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Effects of Fiscal Policy in a Small Open Economy: Evidence of Croatia

Effects of Fiscal Policy in a Small Open Transition Economy: Case of Croatia

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Abstract

In this paper we use structural VAR model to analyze dynamic effects of fiscal shocks on economic activity in Croatia from 2000Q1-2012Q2. Due to the fact that Croatia is a small open economy we assume that shocks of foreign origination can have notable effects on its performance. Therefore, original Blanchard-Perotti (2002) model is extended by introducing variables that represent external (foreign) demand shocks. The results show that the government spending has a positive and statistically significant effect on private aggregate demand and private consumption, and net (indirect) taxes have a negative and statistically significant effect on private consumption and private AD. It should also be noted that this paper represents first attempt of estimating size of fiscal multipliers in Croatia in open economy model.

Key words
fiscal policy, small open economy, Croatia, SVAR

JEL classification
E62, C32, H30, H20, H50

1. Introduction

Current economic crisis has awoken the interest for researching the possibilities and limitations of the stabilization function of public finance, i.e. fiscal policy. This function is of very great importance in countries in which monetary policy is limited by some structural characteristics, as in Croatia which is a small open transition economy with managed exchange rate. Also, since Croatia had slow and difficult transition path, the role and the size of government in its economy is still significant so the responsibility of (fiscal) policy-makers is even larger than in countries with a lower share of government in the economy.

Policymakers can achieve stabilization function with instruments focused on (de)stimulating aggregate supply and aggregate demand. This paper analyses possibilities of short-term effects of the fiscal policy on economic activity (business cycle), through its effect on aggregate demand. Since Croatia is one of the European countries with longest recession period (recession in Croatia still lasts) it can be concluded that fiscal policy in past four years has not been adequate and that it's stabilization potentials have not been fully used, although there were many discretionary changes in fiscal system.

There are three main mechanisms of short-term effects of the fiscal policy on aggregate demand: (i) automatic stabilizers, (ii) discretionary policies and (iii) signal indicators. Discretionary measures of are in the focus of this paper, whose possibilities are theoretically and empirically usually observed through the theory of fiscal multipliers. Thus, the indirect goal of the paper is to estimate the size of government spending multiplier and (indirect) taxes multiplier in Croatia, which is the first attempt in (publicly available) literature. The multiplier size is determined by various structural characteristics of the economy and one of main and most important characteristics is country's openness in terms of foreign trade. That is why the analysis is based on the fact that Croatia is a small and open economy.

After an overview of basic literature in the second part of the paper, the third part briefly explains econometric model that was used. It is a structural VAR model (SVAR) with Blanchard-Perotti method of identification. As Croatia is a small and open economy, model is extended with variables that represent foreign shocks using Ravn & Spange (2012) methodology. Fourth part analyzes used data. Fifth part of the paper shows effects of fiscal shocks on private consumption and private sector demand, as well as the results of calculation of the government spending multiplier and tax multiplier. This part also gives a brief review of methodological limitations of results. The paper ends with a conclusion.

2. Literature review

Number of empirical studies on fiscal policy is extensive, but they can be structured in several directions. First, in VAR literature four main identification approaches can be found to identify fiscal policy shocks: 1) narrative approach (Ramey & Shapiro, 1999), 2) calibrated elasticities (Blanchard & Perotti 1999 (working paper) i.e. 2002), 3) sign restrictions (Mountford & Uhlig 2002), and 4) recursive structure (Kamps & Caldara 2006). Second, analyses of empirical results include dynamic responses to different fiscal shocks and/or fiscal (tax and spending) multipliers, and frequently interpretation of historical facts. Third and last, VAR as standard methodology has developed into DSGE (dynamic stochastic general equilibrium) models. DSGE literature is growing as are different DSGE models like real business cycle (RBC) models and New Keynesian (NK) models. For DSGE literature review and methodology development see Leeper at al. (2012).

Basic paper using structural VAR model for estimating effects of fiscal policy is Blanchard & Perotti (1999 i.e. 2002; further in text acronym B-P is used) and it is still used as benchmark in analyses. Structural VAR approach predict that a positive spending shock (deficit financed i.e. leaving taxes unchanged) has a positive effect on output while a positive tax shock (leaving government spending unaffected) has a negative effect on output. The original model of Blanchard & Perotti (1999) takes

only three variables: government spending, net taxes and real GDP, and the analysis was conducted for USA. Later Perotti (2002) extended the model by adding short-term interest rate and price levels, and expanding analyses including larger OECD countries (Germany, Great Britain, Australia, Canada). From those papers until today, a large variety of papers exist that use the Blanchard-Perroti identification method as benchmark methodology in the research of the effects of fiscal policy. The model has developed and was adjusted according to particularities of different economies. Table 1 gives a brief overview of research using SVAR methodology for estimations of effects of fiscal policy based on Blanchard-Perroti identification method.

