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Dynamic effects of fiscal policy and fiscal multipliers in Croatia*

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Abstract

The aim of this paper is to analyze the effects of discretionary measures of fiscal policy on the economic activity and to estimate the size of fiscal multipliers in Croatia. Econometric framework is based on the structural VAR model (SVAR), with Blanchard-Perotti identification method that uses information on institutional characteristics of fiscal system. The analysis is conducted on quarterly data for total expenditures and indirect taxes of central, central consolidated and general consolidated government and aggregate demand for the period from 2004-2012. The results show that our initial assumptions about the difference in the size of the multiplier of government expenditures and indirect tax revenues between three levels of government consolidation have been confirmed.

Key words: *fiscal policy, fiscal multipliers, SVAR, Croatia*

JEL classification: *E62, H20, H50*

1. Introduction

Recent economic crisis has stimulated new research about the effects and possibilities of the stabilization function of fiscal policy. The results of stabilization activities of the fiscal policy depend on the taken discretionary measures. Since the discretionary measures are in the political decision making domain, timely activities of the fiscal policy, regardless of the possible economic restrictions, often come down to the domain of "alchemy" (Leeper, 2010). However, despite the theoretical

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framework and restrictions inside which the fiscal policy is observed, it has kept a significant status in the economic policy in the conditions of crisis. The relevance of the effectiveness of fiscal policy measures is even greater in small, open and eurized economies with managed exchange rate like Croatia, where monetary policy cannot be active. The subject of this paper is to analyze discretionary fiscal policy measures in Croatia, whose possibilities and effectiveness are most often observed within the theory of the fiscal multipliers, both on theoretical and empirical level. The size of the multiplier is defined by different structural characteristics of the economy.

The main goal of this paper is to estimate the size of the multiplier of government spending and (indirect) taxes in Croatia. According to the existing literature, it is the first attempt of this kind. Considering the fiscal centralization of Croatia, estimation of fiscal multipliers and fiscal policy activities will be conducted on all three government levels (the central, central consolidated and general consolidated government level).

The main hypothesis of the paper is that there is a difference in the multiplier size among three levels of government, especially the one related to government spending, that is assumed to be the highest at the general government level. Because of high fiscal decentralization, Croatia realizes most of her tax revenues through the central government budget. As most of the central government budget expenditures are spent for covering the current expenditures (pensions, health, wages in the public sector etc.), a larger amount of the capital expenditures are visible only through the consolidated central government level (mostly through public enterprises) and general government level (capital expenditures are mostly realized through the local budgets). These mentioned facts should have an influence on the size of the multiplier. Taking into account the previous statements, an answer would be given on how much the government budget (and also the Government) can influence the creation of aggregate demand without changing the existing (unfavorable) public spending structure.

Despite the fact that Croatia is a small open economy, in this paper closed economy model is used due to several theoretical and methodological reasons. Firstly, closed economy model is more suitable for the analysis of the difference in multiplier size on different levels of budget consolidation because, based on the theoretical assumptions, multiplier in closed economies is empirically "cleaner" because there are less "leakages" from the circle of economic activity (Keynesian circular flow model) in the form of net imports. Secondly, open economy models require analysis of additional variables and mechanisms which is not possible in Croatia due to the shortness of time series of budget components. Thirdly, most of the papers that analyze the effects of fiscal policy use closed economy models because it is easier to isolate the effects of discretionary economic policy measures. Lastly, as it is emphasized in the conclusion, our goal is to continue this research using the assumptions about the characteristics of open economies, but on a larger sample of

countries in order to avoid problems associated with the length of the time series in Croatia.

For the purpose of testing before mentioning hypothesis and achieving mentioned goals, the paper is structured as follows. The literature review is given in the second section of the paper, after the introduction. The emphasis is on the literature that uses vector autoregression methodology (VAR) while calculating fiscal multipliers and fiscal policy effects. Afterwards, the third section will briefly describe the applied econometric method. The method used is for identification of structural VAR (SVAR) model is based on the proposed identification scheme by Blanchard-Perotti (2002). The next section analyses used data. Section Five presents the effects of fiscal shocks on the private consumption and private sector demand. Moreover, it presents the calculated results of the government spending and tax multiplier. Final section concludes and states the restrictions in the applied methodology.

2. Literature review

When the stabilization fiscal policy in Croatia is analyzed, it is hard to find a unanimous answer. The reason for this situation lies in a few facts. Firstly, there are a rather small number of empirical research in Croatia. The existing research differs by the methodology and results, thus the basis for any kind of fiscal policy assessment in Croatia is hard to find. Also, it is of great importance that fiscal policy measures have some empirical background in form of policy simulations and the main precondition for quality simulations is information about the size, characteristics and dynamics of fiscal multipliers. Fiscal multipliers are defined as multiplier of government spending and indirect tax multiplier. From the theoretical point of view, government spending multiplier should have stronger effect on national output or aggregate demand, even in case of balanced budget (Haavelmo, 1945). In this context, stabilization measures of fiscal policy should be more focused on the management of public expenditures rather than tax measures and regular changes of tax legislative.

