3. EMPIRICAL ASSESSMENT OF STABILIZATION EFFECTS OF FISCAL POLICY IN CROATIA[1]

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Abstract

The aim of this paper is to assess the stabilization effects of fiscal policy in Croatia in a structural vector auto regression framework as proposed by Blanchard and Perotti (2002). Results prove that the fiscal transmission mechanism in Croatia works mainly in a Keynesian manner. Output reacts negatively to a tax shock and positively to government spending shock. The output multiplier is above 2 at impact and the effect is significant through the whole time span. The negative effect of the tax shock is mostly driven by indirect (not direct) taxes. The positive effect of government spending is more pronounced when government investment is considered, especially when private consumption and private investment responses are observed.

Keywords: fiscal multiplier, spending shock, tax shock, SVAR, Croatia
JEL Classification: C32; E62; H30

1. Introduction

Fiscal policy has been in center of debates in economic circles since decades, even more in periods of economic downturn (during the 1980s or recently in the 2010s), focusing merely on the role of expansionary fiscal policy in stimulating economic growth. Such a debate goes mainly around one question: *what is the transmission of fiscal shocks?*

Empirical research of fiscal policy effects has not shown an absolute consensus on the effects of fiscal policy on the macroeconomics. Even theoretical literature suggests diverging positions with respect to the general effectiveness of fiscal policy (and fiscal stimuli packages at the end). Real business cycle models for instance predict that an increase in government consumption will be completely offset by the decrease in

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private consumption, while Keynesian models assume that the same increase will lead to an increase in private. Moreover, Pappa (2003, 2) points that fiscal shocks are difficult to identify in practice due to the *"endogeneity of fiscal variables, interactions between fiscal and monetary policy variables, delays between planning, approval and implementation of fiscal policies and scarceness of reasonable zero-identifying restrictions"*.

However, empirical results agree on one fact only, i.e. that *a positive government spending shock has a positive effect on output*. The effects of a tax shock on output as well as effects of expenditure and tax shocks on other macroeconomic variables (GDP components, employment, interest rate, inflation) provide contradictory evidence[3]. Blanchard and Perotti (2002) find evidence of Keynesian predictions in a case of a positive government expenditure shock, as well as a negative tax shock, both exerting a positive and significant effect on output and private consumption. Nevertheless, they find that investment reacts negatively to the expenditure shock, which is in line with neoclassical models. Kirchner, Cimadomo and Hauptmeier (2010) show that in the Euro area the reaction of investment to an expenditure shock is positive and significant: a 1% GDP increase in expenditure raises investment by 1.6% GDP. Perotti (2004) shows that the effects of fiscal policy on economic activity in five OECD countries (US, Canada, Australia, Germany and UK) have the propensity to be small and substantially weaker over time. Furthermore, in the case of European countries, Marcellino (2002) finds heterogeneous responses to fiscal shocks in France, Germany, Italy and Spain, but concludes that expenditure shocks are usually rather ineffective in boosting the economy and that tax shocks have minor effects on output. Similarly, Heppke-Falk, Tenhofen and Wolff (2006), de Castro and de Cos, (2008) and Biau and Girard (2005) evidence that a tax shock does not significantly affect output in Germany, Spain and France, respectively.

There are quite few studies that try to assess stabilization effects of fiscal policy in the emerging economies. Baxa (2010) shows that the Czech economy behaves in line with Keynesian assumptions, because the government expenditures positively affect the economic activity. Still, Baxa (2010, 27) finds that government tax shock exercises a *"very uncertain, very to zero, but most probably rather negative"* effect on output. Oppositely, by analyzing fiscal policy shocks in a group of six European transition economies (the Czech Republic, Hungary, Poland, the Slovak Republic, Bulgaria and Romania) Mirdala (2009) finds that output increases after a tax shock in the Czech Republic. The same is evidenced for Hungary, the Slovak Republic, Bulgaria and Romania. Jemec, Strojan Kastelec and Delakorda (2011) show that in Slovenia a 1% GDP increase in government revenue makes output fall by 0.38%, but the negative effect is evidenced only in the first quarter after the shock. Furthermore, they find that

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[3] *Although the latter can be attributed in some extent to different variables, sample periods, dummies and trend, Caldara and Kamps (2008) prove that different methodologies applied to the same dataset lead to conflicting conclusions for responses of GDP components on a fiscal shock. Moreover, even when estimated responses to fiscal shocks are of the same sign and direction, the estimated magnitude and duration can quite differ. However, the most widely applied method in assessing responses to fiscal policy shocks is the Blanchard and Perotti SVAR, based on the assumption that fiscal variables do not react contemporaneously to changes in economic conditions.*

the reaction of private consumption and investment to a tax shock is negative (being 0.05% of the GDP and 0.35% of the GDP, respectively), while an expenditure shock positively affects both components (evidence show an increase by 1.1% of the GDP and 1.6% of the GDP, respectively).

Responses to fiscal shocks on the Croatian case are studied in Ravnik and Žilić (2011) and Šimović and Deskar-Škrbić (2013). Based on a monthly data span 2001M1 to 2009M12, Ravnik and Žilić (2011) conclude that the strongest response after both fiscal shocks has the interest rate, while the lowest the price level. Moreover, non-commonly, they show that the response of output (proxied by industrial production) is positive after a tax shock and negative after a spending shock, concluding that on one hand industrial production may not be a good proxy variable for output, and on the other hand that maybe the crowding out effect predominates the output effect. On the other hand, Šimović and Deskar-Škrbić (2013) show that output reacts strongly and positively to spending shocks (being the multipliers 2.18 at the consolidated general government level and 0.82 at the central government level), while a negative response is evidenced after a tax shock.

Although this research employs the same SVAR method there are *two main novelties* with respect to Ravnik and Žilić (2011) and Šimović and Deskar-Škrbić (2013): *(i) except the effects of fiscal shocks on output, prices and interest rates, the analysis embraces also the response of GDP components (private consumption and private investment), and (ii) the investigation also includes effects of different government expenditure and revenue components on the macroeconomic variables.* The main motivation of the paper in investigating the aforementioned comes from the need of a deeper discussion of the transmission mechanism of fiscal policy in Croatia for policy makers and academics. Croatia, like other countries, opted for several fiscal discretionary measures during the latest economic crisis in order to *ad hoc* achieve fiscal consolidation. Still, no previous research investigated the possible effects of such measures on the private consumption and the private investment, and thus did not take into account the possible outcomes in a medium and long run. Being that the fact, the restrictive tax measures (introduction of new taxes, increment of tax rates, narrowing the tax base, etc.) enforced during recessionary times might have been the driving force why Croatia is experiencing one of the longest recessionary periods amid the EU countries. Moreover, this research with respect to the aforementioned has a different data frequency and longer time span, making the estimates more suitable and reliable.