Table 1. A brief overview of research on the effects of fiscal policy on economic growth using SVAR methodology based on B-P identification scheme

Authors	Model and identification scheme	Period, frequency of data and country	Variables	Fiscal policy effects*
Perotti (2002)	SVAR BP 2002	Quarterly 1960-2001 U.S., Germany, Australia, Great Britain, Canada	Net tax revenue, government spending, GDP, interest rate, inflation rate	weak effect of fiscal shocks on GDP; multiplier less than 1 for all countries except U.S. in the 1980s; after 1980s government consumption effects are considerably weakened (multipliers are smaller, and government spending multiplier changes its algebraic sign)
Krušec (2003)	SVEC BP 2002	Quarterly (for each country different) USA, Great Britain, Canada, Australia, Germany, Italy, Finland	Government spending, net primary tax, real output, inflation rate, interest rate	positive government spending shock increases GDP, while a positive tax shock has a rather insignificant effect on the GDP
Giordano et al. (2005)	SVAR BP 2002	Quarterly 1982-2003 Italy	Net tax revenue, various components of public expenditure, private GDP, inflation, interest rates	a shock to government purchases of goods and services has a sizeable and robust effect on economic activity. effects of fiscal policy shocks on private consumption and investment are positive; shocks to net revenue have negligible effects on all the macroeconomic variables.
De Castro & De Cos (2006)	SVAR BP 2002	Quarterly 1980-2004 Spain	Net tax revenue, government spending, GDP, interest rate, inflation rate	government spending multiplier greater than 1 in the short run and negative in the long run; positive (insignificant) tax effect in the short run, negative in the long run; significant short-term effects of fiscal variables on prices and interest rates
Hur (2007)	Cholesky; SVAR BP 2002	Quarterly 1979-2001 South Korea	Government spending, tax revenue, GDP, foreign GDP and real effective exchange rate (exogenous variables)	weak and short-term effect of government spending and taxes on GDP; size of (cumulative) multipliers between -2 and -1.5 for taxes and 1.2-1.6 for government spending; weaker effect of fiscal shocks in the model with exogenous variables; author emphasizes problems with the significance of results
Baxa (2010)	SVAR BP 2002	Quarterly 1998-2009 Czech Republic	Government revenue, government spending, GDP,	Government spending has a considerable and significant effect (multiplier close to 2); tax revenue has a negative and insignificant

			interest rate, inflation rate	effect on GDP
Auerbach & Gorodnichenko (2012)	SVAR BP 2002; Switching model	Quarterly 1947-2009 U.S.	Government spending, net tax revenue, GDP, different components of government spending, forecast errors	Fiscal multipliers' size varies depending on whether discretionary policies are introduced during recession or expansion; government spending multiplier (different components) is between 1 and 3.56, and tax multiplier between -0.99 and -0.08
Ravn & Spange (2012)	SVAR(X) BP 2002	Quarterly 1971-2011 Denmark	Government spending, personal consumption, net taxes, GDP, foreign GDP (exogenous)	Significant and positive effect of government spending on GDP in the short run (multiplier's size is 1.3); increasing taxes decreases GDP (multiplier is smaller than government spending multiplier); crowding out effect is present; multiplier's size varies in different periods (effects of fiscal shocks are greater in the second period when Denmark introduced fixed exchange-rate system)

Note: *The emphasis is on the effects of fiscal shocks on GDP and its components. Detailed results can be found in original papers.
Source: authors

For example, the broader literature review of the assessments of the effects of fiscal policy using SVAR methodology for several transition countries (Czech republic, Hungary, Poland, the Slovak republic, Bulgaria and Romania) can be found in Mirdala (2009). Further, see Baxa (2010) for Czech Republic, Jemec et al. (2011) for Slovenia, Mancellari (2011) for Albania.

When it comes to estimating the fiscal policy effects in Croatia, the literature is rather modest regarding SVAR methodology. Only two papers can be found in existing literature. Ravnik & Žilić (2011) use multivariate Blanchard-Perotti SVAR methodology to analyze disaggregated short-term effects of fiscal policy on economic activity, inflation and short-term interest rates in Croatia. Šimović & Deskar Škrbić (2013) analyze dynamic effects of fiscal policy and estimate the size of fiscal multipliers at different levels of budget consolidation (government levels) in Croatia, using closed economy model. Open economy model for Croatia has not been found anywhere in literature. Also, Croatia is included in 44 countries dataset in Ilzetski et al. (2011), but individual multipliers for Croatia haven't been calculated.

3. Methodology: Open economy model

In contrast to Blanchard-Perotti identification method, Ravn & Spange (2012) analyze Denmark, a small, open economy with fixed exchange rate. As Croatia is a small and open economy with fixed exchange rate as well, this paper represents the first paper that uses adjusted Blanchard-Perotti methodology, after it was originally presented in Ravn & Spange (2012), for an open economy framework and generally one of the few that uses such framework for this type of analysis. Because Croatia is a small, open, highly dollarized, transition economy with managed exchange rate, this methodology can be the basis for a similar analysis for a number of developing countries with similar characteristics.

The baseline model of this analysis is the reduced form VAR model:

$$X_t = \Psi + \Phi D_t + \Gamma T_t + \sum_{i=1}^{p} A_i X_{t-i} + \sum_{i=1}^{p} B_j Z_{t-j} + u_t, \qquad (1.1)$$

which includes deflated and seasonally adjusted values in log form of net indirect tax revenue (T_t), total general government spending (G_t), personal or private consumption (C_t), foreign-trade weighted GDP[1] (F_t), which comprises of the vector of endogenous variables $X_t = [T_t, G_t, C_t, F_t]$. Exogenous variables included in the model are U.S. GDP (Y_t^{US}), constant (Ψ), time trend[2] ($\mathrm{T_t}$) and 'crisis' dummy variable ($\mathrm{D_t}$), which has a value of 1 from the beginning of the crisis (Q32008) (according to Krznar (2011) and Quandt-Andrews test of structural break). Vector $\mathrm{u_t} = [\mathrm{t, g, y/c, f}]'$ represents the vector of innovations of the reduced model (RF), $\mathrm{u_t} \sim (0, \sum_u)$.

Number of time lags is set to 1, according to SIC and HQ criteria. Greater number of lags isn't desirable due to the short time-series as well. Also, considering the frequency of data, selection of one time lag has its anchor in economic intuition. One time lag applies to endogenous variables and an exogenous variable $Z_t = [Y_t^{US}]$, which indicates an external shock affecting the economic activity of main trade partners and Croatia. Model also assumes that economic activity of main trade partners has an effect on the Croatian economy, and that economic activity in Croatia doesn't affect the activity of main trade partners and the U.S.