Generally, empirical work on fiscal policy can be structured in several directions. First, in VAR literature four main identification approaches have been used: 1) narrative approach (Ramey & Shapiro, 1999), 2) calibrated elasticities (Blanchard & Perotti, 2002), 3) sign restrictions (Mountford & Uhlig, 2002 & 2009), 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 more advanced models which simulate fiscal shocks like 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).

The pioneers of the empirical research on the effects of fiscal policy in the framework of VAR methodology are Ramey and Shapiro (1999) including Edelberg et al. (1999). They have based their researches on the fiscal *dummy* variables associated with periods characterized by exogenous changes in the fiscal policy. This form of identification of VAR model was later called the narrative approach, and today narrative approach is still developing and is used in contemporary research (Romer & Romer, 2010).

The first paper in which SVAR model is used for the assessment of the effects of fiscal policy is Blanchard & Perotti (2002). Today, Blanchard-Perotti (2002) is a certain benchmark in the analyses of the effects of fiscal policy that uses SVAR methodology, which is also the case in this paper. In the identification of SVAR model Blanchard-Perotti (2002) use the information about the institutional elements of fiscal system, in that way setting restrictions on the automatic reactions of government revenues and expenditures to the economic activity. The analysis is conducted on quarterly data of the real net tax revenues, government spending and GDP of the United States from 1947 till 1997. Later Perotti (2005) extended the model by adding short-term interest rate and price levels. The author concludes that the positive shocks in the government spending have a positive effect on the economic activity, whereas positive tax shocks cause a negative effect. The estimated size of the multiplier is smaller than 1. In addition, the authors conclude that the consumption shocks and the increase of taxes have a negative impact on the private investment.

Regarding the relevant international literature, for good review of the literature and last theoretical and empirical results within the fiscal policy, see Sever et al. (2011), and for the trends and the international overview of the answers given to the crisis by the fiscal policy, see OECD (2009) and IMF (2008, 2009, 2010, 2011). The assessments of the size of fiscal multipliers, based on different methods and made for different countries, as well as a detailed review of the literature related to the assessments of the effects of fiscal policy are possible to find in Spilimbergo et al. (2009), Ramey (2011), while the detailed methodology using SVAR, that is SVEC model, is possible to review in Ilzetzki et al. (2011) and Caldara & Kamps (2012). The additional review of the papers which in the assessments of the effects of fiscal policy use (S)VAR methodology can be found in Hur (2007), Mirdala (2009), Baxa (2010), Mancelarri (2011) and Ravnik & Žilić (2011).

Furthermore, the literature review is firstly aimed at the domestic literature, especially the literature focused on the fiscal multipliers and that uses VAR methodology which is the primary methodology within this research. There are a

few papers in Croatia that use VAR methodology in the estimation of the effects of fiscal policy. Since different aspects of fiscal policy are used in the papers, in Table 1 there is a short review of the methodology and main results of the research.

Table 1: A review of the research on fiscal policy in Croatia using VAR and VEC methodology

Authors	Model	Frequency of data and period	Variables	Results
Benazić (2006)	VEC SVEC	Monthly 1995-2004	Revenue and expenditures of consolidated central government and GDP (interpolated)	Expenditures affect GDP growth in the first 10 months; revenues have a negative long-term effect on GDP
Šimović (2009)	VAR	Monthly 2004-2008	Tax revenue and industrial production	There is a reciprocal relation between taxation and economic growth.
Rukelj (2009)	SVEC	Monthly 1997-2008	Expenditures of central government, monetary aggregate M1, economic activity index	Effect of economic policy on economic activity has not proven to be clear enough in this paper to bring out a strong conclusion; results indicate that monetary and fiscal policy have a dominant effect on economic activity only in the short run while in the medium and long-run economic activity is dominated by its own dynamics (variance decomposition results)
Ravnik & Žilić (2011)	SVAR BP 2002	Monthly 2000-2009	Revenues and expenditures of central government, industrial production, inflation rate	Fiscal shocks have the greatest effect on the interest rate, and the weakest on the inflation rate. Shocks in the expenditures have a short-term negative effect on the industrial production, and tax shocks a positive one. Neither of results was significant.
Sever, Drezgić & Blažić (2011)	VAR	Monthly 2004-2011	GDP, different components of current government expenditure, capital expenditures (public investment)	Capital expenditure increases (short run and long run) and goods and services consumption increases (short run) have a positive effect on GDP. Subsidies increase GDP in the short run. Wages, current expenditures and subsidies decrease economic growth rate in the long run.

Authors	Model	Frequency of data and period	Variables	Results
Belullo & Dužman (2011)	VAR; Cointegration	Quarterly 2000-2010	GDP, revenues	Cointegration analysis indicates statistically significant stable long-run relationship between GDP and government revenues. Granger causality test results shows that GDP growth precedes the growth of tax revenues so it can be concluded that GDP has significant impact on the government revenue trends. On the other hand, in the Granger sense, budget revenues do not have impact on GDP trends.

Source: Authors

As it can be seen in Table 1, in the domestic literature it is possible to find only one paper Ravnik & Žilić (2011) that uses SVAR in the estimation of the effects of fiscal policy by applying Blanchard-Perotti (2002) method of identification. When it comes to the papers that estimate the fiscal multipliers in Croatia, not a single one has been found in the existing literature.

