UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

ANA GRDOVIĆ GNIP

ESSAYS IN FISCAL POLICY

DOCTORAL DISSERTATION

Ljubljana, 2014

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The undersigned Ana Grdović Gnip a student at the University of Ljubljana, Faculty of Economics, (hereafter: FELU), declare that I am the author of the doctoral dissertation entitled *Essays in fiscal policy*, written under supervision of professor Igor Masten, Ph.D.

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"Ingratus est qui beneficium accepisse se negat, quod accepit;
ingratus est, qui dissimulat;
ingratior qui non reddit;
ingratissimus omnium, qui oblitus est."

– Seneca, *De Beneficiis*

ESSAYS IN FISCAL POLICY
SUMMARY

Increases in government spending and reduction in taxes can boost private spending of households and firms during economic downturns keeping output and employment at a higher level. Such an idea of fiscal policy as a tool in dampening business cycle downturns dates back to the Great Depression of the 1930s and since then is the cornerstone in the discussions about short-term economic policy. Especially in the 1960s and 1970s these discussion came down to the principal debate about the effectiveness between monetary *versus* fiscal policy. Although evidence from that period are of limited help for today's policymakers due to changes in economic environment and methodological deficiencies of that time (Kretzmer, 1992), the monetary versus fiscal policy debate has been enlightening and *"various ins and outs of the discussion have served valuably to enhance knowledge and awareness"* (McCallum, 1986, p. 24).

However, a large portion of controversies in the fiscal policy domain is today still present. Differently from monetary policy, there is no consensus about fiscal policy effects and different theories foretell different outcomes. This fact along with fiscal policy lags have been over the decades the main *cons* of fiscal policy as a powerful tool in stabilizing the economy. Still, history shows that countries are prone to resort to fiscal policy to stabilize the economy especially in cases of severe economic downturn. The recent 2008-09/10 crisis reopened (again) the debate on the (in)effectiveness of automatic stabilizers and thus the need for stimuli packages.

This doctoral dissertation is a collection of four essays in the field of fiscal policy. The main goal of the dissertation is to extend the existing empirical research on automatic stabilizers and discretionary measures on the case of a small developing (transition) economy such as Croatia and investigate the effects of fiscal policy actions under *normal*, *good* and *bad* economic times. Moreover, this dissertation puts forwards some of the challenging questions regarding the EMU Stability and Growth Pact (SGP) fiscal rule, inspecting its usefulness and appropriateness.

After the introduction given in Chapter 1, Chapter 2 investigates the behaviour of the cyclical and structural component of the budget in Croatia using the official European Commission approach. Results show that in the 1995-2009 period the cyclical and cyclically adjusted budget balance were both on average in deficit. When considering the size of the cyclical component, under a level of uncertainty, it may be concluded that automatic stabilizers are not so strong in Croatia. This may be due to the fact that they may be constraint by the combination of low tax elasticities and a relatively low share of taxes in GDP. Additionally, the role of expenditure stabilizers may be small because of the weak and insufficient formal unemployment and social security compensation schemes. When considering the cyclically adjusted budget balance as a measure

of discretionary fiscal policy it may be concluded that substantial *discretionarism* is evidenced in Croatia in the observed period. Often, the actual budget balance deficit was largely due to the structural rather than cyclical component, meaning that the Croatian government lacked fiscal discipline. Moreover, pro-cyclical fiscal policy is evidenced in several periods.

Chapter 3 explores the effects of discretionary fiscal policy on a set of macroeconomic variables in Croatia in the 1995-2011 period using the structural vector autoregression model. Results show Keynesian effects of government spending increases or tax cuts on output, being the impact multiplier above 2 in both cases, but of different sign. Moreover, private consumption and private investment also react positively after a government spending shock, but the effect is even more pronounced and significant after a government investment shock. If tax cuts are considered then it is possible to conclude that a positive effect on output and private consumption is mainly due to a tax cut in indirect taxes.

Since empirical evidence goes in favor of the fact that discretionary actions are more effective and significant in *bad* economic times (Auerbach and Gorodnichenko, 2012; Batini et al., 2012, among others), Chapter 4 extends the stabilizing effects of fiscal policy in Croatia by distinguish fiscal multipliers during recessionary and expansionary times. In doing so, the smooth transition vector autoregression model is applied within the direct projection method, focussing merely on government spending increases (rather than tax cuts) as fiscal stimuli measures. Results show that multipliers in expansionary times are generally statistically insignificant, while in recessionary times they show to be statistically significant and much larger (than when they are evaluated within a linear framework). When investigating the possible government spending *trilemma* between spending for purchases of goods and services, for wages or for capital goods, it is possible to note that in times of economic downturn in Croatia the effects after the increase in the first are most advantageous.

Given the fact that fiscal rules can dampen the role of automatic stabilizers, Chapter 5 discusses the functionality of the cyclically adjusted budget balance and the SGP fiscal rule. To do so a DSGE model calibrated on the example of a fiscally stable country (Austria) is used. Results show that there is a low correlation between the cyclical component estimated according to the official European Commission (EC) methodology and the same retrieved from the DSGE model. Moreover, there is a substantial disagreement among official and model-based estimates of the fiscal policy stance as well as timing of violation of the SGP structural deficit rule. Above that, in more than half of the cases when both deficit fiscal rules (Maastricht and SGP) are violated, the official methodology signals a deterioration in the structural balance, while the model-based measure indicates it is due to the cyclical slump of the economy.

Keywords: fiscal policy, automatic stabilizers, discretionary measures, fiscal stimuli packages, stabilization effects, Stability and Growth Pact, cyclically adjusted budget balance, SVAR, STVAR, DSGE.

ESEJI IZ FISKALNE POLITIKE
POVZETEK

Povečanje državne potrošnje ter znižanje davkov lahko v času recesije poveča potrošnjo gospodinjstev in podjetij ter s tem ohrani ustvarjeni proizvod in zaposlenost na višji ravni. Takšna ideja o fiskalni politiki kot orodju, ki blaži recesijske faze poslovnega cikla se je pojavila že v Veliki Depresiji v 1930. letih in od takrat dalje predstavlja temelj v razpravah o kratkoročni ekonomski politiki. Te razprave so se zlasti v 1960. ter 1970. letih usmerile v poglavitno diskusijo o učinkovitosti denarne v primerjavi s fiskalno politiko. Čeprav imajo ugotovitve iz takratnega obdobja, zaradi spremenjenega ekonomskega okolja in metodoloških pomanjkljivosti, zgolj omejeno uporabnost za snovalce ekonomske politike v sedanjem času (Kretzmer, 1992), je bila razprava o učinkovitosti denarne in fiskalne politike zelo poučna, poleg tega pa je živahnost razprave o pomembnosti ene in druge ekonomske politike pomembno prispevala k povečanju znanja ter ozaveščenosti (McCallum, 1986).

Kljub temu je danes še vedno prisotnih mnogo polemik o učinkovitosti fiskalne politike. Za razliko od denarne politike, na področju fiskalne politike ni soglasja o njenih učinkih, poleg tega pa različne teorije napovedujejo različne rezultate. To je bila skozi desetletja, skupaj z odlogi v reakciji fiskalne politike, njena poglavitna pomanjkljivost kot učinkovitega stabilizacijskega ekonomskega orodja. Kljub temu zgodovina kaže, da se države pogosto zatekajo k fiskalni politiki za stabilizacijo ekonomije, zlasti v obdobjih močnega upada ekonomske aktivnosti. Nedavna 2008-09/10 kriza je ponovno odprla debato o (ne)učinkovitosti avtomatskih stabilizatorjev in s tem potrebo po stimulacijskih ukrepih.

Ta doktorska disertacija je zbirka štirih esejev s področja fiskalne politike. Poglavitni cilj disertacije je razširiti obstoječe empirične razsikave na področju avtomatskih stabilizatorjev ter diskrecijskih ukrepov s prispevkom za primer majhne razvijajoče (tranzicijske) ekonomije kot je Hrvaška ter preučiti učinke fiskalne politike v normalnih, dobrih ter kriznih ekonomskih razmerah. Poleg tega je v disertaciji izpostavljenih nekaj ključnih vprašanj glede fiskalnega pravila v Paktu za Stabilnost in Rast (ang. Stability and Growth Pact - SGP), z osredotočenostjo na njegovo primernost in uporabnost.

Po uvodnem prvem poglavju je v 2. poglavju, z uporabo uradnega pristopa Evropske Komisije, raziskano gibanje ciklične in strukturne komponente hrvaškega proračuna. Rezultati kažejo, da sta bila v obdobju 1995-2009 tako ciklični kakor tudi ciklično prilagojeni saldo proračuna v povprečju v primanjkljaju. Ob upoštevanju velikosti ciklične komponente, je moč z določeno stopnjo negotovosti zaključiti, da avtomatski stabilizatorji na Hrvaškem niso zelo izraziti. Razlog za to je lahko njihova omejenost, ki izhaja iz kombinacije nizke davčne elastičnosti in nizkega deleža davkov v BDP-ju. Poleg tega je prispevek potrošnih stabilizatorjev majhen tudi zaradi šibkih in nezadostnih nadomestil

za brezposelnost in socialno varnost. Pri proučevanju ciklično prilagojenega salda proračuna kot ukrepa diskrecijske fiskalne politike, je moč zaključiti, da so v proučevanem obdobju na Hrvaškem diskrecijski ukrepi imeli pomembno vlogo. V večini primerov je bil proračunski primanjkljaj rezultat strukturne in ne ciklične komponente, kar kaže na pomanjkanje fiskalne discipline hrvaške vlade. Poleg tega je v več obdobjih opazna prociklična fiskalna politika.