Reduced form of the model (1.1) gives information about RF innovations. RF innovations are correlated and represent linear combination of structural innovations, which prevents their precise economic interpretation. Linear combination of structural innovations (shocks) can be displayed as follows:[3]

$$t_t = a_1 c_t + a_2 f_t + \beta_2 e_t^G + \beta_1 e_t^t \quad (1.2)$$

$$g_t = b_1 c_t + b_2 f_t + \beta_4 e_t^T + \beta_3 e_t^g \quad (1.3.)$$

$$c_t = c_1 t_t + c_2 g_t + c_3 f_t + \beta_5 e_t^c, \quad (1.4.)$$

$$f_t = d_1 t_t + d_2 g_t + d_3 c_t + \beta_6 e_t^f, \quad (1.5.)$$

where $\mathrm{e_t^t}, \mathrm{e_t^g}, \mathrm{e_t^c}$ i e_t^f represent uncorrelated structural shocks of taxes, government spending, personal consumption and foreign demand.

In matrix form:

$$\begin{pmatrix} 1 & 0 & a_1 & a_2 \\ 0 & 1 & b_1 & b_2 \\ c_1 & c_2 & 1 & c_3 \\ d_1 & d_2 & d_3 & 1 \end{pmatrix} \begin{pmatrix} t_t \\ g_t \\ c_t \\ f_t \end{pmatrix} = \begin{pmatrix} \beta_1 & \beta_2 & 0 & 0 \\ \beta_4 & \beta_3 & 0 & 0 \\ 0 & 0 & \beta_5 & 0 \\ 0 & 0 & 0 & \beta_6 \end{pmatrix} \begin{pmatrix} e_t^t \\ e_t^g \\ e_t^c \\ e_t^f \end{pmatrix} \quad (1.6.)$$

equation (1.2) shows that the model assumes that four factors can cause unexpected tax changes during one quarter: reactions on unexpected changes in domestic consumption, reactions on unexpected changes in foreign demand, and reactions on structural shocks in government spending or taxes. Other equations are interpreted in a similar manner.

[1] Calculated as weighted average of GDP of three main Croatian trade partners in the EU – Germany, Italy and Slovenia, in accordance to information about statistics on nominal effective exchange rate of Croatian National Bank.

[2] ADF test i Zivot-Andrews stationarity tests show that all variables are trend stationary so the inclusion of trend guarantees model stability in which the variables are included in logarithmic form; results of these tests can be delivered on request.

[3] In the case of estimating the effect of shocks on aggregate demand of the private sector, variable c_t is replaced with variable y_t.

In order to identify this system, $2K^2 - \frac{1}{2}K(K+1)$ limitations are to be set (Lűtkepohl, 2005), which have to have a strong base in economic theory. As the number of endogenous k=4, 22 limitations are needed. Basic model implies 16 limitations, so 6 more are to be added.

Quarterly data frequencies have the greatest significance in the process of identification. It is due to the assumption that economic policymakers cannot react to changes in the economic environment in one quarter. There are different information, administrative and procedural barriers for reacting in such short period, e.g. most of the statistical reports are published with a couple of months or quarters of delay; there are procedural barriers inside of the parliament etc. Therefore the reaction of fiscal variables on changes in economic activity can only be automatic, i.e. the consequence of automatic stabilizers' activity. That fact allows setting the limitations in the model based on empirical estimation of exogenous elasticities of fiscal variables in relation to changes of certain macroeconomic aggregates. To be more precise, parameter a_1 and b_1 can be interpreted as (automatic) elasticities of tax revenue and expenditures according to aggregate demand changes.

The total calculated elasticity equals $a_1 = 0.95$.[4] According to Blanchard-Perotti (2002), Ravnik and Žilić (2010), Hur (2007), Ravn and Spange (2012), all coefficients related to the equation of the reduced innovation of government spending should equal zero. The reason for that is found in the assumption that the government spending is completely under the control of the economic policy that cannot react within the same period on the changes in the economy. However, Caldara (2011) warns about the "automatic" reaction of the government spending components (which are related to unemployment) to the business cycle. Taking into account this correlation it is necessary to calculate the exogenous elasticities of those components to the changes in the business cycle. Yet, according to the Grdović Gnip (2011) estimation, that elasticity in Croatia is very small (-0.01). Therefore in this paper we also assume that the total expenditures cannot have an influence on the changes in the aggregate demand within the same quarter, hence $b_1 = 0$.

In order to identify other parameters of the system, Blanchard & Perotti (2002) recommend calculation of cyclically adjusted residuals, which are uncorrelated with structural shocks in GDP (and personal consumption) so they can be used as instruments for t_t and g_t in IV regression of income and personal consumption on t_t and g_t, which results in parameters c_1 and c_2.

Parameters β_2 and β_4 show the reaction of taxes on changes in government spending and vice versa. In order to identify the system, it is necessary to assume da one of these parameters is equal to 0, i.e. that there is no reciprocity. This paper assumes that tax revenues react to changes in government spending, and not vice versa, so β_4=0. Blanchard & Perotti (2002) showed that the results of the model can hold this assumption (i.e. they are robust).

The last three limitations are implied in the assumption that foreign demand affects all endogenous variables, and that there is no effect the other way around so $d_1 = d_2 = d_3 = 0$. It is possible to estimate this model in order to get information about structural innovations which are not correlated, so that one can give an economic interpretation of the conclusion of the analysis of impulse response functions (IRF).