Main results are in line with the Keynesian theory. A spending shock positively affects output, private consumption and private investment and the response is significant. Moreover, when investigating the effect of government consumption versus government investment, the positive effect of both with respect to output and output components are significant. A tax shock leads to a drop in output, private consumption and private investment. Interesting is the fact that output responds negatively on impact after a shock in direct taxes, but the negative effect lasts only for a quarter, being afterwards positive and significant for two years. Oppositely, the negative effect of indirect taxes on output is more persistent and lasts for three years. This is in line with the expectations because, among others, indirect taxes make more than 70% of the total tax receipts (social security contributions excluded) in Croatia.

This paper is structured as follow: section two explains the methodology and data, while section three presents the results. The fourth section underlines concluding remarks and gives policy recommendation.

2. Methodology and Data

2.1. Data Description and VAR Setup

The empirical analysis of the impact of fiscal policy on macroeconomic variables in this study is based on a structural vector auto regression (SVAR) approach, particularly on the methodology proposed by Blanchard and Perotti (2002), which is considered the pioneering paper for the fiscal policy SVAR analysis. Blanchard and Perotti (2002) argue that governments cannot react within the same quarter to the changes in macroeconomic setting mainly because fiscal policy decisions involve many agents (parliament, government and society) and, therefore, need a long period of time for implementation. All fiscal policy events that do not reflect automatic responses are seen as structural fiscal policy shocks. The latter are unaffected by the macroeconomic variables in the VAR model, because discretionary fiscal policy shocks are analyzed using fiscal policy decision lags.

This paper uses a quarterly dataset from 1996Q1 to 2011Q4 for output (Y_t), government spending (G_t), government revenue (R_t - also referred to as taxes or net taxes in the rest of the paper), prices (π_t) and interest rates (r_t) in the 5 variable baseline SVAR model. Fiscal variables are defined as in the Blanchard and Perotti (2002) setup, i.e. both net of transfers, but at the consolidated central government level[4]. The price level is measured by the Consumer Price Index, while the interest rate is represented by the short term interest rate on the interbank demand deposit trading. All variables, except the interest rate, are in logarithms, while output and fiscal variables are additionally seasonally adjusted using the ARIMA X12 algorithm. Moreover, all variables are in real terms, they are CPI deflated, 2000 = 100.

Unit root tests find conclusive evidence that only the interest rate variable is stationary in levels at the 1% significance level, while the other variables present unit roots in levels, according to the Augmented Dickey Fuller (ADF) test. Moreover, the results show the presence of co-integrating relations and a possible specification of a vector error correction model, but as noted by Heppke-Falk, Tenhofen and Wolff (2006, 12), when estimating models that have many disaggregated time series it is difficult to find

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[4] *It is common empirical practice to analyze fiscal policy of a country using general government data. Still, this paper (as many others that examine fiscal policy in Croatia (Benazić, 2006; Rukelj, 2009; Grdović Gnip, 2011; Ravnik and Žilić, 2011)) bases the research on consolidated central government data. It is important to point out that quarterly fiscal data for Croatia at the general government level are not available for the period 1995-2004. Nevertheless, such a limitation should not pose significant differences amid results of fiscal policy effects in the Croatian case, principally for two reasons: (1) discretionary decisions are carried by the consolidated central government, and (2) the share of local governments' budgets in the general budget is on average less than 10% and embrace only 53 local units (20 regions, 32 cities plus the City of Zagreb, out of 555 cities and counties in total).*

economically interpretable cointegration vectors[5]. Moreover, Blanchard and Perotti (2002) find no significant differences between results obtained with and without taking the cointegration relation into account.

Although the system is stationary in first differences, the analysis is done using variable in levels, because the focus of the analysis is on the dynamics (i.e. impulse responses), not the coefficient estimation[6]. To choose the appropriate lag length the judgment is based on information criteria results, the length of the sample and economic sense. The AIC criterion suggests two lags, while the BIC and HQC indicate one lag as optimal. This analysis will allow for dynamic interaction up to two lags as suggested by the Akaike criterion.

As previously mentioned, five variables enter the baseline model setup and their order is of particular importance, since it defines the relationship structure amid innovations. It is common empirical practice to order variables according to the timeline of their occurrence. This analysis orders the variables as in Caldara and Kamps (2008), i.e. government spending is ordered first, followed by output, prices, net taxes and interest rate[7].

The reduced form VAR model can be written as:

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

where: Y_t is vector of endogenous variables, $C(L)$ is a $n \times n$ autoregressive lag polynomial matrix and U_t is a vector of reduced form residuals[8].

The errors from a VAR in its reduced form are expected to be i.i.d., but correlated across equations. Perotti (2005) asserts that innovations in the fiscal variables u_t^g and u_t^r can be thought as a linear combination of three types of structural shocks, i.e. of (1) the *automatic* responses of government expenditure and revenue to real output, inflation and interest rate, (2) the *systematic discretionary* response of government expenditure and revenue to the same macroeconomic variables and (3) the *random discretionary* fiscal policy shocks. Since a u_t^j shock contains information about the other shocks of the system, it is not possible to isolate a shock of just one of the variables. Thus, to be able to isolate the shocks in focus, i.e. the fiscal shocks, there is a need of structure on the VAR. This structure is obtained by defining the contemporaneous effects (those that occur in lag=0) of variables among each other. If reduced form residuals U_t are written as a linear combination of structural shocks V_t then the structural VAR can be written as:

$$AY_t = AC(L)Y_{t-1} + BV_t \qquad (2)$$

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[5] *Due to the limited space these results are not reported here, but are available upon request.*

[6] *This is common empirical practice. Studies that estimate a SVAR in levels no matter of the stationarity in first differences are Perotti (2002), Heppke-Falk, Tenhofen and Wolff (2006), de Castro and de Cos (2006), Jemec, Strojan-Kastelec and Delakorda (2011), Ravnik and Žilić (2011).*

[7] *Refer to Caldara and Kamps (2008, 13) for a detailed discussion about the mentioned ordering.*

[8] *Reduced form residuals U_t are a linear combination of different structural innovations and therefore have no economic interpretation.*

To make the system just identified, 35 restrictions should be imposed[9]. The matrix representation of the mentioned system is the following:

$$\begin{bmatrix} 1 & -\alpha_y^g & -\alpha_\pi^g & -\alpha_r^g & -\alpha_i^g \\ -\alpha_g^y & 1 & -\alpha_\pi^y & -\alpha_r^y & -\alpha_i^y \\ -\alpha_g^\pi & -\alpha_y^\pi & 1 & -\alpha_r^\pi & -\alpha_i^\pi \\ -\alpha_g^r & -\alpha_y^r & -\alpha_\pi^r & 1 & -\alpha_i^r \\ -\alpha_g^i & -\alpha_y^i & -\alpha_\pi^i & -\alpha_r^i & 1 \end{bmatrix} \begin{bmatrix} u_t^g \\ u_t^y \\ u_t^\pi \\ u_t^r \\ u_t^i \end{bmatrix} = \begin{bmatrix} \beta_g^g & 0 & 0 & \beta_r^g & 0 \\ 0 & \beta_y^y & 0 & 0 & 0 \\ 0 & 0 & \beta_\pi^\pi & 0 & 0 \\ \beta_g^r & 0 & 0 & \beta_r^r & 0 \\ 0 & 0 & 0 & 0 & \beta_i^i \end{bmatrix} \begin{bmatrix} v_t^g \\ v_t^y \\ v_t^\pi \\ v_t^r \\ v_t^i \end{bmatrix} \qquad (3)$$