According to the fact that the subject of this paper is the impact of fiscal policy, it is necessary to mention a certain number of papers that analyze the connection between fiscal policy and economic activity, but do not use the VAR methodology. Sever (2005) analyses the effect of external debt to economic growth in Croatia by applying the regression analysis. Tkalec & Vizek (2011) by applying regression analysis as well, show that the fiscal policy has a significant impact on the manufacturing in Croatia, especially on the sectors with the low level of technology. Švaljek et al. (2009) estimates the size of a cyclically adjusted budget balance in Croatia, while Grdović Gnip (2011) in the similar way analyses the characteristics of the discretionary measures and automatic stabilizers. In both mentioned papers, the periods of expansionary and restrictive fiscal policy in Croatia are identified.

It is necessary to mention that most of the papers have been written at the beginning of the global financial crisis whose negative effects are still felt in Croatia. The stabilization function of fiscal policy has become the primary focus of research in Croatia, which was not the case before the crisis. On the contrary, the papers on fiscal policy in Croatia before the crisis indicated the exhaustion of the fiscal capacity, the necessity of intervention in the redistribution of income and the encouragement of economic growth and development through structural elements and stimulation of aggregate supply (Družić & Krtalić, 2006). In addition to already mentioned empirical papers, it is necessary to point out a notable number of papers

that analyze the role and possibilities of fiscal policy in Croatia during recession. Those papers warn about the restrictive (expansive) role of fiscal policy in Croatia caused by the restrictions in the amount of public and/or external debt (Mihaljek, 2009; Sopek, 2009). Afterwards, there are papers that warn about the absence of coordination of fiscal policy and other economic policies and necessity of forming more appropriate social relations as well as relocation of government spending by infrastructural and capital expenditures (Sever et al., 2009; Drezgić, 2010 and 2011).

3. Model specification and Blanchard-Perotti identification

Discretionary measures of the fiscal policy have always been and will remain a matter of discussion. Nevertheless, scientifically defined facts and internationally recognized trends should be a certain basis in the formation of the stabilization fiscal policy in Croatia. By analyzing the international literature one can easily conclude that VAR, that is, structural VAR (SVAR) model, has become a certain standard in the research of evaluation of the fiscal policy effects. The same conclusion applies when talking about the fiscal multipliers. For the estimation of size and duration of the effects of fiscal multiplier SVAR or structural VEC (SVEC) model is most often used, while utilizing different explanatory (government spending, government investments, public transfers, direct and indirect taxes) and variables of interest (personal spending, investments, interest rate, industrial production, GDP).

Unlike Blanchard-Perotti (2002), who conduct the analysis for USA and Perotti (2002) who analyses the larger OECD countries (Germany, Great Britain, Australia, Canada), there is a large variety of papers that use the mentioned methodology in the research of the effects of fiscal policy in transition countries.[3] Taking into account the particularities of Croatian economy, the model in this research is tested at the general government and central government level. Because of the high fiscal decentralization, Croatia realizes most of her tax revenues through the central government budget. As most of the budgetary central government budget expenses are spent for covering the current expenditures (pensions, health, wages in the public sector etc.), a larger amount of the capital expenditure is visible only through the consolidated central government level (mostly through public enterprises) and general government level (capital expenditures are mostly realized through the local budgets). These mentioned facts should have an influence on the size of the multiplier.

[3] For example, see Baxa (2010) for Czech Republic, Mirdala (2009) for several transition countries (Czech Republic, Hungary, Poland, the Slovak Republic, Bulgaria and Romania), Hur (2007) for Korea, Giordano et al. (2005) for Italy, Mancellari (2011) for Albania, Ravn & Spange (2012) for Danmark, De Castro & De Cos (2006) for Spain etc.

The first step in the analysis is the estimation of the reduced-form VAR model

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

that includes deflated, seasonally adjusted log values of indirect tax revenues (T_t), total expenditures of central/general government (G_t) and aggregate demand of the private sector (AD_t). Therefore, $X_t = [T_t, G_t, AD_t]$ is a vector of the variables of interest. The deterministic variables included in the model are constant (Ψ), time trend (T_t) and qualitative "crisis" *dummy* variable (D_t), which is assumed to be 1 from the beginning of the crisis (Q42008)[4] onwards. The vector $u_t = [t, g, ad]'$ is a reduced form innovation vector (RF), $u_t \sim (0, \Sigma_u)$.

The number of time lags is found to be 1, according to SIC and HQ criteria. Also, larger number of lags is not preferable because of the small time series. Moreover, regarding the data frequency, the choice of one time lag also has a basis in the economic intuition.

The information on RF innovations is given based on the estimated reduced-form model (1.1).The RF innovations are mutually correlated and represent a linear combination of structural innovations, which disables their precise economic interpretation (Bahovec & Erjavec, 2009). The linear combination of structural innovations (shocks) according to Blanchard-Perotti (2002) can be shown as

$$t_t = a_1 ad + \beta_2 e_t^G + \beta_1 e_t^T \quad (1.2)$$

$$g_t = b_1 ad_t + \beta_4 e_t^T + \beta_3 e_t^G \quad (1.3)$$

$$ad_t = c_1 t_t + c_2 g_t + \beta_5 e_t^{AD} \quad (1.4)$$

where e_t^t, e_t^g, e_t^{AD} represent the structural shocks of tax, government expenditures and aggregate demand.