An analysis of model adequacy has been conducted for the model (1.1). The results of the analysis of residuals (autocorrelation test, normality test, heteroscedasticity test) and stability test show that the

[4] The calculation of the elasticities in relation to the income is given by the calculation of elasticity of tax components to their basis and elasticities of each base to the income. The needed data for the calculation of tax elasticity was taken from Ravnik&Žilić (2011) and Šimović (2012). The rest of the elasticities are author's calculations.

model is adequate and stable. After estimating the structural form of the model, tests were repeated (they include tests for residual normality). That hasn't changed the conclusion on the model adequacy.

4. Data

Data source on the components of GDP in Croatia, GDP of main trade partners and the size of general government consumption and net indirect taxes is Eurostat. All data is at constant prices and exchange rate from 2005. U.S. income data has been taken from FRED database and was converted based on Eurostat data. All variables are in millions of euro. Data series applies to 2000Q1-2012Q2 period, and all data has been seasonally adjusted using the method ARIMA X12.

Aggregate demand of the private sector is calculated as sum of personal consumption and investment (Giordano et al. 2005). This indicator gives information on the effect of fiscal variables on the private sector, thus eliminating possible correlation between fiscal shocks and GDP components related to government spending, high correlation between GDP and the component of GDP government spending (G) and high correlation of net exports and foreign demand variable, which could significantly violate some important econometric assumptions. Also, total GDP includes components such as inventory and import level, which domestic fiscal shocks cannot directly affect. These components are affected by the changes in determinants of personal consumption. Mechanism of the instantaneous effect of fiscal shocks of consumption and indirect taxes on export has not been elaborated in economic literature.

Analysis uses indirect taxes for three reasons: (i) as it has been mentioned in the introduction, the goal of the paper is to analyze effects of fiscal policy on aggregate demand. In theory, personal income tax and profit tax mostly affect aggregate supply, modeling the behavior of workers and companies; (ii) SVAR models are more suitable for the analysis of aggregate demand shocks (Ravn & Spange, 2012; Blanchard-Perotti, 2002). Due to the complexity of the mechanism of the effect of taxes on aggregate supply, broader methodological framework of DSGE model is required to analyze these effects; (iii) Croatian tax system is mainly consumption-oriented and the most of discretionary changes since the beginning of the crisis were related to indirect taxes so we want to try to estimate the consequences of those changes.

As in all papers using Blanchard-Perotti (2002) methodology, taxes are in net form. Unlike other authors, in this paper we deduct subsidies from indirect taxes according to ESA 95 methodology, whereas other papers deduct interest and social expenditures from total tax revenue.

Total general government spending is also based on ESA 95 methodology (European Commission, 2012, 17-21). It comprises of individual and collective general government spending. The paper uses this indicator of government spending for three reasons: (i) Croatian data on total expenditures of consolidated general government is available from the third quarter of 2004 – a period too short to be analyzed; (ii) the level of aggregation of consolidated central government's total expenditures category, which has been adjusted to changes in GFS methodology 1986.-2001. for the requirements of this paper and Grdović Gnip (2011), is too high, and certain components cannot be compared; (iii) most papers (including the original Blanchard-Perotti (2002) and Perotti (2002)) which use SVAR methodology for estimating multiplier size use data on current consumption (goods and services consumption) and investment spending of the government, for which data is not available in Croatia.

5. Results

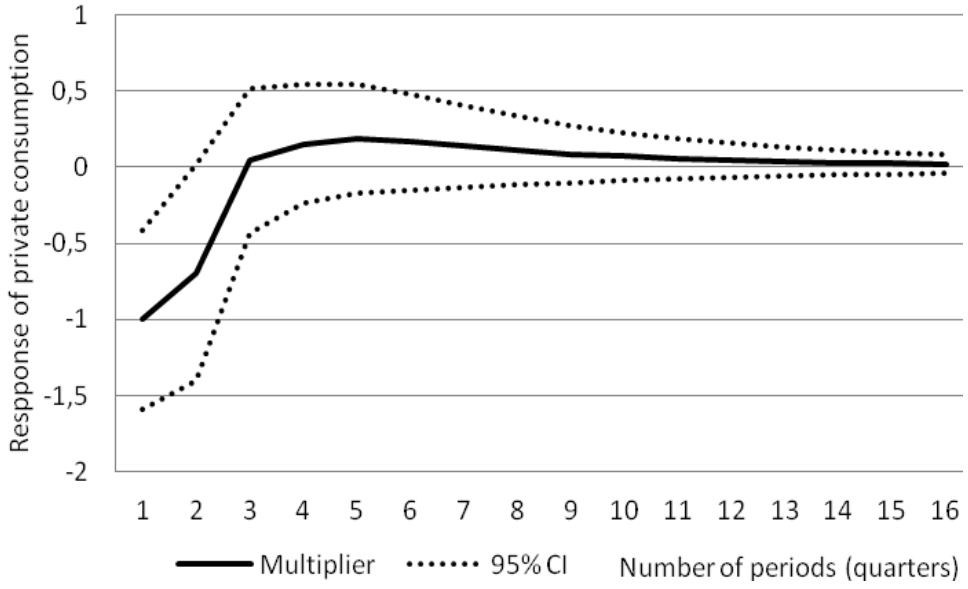
All results of the analysis of impulse response functions (IRF) from structural model 1.6. are shown in Appendix 1. This part only shows reactions of personal consumption and private AD on structural shocks in net indirect tax revenue and in total spending of central government. Impulses show multiplier's size in accordance similar researches (Mancelarri, 2011; Hur, 2007; Šimović & Deskar-Škrbić, 2013).

5.1. Multiplier in an open economy model

Figure 1 shows the effect of one unit shock in net indirect tax revenue on personal consumption. The effect is statistically significant in first two quarters after the shock. Multiplier size is -0.99 in the first quarter and -0.69 in second quarter. The effect becomes slightly positive in the third quarter (average size is 0.08), and it stays on approximately that level before disappearing after the fourth year. However, multiplier is statistically insignificant in that period.