The imposed restrictions include the following: (i) values across the main diagonal of matrix A are set to one, which makes five restrictions; (ii) matrix B contains 18 elements set to zero, which makes additional 18 restrictions; (iii) in the equation explaining reduced innovation in government spending α_y^g, α_r^g and α_i^g are set to zero because it is assumed that government spending is solely under the control of fiscal authority, while the impact of inflation α_π^g is assumed to be -0.5, as in Perotti (2002) among others; all these make additional four restrictions; (iv) the assumption that the short term interest rate innovation does not influence the other reduced innovations makes α_i^y, α_i^π and α_i^r zero; the reduced form innovation of output is not affected by the innovation of inflation, so α_π^y is also set to zero; all these add four restrictions; (v) the impact of the innovation of output and prices on the innovation of taxes, i.e. α_y^r and α_π^r respectively, are estimated exogenously (see further in this section) which makes two addition restrictions; (vi) the remaining two restrictions depend on how the relationship between two fiscal variables are modeled. The impact of government spending on taxes is modeled through the B matrix, so α_g^r is set to zero, and assuming that government spending decisions come first it means setting β_r^g to zero, which gives the last two needed restrictions.

The *random discretionary* fiscal policy shocks are actually of main interest and represent underlying structural shocks used to study the response of macroeconomic variables. Thus, to explain the relationship between fiscal variables, let us focus on the equations showing the reduced form innovations of government spending and revenues:

$$u_t^g = \alpha_y^g u_t^y + \alpha_\pi^g u_t^\pi + \alpha_i^g u_t^i + \beta_r^g v_t^r + v_t^g \qquad (4)$$

$$u_t^r = \alpha_y^r u_t^y + \alpha_\pi^r u_t^\pi + \alpha_i^r u_t^i + \beta_g^r v_t^g + v_t^r \qquad (5)$$

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[9] *The system needs* $2n^2 - \left(\dfrac{n^2 - n}{2} + n \right)$ *restrictions, where n is the number of endogenous variables.*

where: v_t^g and v_t^r represent structural shocks to government spending and revenue, respectively. The α_i^j coefficients capture the automatic responses of macroeconomic variables to a government spending and revenue shock under the existing fiscal policy rules, as well as any discretionary adjustment of fiscal policy in response to unexpected movements in the macroeconomic environment. The β_i^j coefficients express how the structural shock to government spending and revenue affects the revenue or spending, respectively.

Since the reduced form residuals are correlated with pure structural shocks v_t^g and v_t^r, in order to correctly identify the shocks *exogenous elasticities* are used to compute cyclically adjusted reduced form fiscal policy shocks:

$$u_t^{g,CA} = u_t^g - (\alpha_y^g u_t^y + \alpha_\pi^g u_t^\pi + \alpha_i^g u_t^i) = \beta_r^g v_t^r + v_t^g \tag{6}$$

$$u_t^{r,CA} = u_t^r - (\alpha_y^r u_t^y + \alpha_\pi^r u_t^\pi + \alpha_i^r u_t^i) = \beta_g^r v_t^g + v_t^r. \tag{7}$$

Next, it is necessary to make a *decision with respect to the relative ordering of the fiscal variables*. Assuming that tax decisions come first, it means setting β_g^r equal to zero, while oppositely, assuming that expenditure decisions represent government priority number one it means setting β_r^g equal to zero.

Although Perotti (2002) points out that neither of the alternatives of priority has any theoretical or empirical basis, most of the works as well as Blanchard and Perotti (2002) and this research test both assumptions to see whether the ordering makes difference to the impulse responses.

Assuming that a government tends to decide on expenditure first, it means that:

$$u_t^{g,CA} = v_t^g \text{ and} \tag{8}$$

$$u_t^{r,CA} = \beta_g^r v_t^g + v_t^r, \tag{9}$$

where: β_e^r is estimated by OLS to retrieve the structural shocks to the fiscal variables.

Other reduced form residuals' equations are estimated recursively using instrumental variables regressions, in order to account for the correlation of the respective regressors and error terms. Since the cyclically adjusted variables are orthogonal, they are used as instruments (Blanchard and Perotti, 2002)[10].

2.2. Exogenous Elasticities

The exogenous elasticities of a budgetary item with respect to output are obtained as product of the elasticity of the budgetary item to its macroeconomic base and the elasticity of this base with respect to output. If the elasticity of a budgetary item is

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[10] *Since Blanchard and Perotti (2002) base their seminal work on a three variable VAR, cyclically adjusted fiscal variables are used as instruments only. Nevertheless in a five variable VAR, there is more then one equation to be estimated using the IV method, therefore obtained structural shocks are used as instruments as well (Perotti, 2005; Heppke-Falk, Tehnhofen and Wolff, 2006; Giordano, Momigliano, Neri and Perotti, 2007; among others).*

constructed as an average value of two or more sub-components' elasticities, then their respective shares in the budgetary item's volume are used as weights[11]. The tax elasticity to output is:

$$\alpha_y^r = \sum_{i=1}^{n} \alpha_{B_i}^{\tau_i} \cdot \alpha_y^{B_i} \cdot \frac{T_i}{T}.$$

(10)

Table 1 shows the elasticities of different budget components to output and prices. It is important to note that the overall total tax elasticity is 0.93, but since the fiscal variable regarding government revenues used in the analysis is constructed following the Blanchard and Perotti (2002) assumptions, i.e. net of transfers, it is corrected by the elasticity of unemployment related expenditures to output weighted by the share of this expenditure in total government expenditure[12].

Calculating the elasticity of taxes with respect to prices means adjusting equation (11) for the elasticity of the macroeconomic base with respect to prices, i.e. $\alpha_\pi^{B_i}$ instead of $\alpha_y^{B_i}$. The results indicate that the price elasticity of taxes (α_π^r) is 0.73, which again it does not deviate from the results obtained by other studies in this field.

Table 1

Exogectnous Elasticities with Respect to Output and Prices

	w.r.t. real output	w.r.t. prices
Budgetary item	α_y^r	α_π^r
Net taxes	0.92	0.73
Direct taxes	0.53	-0.32
Indirect taxes	1.36	1.90
Government expenditure	0	-0.5
Current expenditure	0	-1
Capital expenditure	0	-1
Public wages expenditure	0	0
Public purchases expenditure	0	-1

Note: For details on sub-components elasticities, see Appendix C; the price elasticity of total government expenditure and its components is set as in Perotti (2002). Source: Perotti (2002) and author's calculation.

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[11] *Details on each tax item's elasticity to its macroeconomic base, as well as the elasticity of the latter with respect to output or prices are available upon request.*

[12] *Following Grdović Gnip (2011), the output elasticity of unemployment related expenditures is -0.58, and these expenditures amount to 0.85% of total consolidated central government expenditures, which allows for a -0.01 correction of the total tax elasticity, to obtain the output elasticity of net taxes.*

Same as in Heppke-Falk, Tenhofen and Wolff (2006), among others, this study assumes that expenditures do not respond to output within a quarter because they are predetermined in a budgetary plan and, therefore, not elastic in the short run[13].