Tretje poglavje proučuje učinke diskrecijske fiskalne politike na določene makroekonomske spremenljivke, z uporabo strukturnega vektorskega avtoregresijskega modela. Rezulati kažejo keynesianske učinke povečane državne potrošnje oz. nižjih davkov na ustvarjeni proizvod. V obeh primerih je velikost muliplikatorja nad 2, vendar z različnim predznakom. Zasebna potrošnja in investicije se ravno tako pozitivno odzovejo na povečano državno potrošnjo, učinek pa je največji, ko je državna potrošnja usmerjena v investicije. Pozitivni učinek znižanja davkov na ustvarjeni proizvod ter zasebno potrošnjo nastane predvsem preko znižanja posrednih davkov. Ker gredo zaključki empiričnih raziskav v prid dejstvu, da so diskrecijski ukrepi bolj učinkoviti in pomembni v kriznih ekonomskih razmerah (Auerbach and Gorodnichenko, 2012; Batini et al., 2012, poleg ostalih), so v 4. poglavju stabilizacijski učinki fiskalne politike na Hrvaškem nadaljnje proučevani z razlikovanjem učinkov med recesijsko in ekspanzijsko fazo poslovnega cikla. Za ta namen je uporabljen vektorski avtoregresijski model z gladkim prehodom (ang. smooth transition VAR - STVAR) z metodo direktne projekcije. Analiza se osredotoča na učinke povečane državne potrošnje kot stimulacijskega fiskalnega ukrepa. Rezultati kažejo, da so multiplikatorji v času ekspanzije povečini statistično neznačilni, medtem ko so v času recesije statistično značilni ter bolj izraziti (v primerjavi z ovrednotenjem znotraj linearnega okvira). S proučevanjem učinkov povečane državne potrošnje, usmerjene v nakup proizvodov in storitev, plače oz. kapitalske dobrine, je moč zaključiti, da so v kriznih ekonomskih razmerah učinki največji v primeru nakupa proizvodov in storitev.

Fiskalna pravila lahko zmanjšajo vlogo fiskalnih stabilizatorjev, zato je v 5. poglavju proučevana funkcionalnost ciklično prilagojenega salda proračuna ter SGP fiskalnega pravila. Za ta namen je uprabljen DSGE model, ki je kalibriran za primer fiskalno stabilne države, kot je Avstrija. Rezultati kažejo na nizko korelacijo med ciklično komponento ocenjeno skladno z uradnimi priporočili Evropske Komisije ter isto komponento, ki izhaja iz DSGE modela. Poleg tega obstaja tudi precejšnje neskladje med uradnimi in modelskimi ocenami o usmeritivi fiskalne politike, kakor tudi o času kršitve SGP strukturnega proračunskega pravila. V več kot polovici primerov, ko sta kršeni obe proračunski fiskalni pravili (Maastricht ter SGP), uradna metodologija signalizira poslabšanje strukturne bilance, medtem ko modelske ocene kažejo, da je to posledica cikličnega upada ekonomske aktivnosti.

Ključne besede: fiskalna politika, avtomatski stabilizatorji, diskrecijski ukrepi, fiskalni stimulacijski ukrepi, stabilizacijski učinki, Pakt za Stabilnost in Rast, ciklično prilagojen saldo proračuna, SVAR, STVAR, DSGE.

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ABBREVIATIONS

ABB	Actual Budget Balance
ADF	Augmented Dickey Fuller (test)
AIC	Akaike Information Criterion
BIC	Bayesian Information Criterion
CABB	Cyclically Adjusted Budget Balance
CBB	Cyclical budget balance
CBS	Croatian Bureau of Statistics
CC	Cyclical component
CESEE	Central, Eastern and Southeastern Europe
CIT	Corporate Income Tax
DSGE	Dynamic Stochastic General Equilibrium
EA	Euro Area
EC	European Commission
ECB	European Central Bank
Ecofin	Economic and Financial Affairs Council (EU)
EDP	Excessive Deficit Procedure
EERP	European Economic Recovery Plan
EMU	European Monetary Union
ERM	Exchange Rate Mechanism
ESCB	European System of Central Banks
EU	European Union
G-20	Group of Twenty
GDP	Gross Domestic Product
GFS	Government Finance Statistics
GFSM	Government Finance Statistics Methodology
GLS	Generalized Least Square
GMM	Generalized Method of Moments
HP	Hodrick-Prescott (filter)
HQC	Hannan-Quinn information Criterion
HRK	Croatian Kuna
IMF	International Monetary Fund
IRF	Impulse Response Function
LFS	Labour Force Survey

MCMC	Markov chain Monte Carlo
MFIN	Ministry of Finance
MTO	Medium-Term budgetary Objective
NK	New Keynesian
NMS	New Member States (EU)
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
PF	Production Function
PIT	Personal Income Tax
RBC	Real Business Cycle
SGP	Stability and Growth Pact
SSC	Social Security Contributions
STVAR	Smooth Transition Vector Autoregression
SURE	Seemingly Unrelated Regressions
SVAR	Structural Vector Autoregression
SVEC	Structural Vector Error Correction
TEU	Treaty on European Union (Maastricht Treaty)
UK	United Kingdom
US	United States
VAR	Vector Autoregression
VAT	Value Added Tax

1. INTRODUCTION

1.1 Motivation

The effectiveness of fiscal policy as a stabilizing tool has always been observed with a fair portion of skepticism. As highlighted by Auerbach (2012) such a distrust is mainly due to four reasons: (i) fiscal policy can operate without active interventions by policymakers through the work of automatic stabilizers; (ii) short term discretionary fiscal policy interventions "suffer" from *fiscal policy lags* that occur between making, implementing and enacting fiscal policy actions, including thus the *information, recognition, decision and implementation lag*; (iii) the effectiveness of a policy tool is often dampened by the implications of uncertainty when selecting the optimal policy (Brainard, 1967); and (iv) stabilizing effects can be undermined by the expectations and actions of rational agents who observe the government decision making process (Lucas, 1976).

It is well known that the Twentieth century economists mostly favored monetary policy because central banks are able to implement adjustments more quickly than governments, therefore their timing and appropriate size of intervention are more effective. Moreover, the disfavor of expansionary fiscal policy is mainly linked to the increase in fiscal deficits and public debt. Ball and Mankiw (1995) and Rubin et al. (2004) argue that a permanent deficit increase reduces economic growth in the long run in the US, especially in times of crisis. Moreover, rational agents tend to consume less due their expectations of higher taxes, making discretionary fiscal policy less effective. Focusing on a sample of 20 developed economies, Reinhart and Rogoff (2010) find that, on one hand the relationship between government debt and permanent growth is weak in countries that have the debt-to-GDP ratio below 90%, but, on the other hand, if the same ratio exceeds 90% then the median growth rate falls by one percent and the average by even more. Similarly, Checherita and Rother (2010) conclude that in the case of twelve euro area countries the relationship between public debt and economic growth is concave, with the debt turning point at about 90%-100% of GDP, meaning that debt-to GDP ratio above the threshold lowers long term growth.

Nevertheless, the fame of fiscal policy as policy tool has historically rose and declined. Smithies (1946) underlines that in the Thirties (precisely before year 1938) fiscal policy was a *"matter of accident"*, and in detail, was a *"mass of contradiction"*. Three decades afterwards, i.e. in the early Sixties, *"fiscal policy was all the rage, and discussions of monetary policy often fell into the 'oh, by the way' category"* (Blinder, 2006, p. 25). Referring to the work of Stein (1969) in particular, Blinder emphasizes that in the mentioned period monetary policy was not considered *"a particularly useful tool for stabilization policy"*. Four decades later Solow (2002, p. 1) highlights that macroeconomic literature invokes the existence of only one policy goal assigned to monetary policy, i.e. the control of inflation and points that *"serious discussion of fiscal policy has*

almost disappeared". However, the *fame* of fiscal policy arose mainly in periods of severe economic downturns and nowadays it is a widespread agreement that *the interaction* of these two policies should result in the stabilization of the output over the business cycle. Brainard (1967) points that policymakers should use all of the available instruments in stimulating the economy, thus combining fiscal and monetary measures. This way they reduce the uncertainty about the total ultimate effect.

Theoretical and empirical works largely agree on the stabilization effects of monetary policy instruments; for instance, a large body of empirical works shows that an exogenous increase in the federal fund rate causes a decrease in inflation and growth[1]. On the other hand, a large body of theoretical (and empirical) works in the field of fiscal policy disagree even on the fundamental effects of fiscal policy, increasing even further the disbelief in the appropriateness and effectiveness of fiscal policy as a stabilizing tool. For example, under the Keynesian view expansionary fiscal policy stimulates private consumption, while, oppositely, Real Business Cycle (RBC) models argue that an increase in government consumption is de-stimulative with respect to private consumption since consumers are set as forward looking[2] (Table 1.1).

Table 1.1: *Overview of the effects of expansionary fiscal policy across theoretical models*

*Models **without** micro-founded forward looking behaviour*							
	Y	C	I	i	L^d	L^s	w
Keynesian *closed economy*	+	+	−	+	+	+	−
Keynesian *open economy: fixed exchange rate*	+	+	:	:	+	+	−
Keynesian *open economy: flexible exchange rate*	:	+	:	:	:	:	:
*Models **with** micro-founded forward looking behaviour*							
	Y	C	I	i	L^d	L^s	w
Real Business Cycle (RBC)	+	−	+	+	:	+	−
New Keynesian (NK)	+	−	−	+	+	+	+

Notes: Y, C, I, i, L^d, L^s and w denote output, private consumption, private investment, interest rates, labour demand, labour supply and real wages respectively; "+" indicates a positive effect (increase); "−" indicates a negative effect (decrease); ":" indicates no effect.
Source: Author's systematization.