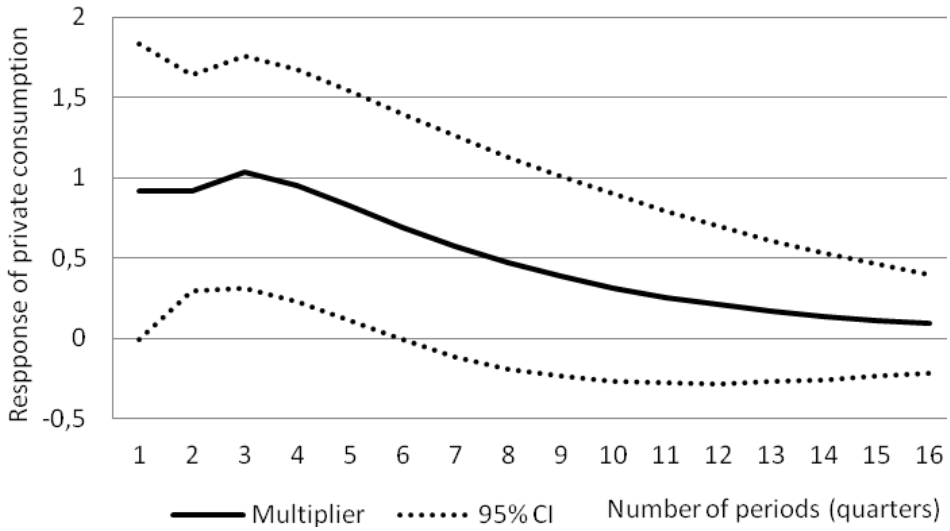
Figure 2 shows the effect of one unit shock of government spending on personal consumption. The effect is statistically significant in first five quarters after the shock. Multiplier size is in range between 0.92 in first quarter and 0.83 in the fifth. Multiplier is the greatest in the third quarter (1.03), which is not in accordance with theoretical assumption of gradually decreasing effect after the first period. However, it matches the movements in other papers such as Ravn & Spange (2012).

Figure 1. Indirect tax multiplier (private consumption)



Source: own calculations.

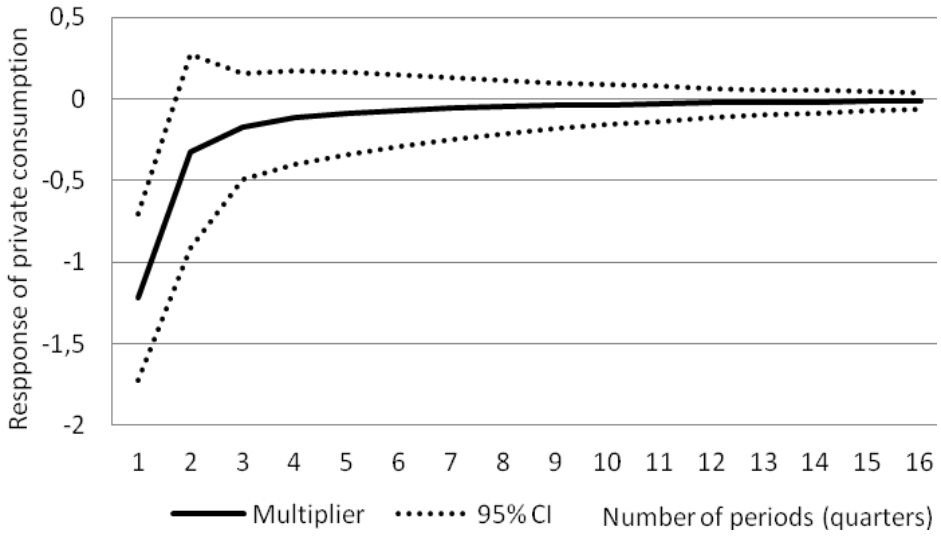
Figure 2. Government spending multiplier (private consumption)



Source: own calculations.

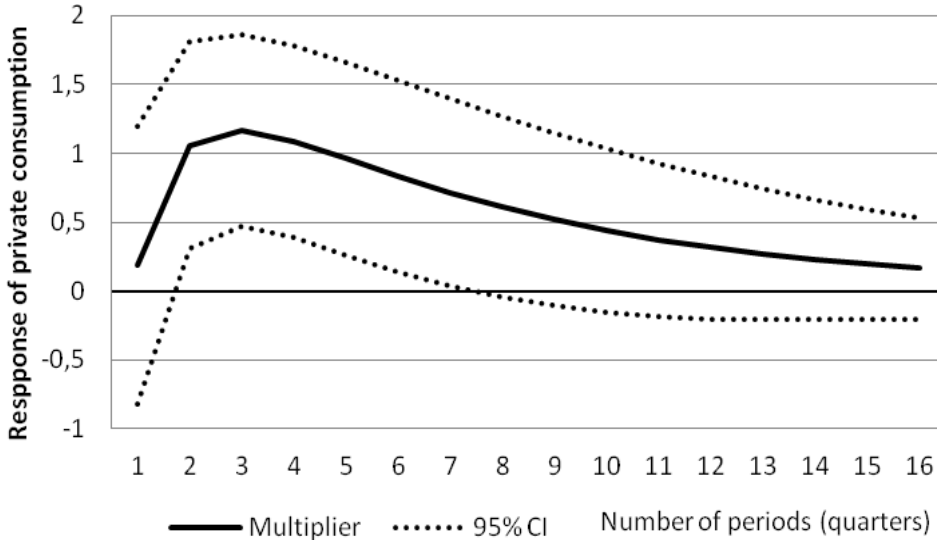
Figures 3 and 4 show the effects of shocks in fiscal variables on private aggregate demand. Tax effect is negative and statistically significant only in the first period. Multiplier size in the first quarter is higher compared to previous case with personal consumption. This can be explained through consumption and investment relation (investment accelerator), as consumption is one of key determinants of investment. Government spending effect becomes significant in the second quarter after the shock and lasts for five quarters. Multiplier is once again higher in comparison to personal consumption, which can be explained through accelerator mechanism as well. It is worth mentioning that multiplier's size is, in accordance with theory, lower than in closed economy model which was explored by Šimović & Deskar Škrbić (2013).