2.3. Fiscal Policy Effects in Alternative Models

In order to assess the stabilization effects of fiscal policy on different GDP components (private consumption and private investment) and labor market, as well as effects of different spending and tax components the re-estimation of (4) is done by extending the SVAR into a six variable model, as follows:

a. In order to examine the effects of fiscal shocks on the GDP components (private consumption and private investment) the vector of endogenous variables Y_t is extended, being yet $\begin{bmatrix} g_t & y_t & z_t & \pi_t & r_t & i_t \end{bmatrix}$' where z_t corresponds to the (in turn) added variable, i.e. private consumption or private investment. This order follows the suggestion by Caldara and Kamps (2008), as in the case of the baseline model and the mentioned assumptions (see Footnote (7)). To recall, placing private consumption or private investment at the third place means it does not react contemporaneously to prices, taxes and interest rates shocks, but is contemporaneously affected by government spending and output shocks. Yet, the equations showing reduced form innovations of fiscal variables are:

$$u_t^g = \alpha_y^g u_t^y + \alpha_z^g u_t^z + \alpha_\pi^g u_t^\pi + \alpha_i^g u_t^i + \beta_r^g v_t^r + v_t^g \quad \text{and} \tag{17}$$

$$u_t^r = \alpha_y^r u_t^y + \alpha_z^r u_t^z + \alpha_\pi^r u_t^\pi + \alpha_i^r u_t^i + \beta_g^r v_t^g + v_t^r \tag{18}$$

where: α_z^g and α_z^r represent the elasticity with respect to the GDP component (private consumption or private investment) of government spending and taxes respectively, while u_t^z are the reduced form innovations of the GDP component under analysis. In order to fully identify the SVAR the mentioned two elasticities have to be estimated. Recalling the assumption that government spending are solely under the control of fiscal authority, in the equation explaining reduced innovation in government spending all elasticities (except the price elasticity) are again set to zero. Therefore, the spending elasticity with respect to private consumption and private investment is zero. On the other hand, the tax elasticities with respect to private consumption and private investment have to be estimated. Following the same procedure as in case of previous exogenous elasticity estimation, the elasticity of (total) taxes with respect to private consumption and private investment results to be 0.84 and 0.49, respectively.

b. Since different government spending components can affect economic activity in a different manner, the effects of government consumption and government investment shocks on the macroeconomic environment in Croatia are inspected.

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[13] However, worth noting is that some recent studies challenge this assumption. Among others, Rodden and Wibbles (2010) find evidence of spending elasticity with respect to output at the state and local level in the US being 0.17. But, this work (as well as others in this field) is based on annual data, so it is reasonable to assume that such a pro-cyclicality vanishes in quarterly frequencies.

To do so, total government spending g_t is replaced in the six-variable model in turn by government consumption or government investment. Therefore, the vector of endogenous variables Y_t is now $\begin{bmatrix} g_t^j & y_t & z_t & \pi_t & r_t & i_t \end{bmatrix}'$, with g_t^j being a spending component. Government consumption is defined as in Heppke-Falk, Tenhofen and Wolff (2006), i.e. the sum of personnel and operating budget expenditure, while government investment corresponds to capital spending.

c. Following a similar rationale as ad b., the vector of endogenous variables in case of investigating the effects of tax shocks by component is $Y_t = \begin{bmatrix} g_t & y_t & z_t & \pi_t & r_t^j & i_t \end{bmatrix}'$, being r_t^j a tax component, i.e. direct taxes or indirect taxes. In order to correctly define the fiscal equation, the exogenous elasticities in case of different tax components with respect to output and prices were already presented in Table 1 of this paper. Since it is important to inspect different tax components effect on the GDP components as well, the elasticities of direct and indirect taxes with respect to private consumption and private investment were estimated. In line with the previously explained methodology, the elasticity of direct taxes with respect to private consumption and private investment results to be in Croatia 0.23 and 0.29, respectively. On the other hand, the elasticities of indirect taxes with respect to private consumption and private investment are 1.53 and 0.7, respectively.

3. Results

This section presents the impulse response functions and multipliers derived from the baseline model, as well as the extended models. According to the level specification, structural shocks are interpreted as one percentage point increase in the policy variables, while impulse responses represent the percent change in the responding variable. The path is shown for a horizon of 20 quarters, i.e. five years. Moreover, the 95% percentile confidence intervals coverages are shown, obtained from 100 bootstraps of the impulse response distribution[14].
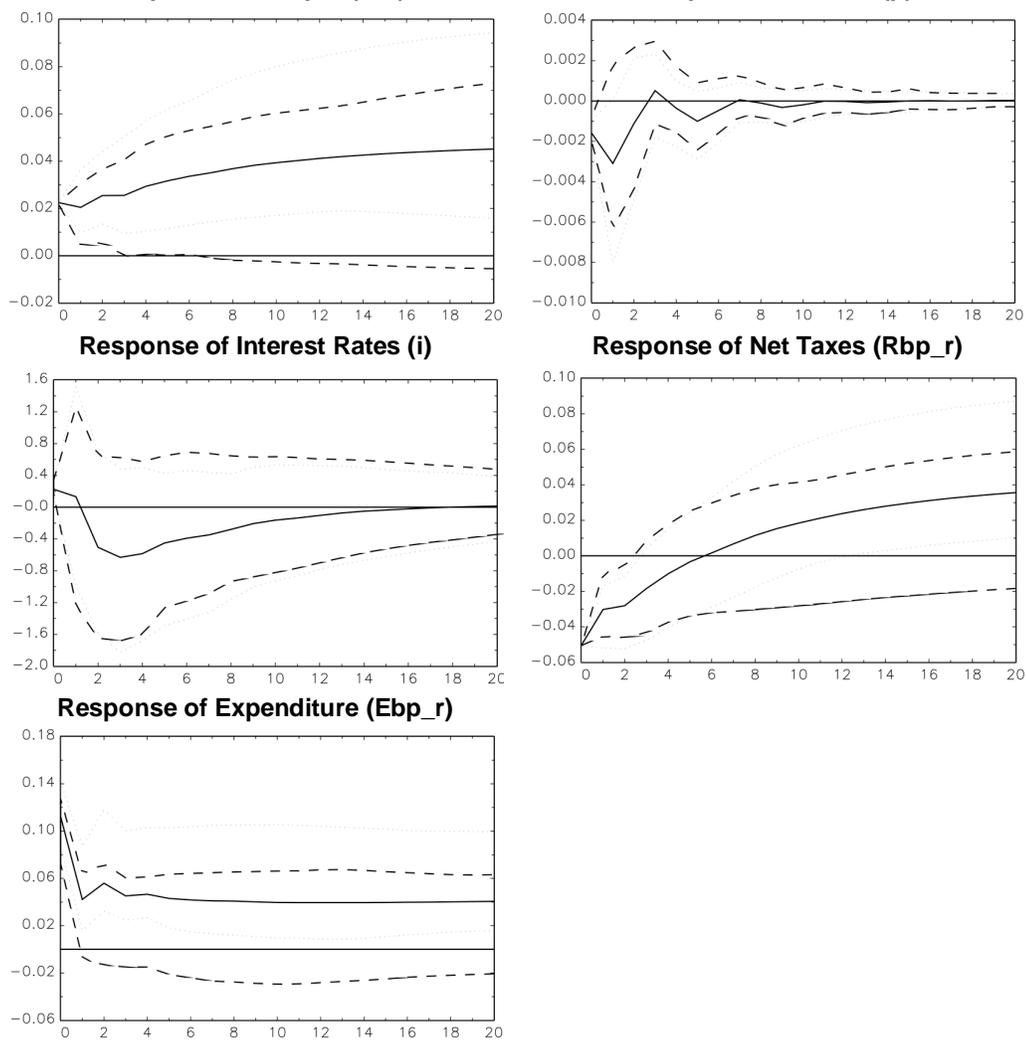
3.1. The Baseline Model