All theoretical models agree only on the positive effect of expansionary fiscal policy on output[3]. The predicted effect on other macroeconomic variables shows a reasonable level

[1] Although there is the agreement about the sign of the effect, it has to be pointed out that its size and/or timing differ across studies. For a deeper discussion on the monetary transmission mechanism in the US refer, among others, to the works of Bernanke and Mihov (1995) and Christiano et al. (1996, 2000), or Angeloni et al. (2003) for the euro area.

[2] The reason of a different impact on private consumption lies in the assumption how consumers behave on the market. The RBC model assumes an infinitely-lived household, whose consumption decisions at any point in time are based on an inter-temporal budget constraint. On the other hand, according to the the Keynesian view consumers consumption is a function of their current disposable income and not of their lifetime resources.

[3] Same agreement is evidenced in empirical studies of fiscal policy. A broader discussion is presented in Chapter 3 of this work.

of disagreement. All variations of the Keynesian view predict a fiscal policy effect of the same sign, just the effect becomes weaker the more the economy is opened and the more the exchange rate is flexible. The predictions derived from micro-founded models that emphasize agents' inter-temporal choice (i.e. dynamic stochastic general equilibrium − DSGE − models) differ from the Keynesian view. The main difference between RBC and NK DSGE models is that according to the RBCs prices are flexible and perfect competition prevails in all markets, while according to the NKs prices are sticky and the competition is imperfect[4].

RBC models assume that consumers are forward looking and therefore an increase in government spending reduces the household wealth (i.e. after-tax income) by increasing the present value of household tax liabilities. This negative wealth effect induces consumers to cut their consumption leading thus to a decrease in aggregate private consumption. However, such a wealth effect gives rise to the quantity of labour supplied, which leads to a lower real wage, higher employment and higher output (Edelberg et al., 1999; Burnside et al., 2004). Therefore, it is important to point out that expansionary fiscal policy in RBC models is de-stimulative with respect to private consumption, but not with respect to output as shown in Table 1.1. Additionally, if sufficiently persistent, the triggered increase in employment can cause a rise in the expected return to capital and thus influence a rise in private investment[5].

NK models generally give similar predictions to RBC models to an expansionary fiscal policy, i.e. an increase in output and a decrease in consumption[6] with the main difference arising from the labour market response. As highlighted by Pappa (2009), real wages in a NK model increase after a positive shock to government consumption, because the resulting increase in output raises the demand for labour which in a NK setup offsets the increase in the labour supply due to the negative wealth effect. Monacelli and Perotti (2010) show that an increase in government spending in a standard open economy DSGE model typically causes an appreciation of the real exchange rate and worsens the trade balance[7].

[4] An extensive overview of RBC models is presented in Rebelo (2005).

[5] RBC models and underlying effects are extensively described in the works of Aiyagari et al. (1990), Baxter and King (1993), Christiano and Eichenbaum (1992) among others. Important to note is that the qualitative features of the dynamics of variables after a shock strongly depend on the way an increase in government spending is financed (distorting taxes or debt) and on the details of the model. For instance, Galí et al. (2004) show that the coexistence of sticky prices and rule-of-thumb consumers (who do not borrow or save, consuming their wage instead) is a necessary condition for an increase in government spending to raise private consumption. Bouakez and Rebei (2003) stress that the complementarities between private consumption and government consumption are crucial for the effects of expansionary fiscal policy on aggregate private consumption.

[6] It is important to point out that some alterations to DSGE models may lead RBC and NK predictions to be in line with Keynesian outcomes, showing thus a positive effect on consumption as well as output. Some models employ non-separable utility function in leisure and consumption (Linnemann, 2006, for instance), some introduce habit persistence in consumption at the good level (Ravn et al., 2006, among others), some include two types of households: Ricardian and non-Ricardian (Galí et al., 2004; Coenen and Straub, 2005).

[7] Still, Ravn et al. (2007) or Corsetti et al. (2009) show that expansionary fiscal policy can lead to an increase in consumption and depreciation of the real exchange rate.

Despite that, citing Solow, a *"serious discussion"* of fiscal policy (re)appeared during the latest crisis. The severe downturn of the 2008-2009/10 led policymakers to reconsider the magnitude of fiscal policy interventions opting for fiscal stimuli packages no matter of the mainstream view how fiscal policy should be as much as *automatic* as possible. This means that the amount of automatic stabilization provided within fiscal systems was insufficient in boosting demand[8]. When assessing the effects of fiscal stimulus packages during episodes of banking crises in advanced and emerging economies over the 1980-2008 period, i.e. before the recent global economic crisis, Baldacci et al. (2011) show that timely countercyclical fiscal measures contribute in shortening the crisis period by boosting demand and offsetting the fall in private investment. Still, Baldacci et al. emphasize that such a fiscal contribution is weaker for countries with limited budgetary room.

All OECD and EU27 countries resorted to fiscal measures in the 2008-2010 period with a substantial cross-country variation in the scale of introduced measures. On average an OECD country carried out a fiscal package of 1.9% GDP in the 2008-10 period, with the United States having the largest fiscal package at about 5.6% GDP, while an EU country on average stimulated the economy at about 1.1% GDP (Figure 1.1).

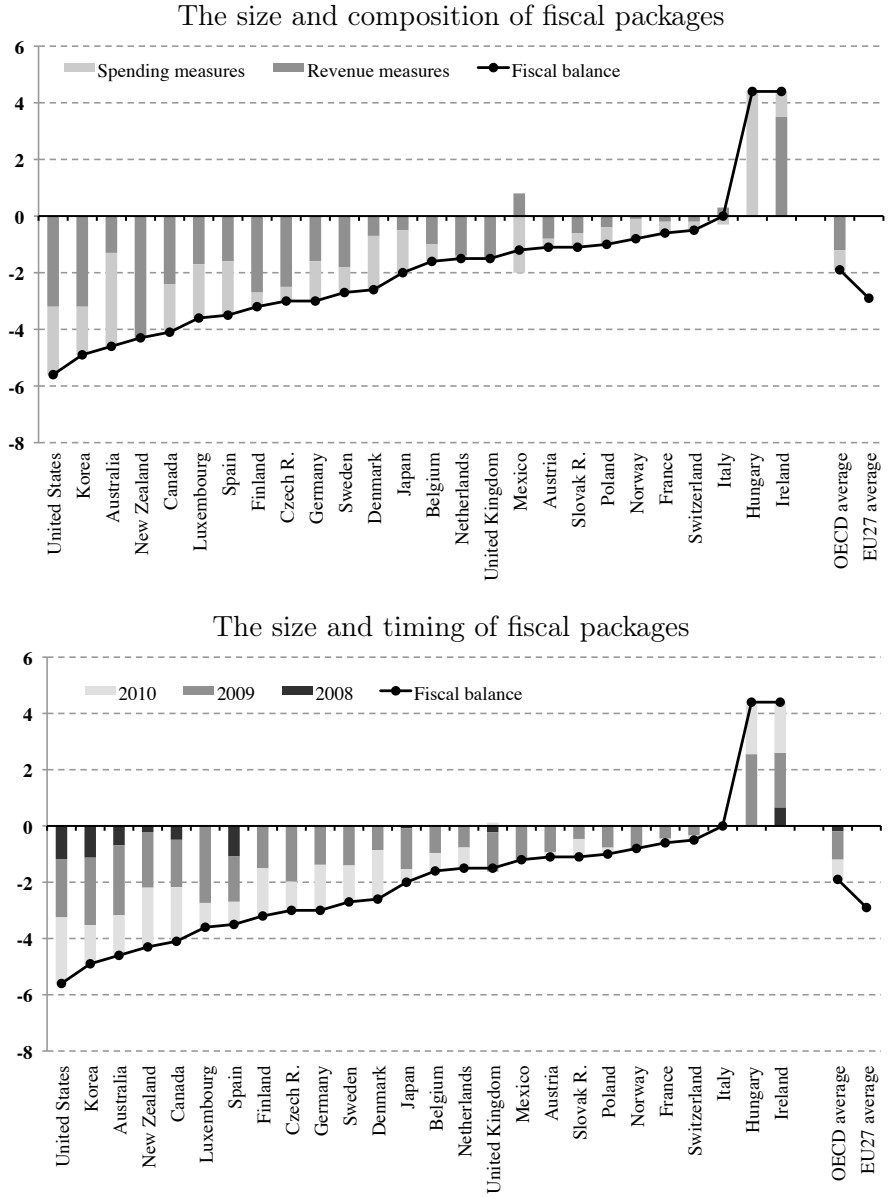
As Figure 1.1 shows, the majority of countries opted for expansive fiscal policy and have given precedence to tax cuts over spending increases[9]. In most countries tax cuts focused on personal income taxation[10], while increased spending was mostly directed in public investment programmes and transfers to households. Baldacci et al. (2011) show that fiscal expansions based on government consumption and income tax cuts are most effective in shortening the recession period, while expansions largely based on public investment programmes have a strong positive effect on output growth. If timing is considered, only eight countries started boosting demand in 2008 already. The largest share of fiscal stimulus was enacted in year 2009 in the majority of countries, with the exception of Denmark, Slovak Republic and Italy that registered the strongest fiscal injection in 2010.

[8]Debrun and Kapoor (2011) claim that fiscal policy is unambiguously effective at stabilizing the economy when it operates in the same way as automatic stabilizers.