[4] According to Quandt-Andrews structural break test.

The equations (1.2)-(1.4) can be written in a matrix form:

$$\begin{pmatrix} 1 & 0 & a_1 \\ 0 & 1 & b_1 \\ c_1 & c_2 & 1 \end{pmatrix} \begin{pmatrix} t_t \\ g_t \\ ad_t \end{pmatrix} = \begin{pmatrix} \beta_1 & \beta_2 & 0 \\ \beta_4 & \beta_3 & 0 \\ 0 & 0 & \beta_5 \end{pmatrix} \begin{pmatrix} e_t^T \\ e_t^G \\ e_t^{AD} \end{pmatrix} \tag{1.5}$$

which gives a form $Au_t = Be_t$ of SVAR model. In order for this system to be identified, it is necessary to set $2K^2 - K - \frac{1}{2}K(K + 1)$ restrictions that preferably have a basis in the economic theory. Since the number of endogenous variables is K=3, after the diagonal elements of matrix A are normalized, 9 additional restrictions need to be set. The baseline assumptions of the model (shown in the equations (1.2.)-(1.4.), implicate 6 of them. Therefore, 3 more restrictions need to be imposed.

In the process of identification, quarterly data frequencies are the most important. The reason for that is the assumption that the policy makers cannot react on the changes in the economic environment within one quarter. There are numerous information, administrative and procedural obstacles to the reaction of the economic policy in such a short period; the procedural obstacles within the parliament etc. So, the reaction of the fiscal variables to the changes in the economic activity can only be automatic, i.e. the reaction can only be an outcome in the activity of the automatic stabilizers. The mentioned fact enables the setting of restrictions in the model. The restrictions are based on the empirical estimation of the exogenous elasticities of the fiscal variables in comparison with the changes in the certain macroeconomic aggregates. Specifically, a_1 and b_1 parameters can be interpreted as (automatic) elasticities of the tax revenues and expenditures to the changes in the aggregate demand. The total calculated elasticity of indirect taxes to private AD equals to $a_1 = 1.05$[5].

Next, according to Blanchard-Perotti (2002), Ravnik and Žilić (2011), 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 makers that cannot react to changes in the economy instantaneously, i.e. in the first quarter after the "shock". However, Cladara (2011) warns about the "automatic" reaction of the government spending components (which are related to unemployment) to the business cycle. Taking into account

5 Because the variable of interest in our econometric model is private aggregate demand, it was necessary to calculate elasticity of indirect tax to that variable in order to obtain consistent results Elasticity was calculated using DOLS method on consolidated central government data, as in Sobel and Holcombe (1996). Since the analysis is based on a fairly short time series we use long term elasticity. The value of obtained elasticity is similar (between) to values of elasticities of indirect tax on private consumption, Ravnik and Žilić (2011) (0,89) and Švaljek et al (2009) (1,13).

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 it is also assumed 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 achieve a correctly identified system, it is essential to set one more restriction. The parameters β_2 and β_4 describe how the taxes react to the changes in the government spending, i.e. how government spending reacts to the changes in taxes. For the system to be identified it is necessary to assume that one of this parameters equals to 0, i.e. that only one variable effects the other. In this paper it is assumed that the tax revenues can react to the changes in the government spending, therefore $\beta_4 = 0$.

Regarding the mentioned restrictions, the final form of the SVAR model, is as follows:

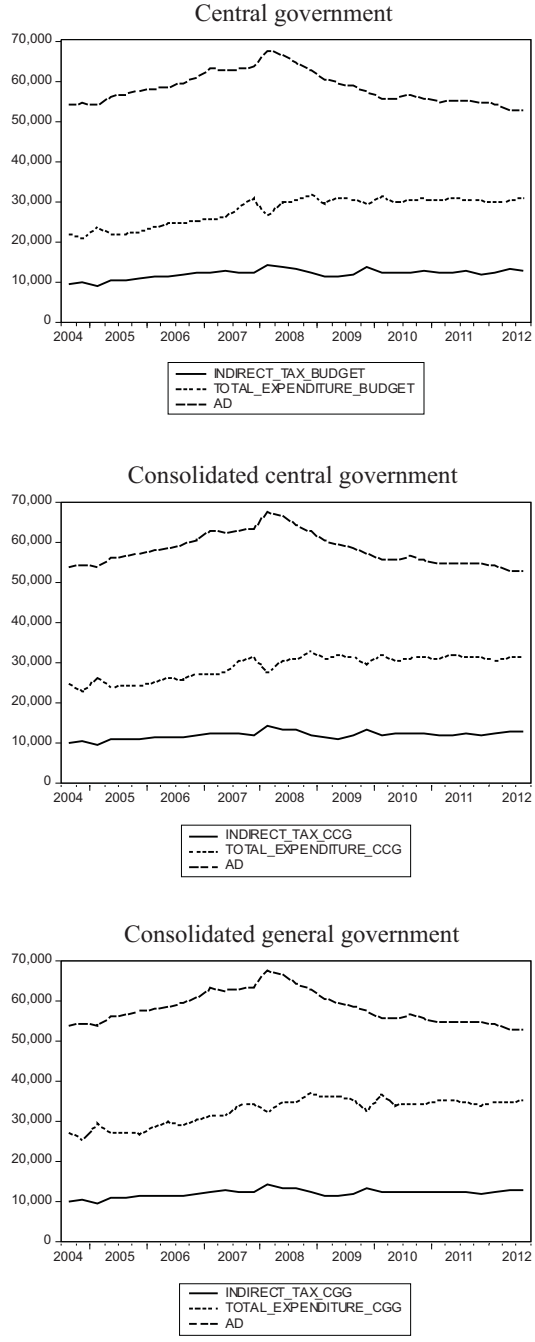
$$\begin{pmatrix} 1 & 0 & -1.05 \\ 0 & 1 & 0 \\ c_1 & c_2 & 1 \end{pmatrix} \begin{pmatrix} t_t \\ g_t \\ ad_t \end{pmatrix} = \begin{pmatrix} \beta_1 & \beta_2 & 0 \\ 0 & \beta_3 & 0 \\ 0 & 0 & \beta_5 \end{pmatrix} \begin{pmatrix} e_t^T \\ e_t^G \\ e_t^{AD} \end{pmatrix} \tag{1.6}$$