It is possible to notice that output responds positively to a government spending shock and the positive impact is significant throughout the whole time horizon (Figure 1). A long term positive effect is also evidenced in Blanchard and Perotti (2002), Perotti (2004) and Fatas and Mihov (2001), who show that in the case of the US the government spending positively affects output for more than five years[15].

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[14] *Confidence intervals are obtained using the Hall (dashed lines) and Efron (dotted lines) Bootstrap available in the JMulTi package, which was used along with Gretl software throughout the estimations in this paper.*

[15] *In case of other developed countries the positive impact is more of short and/or medium term. Refer to Perotti (2004), Marcellino, (2002), Biau and Girard (2005) and Giordano et al. (2007), among others.*

Figure 1.

Impulse Responses to an Increase in Government Spending (Baseline Model)

Response of Output (Y_r)   **Response of Prices (p)**

Response of Interest Rates (i)   **Response of Net Taxes (Rbp_r)**

Response of Expenditure (Ebp_r)

Source: Author's estimation.

Although not of typical hump-shape, the response of output results to be similar to the same in developing countries. Mirdala (2009) shows that, after the initial positive impact, output starts to increase gradually in Romania, the Slovak Republic, Poland and Hungary, and its effects vanish only in the long term. The cumulative output

multiplier in Croatia is above one unit in all presented periods, being the highest at impact[16] (Table 2).

Table 2

Cumulative Output Multipliers to Government Spending Shocks

Shock to:	Quarters			
	4th	8th	12th	16th
Government spending	2.45	1.79	1.49	1.33

Source: Author's estimation.

If the given multipliers are compared to those obtained by Šimović and Deskar-Škrbić (2013) for the same (consolidated central) government level, then it is possible to observe that in the first year their multiplier is by almost one percentage point lower (being 1.58), while the one corresponding for the first two years is almost the same (being 1.80 in their case). The difference that occurs in the short-run may be due to two things mainly: (1) a shorter time span in Šimović and Deskar-Škrbić (2013) and (2) a "smaller" VAR model, which embraces three variables only.

The negative response of price after the same spending shock is minimal and vanishes in two years. Empirical evidence does not find conclusive results here although theoretically one would expect an increase in the price level after a government spending shock either at impact or for a longer time period. Still, among developing countries evidence show a predominant, at least initially, positive effect[17], while in the case of developed countries the results are various[18].

A spending shock positively affects interest rates only at impact, while afterwards the response is negative throughout the whole period, as in Caldara and Kamps (2006) or Mancellari (2011). Keynesian theory suggests that an increase in interest rates is due to an increase in income. Moreover, Barro (1987) argues that, when the increase in government spending is taken as permanent the increase in output will be realized without increasing interest rates.

If innovations in taxes are considered, the response of output after a tax shock is negative over the whole time horizon of five years (Figure 2). Important to notice is that it shows to be permanent, not temporary, and, moreover, as in the case of a spending shock, the response is significant throughout the whole time horizon. If this is looked through the lenses of other empirical studies it maybe concluded that Croatia is closer to the average results of the developed rather than the developing countries, where one can find more evidence of a positive response of output initially or for a
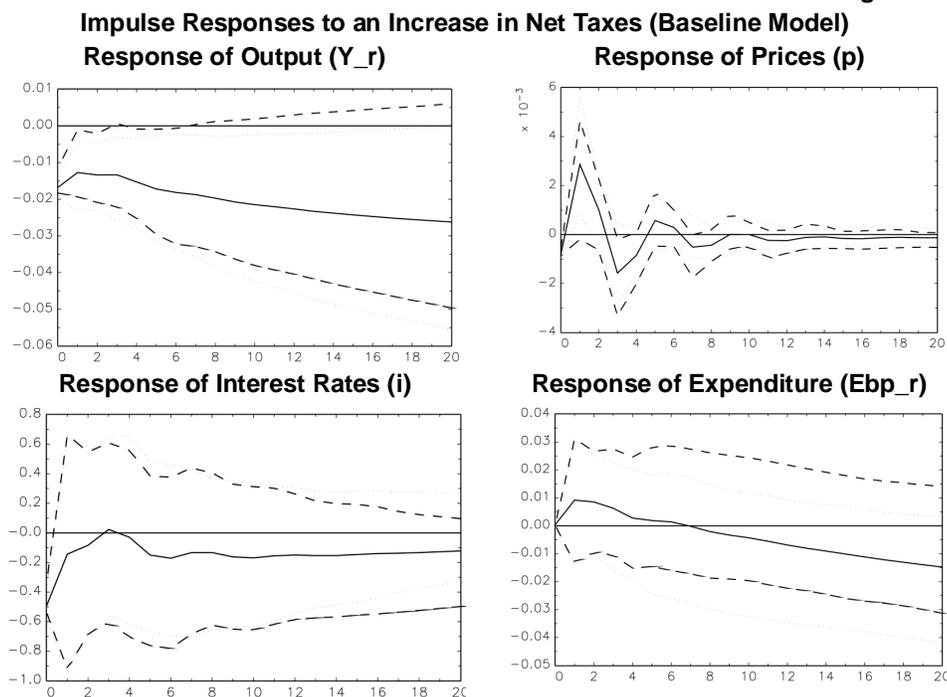
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[16] *The cumulative output multiplier in a given quarter is calculated as the ratio between the cumulative response of output and the cumulative response of government expenditure after the government spending shock.*

[17] *Mirdala (2009) shows that prices react positively after a spending shock in the Czech Republic, Hungary, Poland, the Slovak Republic, Bulgaria and Romania, vanishing in the latter only in the long run.*

[18] *Similar to the results of this study, Fatas and Mihov (2001), Mountford and Uhlig (2002) and Caldara and Kamps (2006) evidence that prices react negatively throughout the whole time horizon.*

longer time horizon[19]. Moreover, the response of taxes after a tax shock confirms the hypothesis of permanent change.

Figure 2.