Figure 3. Indirect tax multiplier (private AD)



Source: own calculations.

Figure 4. Government spending multiplier (private AD)



Source: own calculations.

5.2. Research limitations and robustness check

Aforementioned results point to several methodological limitations. First of all, these results are to be taken *cum grano salis* due to relatively short time series and its characteristics, such as the structural break from the beginning of the crisis in 2008.

Further, fiscal multiplier is originally defined as the effect of unit change of fiscal variables on the total income, and this paper analyses fiscal policy effects on personal consumption and private demand, so multiplier's size should be observed in that context. Selection of other endogenous and exogenous variables could result in other conclusions. That is why authors will continue this research and assess models with other set of variables. Nevertheless, great number of research shows that

multiplier's size is largely determined by the stage in a business cycle (it is higher in recessions). As Croatia is in recession for more than 40% of analyzed period, it can be concluded that multiplier size is partially overestimated.

Paper uses elasticities from other research which were calculated for period which isn't in accordance with the analyzed period in this paper, but have shown to be theoretically appropriate for Croatia. Literature emphasizes the choice of elasticity as one of the most important determinants for differences in multiplier's sizes in different countries. Thereby, key assumption which affects the multiplier's size is government spending elasticity on changes in cycles. In this, as in most of the papers using Blanchard-Perotti methodology, multiplier's size is assumed to be 0.

Share of consumption defined according to ESA 95 and of indirect taxes in chosen macroeconomic variables is lower compared to other definitions. As the formula for calculation of multiplier uses inverse share of aforementioned variables, it can be concluded that lower shares increase multiplier's size.

The most common method for checking the robustness of SVAR models is the breakpoint test, where the series is divided into two parts. Due to the small number of observations this test can't be applied in this paper. In addition to breakpoint test there are several other "tests" that can be used in examining robustness of results.

Firstly, it is necessary that SVAR model is stable and model adequacy tests in Appendix 2 show that all roots of characteristic polynomial are inside the unit circle, i.e. that defined models are stable. Secondly, as mentioned above, because SVAR models are sensitive to assumptions about exogenous elasticities we substituted parameter $b_1 = 0$ (no instantaneous reaction of government expenditure to business cycle movements in) with $b_1 = 0.01$, which is the estimated elasticity of unemployment related current expenditure in Grdović-Ginp (2011). Our main conclusions have not changed due to this test and the multiplier size has changed slightly. Also, in the baseline model we assumed that tax revenues react to changes in government spending, and not vice versa, so β_4=0. As in all papers in which Blanchard-Perotti methodology is used, changing this assumption does not materially effect the main conclusions of the paper.

Also, it is important to notice that that there are several already entrenched criticism of Blanchard-Perotti methodology: (i) as already mentioned, Caldara & Kamps (2012) emphasize the sensitivity of results on the assumptions on the size of elasticities; (ii) in the current debate on the effects of fiscal consolidation it is pointed out it is of great importance to include the feedback between the level of public debt and growth in the analysis of the effects of fiscal policy on economic growth; (iii) it is very important to explicitly model the effects of monetary policy in the fiscal SVAR analysis because the effectiveness of fiscal policy in large extent depends on the monetary policy stance; (iv) according to the results of switching regime models (eg. Auerbach and Gorodnichenko, 2012) the size of fiscal multipliers strongly depends on the stage of the business cycle; (v) recent research has shown that the size of fiscal multipliers strongly depends on economic environment (eg. Corsetti et al., 2012) so, for the robustness of the results, it is important to include in the analysis structural characteristics of the economies such as level of indebtness, exchange rate regime, health of financial system etc. But, despite all the criticism B-P methodology is still the most widely used framework for fiscal policy analysis in time series framework.

In this paper it was impossible to include different control variables due to very limited length of all relevant time series. If the authors have introduced a number of control variables, which are certainly very important, the OLS assumptions would be seriously violated (CLT) and the results would further lose on quality. Thus, in the future analysis of the effectiveness of fiscal policy in Croatia it is of great importance to use the panel or cross-section time series framework because that is the only way to achieve a sufficient number of observations to include the control variables mentioned above.

In future research, chosen model can be expanded with other structural characteristics of the Croatian economy, e.g. exchange-rate regime, public and external debt, capital market development, investor perception, expectations etc. Also, in addition to effects of government spending, literature often analyzes the effects of government investment on economic activity, which hasn't been done here due to lack of data.

6. Conclusion

This paper provides first fiscal multiplier estimations in open economy model in Croatia. Original Blanchard-Perotti model is extended by introducing variables that represent external (foreign) demand shocks. Estimated multiplier size in this paper corresponds to intervals set out in literature. Open economy model results show negative tax multiplier in case of personal consumption and aggregate demand. On the other hand, public expenditure multiplier is positive in both cases. Also, multiplier's size is, in accordance with theory, lower than in closed economy model, which presents another expected limitation for Croatian (fiscal) policy makers. Again, it is important to note that there are some methodological limitations because of which results have to be taken *cum grano salis.*

Since Croatian economy is in recession from the second half of 2008, it can be concluded that fiscal policy in past four years has not been adequate and that its stabilization potentials have not been fully used, although there were many discretionary changes in fiscal system. The relevance of this paper can be found in exploring the possibilities and limitations of fiscal policy measures in macroeconomic management of Croatian economy, which is of great importance due to the fact that Croatia is a small open economy with a managed exchange rate. Furthermore, the relevance of this and potential future research is even greater in the context of the accession to EU, because monetary sovereignty and the possibilities of Croatian monetary policy will be further reduced.

