio is evaluated at the sample mean. We borrow an example from Kirchner et al. (2010) to clarify the concept: suppose we have a shock in spending in the size of 1%, since a share of spending in GDP is about 25%, this size of the shock corresponds to 0.25% of GDP. After this shock output increases by 0.5%. In this case we would calculate the corresponding multiplier (increase in % of GDP due to a 1% of GDP increase in spending) as response of output divided by ratio of spending over GDP (0.5/0.25=2). After this same shock consumption increases by 0.25% or expressed as % of GDP, by 0.125%, since the share of consumption in GDP is approximately 50%. We calculate the consumption multiplier as a response of consumption expressed as % of GDP (0.25*0.5=0.125) divided by the spending shock in the size of 1% of GDP (0.25). The consumption multiplier is therefore 0.5 (0.125/0.25=0.5).

which is in line with the majority of the literature from that field. The GDP reaction appears to turn positive and insignificant already in the first quarter. It stays insignificant throughout the presented period.

Figure 4: Response of GDP due to a 1% of GDP increase in fiscal variables



Our finding that positive government spending shock seems to have a significantly positive effect on output, at least in the short-term, is in line with the majority of the literature. When we compare Slovenia to other small open European economies[18], we can see that in Ireland positive spending shock also significantly increases output on impact, but affects it is a significantly negative way in the long-run (Benetrix, Lane, 2009). Similar to Ireland, long-run effect is also significantly negative in Portugal, while they find no response of GDP on impact (Afonso, Sousa, 2009). For bigger European countries, where the same methodology is used as in our case, we can see that spending shock affects output in a positive way on impact. Their impact multiplier is however smaller than in Slovenia, it is 0.6 for Germany (Hepke-Falk et al., 2006) and 0.1 for Italy (Giordano et al., 2006). [19] In the long-run the effect is positive and insignificant for Germany (Hepke-Falk et al., 2006), which is the same as in our case. On the other hand, it is negative and significant for Italy (Giordano et al., 2006) and Spain (De Castro, Hernandez de Cos, 2006). [20]

When we compare results for Slovenia regarding taxes to findings for Portugal- another small open European economy, we can see that in our case positive tax shock tends to have a negative effect on GDP, the effect is significant on impact and insignificant in the long run. While it is 0 on impact and significantly negative in the long-run for Portugal (Afonso, Sousa, 2009). When we can compare it to other European countries, we can see that Spanish results (De Castro, Hernandez de Cos, 2006) are very similar to those of Portugal. In Italy (Giordano

[18] Afonso and Sousa (2009) for Portugal and Benetrix and Lane (2009) for Ireland have used different methodology and do not report the size of the multiplier, so we comment only on the direction of the response.
[19] For Spain they do not report on comparable multipliers (De Castro, Hernandez de Cos, 2006).
[20] For comparisons with other countries see Table 1.

et al., 2006) the effect is negative, though insignificant. Contrary to that, the response of GDP to a tax shock in Germany is positive and insignificant. [21]

6.2 Effects on private consumption and investment

To get a more detailed picture, we also check how different GDP components react to a shock in spending and taxes. More specifically, we check the effect of fiscal shocks on private consumption and investment. With this exercise we can check how are alternative theories supported by the Slovenian data. For example, both neoclassical theory and Keynesian models predict a positive effect of government spending changes on GDP. Their views are, however, opposing when it comes to a reaction of private consumption to a spending shock. Keynesian models imply that consumption increases after a spending shock, while the neoclassical theory predicts that private consumption may fall via the crowding out effect. We use the approach of Blanchard and Perotti (2002) to estimate the effects of fiscal shocks on private consumption and investment. We estimate a 4-variable VAR by adding one more equation for the component of GDP to our basic model, resulting in an additional equation for the residual:

$$u_t^{y_i} = \alpha_T^{y_i} u_t^T + \alpha_g^{y_i} u_t^g + v_t^{y_i} \quad (13)$$

$u_t^{y_i}$ stands for the reduced form residual of the GDP component, either private consumption or investment in our case. $v_t^{y_i}$ and v_t^y form equation (13) will in general be correlated.