Impulse Responses to an Increase in Net Taxes (Baseline Model)

Response of Output (Y_r)	**Response of Prices (p)**

Response of Interest Rates (i)	**Response of Expenditure (Ebp_r)**

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[19] *In the case of the US, Blanchard and Perotti (2002), Perotti (2004) and Mountford and Uhlig (2002) show that the negative response of economic activity lasts for more than five years. Empirical evidence based on German data does not provide such unanimous results (Perotti, 2004; Marcellino, 2002; Heppke-Falk, Tenhofen and Wolff, 2006), while in the case of Spain, France and Italy output response to a revenue shock is insignificant, being negative in the first two cases and positive in case of Italy (de Castro and de Cos, 2008; Biau and Girard, 2005; and Giordano et al., 2005; respectively). On the other hand, Mirdala (2009) shows that after a tax shock output increases in the Czech Republic, Hungary, Poland, the Slovak Republic, Bulgaria and Romania, being positive throughout the whole time horizon in all cases, except for Poland. Same is evidenced for Albania (Mancellari, 2011), while in Colombia the positive response vanishes after two years.*

Figure 2.(cont.)

Impulse Responses to an Increase in Net Taxes (Baseline Model)
Response of Net Taxes (Rbp_r)
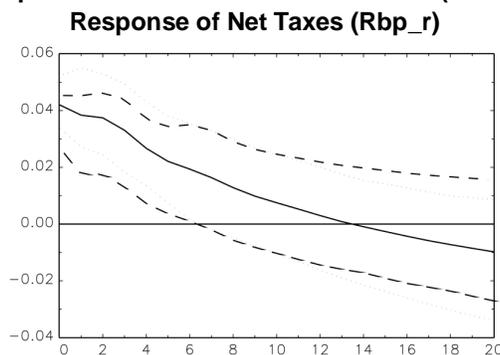
Source: Author's estimation.

If tax multipliers are considered, then it is possible to conclude that its size on impact is very similar to the same obtained by a spending increase, but of opposite direction (Table 3). Moreover, the effect is highly comparable to Šimović and Deskar-Škrbić (2013, 67).

Table 3

Cumulative Output Multipliers to Tax Shocks

Shock to:	Quarters			
	4th	8th	12th	16th
Taxes	-2.35	-1.66	-1.17	-0.81

Source: Author's estimation.

The response of prices to a tax shock is positive the first two quarters and then volatile around zero. Similar evidence can be found among other studies. The effect of a revenue shock on prices in the US is initially positive and then turns negative. According to Perotti (2004) inflation is evidenced only in the first quarter, while Mountford and Uhlig (2002) prove that it lasts for the first four quarters. Oppositely, the same effect in Germany is negative according to Perotti (2004), while Marcellino (2002) partly disagrees stating that the effect turns negative after being initially positive during the first year. Moreover, Giordano et al. (2005) find the effects on inflation very small and insignificant in the case of Italy. In Poland, the Slovak Republic and Bulgaria a tax shock increases inflation, while in the Czech Republic, Hungary and Romania it decreases the rate of inflation (with different intensity and durability in both cases) (Mirdala, 2009, 11).

A tax shock exercises a negative and insignificant response of the interest rate in Croatia. A negative response of the interest rate on a tax shock is also evidenced in the case of Hungary, Poland, the Slovak Republic and Bulgaria and remains permanent throughout the whole time horizon (Mirdala, 2009). Additionally, the effects

on interest rates in Croatia showed to be insignificant after a tax shock, same as in Germany (Heppke-Falk, Tenhofen and Wolff, 2006), while in Spain the interest rates tend to increase persistently (de Castro and de Cos, 2008).

3.1.1. Robustness Check

The robustness of the baseline results was checked by means of four alternatives: (1) Changing the values for α_y^r and α_π^r, i.e. using different elasticities of taxes with respect to output and prices. In this case, the elasticities obtained by Ravnik and Žilić (2011) are used to estimate the model and extract the impulse response functions. (2) Changing the value of α_π^g, i.e. the price elasticity of government spending. It has been mentioned earlier that the price elasticity of spending is set to be -0.5 following Perotti (2002). Still, this elasticity ranges from -1 to 0, so both the extreme cases of α_π^g are tested. (3) Assuming that a government tends to decide on taxes first, i.e. defining that β_g^r=0. (4) Using a first order lag polynomial as suggested by Schwarz and Hannan-Quinn.

In none of the four cases the results do change substantially. The pattern of response remains the same. Moreover, since the response of prices and interest rates is small and/or insignificant, a simple three variable SVAR including government spending, output and net taxes (as in the seminal paper of Blanchard and Perotti, 2002) is also run, in order to check whether the responses of output move in the same direction after a fiscal shock. Indeed, results are similar and the responses are significant in cases of both confidence intervals bootstrapping method. Furthermore, nothing changes if the observed time period is shortened, starting from first quarter 2000[20].

3.2. Alternative Models

Government spending increases lead to a positive effect in private consumption and private investment, with a slightly different development throughout the time horizon (Figure 3). Interesting is the fact that the effects are significant in the short run and result to be permanent.

Fatas and Mihov (2001), Blanchard and Perotti (2002) and Caldara and Kamps (2006) outline that a positive government spending shock in the US increases the private consumption significantly. In the case of Germany and Spain, the private consumption increases initially after the expenditure shock, falling subsequently to levels below the initial one (Heppke-Falk, Tenhofen and Wolff, 2006; and de Castro and de Cos, 2008, respectively). Giordano *et al.* (2007) and Biau and Girard (2005) find that the response of private consumption to an expenditure shock in Italy and France is hump-shaped, i.e. after the initial stimulation the effect decreases progressively in the medium term. Still, Kirchner, Cimadomo and Hauptmeiere (2010) find evidence that in the Euro Area

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[20] *The reasoning behind this decision is supported by the fact that the Croatian Bureau of Statistics started to publish a quarterly GDP estimation in 2000 (quarter by quarter). The quarterly GDP/output data prior to year 2000 are results of an a posteriori estimation done also by Mikulić and Lovrinčević (2000), which is commonly and widely used in empirical studies on the Croatian case.*

the reaction of private consumption is positive and significant. A 1% GDP increase in expenditure raises private consumption by 1.1% of the GDP.
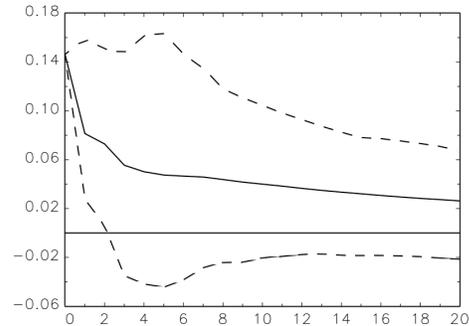
Responses to an Increase in Government Spending (Alternative Model)