For the model (1.1), with different endogenous variables, adequacy and stability analysis was conducted. The results of the residual analysis (test of autocorrelation, normality test and heteroskedasticity test) and the stability test indicate that the model is appropriate and stable. After the estimation of the structural form of the model, the tests have been repeated (including the test for normality in residuals from the structural model). The repetition did not change the conclusions about the adequacy of the models. The results are available in the Appendix 1.

4. Data

The source for the data on indirect tax revenues and total expenditures (including non-financial assets transactions/public investment) is the Ministry of Finance. The time series of the consolidated central and general government on the web pages of the Ministry of Finance start from the year 2004 (after the change of the GFS methodology). Data of the components of the aggregate demand are taken from national accounts series, provided by the Croatian bureau of statistics. All the data are deflated by the implicit GDP deflator (AD) and CPI (fiscal variables) with 2005. as the base year. Seasonal adjustment has been performed using X-12 ARIMA, and variables are included in models in logarithmic form to obtain the results that can be recalculated in the fiscal multiplier form. Empirical analysis, stability and adequacy tests and seasonal adjustment were performed using statistical software Eviews 7.

Figure 1: Government expenditures, indirect taxes and private AD in Croatia 2004-2012 (mil HRK)



Source: Authors

Figure 1 shows movements of data that is used in our three models. It is important to notice several characteristics that could influence the results of our model: (i) there are structural breaks in all series at the end of year 2008, i.e. the beginning of recession in Croatia; (ii) there are numerous unexplainable outliers (spikes) in series of indirect taxes and government expenditures, (iii) Croatian economy has been faced with recession conditions for 48%; (iv) although one could conclude that some series are non-stationary, Zivot-Andrews unit root test[6] showed that all variables are stationary, at usual statistical significance levels, which is not surprising due to quite short time series (vi) dynamics of government expenditure and indirect tax revenues have very similar dynamics on all three levels of consolidation, while the difference in the values are mainly the result of net acquisition of non-financial assets.

Domestic aggregate demand of private sector is calculated as the sum of private consumption and gross fixed investment, as in Giordano et al. (2005). This indicator is providing the information on the impact of fiscal variables on the sector of the households and enterprises. Also it eliminates the possible correlation between fiscal shocks and GDP components related to public spending. Furthermore, the total GDP includes components such as inventories and the level of imports which the domestic fiscal shocks cannot directly affect. They are changing as a result of changes in personal consumption (or AD). Also, the mechanism of the instantaneous impact of fiscal spending shocks and indirect taxes on exports is not known in the economic literature. Also, domestic private AD (excluding imports and exports) is the logical choice for the analysis based on a closed-economy theoretical and empirical framework.

The indirect taxes are used in the analysis for three reasons: (i) as mentioned in the introduction, the aim of this paper is to analyze the effects of fiscal policy on aggregate demand. According to the theory, income tax and corporate tax are mostly affecting aggregate supply by influencing the behavior of workers and enterprises (Jurković, 2002: 260-263); (ii) SVAR models are much more suitable for the analysis of shocks to aggregate demand side (Ravn & Spange, 2012; Blanchard & Perotti, 2002). Because of the complexity of the mechanism of the impact of taxes on aggregate supply, their effects need to be evaluated in the broader methodological framework of DSGE models, (iii) household decisions on current spending can change in a relatively short time (within a quarter or two, except in the case of necessity products).

[6] We use Zivot-Andrews unit root test because it includes the effects of strucural breaks in observed series. Dickey Fuller test (and similary Phillips-Perron) has proved to be inadequate in determining the presence or absence of unit roots in time series characterized with structural breaks (for broad discussion see Glynn & Perera, 2007). The results of Zivot-Andrews test are shown in Appendix 2.