Figures 5 and 6 show the responses of consumption and investment in % of GDP due to a 1% of GDP increase in spending and taxes. The impulse response of real GDP changes slightly with private consumption or investment added to the system, however the results in terms of statistical significance do not change, so we do not report them in this section.

The reaction of both private consumption and investment to a government spending shock appears to be positive and significant on impact. More specifically, a 1% of GDP increase in spending seems to raise private consumption by 1.1% of GDP and investment by 1.6% of GDP. The impact multiplier tends to be, therefore, in both cases higher than 1. The reactions of both GDP components appears to turn insignificant after that.

The positive private consumption response after a positive spending shock is in line with the above mentioned Keynesian theory. When we compare our results to findings of another small open European economy, such as Portugal (Afonso, Sousa, 2009), we can see that their results are different from ours, since their response of private consumption to a positive spending shock is zero on impact and significantly negative in the long-run. Our results are, however, comparable to the ones of other European countries, that use the same methodology

[21] Comparable multipliers are not reported for these countries. For comparisons with other countries see Table 1.

as we do. Namely, in Germany (Hepke-Falk et al., 2006), Spain (De Castro, Hernandez de Cos, 2006) and Italy (Giordano et al., 2006) private consumption reacts positively to a positive shock in government spending on impact. However, except for Spain, the effect is not statistically significant. [22]

Our results of positive investment reaction after a government spending shock are again contrasted to the ones of Portugal (Afonso, Sousa, 2009), since in their case the response of investment is again zero on impact and significantly negative in the long-run. That is similar to results for Spain (De Castro, Hernandez de Cos, 2006) and Germany (Hepke-Falk et al., 2006). Findings for the latter are, however, not statistically significant. On the other hand, our findings are in line with those for Italy (Giordano et al., 2006), where again are generally not significant. [23]

The reaction of both private consumption and investment to a tax shock seems to be negative and significant on impact. A 1% of GDP increase in taxes tends to decrease private consumption by 0.05% of GDP and investment by 0.35% of GDP on impact. The impact multipliers appear to be in both cases smaller than 1. After that the reactions of both GDP components seems to turn insignificant.

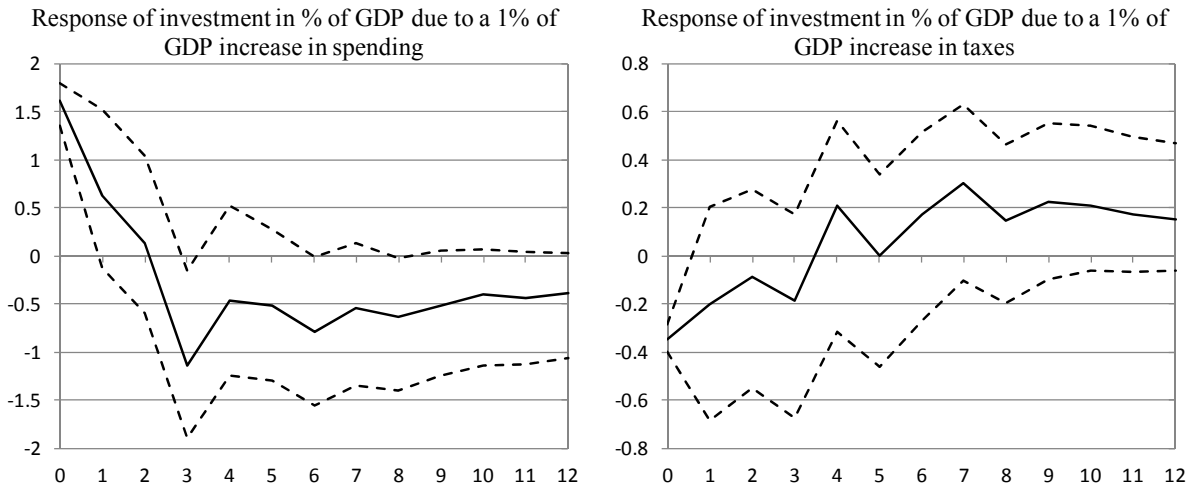
Our negative consumption response to a tax shock, is different than the Portuguese one (Afonso, Sousa, 2009), where private consumption does not react on impact, but reacts in a negative and insignificant way in the long-run. German response (Hepke-Falk et al., 2006) is similar to ours, negative on impact. It is, however, insignificant. Italian response (Giordano et al., 2006) is also insignificant. Spanish response (De Castro, Hernandez de Cos, 2006), on the other hand, is significantly positive on impact and significantly negative in the long-run. [24]