Response of Private Consumption (C_r) **Response of Private Investment (I_r)**
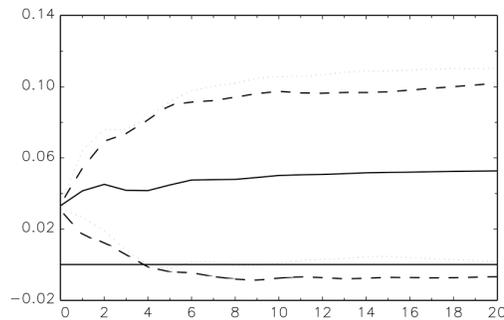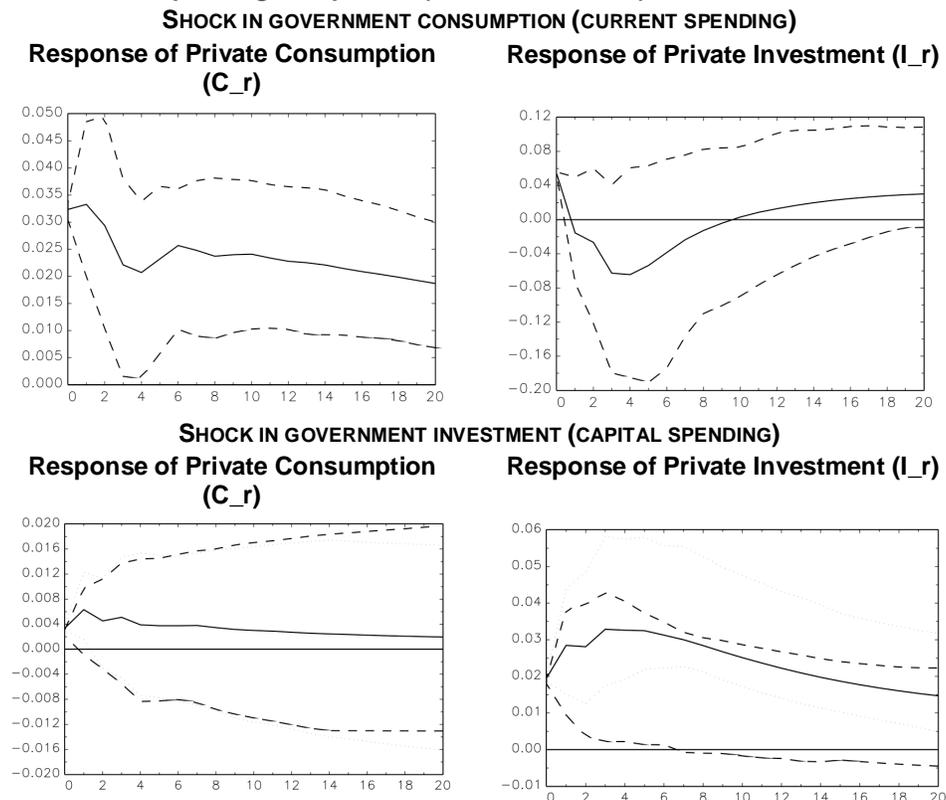

Source: Author's estimation.

Although both responses are persistent, the positive response of private investment to a spending shock is higher (in terms of units of measurement) throughout the whole time horizon. Kirchner, Cimadomo and Hauptmeiere (2010) find evidence that in the Euro Area the reaction of investment to an expenditure shock is positive and significant. A 1% GDP increase in expenditure raises investment by 1.6% of the GDP. Oppositely, Fatas and Mihov (2001) show that investment does not react significantly in the US to the increases in government spending. Similarly, in Spain investment does not appear too persistent to a government expenditure shock (De Castro and de Cos, 2008), while in Italy the impact is evidenced in the fourth quarter at about 0.2 percentage points of the GDP (Giordano *et al.*, 2007).

Private consumption reacts in a Keynesian manner after a government spending shock; still the effect is not the same when the spending shock occurs due to increase in government consumption or due to government investment (Figure 4).

Responses of Private Consumption and Private Investment to an Increase in Government Spending Component (Alternative Model)

SHOCK IN GOVERNMENT CONSUMPTION (CURRENT SPENDING)

Response of Private Consumption (C_r)

Response of Private Investment (I_r)

SHOCK IN GOVERNMENT INVESTMENT (CAPITAL SPENDING)

Response of Private Consumption (C_r)

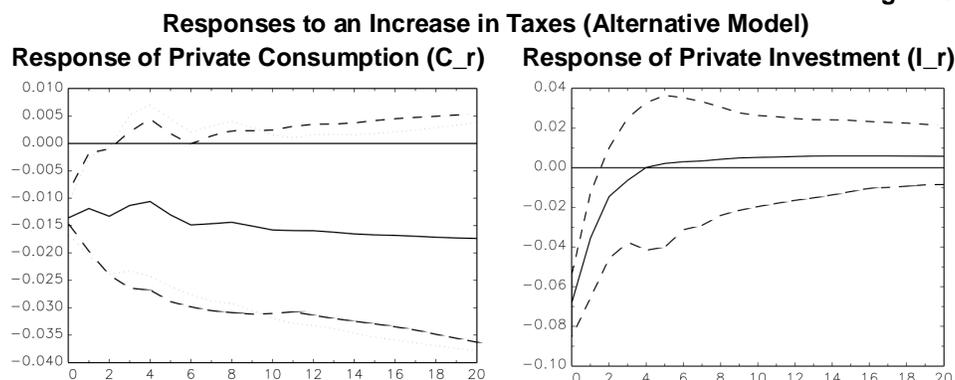**Response of Private Investment (I_r)**

Source: Author's estimation.

Both (government consumption and investment) shocks increase the private consumption, but the effect after a government consumption shock is significant, permanent and larger throughout the whole period (Figure 4). On the other hand, the response of private investment is larger, significant and permanent after a government investment shock. Similarly, Heppke-Falk, Tenhofen and Wolff (2006) find that in Germany after a government investment shock the private investment increases[21,22].

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[21] *Moreover, in this case Heppke-Falk, Tenhofen and Wolff (2006) find that output reaction is weak and insignificant in the case of a government consumption shock, being strong, significant and persistent in the case of a government investment shock.*

[22] *It is important to point that, no matter of the GDP component included in the model and of the spending component under analysis, the effect on prices and interest rates results to be insignificant and of similar pattern as in the baseline model. A government consumption shock makes prices fluctuate around zero (after an initial positive impact) and stabilize after a year,*

When investigating tax shocks on private consumption and private investment it is noticeable that the effect on impact is negative in both cases, but with a different development afterwards (Figure 5).

Responses to an Increase in Taxes (Alternative Model)

Response of Private Consumption (C_r)   **Response of Private Investment (I_r)**

Source: Author's estimation.

After a tax shock private consumption drops and remains permanent and negative throughout the whole time horizon. On the other hand, the effect of the same shock on investment is much larger, but it stabilizes after the first year. Blanchard and Perotti (2002) reveal that both the increases in taxes and the increases in government spending have a strong negative effect on investment spending in the US. Moreover, the response of investment after a tax shock is insignificant in Germany and Spain (Heppke-Falk, Tenhofen and Wolff, 2006; and de Castro and de Cos, 2008; respectively).