5. Results and discussion

In this section the results of impulse-response analysis are presented. Impulses were adjusted to present the size of fiscal multipliers as in Mountford and Uhlig (2002) and Hur (2007). Dynamic multipliers are presented in Appendix 3 and original series, due to extensiveness of results, can be provided on request. Fiscal shocks in IRF analysis represent an increase of "independent variable" by one standard deviation, so the elasticity of aggregate demand to each fiscal shock is defined as the ratio of the change of log AD (percentage increase) and the standard deviation of the sample of corresponding fiscal shock (rate of change). If the mentioned ratio is multiplied by the reciprocal value of the average share of each fiscal variable in aggregate demand then one can obtain the value of multiplier, according to the formula for elasticity (see Hur (2007); for mathematical derivation see Caldara (2011)).

Table 2: Fiscal multipliers in Croatia 2004q3-2012q3

Fiscal multipliers	Central government budget	Consolidated central government	Consolidated general government
Tax			
4 quarters	-0.636	-2.15	-1.32
8 quarters	2.61	-0.66	-0.81
Government expenditure			
4 quarters	0.82**	1.58**	2.18**
8 quarters	1.60	1.80**	1.91**
Tax			
High	-1.06 (q1)**	-1.11 (q1)	-0.82 (q2)
Low	-0.68 (q2)	-0.06 (q16)	-0.08 (q16)
Government ependiture			
High	0.98 (q2)**	1.20 (q2)**	1.39 (q2)**
Low	0.17 (q16)	0.19 (q16)	0.19 (q16)
Reversed sign			
Tax	q3-q16	-	-
Government expenditure	q1***	q1	-

Note: *within 95% confidence interval; **within 68% confidence interval
Source: Authors

As it can be seen in Table 2 our results confirm the main hypothesis of the paper about the difference in the size of fiscal multipliers between three levels of government consolidation[7]. As in standard literature, cumulative multipliers after

[7] Also see Appendix 2 for dynamic multiplier figures.

four and eight quarters following the (discretionary) unexpected shock in each fiscal variable are presented. The value of government spending multiplier (impact and cumulative) is largest at the consolidated general government level and smallest on the central budget level. Also, the impact of fiscal policy shocks on consolidated central and general government is statistically significant in longer period. It is important to notice that our results suggest some (theoretically) unexpected and statistically significant effects of government spending at the central government budget level, where the increase of government expenditure reduces private aggregate demand in the first quarter (the impact is positive form second quarter onwards). Negative effects of government spending are most commonly interpreted through Ricardian equivalence and public spending ineffectiveness hypothesis, but since this result is short-lived, one can conclude that these explanations are not plausible for our analysis.

On the other hand, tax multiplier is the largest on consolidated central government level, which is expected since most of the tax revenues in Croatia is collected at this level. But, confidence intervals show that the impact is not statistically significant. Only statistically significant result for tax effects shows that an increase in taxes for one unit (from the mean) reduces private aggregate demand in the first quarter by 1.06 units. Statistical insignificance of results could be explained by large standard errors in series of indirect tax revenues so it is important to emphasize the importance of the characteristics and quality of data for valid analysis. In further research it is important to try to evaluate the results after the adjustment of data for structural breaks with some of standard econometric techniques such as *dummy* variables[8]. Also, it is important to notice that our results suggest (contrary to theoretical assumptions) that increase in tax revenues on central government budget level results in growth of private aggregate demand for 13 quarters after the shock. Again, this result could be interpreted through the "confidence hypothesis" that states that in economies with relatively unstable public finance (such as Croatia[9]) tax increase could represent a signal of political will and attempt of policy makers to achieve prudential fiscal position. But, due to the fact that these results are not statistically significant there are no foundations for the discussion on the validity of this hypothesis.

It is worth noticing that recent research based on regime-switching models shows that the size and movement of fiscal multipliers are strongly influenced by the stage of the business cycle (eg Auerbach and Gorodnichenko, 2012), i.e. there are

[8] As it can be seen from the figures above, there are several other structural breaks in indirect tax revenues series, apart from the economic crisis from 2008q3, which was included in our model through "crisis" dummy variable.

[9] According to Jelenković & Mrsnik (2012) the main reasons for degradation of Croatian credit rating to the "speculative" category are high growth of public debt in recent years, general government deficit that does not meet Maastricht's criteria and high tax burden.

strong theoretical and empirical arguments that multipliers are higher in times of crisis. Since the Croatian economy has faced the crisis from 2008 to 2012 (correctly 48% of the analyzed period) these findings are very important for discussion of our results. Also, since Croatian economy is operating in the surrounding of some form of liquidity trap and growing (and persistent) unemployment it is no surprising (from the theoretical point of view) that government expenditure (especially one that contains public investment) have strong and positive effect on economic activity. But it should be noticed that the fiscal multiplier in economic literature is defined as the change in gross domestic product under the influence of selected fiscal variables, while in this study the effects of government revenue and expenditure on private aggregate demand are estimated, so it is important to observe the size of the fiscal multiplier in this context.

To analyze statistical significance of our results, 95% and 68% confidence interval are used. Although 95% interval is mostly used level of confidence in the economic literature, characteristics, quality and the length of time series give firm foundation for using a "less certain" confidence level. Also, according to Sims and Zha (1999) it is a good idea to make one-standard-error intervals the norm, as they are likely to be closer to relevant range of uncertainty because the use of high-probability intervals camouflages the occurrence of large errors of over-coverage. One standard error interval is often used in determining the significance of the effects of fiscal policy in SVAR framework (eg. Caldara (2011); Mountford and Uhlig (2002); de Castro and Garotte (2012)).