Our negative investment response is in line with the Keynesian theory, which predicts that the response of investment to a tax shock should have the opposite sign than the response to a spending shock. Compared to Portugal (Afonso, Sousa, 2009), our findings are different, since in their case investment does not react to a tax shock on impact, but react in a significantly negative way in the long-run. In our case, the response is positive and statistically insignificant in the long-run. Spanish findings (De Castro, Hernandez de Cos, 2006) are similar to Portuguese. While in Germany (Hepke-Falk et al., 2006) and Italy (Giordano et al., 2006) the response of investment to a tax shock is statistically insignificant. [25]

[22] Comparable multipliers are not reported for these countries.
[23] Comparable multipliers are not reported for these countries.
[24] Comparable multipliers are not reported for these countries.
[25] Comparable multipliers are not reported for these countries.

Figure 5: Response of private consumption in % of GDP due to a 1% of GDP increase in fiscal variables

Figure 6: Response of investment in % of GDP due to a 1% of GDP increase in fiscal variables



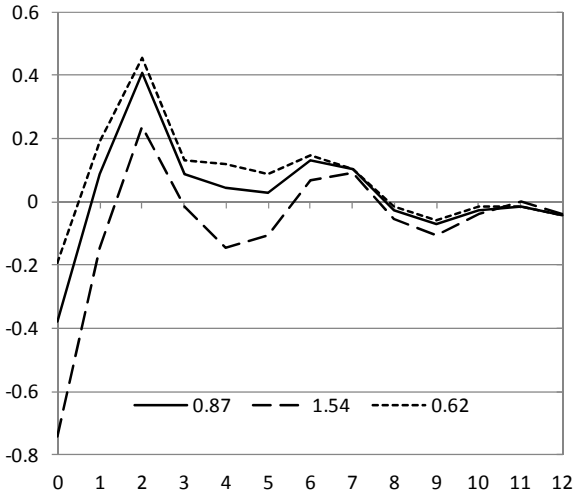
7. Robustness checks

7.1 Alternative net tax elasticities

The exogenously determined elasticities are crucial to our identification procedure. As a robustness check we thus test how sensitive are our results to alternative values of the elasticity of net taxes with respect to GDP, α_y^T, which is the central elasticity in our case.

To calculate it, we follow the OECD methodology as proposed in Giorno et al. (1995). De Castro Fernandez and Hernandez de Cos (2006) also follow this approach to calculate elasticity for Spain and Burriel et al. (2009) for EMU. Therefore, we take their elasticities to implement the robustness test. In Figure 7 we show the effects of a 1% of GDP increase in taxes on GDP for three different values of α_y^T: the Spanish value of 0.62, our baseline value of 0.87 and the value for the EMU of 1.54. We believe that this range covers the relevant range of values for α_y^T. The results do not change much with different values of elasticities, so the response of GDP is robust in this sense. It should be noted however, that the higher the value of α_y^T, the more negatively GDP reacts to a rise in taxes. Other variables are unaffected by this change.

Figure 7: Response of GDP to a 1% of GDP increase in taxes under alternative tax elasticities



7.2 Additional robustness checks

We perform some additional robustness checks with our baseline model. We have tested how the use of different deflators affects the results. First we tried the CPI instead of the GDP deflator and we obtained very similar results. We also deflated government spending with the government consumption deflator and our results did not change significantly. Furthermore we have tried seasonal adjustment with quarterly dummies and our results remain very similar. Finally, we estimated our basic VAR only for the pre-crisis period and we again obtained very similar results as for the whole period.