[9]Exceptions are Japan, France, Australia, Denmark and Mexico that relied mostly on increases in government spending, while Hungary and Ireland opted for fiscal tightening. Hungary decreased government spending by 4.4% GDP, while Ireland increased taxes and decreased spending by 3.5 and 0.9 percent GDP respectively.

[10]United Kingdom exceptionally introduced a temporary VAT cut.

Figure 1.1: *The size, composition and timing of fiscal stimuli packages in OECD countries and EU27 average in the period 2008-2010 as % of GDP*



Source: OECD (2009); European Commission (2010).

Such discretionary actions made the already inconclusive debate about the stabilization effects of fiscal policy and its effectiveness (measured by fiscal multipliers) even more fervent. Some macroeconomists and theoreticians argued that a fiscal stimulus is crucial for getting out of the crisis assuming a fiscal multiplier above unity, while other defined a stimulus as irresponsible assuming the same multiplier being below unity[11]. Fischer and Justo (2011) conclude that, on the aggregate level, discretionary measures introduced by

[11]The uncertainty problem regarding the size of a fiscal multiplier was a well known issue before the crisis and empirical research does not provide an unambiguous answer except in the case that a positive government spending shock positively affects output, as suggested by theoretical models (Table 1.1). A deeper literature review of fiscal policy effects is provided in Chapter 3.

EU member states in response to the crisis were timely, temporary and targeted, and that countries with limited fiscal room generally took more restrictive actions. Bouthevillain and Dufrénot (2011) point that expenditure-oriented stimulus plan can be more effective than a tax-oriented plan, because public expenditure has a stronger impact on GDP during crises being the spending multiplier greater than the tax multiplier. Moreover, Van Brusselen (2011) reports that the European Economic Recovery Plan (EERP) raised the GDP of twelve euro area countries by 0.77 and 0.62 percentage points with respect to the baseline in 2009 and 2010, respectively. The author emphasizes that over the 2011-15 period the effects of taken stimuli packages on output are going to decline, with real GDP falling toward its baseline level.

Evidently, the study of fiscal policy is quite country- and time-specific. The already vivacious debates in the field of fiscal policy during *normal (ordinary)* times became even more intense during the latest *bad* time. History shows that governments, as well as austere institutions as the IMF or EC, are prominent to resort to fiscal policy to smooth severe economic downturns, although the overall effect and/or effectiveness is proven to be ambiguous and uncertain. Leaving aside the initial Keynes-Friedman debate about fiscal versus monetary policy, most dynamics can be found about the automatic stabilizers versus discretionary changes debate, as well as the benefits of fiscal rules.

Hence, the main motivation of this dissertation is to extend the growing literature in the field of fiscal policy mainly focussing on the Croatian case. Research on the Croatian case is very scarce, generally involving fiscal policy effects on output. The main goal is to encompass Croatian fiscal policy in the European Union framework under the Stability and Growth Pact (SGP) and its provisions, but not solely. It tackles the cyclically adjusted budget balance, fiscal multipliers in normal and extraordinary times, as well as stabilization effects on macroeconomic variables. The provided discussions and results should help in understanding the fiscal transmission mechanism in a small and open economy, such as Croatia and thus serve to policy makers in evaluating possible fiscal outcomes when gauging macroeconomic goals. Moreover, since Croatia can *fiscally* be considered as a relatively unstable country (with respect to tax system stability, fiscal discipline and fiscal projection accuracy), the last part of the dissertation, is devoted to discussing fiscal policy stance and related issues on the case of a fiscally stable country, i.e. Austria. New insights into measuring the fiscal policy stance as well as the appropriateness of such measures are aimed at a broader audience and should (at least) confront some of the revealed drawbacks and dare policymakers and academia to develop better and efficient fiscal estimates.

1.2 Automatic stabilizers *versus* discretionary fiscal policy

As already pinpointed, the last economic crisis exhibited a shift in favouring automatic stabilizers versus discretionary changes as an effective tool in boosting demand. Some

argued that the severity of the crisis demanded automatic stabilizers to be complemented with discretionary fiscal policy because interest rates were constrained at their zero lower bound and because the size of fiscal multiplier is much higher in extraordinary times (Christiano et al., 2009; Auerbach and Gorodnichenko, 2012; Coenen et al., 2012). Nevertheless, following the pre-crisis conclusions of Eichenbaum and Feldstein[12] some remained of the opinion how it is best to let fiscal policy operate *automatically* (Taylor, 2009; Cogan et al., 2010, among others).

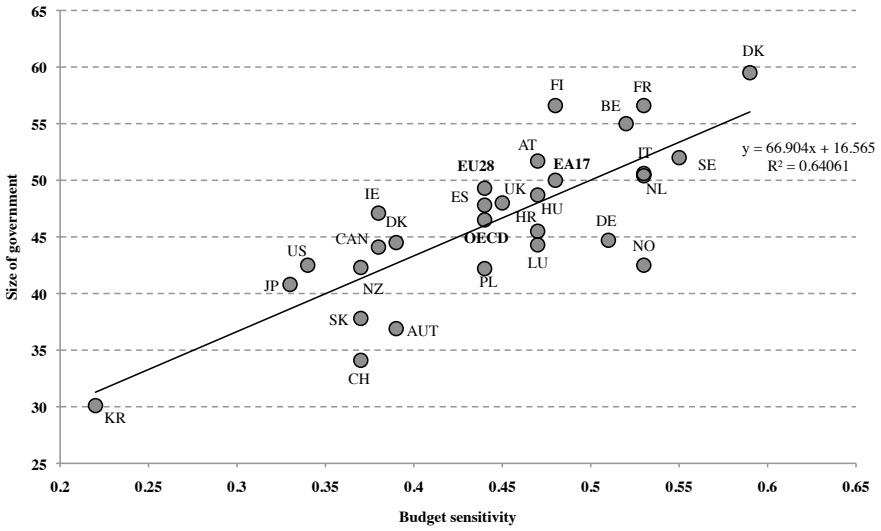
The literature presents two proxies for automatic stabilizers; on one hand automatic stabilizers are associated with the size of government (predominantly measured as the share of general government expenditure in GDP), while on the other they are leveled with the cyclical sensitivity of the budget (budgetary sensitivity). Fatás and Mihov (2001b) and Lee and Sung (2007) find the size of government negatively correlated with the fluctuation in GDP, meaning that the majority of *non-automatic* government spending (wages and transfers) is generally neither cut during recessions nor increased during expansions (In 't Veld et al., 2012).

Figure 1.2 shows automatic stabilizers for OECD and EU countries in 2012, proxied by the size of government and budget sensitivity[13]. Automatic stabilizers in OECD countries are lower than those in EU countries, mainly due to a lower share of government in GDP. The average budget sensitivity in OECD and EU countries is equal, being 0.44. However, in Euro area countries tend to have bigger government size as well as higher sensitivity of the budget. United States and Norway for example have the same size of the government (42.5% GDP), but the budget sensitivity is much higher in the case of Norway (0.53) than in the United States (0.34).

[12] In 1997 Eichenbaum accented that *"countercyclical discretionary fiscal policy is neither desirable nor politically feasible"*, while Feldstein concluded in 2002 that *"deliberate 'countercyclical' discretionary policy has not contributed to economic stability and may have actually been destabilizing in the past"*. However, in 2009 the same author writes in favor of fiscal packages as a stabilizing tool (Feldstein, 2009).

[13] As mentioned, automatic stabilizers are commonly defined as the change in the budget resulting from the change in economic activity due to business cycle fluctuations. Generally two indicators are used to show such changes. the budget sensitivity and the semi-elasticity. It is important to point out that, the budget sensitivity (used by the EC) measures the change in the level of government revenues and expenditure from a marginal change in GDP, while the semi-elasticity approach (used by OECD and IMF) measures the reaction of the ratios of expenditure and revenues to GDP relative to a change in GDP. However, as pointed by In 't Veld et al. (2012, p. 7) the estimates of both indicators are almost the same for the budget as a whole, but significantly differ as regards the relative contribution of government expenditure and revenues, since the budgetary sensitivity indicator allocates the predominant contribution to automatic responses to the government revenues, while the semi-elasticity indicator associates the same to the expenditure side of the budget.

Figure 1.2: *Automatic stabilizers in OECD and EU countries in 2012*



Note: The size of government (y-axis) refers to the general government expenditure as % GDP. For non-EU OECD members the size of government refers to year 2011 or 2010 depending on the data availability. The budget sensitivity shows the change in the level of budget balance from a marginal change in GDP.
Source: Eurostat; OECD; Grdović Gnip (2011); In 't Veld et al. (2012).

The cross-country differences are due to several factors, amid which the degree of progressiveness of the tax system, the importance of unemployment related benefits, the share of different taxes in GDP, openness of an economy etc. The two extremes are represented by Denmark and Korea. Denmark stands out mainly due to a fact that the majority of tax revenues are collected from direct taxes, which are in turn highly progressive, and a very little portion goes to social security contributions, which tend to be proportional.

Despite the large body of literature on automatic stabilizers, only a few investigate their effectiveness as a stabilizing tool. Auerbach and Feenberg (2000) estimate that automatic stabilsers offset 8% of cyclical output fluctuations in the US, while Meyermans (2002) finds that GDP stabilisation after a demand shock equals 20% in the US and 11% in the euro area. Brunila et al. (2003) and Tödter and Scharngal (2004) stress that the effectiveness of automatic stabilizers depends on the type of shock hitting the economy and show that a consumption shock is better smoothed than other shocks[14]. Dolls et al. (2009) find that the amount of automatic stabilization depends strongly on the type of income shock and show that automatic fiscal policy absorbs 38% of a proportional income shock in the EU, compared to 32% in the US. Moreover, they emphasize that there is considerable heterogeneity within EU and that in general automatic stabilizers in Eastern and Southern European countries are considerably lower than in Continental and Northern European countries. In 't Veld et al. (2012) show that automatic stabilizers

[14]Brunila et al. (2003) estimate that automatic stabilizers smooth 20 to 30 per cent of the consumption shock in euro area countries.

could have smoothed the drop of GDP in the euro area during the latest crisis by 13% and 27% depending on the chosen budget benchmark[15]. McKay and Reis (2013) find that in the case of the US lowering taxes (on sales, property, and corporate and personal income, or reducing the progressiveness of the personal income tax) does not have a significant impact on the volatility of the business cycle, while higher transfers to the unemployed and poor result to be quite effective at lowering volatility, meaning that a bigger safety net might lead to a more stable economy.