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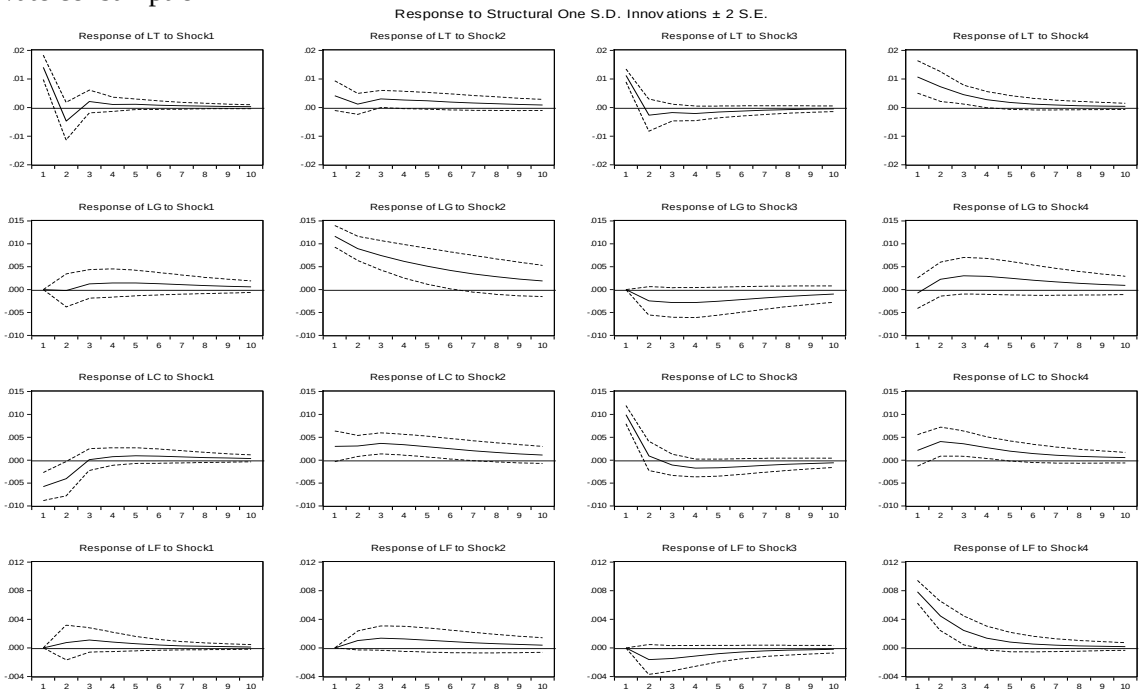
Appendix 2 Impulse response functions

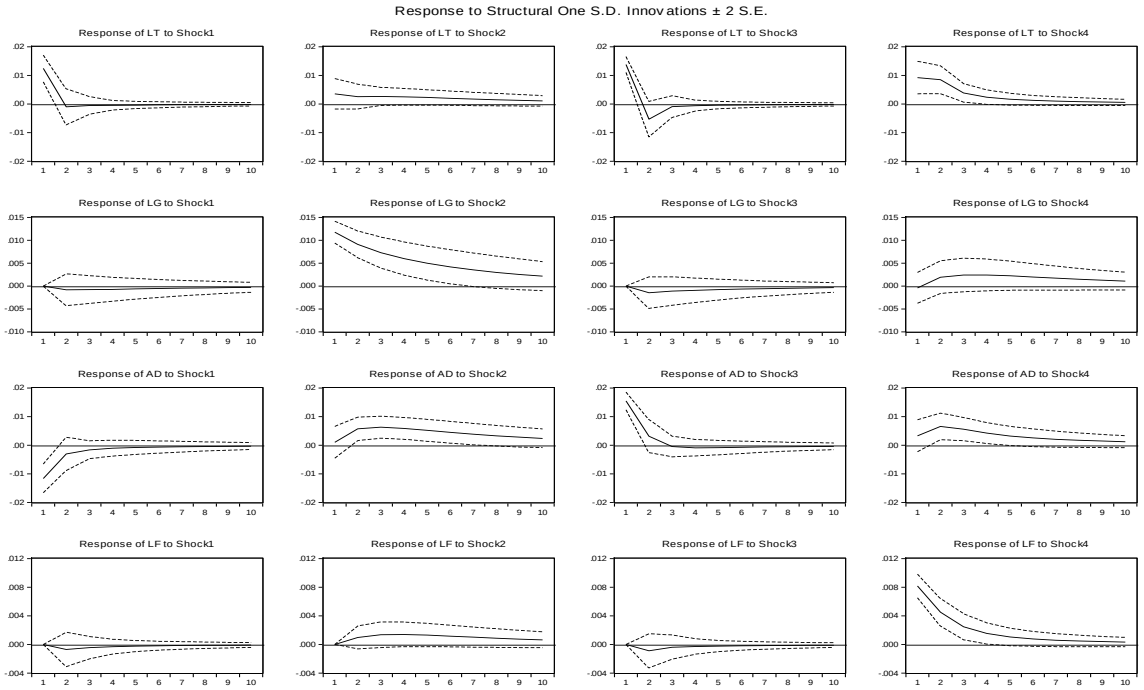
Note: L (logaritham); T – tax; G – government spending; C – private consumption; F – foreign demand; AD – private AD