The quality of the estimated model and the robustness of the results are tested in several ways. Firstly, it is important to repeat that the tests of the adequacy and stability of the model are satisfied. In all estimated models there are no problems of autocorrelation, heteroskedasticity and non-normality of residuals. All the roots of the characteristic polynomial are inside the unit circle, which means that the model meets the basic criteria of stability. To check the robustness of the model, standard starting point is dividing analyzed series into two parts and estimating those models in each part separately. However, because of the very small time series, in this study the robustness has been tested by changes of the assumptions about elasticities. As already mentioned, the SVAR models are quite sensitive to assumptions about elasticity. Results of the model are also tested by changing the assumption about the parameter $b_1 = 0$ (inelastic government expenditure/spending on cycle) with an estimated elasticity of expenditures related to unemployment from Grdović Gnip (2011) $b_1 = -0.01$. This change does not affect the basic conclusions. Also, in the identification scheme of the model it is assumed that tax revenues respond to the changes in government spending and not *vice versa*, that is $\beta_4 = 0$. As in all studies which use the Blanchard-Perotti (2002) identification method, the assumption of the different direction of relation between those variables (i.e. $\beta_4 = 0$) does not change the basic conclusions of the model.

6. Conclusion

The results show that our hypothesis about the difference in the size of the multiplier of government expenditures and indirect tax revenues between three levels of government consolidation has been confirmed. The estimated values of multipliers correspond to results presented in the existing literature on the effects of fiscal policy in a closed economy framework. Although it is not possible to accurately determine the sources of these differences, it can be assumed that most of the differences are consequences of the greater use of capital expenditures, or public investments, on the consolidated level of central and general government level. This conclusion supports the findings of certain other studies that analyze the effect of individual components of government spending on economic growth in Croatia.

Regardless of the above-mentioned limitations, the results of this paper could be of great importance for domestic literature on fiscal policy. As it can be seen from public discussions, policy makers and economic agents in Croatia have great expectations from the government budget, which is mostly oriented on current expenditure. Our results present an empirical indication that the size of multiplier strongly depends on the structure of government expenditure. Government spending multiplier is the highest on general government level because it contains capital expenditures (public investment) from local authorities and certain public enterprises (extrabudgetary users), which were one of the main drivers of investment cycles in the observed period. So the main policy implication of this paper would be that to achieve greater effects of fiscal policy on economic activity in Croatia, it is necessary to change the structure of government expenditures in the direction of the increase in public investment. Also, as was mentioned, in this paper the first estimation of the size of fiscal multipliers in Croatia is presented in hope that future policy discussions will be more grounded on empirical findings. But it is important to notice that the results should be interpreted and analyzed with a dose of caution, due to the certain methodological issues. Time series data for revenues and expenditures of the consolidated general government restricts the analysis to only 33 observations. With three variables of interest and three exogenous variables (constant, trend and dummy variable) it represents a significant limitation in the context of OLS and the CLT assumptions so it should be emphasized that obtained results are only indicative.

To conclude, as already mentioned, stabilization function of fiscal policy is very important in time of economic recessions, especially in a small open economy with a managed exchange rate such as Croatia. So it is necessary to further explore the possibilities and limitations of fiscal policy measures in "macroeconomic management" of Croatian economy. The relevance of such studies is even greater in the context of the accession to EU, because monetary sovereignty and the possibilities of monetary policy will be further reduced. The model presented in

this paper should be expanded in further research. It can be expanded by variables which will simulate the effects of important structural features of the Croatian economy, such as the openness of economy, exchange rate regime, the degree of indebtedness (public and external debt), capital market development, investor perception etc. However, the length of the time series and the comparability and quality of data will continue to be one of the major limitations in the analysis of the effects of fiscal policy in Croatia. Our goal is to continue this research using the assumptions about different characteristics of open economies, but on a larger sample of countries in order to avoid problems associated with the characteristics of fiscal data in Croatia.

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Dinamički učinci fiskalne politike i fiskalni multiplikatori u Hrvatskoj

Hrvoje Šimović[1], *Milan Deskar-Škrbić*[2]

Sažetak

Cilj ovog rada je analizirati učinke diskrecijskih mjera fiskalne politike na gospodarsku aktivnost privatnog sektora te procijeniti veličinu fiskalnih multiplikatora u Hrvatskoj. U radu se koristi strukturni VAR model (SVAR) za čiju se identifikaciju koristi Blanchard-Perotti metoda utemeljena na institucionalnim obilježjima fiskalnog sustava. Analiza se provodi nad kvartalnim podacima o ukupnim rashodima i indirektnim porezima središnje, središnje konsolidirane i opće konsolidirane države te agregatnoj potražnji za razdoblje od 2004.-2012. godine. Rezultati empirijske analize potvrđuju našu polaznu hipotezu da postoji razlika u veličini multiplikatora na različitim razinama konsolidacije državnog proračuna.