Knowing that no particular government intervention is needed to make the automatic stabilizers work, it is obvious that budget figures incorporate them as well. In order to perceive the degree to which budgetary revenues and expenditures are affected by the cycle, there is a need of differentiating between *cyclical* and *structural* component of the budget. Thus, the *cyclical component* is a way of measuring the size of automatic fiscal stabilizers. Meaning that changes in the *structural* or *cyclically adjusted* component are the most commonly used indicator of discretionary fiscal policy effort (Larch and Salto, 2003). Chouraqui et al. (1990) consider a "dual relevance" of the structural balance as an indicator for evaluating the discretionary policy. On one side, they argue that the structural balance provides a preliminary assessment of orientation of fiscal policy and facilitates the description of the evolution policy. On the other side, since many policy decisions have multi-annual (long-term) implications, a change in the structural balance can be a leading indicator of the future course of policy (Chouraqui et al., 1990, p. 5). Alesina and Perotti (1995a) stress that these changes are also known as fiscal impulses. Moreover, Giorno et al. (1995) consider the changes in the structural budget balance important for understanding the degree of influence of fiscal policy on aggregate demand.

However, Larch and Salto (2003) point out how the basic idea in using cyclically adjusted budget balance's changes as an indicator of discretionary fiscal policy is that, once the budget is purged of its cyclical component, any remaining difference across time should, by exclusion, signalize the effect of active fiscal policy interventions. Amid the first to form and calculate an indicator, which measured the level of the budget balance when the economy operates at a full employment level, was Brown in (1956) for the US economy, naming it the *full employment surplus*[16]. Because of its main disadvantage that, on average, economies operate below full employment, full employment surplus was replaced by the trend output or potential output, and consequently became the first predecessor of what today is the cyclically adjusted budget balance (CABB). In the 1990s improvements in the methodology measuring cyclically adjusted budget balance have been developed by international institutions such as European Commission, IMF,

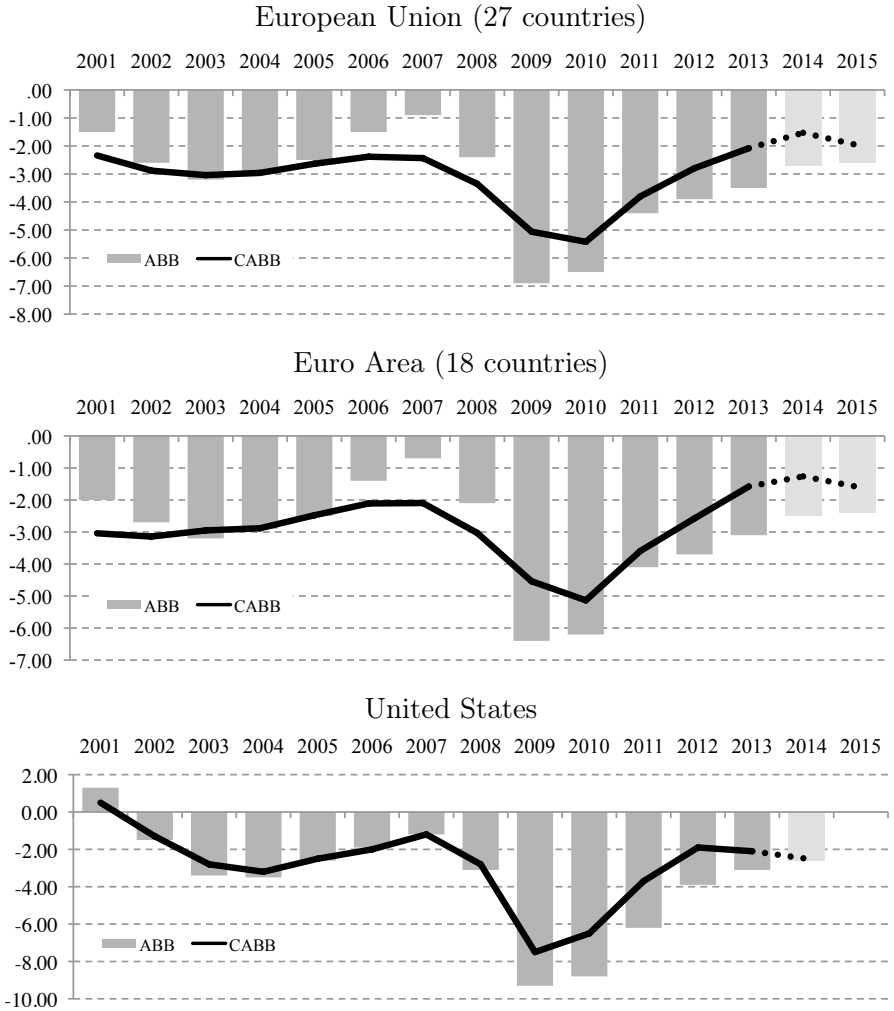
[15]If the benchmark budget comprised fixed levels of revenues and expenditure the degree of smoothing resulted in 13%, while if benchmark encompassed revenues and expenditure following GDP it increased to 27%.

[16]The analysis showed that the assessment of the fiscal policy in the US in the 1930s would have significantly changed if, instead of using the headline budget balance, it had been adjusted for the effect of unemployment (Brown, 1956).

OECD and the ESCB (ECB), which nowadays use the structural balance (or cyclically adjusted budget balance) to evaluate efficiency of fiscal policies in short, medium and long run.

In line with aforementioned, the government should focus on the cyclically adjusted balance when achieving fiscal policy goals as well as fiscal consolidation. If the cyclically adjusted budget is in balance, then deficits and surpluses in the actual budget will balance over time. The European Commission has among other international institutions mostly succeed in *institutionalizing* this indicator within the Stability and Growth Pact (SGP). The latter is a rule-based framework for the coordination of national fiscal policies between EU countries. The cornerstone of the SGP is the medium-term budgetary objective based on the cyclically adjusted budget balance (which should not exceed – 0.5% GDP) and special attention (in terms of CABB) is devoted when assessing the path for deficit reduction. Figure 1.3 shows the general government budget in actual and cyclically-adjusted terms for the EU as a whole, Euro area and the US in the period between 2001 and 2015.

Figure 1.3: *Actual and cyclically adjusted budget balance in EU and US in the period between 2001 and 2015 as % GDP*



Note: ABB and CABB stand for actual budget balance and cyclically adjusted budget balance. Figures for 2013 are first release figures, while for 2014 and 2015 are based upon official projections. European Union data do not include Croatia. Data for the US for the year 2015 is non available.
Source: Eurostat; Congressional Budget Office.

It is possible to observe that European economies (no matter whether EU or EA) from 2006 onwards show a significant impact of cyclical fluctuations on budget figures. Namely, evidence show that before the crisis a surplus in the cyclical budget balance due to an expansionary phase of the economy, significantly affected actual budget balance outcomes. However, in the 2001-2013 period the average actual budget was in deficit by 3.3, 3.2 and 1.8 percent GDP in European Union, Euro area and US respectively. In the same time span the cyclically adjusted budget balance was on average 3.2, 3.0 and 1.6 percent GDP in deficit in the European Union, Euro area and US respectively.

As stressed before, the budget balance deteriorated during the crisis partly due to the automatic reaction of budget figures. Despite that, Figure 1.3 shows a substantial slump

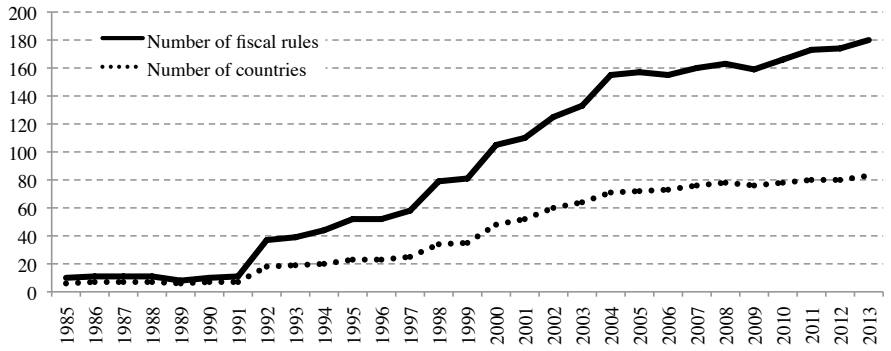
in the structural part of the budget in 2009 and 2010 mainly due to fiscal stimuli packages mentioned earlier, but with a convergence to the medium-term objective in the subsequent years. Such discretionary actions may potentially damage economic growth and lead to less sustainable public finances. One way to safeguard public finance positions is to establish fiscal rules that constraint fiscal policy. However, legislating fiscal rules does not necessary lead to sustainable fiscal policy. For instance, although national fiscal policies of European Union (and European Monetary Union) members were conditional to Maastricht and SGP rules, evidence show a substantial lack of enforcement of these rules even before the latest crisis (Schuknecht, 2004; European Central Bank, 2005; Morris et al., 2006; European Central Bank, 2008; van Riet, 2010, among others)[17].