8. Conclusions

In this paper, the effects of fiscal policy shocks on the Slovenian economy are quantified, using the Blanchard and Perotti (2002) SVAR approach.

The main finding of the paper is that in Slovenia one-time fiscal spending shocks tend to increase output, private consumption and investment on impact, but the effect seems to become statistically insignificant in the period following the shock. Tax shocks on the other hand appear to decrease output, private consumption and investment on impact, but the effect also tends to vanish subsequently. In contrast to short-term effects, the obtained results indicate that one-off changes in government spending and taxes do not have significant long-lasting effects on macroeconomic variables in Slovenia. In general, investment tends to react stronger than private consumption to either fiscal spending or tax shocks. However, as in the case of aggregate output, the effect appears nonsignificant after the initial period. Our findings regarding the direction of response are in line with the bulk of other research on this issue. The results have been confirmed by various robustness checks, including applying a range of deflators, seasonal adjustment techniques, periods of estimation and also a range of different values for the exogenous elasticities, crucial to identify the shocks.

These findings suggest two major conclusions. First, short-term effects on economic activity may enable the fiscal policy to act counter-cyclically if appropriately geared to affect economic activity. This would require forming sufficient buffers in the fiscal balance in favourable times, to enable additional spending in the downswings of the economic cycle. Second, restrictive fiscal policy measures would most likely negatively impact the economic activity in the short-run, but there can not be much said about the longer-term perspective. These results may not have direct implications for the economic policy, since they are surrounded by a certain degree of uncertainty due to the small sample which is furthermore contaminated by the crisis and must therefore be interpreted with caution. In addition, the applied SVAR model is in principle capable of simulating the effects of temporary shocks, whereas fiscal consolidation requires the use of permanent fiscal measures. Moreover, the SVAR model used in the paper is a very simple one, where the modelling exercise does not incorporate agents' expectations, which might strongly affect the results. Such issues could, in principle, be better addressed with a structural model, which is beyond the scope of this paper.

Adding some additional variables to the SVAR, such as estimating shocks by disaggregating the government spending and fiscal revenues and re-estimating the model may enrich our current knowledge of the fiscal policy effects in Slovenia. These are some of the possible extensions of the exercise, left for further research.

Appendix: Calculation of output elasticity of net taxes

In the OECD approach (Giorno et al., 1995), the elasticity of various taxes with respect to their base is calculated on the basis of tax legislation and related fiscal data, while the sensitivity of the different tax bases with respect to output is estimated econometrically using time-series data. Regarding the elasticity of various tax proceeds with respect to their base in Slovenia, we take into account mainly the tax legislation. For proportional taxes, it has a value of unity. However, it can exceed unity (progressivity) or fall below it (regressivity) in the case of several tax rates. The sensitivity of different tax bases with respect to output is estimated econometrically.

Personal income tax in the period under consideration accounts for 5.7% of GDP. The personal income tax is progressive in Slovenia, as in most other countries, as the tax rate rises with taxable income. Its elasticity with respect to the tax base is set at 1.5.[26] The output elasticity of personal income tax ($\varepsilon_{tdirh,y}$) is computed as follows (see also Burriel et al., 2009):

$$\varepsilon_{tdirh,y} = (\varepsilon_{tdirh,w}\varepsilon_{w,emp} + 1)\varepsilon_{emp,y} \quad \text{(A1)}$$

where $\varepsilon_{tdirh,w}$ represents the elasticity of personal income tax to earnings, $\varepsilon_{w,emp}$ the employment elasticity of the real wage and $\varepsilon_{emp,y}$ the output elasticity of employment.