Ključne riječi: *fiskalna politika, fiskalni multiplikatori, SVAR, Hrvatska*

JEL klasifikacija: *E62, H20, H50*

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Appendix 1: Model adequacy tests*

* CGB – central government budget model; CCG – consolidated central government model; CGG – consolidated general government model

VAR Stability condition check		
Roots of characteristic polynomial		
CGB	CCG	CGG
0.914337	0.912873	0.909077
0.389635	0.329116	0.329774
-0.25174	-0.24191	-0.23705

Source: Authors

VAR Residul heteroskedasticity white test (Prob)		
CGB	CCG	CGG
0.1635	0.337	0.3275

VAR Residual normality tests (Jaque-Bera, Prob)		
CGB	CCG	CGG
0.2623	0.3409	0.7187

Source: Authors

	VAR Residual corelation LM Test (Prob)		
	CGB	CCG	CGG
1	0.2285	0.1628	0.1432
2	0.5023	0.5392	0.4276
3	0.434	0.2817	0.5712
4	0.9727	0.9881	0.9489
5	0.0619	0.0823	0.3051
6	0.6915	0.1893	0.5305
7	0.4997	0.5487	0.2497
8	0.171	0.1649	0.2071
9	0.5362	0.3281	0.1171
10	0.2025	0.1617	0.0648
11	0.2195	0.1566	0.1229
12	0.5567	0.4558	0.4456
13	0.6257	0.5196	0.3258
14	0.8485	0.8721	0.8073
15	0.2685	0.2842	0.2495
16	0.0907	0.0935	0.0722

Source: Authors

Appendix 2: Zivot-Andrews unit root test (with structural breaks)

Lag length: AIC

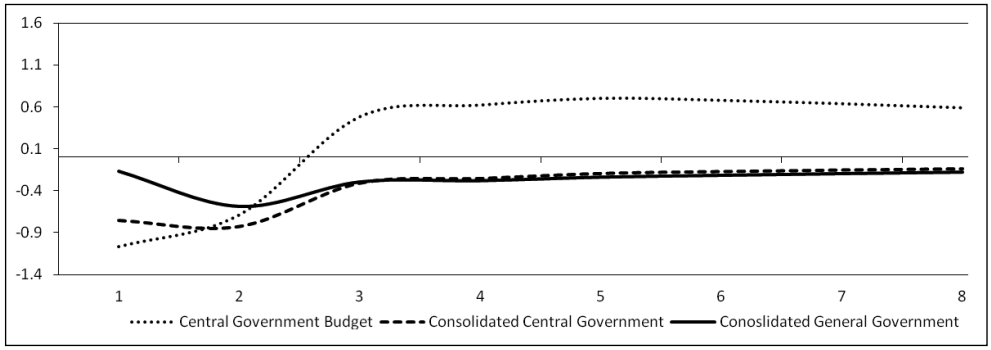
Null hypothesis: Variable has a unit root with a structural break in constant and trend

Variable	T-statistic	Critical values	
Aggregate Demand	-4.903174	1% critical value	-5.57
		5% critical value	-5.08
		10 % critical value	-4.82
Government expenditures			
Central government budget	-4.878717	1% critical value	-5.57
		5% critical value	-5.08
		10 % critical value	-4.82
Consolidated central government	-4.82677	1% critical value	-5.57
		5% critical value	-5.08
		10 % critical value	-4.82
Consolidated general government	-4.990508	1% critical value	-5.57
		5% critical value	-5.08
		10 % critical value	-4.82
Indirect taxes			
Central government budget	-5.730752	1% critical value	-5.57
		5% critical value	-5.08
		10 % critical value	-4.82
Consolidated central government	-5.947307	1% critical value	-5.57
		5% critical value	-5.08
		10 % critical value	-4.82
Consolidated general government	-5.860505	1% critical value	-5.57
		5% critical value	-5.08
		10 % critical value	-4.82

Source: Authors

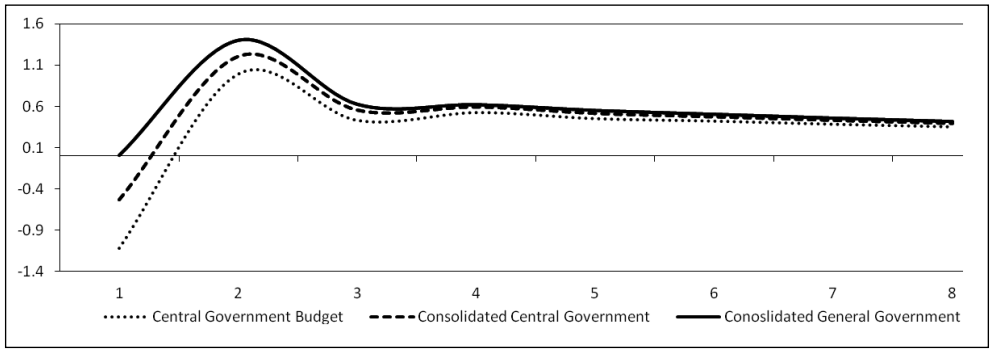
Appendix 3: Dynamic multipliers

Reaction of domestic aggregate demand to one unit shock in indirect taxes



Source: Authors

Reaction of domestic aggregate demand to one unit shock in expenditures



Source: Authors