1.3 Fiscal rules

Fiscal policy rules are commonly defined as a numerical target for budgetary aggregates. Specifically, within fiscal rules governments place a permanent constraint on fiscal policy, expressed in terms of a fiscal indicator such as government budget balance, debt, expenditure or revenue. Effective fiscal rules help safeguard sound public finances, but their benefits are possible only if appropriate institutions for monitoring and enforcement mechanisms are in place or supported by strong political commitment. From a policy makers' standpoint, enacting a fiscal rule means willingly giving up some of their policy discretion.

The use of fiscal policy rules started to strongly rise during the 1990s. According to the International Monetary Fund (2014) 180 fiscal rules were implemented across eighty-three countries in year 2013, compared to year 1990 when only seven countries adopted a total of ten fiscal rules (Figure 1.4).

Figure 1.4: *Number of fiscal rules and number of countries implementing fiscal rules in the period between 1985 and 2013*

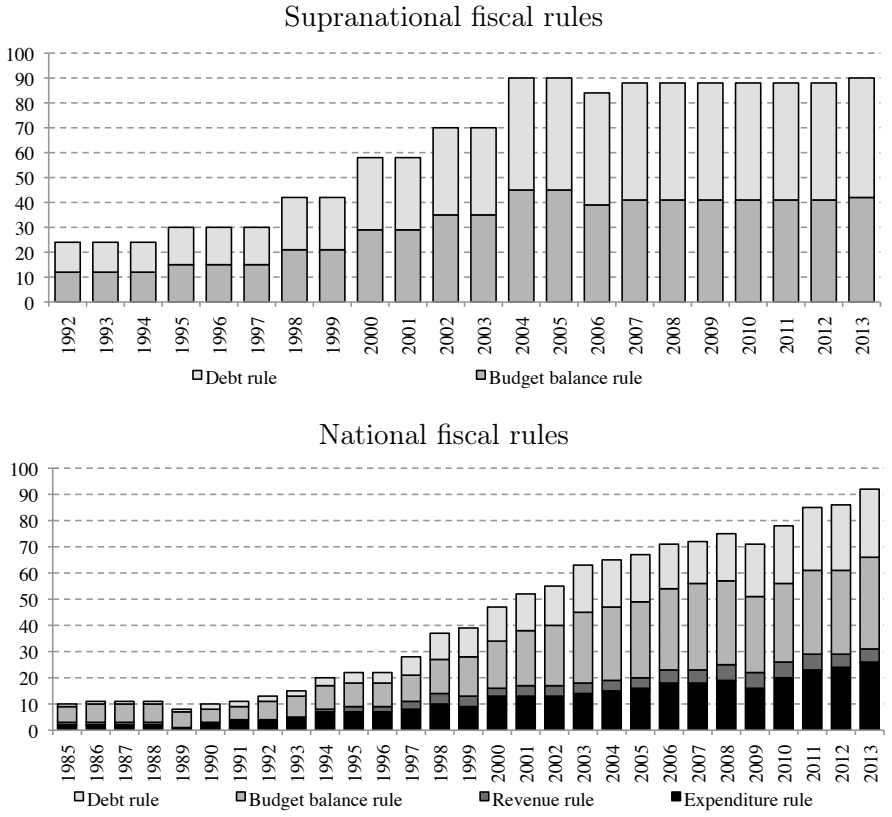


Source: International Monetary Fund (2014).

[17]In this respect the EU and EMU enacted several improvements in the 2011-2013 period mainly within a *newer* SGP and the so-called Fiscal compact, which is deeply discussed in Chapter 5.

Fiscal rules can be set at the national or supranational level. Figure 1.5 shows that supranational rules mainly involve targeting budget balance and debt, while at the national level the palette of rules is more various and additionally includes expenditure and revenue rules, being the latter the most rare adopted rule. In the case of the EU, supranational fiscal policy rules involve the deficit- and debt-to-GDP ratios set within the Maastricht's Treaty on European Union and the structural balance rule defined within the Stability and Growth Pact (SGP). However, it is not a rare case in EU members that the budget balance and/or debt rule are additionally declared at their national level too[18].

Figure 1.5: *Number of fiscal rules according to the government level and type in the period between 1985 and 2013*



Source: International Monetary Fund (2014).

The balanced budget rule is the most common fiscal rule. As mentioned earlier, the main goal of fiscal rules is to promote budgetary discipline. Therefore, if the *balance* is targeted in structural terms (as in case of the SGP) then such a rule additionally ensures that a government has sufficient flexibility to run deficits during recessions to support the economy whilst, at the same time, forcing them to rein in spending and raise revenues when the economy is much stronger.

[18]This is the case of Bulgaria, Germany, Luxembourg or Hungary for example.

Despite the fact that the number of implemented fiscal rules raised over the last two decades, a substantial portion of controversy remained. For instance, von Hagen (2006) concludes that fiscal rules can be effective only if they are backed by political support and integrated in the yearly budgetary process, while Wyplosz (2005) points that the record (on fiscal rules) is not satisfactory because "rules are either too lax or too tight and then ignored".

Focussing on the EU and EMU only, empirical evidence also suggests contradictory results. European Commission (2004a) show fiscal rules to be effective providing evidence that in the absence of the EU fiscal rules in the early 1990s, debt ratios would have been 8 percentage points of GDP higher by 2003. Deroose et al. (2006) focus on the impact of expenditure rules on developments in nominal expenditure in EU-15 countries and conclude that expenditure rules reduce significantly the increase in nominal expenditure and improve the ability of governments to stick to their medium-term expenditure targets. Moreover, Gali and Perotti (2003) find that after the signing of the Maastricht Treaty (1992) fiscal policy in EU countries is less pro-cyclical[19]. On the other hand, Hallet and Lewis (2008) show that EU fiscal rules were effective only during a limited period of time around 1996/97 when entry into EMU was conditional upon compliance with the fiscal rules. Authors stress that fiscal discipline gradually weakened once countries had been accepted into EMU. Additionally, Ayuso–i–Casalas et al. (2007) conclude that in EU national fiscal rules affect fiscal performance. They point that rules targeting the budget balance or the general government debt have a significant and sizable impact on deficits, while expenditure rules do not appear by themselves to affect significantly budget balances, and even their impact on government expenditure is not statistically robust.

1.4 Purpose, goals and research questions

Essays in fiscal policy consist of four separate articles that discuss main fiscal policy issues tackled in the introductory part of this thesis. The first three essays focus on the Croatian case, while the last essay derives conclusions based on the Austrian case.

The Croatian fiscal system has been undergoing substantial changes in the early Nineties after the separation of the former Republic of Yugoslavia. From its first set up, it suffered from ineffective spending allocation, rising public deficits together with rising and irregular public debt payments. Moreover, in the Nineties, government expenditures were increasing much faster than revenues. Within the cointegration framework Krznar (2005) shows that for every kuna increase in government spending, government revenue on average increase 39 lipas. In 1999 solvency of the whole economy was seriously infringed and the an attempt of fiscal consolidation was implemented. In spite of that, Croatia

[19]Similarly, Manasse (2006) concludes that the existence of numerical fiscal rules reduce the degree of pro-cyclicality of fiscal policy.

is still facing high general government budget deficits from year to year, along with increasing public debt. Additionally, by the end of 2013, after receiving full membership in the EU in July of the same year, Croatia applied for the excessive deficit procedure due to the violation of the EU fiscal deficit rule.

Stabilizing the business cycle via fiscal policy involves the usage of automatic stabilizers and discretionary measures. By putting the structural balance under constraint in the Stability and Growth Pact, the European Commission accents that fiscal stabilization should be primarily left to automatic stabilizers, while the discretionary fiscal policy should be an exception (Buti and van den Noord, 2004). Additionally, some studies find that automatic stabilizers contribute to the reduction in output volatility (van den Noord, 2000; Brunila et al., 2003, among others).

Aiming the full membership in the European Union until 2013 when this goal was accomplished, meant adapting to a stronger fiscal discipline constrained to the Maastricht and SGP fiscal rules. The latter involve targeting the budget balance in structural terms, an indicator that until 2009 has never been estimated in the Croatian case. The first to do so were (Švaljek et al., 2009) applying the ESCB (ECB) methodology. Authors show that the cyclically adjusted budget deficit was constantly increasing in the period between 1995 and 2000 (when it amounted to more than 5,0% of GDP), while afterwards it registered a decreasing trend (reaching the level of 0,5% GDP in 2006). In the same period the Croatian fiscal policy registered alternating counter- and pro-cyclical movements, i.e. stabilizing and destabilizing movements. Švaljek et al. (2009) show that discretionary fiscal policy was expansionary for instance in 2000 when the Croatian economy was operating below its potential level (negative output gap) which leads to a countercyclical movement, but also in 2003 when the economy was operating above its potential level (positive output gap) which indicates a pro-cyclical movement.

In this respect, Chapter 2 aims at estimating the structural budget balance according to the official EC approach used in fiscal surveillance through the convergence programmes[20]. The purpose is to discuss retrieved results focussing on the following research questions:

1. Is the cyclically adjusted budget balance in the limit of 0.5% GDP as set by the SGP in Croatia? Does breaching this threshold also mean a violation of the Maastricht deficit rule?
2. What is the size and role of automatic fiscal stabilizers in Croatia?
3. Was the Croatian fiscal policy pro- or counter-cyclical?