In the Croatian case, it can be concluded that results go in favor of the Keynesian assumptions, because, on one hand, a spending shock affects the private consumption positively, and, on the other hand, the response of private investment to a spending shock is opposite of its response to a tax shock.
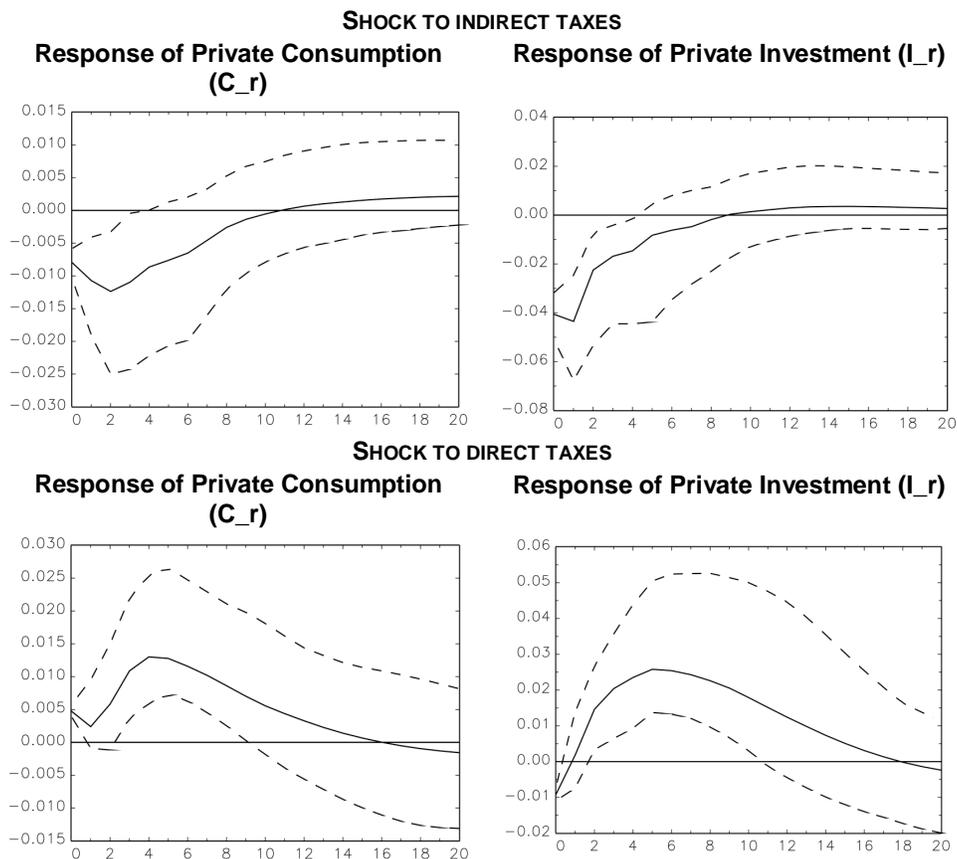
Recalling that the baseline model results showed that a tax shock negatively affects output, it is yet possible to inspect whether the negative effect comes more from direct or indirect taxes. The results are in line with the expectations, since one would expect that, due to its high share in total taxes, indirect taxes category mainly affects economic activity.

Results show that an indirect tax shock negatively affects private consumption for three years, when the effect stabilizes around zero (Figure 6). Private investment also reacts negatively after an indirect tax shock, but the effect fades out after two years.

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while the effect on interest rates is negative and permanent. A government investment shock exercises a small and negative effect on prices and a positive and permanent effect on interest rates, the latter being expected in accordance to the increase in output.

**Responses of Private Consumption and Private Investment to an
Increase in Indirect and Direct Taxes (Alternative Model)**

SHOCK TO INDIRECT TAXES

**Response of Private Consumption
(C_r)**

Response of Private Investment (I_r)

SHOCK TO DIRECT TAXES

**Response of Private Consumption
(C_r)**

Response of Private Investment (I_r)

Source: Author's estimation.

The response of output components to a tax shock is a bit "odd" in the Croatian case. An increase in direct taxes leads to an increase in private consumption (although the magnitude of the effect is really small) and to a decrease in private investment at impact only. This may be also due to several reasons. On the one hand, the methodological limitations may influence the results, since a SVAR model implies time-invariant elasticities. In the case of direct taxes, in the Croatian case this may be a problem due to the fact that, since its introduction in 1994, the personal and corporate income tax legislations are characterized by frequent changes (more than forty in the case of personal income tax only). Although the elasticity estimation procedure embraces all those changes, it ends up as a one-number only, which cannot effectively represent the whole time span under analysis. Indirectly, these odd

results may be attributed to the problem of "shadow economy" in the Croatian case. Namely, an increase in the personal income taxes reduces employers' incentives to hire new persons. Since decades, Croatia registers a substantial gap between the registered and the LFS unemployment rate, meaning that a substantial number of persons registered as unemployed operates on the labor market. This share of individuals gets paid, and thus consumes (keep in mind that the direct tax revenues do not capture labor market outcomes). A further research extended for the labor market outcomes is needed in order to deeply investigate the propagation of direct tax shocks[23].

4. Policy Recommendations and Conclusion

This paper assesses the stabilization effects of fiscal policy in Croatia in the period 1996-2011 using the structural vector auto regression model proposed by Blanchard and Perotti (2002). The results show that output moves in line with the Keynesian assumptions, i.e. it increases after a government spending shock and decreases after a tax shock. The impact multiplier is above 2 in both cases, but being positive when the government uses spending- and negative when using a tax-increase. Moreover the effects on output are permanent and significant in a long term. When extending the model for an additional macroeconomic variable, among others it is worth mentioning the following results: (a) private consumption and private investment follow the same responses as output after a government shock, (b) government consumption shock leads to a significant increase in private consumption, while government investment exercise an even more important effect on private investment, (c) a drop in output and private consumption after a tax shock is mainly driven by indirect (not direct) taxes.

If considering the mentioned results through the lenses of the recent crisis that affected the economic activity of all countries across the globe, there are several relevant points. In order to achieve fiscal consolidation, the Croatian governments during the last five years mainly opted for discretionary measures on the tax side of the budget, i.e. increment of the VAT standard rate twice, several increments of excise duties, introduction of the so-called "crisis tax" levied on net wages, and reduction of the personal income tax base in all three tax brackets. The spending side of the budget grew more or less according to constant rates and was left intact, since the governments were confident that increased revenues would cover eventual deficits. Having in mind the shown results, that an increase in taxes leads to a drop in output (being the multiplier larger than 2) and that an increase in indirect taxes, as Croatian major revenue spring, leads to a significant decrease in private consumption and investment, the effectiveness of the taken discretionary measures as stabilizing tool are under question. Although this will be possible to investigate empirically, once the crisis period ends and the data become available, it is already noted that Croatia, among the EU countries, registers the longest recessionary period. Moreover, the

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[23] *This paper does not go into detail regarding this respect mainly because of the availability of labor market data for the given (1996Q1-2011Q4) time span. Reducing the time span would seriously lower the power of tests in a 6 variable SVAR.*

assigned excessive deficit procedure proves that taken were a leading force in creating a so-called fiscal cliff. Additionally, a drop in output resulted to a huge drop in employment, giving additional headaches to the Croatian government, since it implies even higher spending and lower revenue collection.

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