Social security contributions represent an important source of revenue, reaching 14.7% of GDP on average from 1995 to 2010. As social security contributions represent a fixed percentage of wage and since there is no upper limit for contributions, their elasticity with respect to the tax base is set to 1. Elasticity with regard to output ($\varepsilon_{ss,y}$) is calculated similarly as for the personal income tax, where $\varepsilon_{ss,w}$ is the elasticity of social security contributions to earnings:

$$\varepsilon_{ss,y} = (\varepsilon_{ss,w}\varepsilon_{w,emp} + 1)\varepsilon_{emp,y} \quad \text{(A2)}$$

Corporate income tax represents in the analysed period on average 1.7% of GDP. However, it varies a lot during the period, ranging from less than one percent at the beginning of the period to the highest value of 3.2% of GDP in 2007. Due to the complexity of the tax system, the elasticity of corporate income tax to its base, i.e. profits and mixed income, it is hard to estimate and therefore often set to 1. This is also the case in our calculations as corporate income tax is levied at a single rate. The output elasticity of corporate income tax revenues is obtained by multiplying the elasticity of tax revenues to gross operating surplus ($\varepsilon_{tdir,gos}$) and

[26] This is the average elasticity of the personal income tax base to wage (compensation per employee) estimated for EU countries in Bouthevillain et al. (2001). The estimated elasticities of personal income tax to wage vary from 1.2 for France, Denmark and the UK to 2.6 for Netherlands. Changing this parameter does not influence the final estimate of output elasticity of net taxes substantially.

the output elasticity of the gross operating surplus ($\varepsilon_{gos,y}$). It is calculated in the following way:

$$\varepsilon_{tdirc,y} = \varepsilon_{tdir,gos}\varepsilon_{gos,y} \quad \text{(A3)}$$

Indirect taxes represent another important revenue source, similar in value to social security contributions, i.e. on average 15.3% of GDP in the period from 1995 to 2010. Their elasticity to tax base, i.e. consumption ($\varepsilon_{tind,c}$), is set to 1. Although there are reasons for which this elasticity could be different, this seems the most reasonable number.[27] The output elasticity of indirect taxes ($\varepsilon_{tind,y}$) is calculated by taking into account the private consumption elasticity of indirect taxes ($\varepsilon_{tind,c}$) and the output elasticity of private consumption ($\varepsilon_{c,y}$):

$$\varepsilon_{tind,y} = \varepsilon_{tind,c}\varepsilon_{c,y} \quad \text{(A4)}$$

The output elasticity of *net transfers* is set to -0.2, similar to other studies and following Perotti (2002). The unemployment benefits respond to the underlying economic conditions. In Slovenia these have been low, so the estimate might be on the upper side.

Table A1: Output elasticities of net taxes

			Output elasticities
$\varepsilon_{tdirh,w}$=1.5	$\varepsilon_{w,emp}$=0.0	$\varepsilon_{emp,y}$=0.09	$\varepsilon_{tdirh,y}$=0.09
$\varepsilon_{ss,w}$=1.0			$\varepsilon_{ss,y}$=0.09
$\varepsilon_{tdirc,gos}$=1.0		$\varepsilon_{gos,y}$=0.72	$\varepsilon_{tdirc,y}$=1.53
$\varepsilon_{tind,c}$=1.0		$\varepsilon_{c,y}$=1.53	$\varepsilon_{tind,y}$=0.72
			$\varepsilon_{transf,y}$=-0.20
			$\varepsilon_{t,y}$= 0.87

Source: Authors' calculations.

The output elasticities of the relevant tax bases were estimated using the following equation (see also Burriel et al.):

$$\Delta Ln(B_t^i) = \gamma + \varepsilon_i \Delta Ln(Y_t) + \eta_t \quad \text{(A5)}$$

where $B^i$is the relevant tax base for the ith tax category and ε_i is the output elasticity of this tax base. Due to the likely contemporaneous correlation between the independent variable and the error term, the equations have been estimated using instrumental variables estimation techniques.

[27] It could be larger due to the fact that in the economic upswing the consumption of products which are taxed at higher rates increased more, and vice versa in a downturn. But on the other hand indirect taxes include also taxation of products, where the amount of tax is determined by real consumption (like excise duties), which represent the regressive element in taxation.

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