The answer to the first question will give insight in the fiscal discipline in Croatia and its implementation in the EU and SGP framework. As mentioned previously the cyclical

[20]This essay was written and published two years before Croatia obtained full EU membership.

component of the budget reflects the size of automatic stabilizers. Given the reliance on automatic stabilizers it is important to underline their role and strength in the Croatian economy. Besides the structural and cyclical budget balance, in assessing answers for the second and third research questions the output gap volatility will be taken into consideration. The output gap will show the business cycle of the economy while changes in the structural balance will indicate whether expansionary or contractionary fiscal policy was implemented in a given phase of the cycle.

As mentioned earlier, it is commonly accepted that the size of the government sector (along with the relative share of taxation of cyclically sensitive tax bases and the abundance of unemployment benefit system) affects the size of automatic stabilizers. In the 1996-2003 period government spending was on average 40% GDP, which affects the strength of automatic stabilizers as well as other macroeconomic developments in case of discretionary actions. Chapter 3 gives attention to the effects of discretionary fiscal policy on a set of macroeconomic variables in Croatia with the main goal to assess the pattern of stabilization effects. In order to do so a structural vector autoregression (SVAR) is employed trying to answer the following set of research questions:

1. Does the Croatian economy respond in a Keynesian manner regarding output?
2. With respect to the response of private consumption, can consumers in Croatia be mainly categorized as Ricardian or non-Ricardian?
3. Are government spending or taxes more effective in boosting private investment?
4. Is there a relation between discretionary fiscal policy and labour market outcomes?

Further, when stabilizing the economy during the latest economic crisis most of the attention is devoted to discretionary fiscal packages as effective tools in boosting output. In order to enlighten the possible (positive) effects of fiscal stimuli even more, a number of studies distinguish fiscal multipliers during recessionary times from those during expansionary times. Empirical evidence show that discretionary actions are much more effective and significant during downturns (Auerbach and Gorodnichenko, 2012; Ilzetzki et al., 2010; Batini et al., 2012, among others). In this respect, Chapter 4 shed some light on fiscal multipliers in Croatia in a non-linear framework. The main goal of this study is to investigate whether the conclusion of more effective and significant multipliers in *bad* times also holds on the Croatian case, and it provides answers to the following questions:

1. Is the spending or tax multiplier more effective during economic downturns?
2. Are current or capital spending more efficient in boosting output, private consumption and private investment?
3. Can government spending for wages create a significant shift in output or private consumption?

These three essays (Chapters from 2 to 4) contribute to the study of fiscal policy in Croatia. Although they mainly involve standard estimation procedures, they present results in the field that had no prior empirical evidence on the Croatian case and is of great importance not only for Croatian policymakers and academia, but for a broader audience as well when searching for instance a pattern of stabilization effects in developing or Central and Eastern European countries.

One of the most controversial issue in fiscal policy, deeply discussed within its theoretical and empirical aspect is represented by the cyclically adjusted budget balance. As already mentioned this indicator is of crucial relevance for EU countries and fiscal surveillance almost entirely relies on its estimation. The main benefit of this measure is that it shows the true effort of policymakers in balancing their budgets and maintaining sound public finances.

However, the cyclically adjusted budget balance still presents some crucial shortcoming regarding its measurement and estimation. Generally, its estimation is carried on in three steps. The first step implies the estimation of potential output and output gaps. The second step deals with the estimation of the overall budget elasticity as a compound measure of different tax and spending elasticities with respect to output gap. The last, third step involves combining estimated output gaps and budgetary elasticity in order to perceive the cyclical component of the budget first, followed by the cyclically-adjusted figures. During such an estimation process two main shortcomings of the CABB as a indicator of fiscal policy arise. On one hand potential GDP is unobservable and therefore its estimation is highly sensitive to the usage of methodology. Therefore, all output gap estimates (and cyclically-adjusted budget balance figures) are subject to substantial unreliability. Langedijk and Larch (2007) conclude that uncertainty in output gap estimates can even give rise to an inappropriate policy response. On the other hand, the overall budgetary elasticity parameter, except for being time invariant, is obtained as a weighted sum of different tax and spending component elasticities. When computing these the problem of endogeneity arises, that has not been properly addressed within the official methodology[21].

Therefore the main aim of the last essay presented in Chapter 5 is to debate the functionality of the cyclically adjusted budget balance and the SGP structural budget fiscal rule. In order to pursue this goal in the most objective manner, the research is not

[21]The official methodology in computing the overall budget elasticity follows the work of Girouard and Andre (2005), which take over from van den Noord (2000). In the case of the latter only OLS estimators were employed, while Girouard and Andre (2005) introduce the GMM in case of some tax elasticity equations. Girouard and Andre (2005, p. 28) conclude that *"overall, the effect of the revised set of elasticities and the impact of lags did not modify significantly the cyclically-adjusted position of most OECD economies"*. However,Murchinson and Robbins (2002) show an exercise of estimating the CABB as well as the fiscal policy stance on the case of Canada by comparing the OLS and GMM estimator. Their results show that the coefficients of the OLS estimation are biased toward zero and that the cyclical component is systematically larger in absolute terms (more than twice) under the GMM methodology.

based on a Croatian, but Austrian dataset. Due to a number of problems that characterize Croatian fiscal policy (such as data availability, inconsistent government statistics, tax unpredictability and numerous changes within all tax components) focussing on the Croatian case in this situation could significantly bias the results. It involves estimation of a DSGE model calibrated on the Austrian case, and a simulation experiment based on the retrieved parameters is used as the data generating process of all macro-variables needed to compute the elasticity estimations, the output gap estimations, the cyclically adjusted budget balance estimations as well as retrieve informations about fiscal policy based on the latter. Moreover, all the results retrieved within the official methodology framework are compared to two alternatives retrieved from the DSGE model. Therefore, this Chapter proposes an alternative way of measuring automatic and discretionary fiscal policy and compares the results retrieved in such a manner with what would be official EC estimates. Main research questions include the following:

1. Is structural budget balance measured within a DSGE model significantly different from the same obtained using the EC methodology?
2. Is there a mis-signal with respect to the fiscal policy stance when using different estimation approaches?
3. Is a 0.5% GDP structural deficit limit a good threshold for not violating the Maastricht deficit rule?
4. Does the alternative approach in measuring fiscal policy lead to a more effective fiscal policy action and response? Would it lead to better macroeconomic developments with respect to output growth, employment, inflation for example?

1.5 Data and methodology

As previously mentioned Chapters 2 to 4 investigate fiscal policy issues on the Croatian case. Data used throughout these Chapters involve macroeconomic and fiscal variables retrieved from several sources[22]. The macroeconomic variables (like output, private consumption and investment, inflation, wages, etc.) are sourced from the Croatian Bureau of Statistics (CBS) official web page and its corresponding periodical publications. Fiscal variables are on the other hand either retrieved directly from the Croatian Ministry of Finance (MFIN) or from their publications (Monthly statistical reviews) available at their official web page. Although each Chapter includes a Section devoted to the explanation of data and methodology it is important to point out two things regarding fiscal data on the Croatian case. All fiscal variables used throughout the estimation procedures involve the consolidated central government level and are expressed within the Government Finance Statistics 1986 (GFS1986) framework, discussed a bit in details in

[22] A detailed description of all the variables is presented in Appendix C

Chapter 2. The fifth Chapter investigates some key fiscal policy issues by proposing a new point of view, not on the Croatian case anymore, but with respect to the Austrian case, as one of the fiscally most stable countries amid European Union members. In the latter case all variables (macroeconomic and fiscal) are retrieved from the Eurostat official web page. Moreover, since the essays are written in different point of time the data coverage slightly differs amid Chapters, i.e. the first essay covers a period from 1995 to 2009, while the rest extend up to year 2011.

The used methods vary according to the different research questions under analysis. In order to measure the cyclical as well as the cyclically adjusted budget balance on the Croatian case, the estimation procedure follows official European Commission (EC) methodology steps, employing mostly simple regression (OLS) analysis (Chapter 2). To investigate the stabilization effects of government spending and tax shocks (Chapter 3) on a set of macroeconomic variables a structural vector auto regression (SVAR) analysis is applied, as proposed by Blanchard and Perotti (2002). Since these results represent the stabilization outcomes in the so called *normal* times, in order to investigate whether there is a significant difference among same effects in *good* (expansion) and *bad* (recession) times a smooth transition vector autoregression (STVAR) framework is used along with the direct projection approach as proposed by Auerbach and Gorodnichenko (2011) (Chapter 4). At last, in order to point some limitations and shortcomings of the EC official methodology when assessing the cyclically adjusted budget balance and fiscal stance, and in order to propose a different point of view a medium scale small open DSGE model is employed. However, all methodologies are in detail explained and presented within the corresponding Chapter.

1.6 Structure of the dissertation

This dissertation is written in the form of four publishable papers (essays) discussing the aforementioned main fiscal policy issues: the cyclically adjusted budget balance as the main *fiscal indicator* and the effects of discretionary fiscal policy on the macroeconomic environment. Before the four essays there is an introductory chapter setting forth the link among the essays as well as the theoretical and empirical background that relates them as a whole. At the end of the dissertation a concluding chapter summarizes the main research findings across all studied fields, describing the overall contribution and setting some main policy implications of the performed analyses.