Model 1

Private consumption



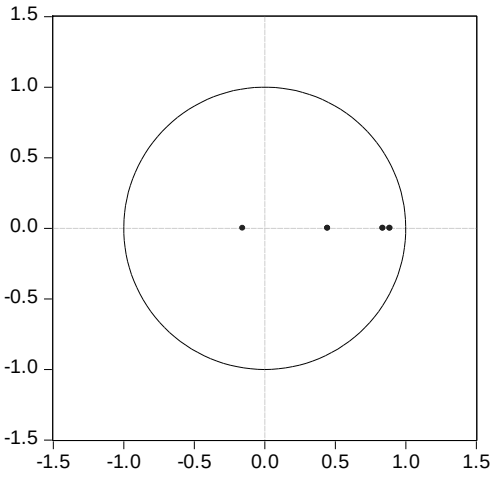
Private AD



Appendix 2 Model adequacy

Model 1 - Consumption

Inverse Roots of AR Characteristic Polynomial



VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 01/29/13 Time: 14:44
Sample: 2000Q1 2012Q2
Included observations: 49

Lags	LM-Stat	Prob
1	18.67130	0.2861
2	20.45608	0.2004
3	14.25282	0.5799
4	29.63618	0.0200
5	10.63893	0.8312
6	14.80011	0.5393

Probs from chi-square with 16 df.

VAR Residual Normality Tests
Orthogonalization: Estimated from Structural VAR
Null Hypothesis: residuals are multivariate normal
Date: 01/29/13 Time: 14:45
Sample: 2000Q1 2012Q2
Included observations: 49

Component	Jarque-Bera	df	Prob.
1	3.671000	2	0.1595
2	3.251655	2	0.1967
3	2.110366	2	0.3481
4	4.272280	2	0.1181
Joint	13.30530	8	0.1018

VAR Residual Heteroskedasticity Tests:
Includes Cross Terms
Date: 01/29/13 Time: 14:47
Sample: 2000Q1 2012Q2
Included observations: 49

Joint test:

Chi-sq	df	Prob.
445.014965494 2147	410	0.1126

Structural VAR Estimates
Date: 01/09/13 Time: 17:56
Sample (adjusted): 2000Q2 2012Q2
Included observations: 49 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 7 iterations
Structural VAR is just-identified

Model: Ae = Bu where E[uu']=I
Restriction Type: short-run pattern matrix

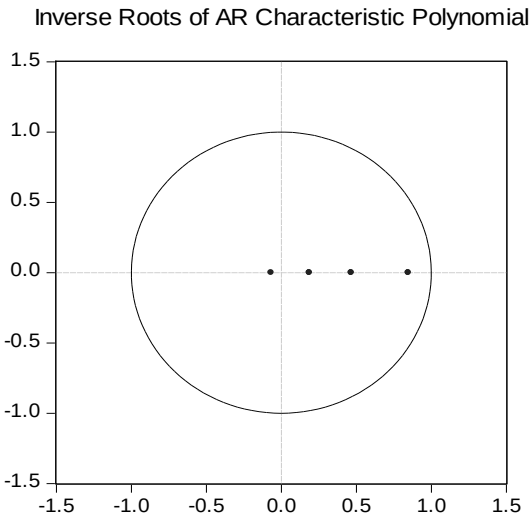
Estimated A matrix:

1.000000	0.000000	-1.130000	-1.030375
0.000000	1.000000	0.000000	0.059148
0.533570	-0.800850	1.000000	-1.176497
0.000000	0.000000	0.000000	1.000000

Estimated B matrix:

0.020550	-0.000404	0.000000	0.000000
0.000000	0.012291	0.000000	0.000000
0.000000	0.000000	0.019422	0.000000
0.000000	0.000000	0.000000	0.007764

Model 2 – private AD



VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 02/04/13 Time: 11:36
Sample: 2000Q1 2012Q2
Included observations: 49

Lags	LM-Stat	Prob
1	31.98907	0.1101
2	18.65219	0.2871
3	17.86708	0.3317
4	28.68041	0.0262
5	25.79784	0.0569
6	11.01960	0.8083

Probs from chi-square with 16 df.

VAR Residual Normality Tests
Orthogonalization: Estimated from Structural VAR
Null Hypothesis: residuals are multivariate normal
Date: 01/29/13 Time: 15:16
Sample: 2000Q1 2012Q2
Included observations: 49

Component	Jarque-Bera	df	Prob.
1	3.732140	2	0.1547
2	1.683926	2	0.4309
3	1.569457	2	0.4562
4	3.380067	2	0.1845
Joint	10.36559	8	0.2403

VAR Residual Heteroskedasticity Tests:
Includes Cross Terms
Date: 01/29/13 Time: 15:17
Sample: 2000Q1 2012Q2
Included observations: 49

Joint test:		
Chi-sq	df	Prob.
450.5530	410	0.0815

Structural VAR Estimates
Date: 01/29/13 Time: 15:23
Sample (adjusted): 2000Q2 2012Q2
Included observations: 49 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 7 iterations
Structural VAR is just-identified

Model: Ae = Bu where E[uu']=I
Restriction Type: short-run pattern matrix
Estimated A matrix:

1.000000	0.000000	-0.890000	-0.767052
0.000000	1.000000	0.000000	0.049935
0.937413	-0.367590	1.000000	-1.472477
0.000000	0.000000	0.000000	1.000000

Estimated B matrix:

0.022740	0.002642	0.000000	0.000000
0.000000	0.011759	0.000000	0.000000
0.000000	0.000000	0.028351	0.000000
0.000000	0.000000	0.000000	0.008178