The first essay (Chapter 2) deals with the estimation of the cyclically adjusted budget balance based on the European Commission official methodology using the evidence from Croatia. As mentioned earlier, this research has been done in time when Croatia was not part of the European Union and therefore the main goal was to investigate a hypothetical situation of compliance to the SGP. Moreover, another goal was to shed some light on the character of fiscal policy on the Croatian case and inspect its eventual

counter-cyclical behavior. This Chapter is divided into five sections. The introductory part is followed by a theoretical background that introduces the concepts of cyclical and cyclically-adjusted (structural) budget balances, presents its development as an indicator in the field of fiscal policy across time, pinpoints the strengths and shortcomings revealed in the relevant literature. Moreover it places its importance in the context of the EU and EMU and their fiscal policy rules. The next section deals with the two main fiscal policy tools: automatic stabilizers and discretionary measures focussing on the Croatian case. In order to assess those, this section gives insights into the development of the Croatian fiscal policy during the period of analysis (1995-2010) and in parallel inspects the output gap using the HP filtering on the Croatian case. It presents the results about the overall budget balance sensitivity according to the official methodology and its influence on the size of cyclical (and thus cyclically-adjusted) component of the budget in Croatia in the observed period. Moreover, obtained results are used to define the fiscal policy stance and to gauge the pro- and counter-cyclicality of the Croatian fiscal policy. After that, the results are discussed in light of policy recommendations and implications, conferring about the (at that time) hypothetical *obedience* of Croatia to the SGP and about the public debt problematics, proposing eventual gains in targeting the budget balance in structural and not actual terms. Concluding remarks are presented in the last (fifth) section of this Chapter.

The third Chapter investigates the power of fiscal policy as a stabilizing tool on the Croatian case. Same as in case of the previous Chapter it is structured into five sections. The first section introduces the problem of assessing the stabilization effects of fiscal policy no matter of the country case in question and explains why there is no empirical proof of unanimous evidence of such effects. The next section presents an extensive literature review of the relevant studies in this field. It provides evidence of empirical results regarding the effects of the main fiscal instruments (government spending and taxes) as well as their subcomponents (such as capital spending or direct taxes only) on a set of macroeconomic variables: output, private consumption, private investment, prices, interest rates and labour market variables. Moreover, the relevant studies are divided among developed and developing countries. The third section of this Chapter describes the methodology and data used in assessing the stabilization effects of fiscal policy in Croatia. In wake of that, next section presents the results of the pinpointed effects and stresses the size of spending and tax multipliers in Croatia across twenty quarter. The last section of this Chapter is reserved for concluding remarks.

As mentioned earlier, there is an emerging strand of literature explaining that fiscal policy effectiveness in stabilizing the business cycle fluctuation strongly depends upon the registered phase of the business cycle when implementing fiscal stimuli packages and thus discretionary fiscal policy. In light of that, the effects analyzed in the third Chapter may differ depending whether the economy is experiencing *good* or *bad* economic times. Therefore the fourth Chapter presents the results of fiscal policy effects in a non-linear framework where the effects are detached between expansions and recessions. This

Chapter is structured into five sections. After a brief introduction, the second section provides the underlying theoretical assumptions and compares empirical evidence of fiscal policy effects among a linear and non-linear empirical strategy across countries. This section is followed by a detailed explanation of the methodological frameworks (linear and non-linear) and data used in assessing the fiscal policy effects on the Croatian case. The fourth section comparatively presents the results, which include the effects of government spending and taxes on output, private consumption and private investment when business cycle fluctuation are and are not taken into considerations. Moreover, since fiscal stimuli packages that involve government spending are considered to be *easier* (than taxes) due to a decreased problematic with respect to the *fiscal policy lags*, a deeper analysis of the effects of different spending components is also carried out. Conclusions together with policy recommendations are set forth in the last (fifth) section of this Chapter.

The fifth Chapter returns to the problem of measuring fiscal policy. After showing all the retrieved results on the Croatian case, this Chapter proposes another way of measuring the cyclical and structural component of the budget when assessing compliance to the SGP as well as defining a country's fiscal stance and cyclical behaviour of fiscal policy. In order to investigate potential benefits when relying on a different methodology this research does not involve the Croatian case, but tries to examine a new approach under the light of a fiscally stable country. The latter is represented by Austria, and the Chapter is divided into six sections. The first introductory section pinpoints the discussions regarding the appropriateness of the cyclically-adjusted budget balance as a single-number measure of discretionary fiscal policy and highlights the problems of the official EC methodology. Moreover, it gives the overview of the European fiscal rule legislation with an emphasis on the post-crisis novelties. The second section explains the need of fiscal rules in the EU governance framework and emphasizes the role of the cyclically-adjusted budget balance as a (remaining) cornerstone within the SGP and the post-crisis introduced Fiscal compact. The third section describes the model and the assessment of the official and alternative methodologies used when estimating the structural budget balance. It gives a brief explanation of the official methodology and of the model-based measurement. The results are presented in the following two sections. The fourth section presents the results regarding the output gap, as well as cyclical and structural component estimates. Moreover, after assessing the fiscal policy stance, this section presents the average number of cases when there is dissent amid the model-based and alternative methodologies in defining fiscal policy restrictive, expansive or neutral. The fifth section deals with the results within the European fiscal framework, i.e. the Maastricht deficit rule and the SGP structural deficit rule, with the emphasis on the evidenced disagreement about time of occurrence. The last section presents the results, followed by the concluding section.

After the overall concluding Chapter (Chapter 6), there is the reference list and appendices related to the four essays. These include a detailed overview of the data definitions

and sources, additional estimation tests and/or results that are not presented across the main works, supplementary figures, deeper model explanations and similar.

2. DISCRETIONARY MEASURES AND AUTOMATIC STABILIZERS IN THE CROATIAN FISCAL POLICY[1]

2.1 Introduction

The public economics literature has shown that economic cycles have important short-term effects on public finance. To look at the cyclical properties of the overall budget balance, it is common to split it in two components: the cyclical balance and the cyclically adjusted (or structural) balance (Gali and Perotti, 2003). Variations in the cyclical balance are out of the control of fiscal authorities and show the work of automatic stabilizers, while changes in the cyclically adjusted budget balance are generally interpreted as resulting from discretionary actions taken by policy makers. Moreover, the latter can be used to provide an early warning of the need for budgetary adjustment and changes in the future direction of policy (Chouraqui et al., 1990).

Recently, the cyclically adjusted budget balance became important as an indicator for surveillance of fiscal discipline, especially in the context of the European Monetary Union and the related Stability and Growth Pact (SGP). According to the latter, the cyclically adjusted budget balance is calculated to assess whether the prevailing fiscal situation in individual member states is sufficient to adhere to the requirements of the Pact. Based on these calculations the European Commission is able to determine whether the member states position is strong enough to guarantee that the actual budget deficit does not exceed the threshold of three percent of GDP during a cyclical downturn (European Commission, 2006). In this way the European Commission accents that fiscal stabilization should be primarily left to automatic stabilizers, while discretionary fiscal policy should be an exemption (Buti and van den Noord, 2004).

The main issue of this paper is to discuss the role and impact of fiscal policy in Croatia by disentangling the budget balance in its cyclical and structural (i.e. cyclically adjusted) component. The purpose of calculating cyclical components of the budget balance is to obtain a clearer picture of the impact of cyclical variations in economic activity on the Croatian government budget and to use this information as an indicator of the degree of economic stabilization resulting from *automatic* fiscal policy. Emphasizing the structural component of the budget balance along with its changes for Croatia aims at identifying the fiscal policy stance in contraction and expansion times in Croatia. Still, although a similar research is done by Švaljek et al. (2009) using the methodology developed by the European System of Central Banks, this paper tries to accent how would the European Commission and European Council evaluate the Croatian fiscal policy in the context of the SGP (i.e. in the framework of the so called preventive and dissuasive arm) and apprise eventual fiscal policy rules. Moreover, the motivation for this paper lies also in

[1] Published in *Ekonomska istraživanja*, 24(3), September 2011.

assessing the fiscal policy stance as well as the role, extent and strength of automatic stabilization in Croatia, which should be an important input for future empirical and theoretical research in economic policy on the Croatian case.

Main results indicate that the overall responsiveness of the budget to cycle fluctuations in Croatia in the observed period is 0.47% of GDP. Countercyclical (and stabilizing) periods in the Croatian economy are observed in the period between 1998 and 2000, and then in 2005, while fiscal authorities carried out pro-cyclical discretionary policy during an expansion phase in 1997 and 2007, which even amplified the actual budget deficit. When comparing these results with those in other countries, automatic stabilization in Croatia seems to be comparable with NMS-12 or CESEE countries. If considering a hypothetical Croatian case under EU fiscal rules, it is noticeable that the budget deficit exceeded Maastricht deficit rule in 2000 and 2009. Still, in year 2000 there was no particular downturn that caused the deficit exceeding the threshold of 3% GDP and would (*a posteriori*) be the year when the Ecofin Council would implement the excessive deficit procedure and follow the given Ecofin measures.

The rest of the paper is organized as follows. Section 2.2 presents a theoretical framework of fiscal policy's channels for macroeconomic stability and the reason why the cyclically adjusted budget balance became crucial for deriving policy conclusions. Section 2.3 is divided in three parts. The first part deals with some empirical facts about business cycles, budget balance and fiscal ratios in the case of Croatia. The second part shows the estimation results of the cyclical and structural component of the budget balance using the European Commission approach, while the third part questions the implications of the structural budget balance in managing public debt in a very intuitive manner. Section 2.4 considers some policy implications and recommendations while Section 2.5 is reserved for concluding remarks.

2.2 Theoretical framework

Fiscal policy can contribute to macroeconomic stability through three main channels. The *first* channel involves automatic stabilizers. They reflect the capability of the tax and public spending system to adjust over the business cycle without direct government intervention[2]. Automatic stabilization occurs because tax revenues tend to be broadly proportional to national income and expenditure, whereas public spending reflects government commitments independent of the business cycle and unemployment benefits

[2]For example, in boom times, governments collect more taxes and decrease the unemployment benefit support, which results in lowering private income to taxpayers and prevents the expansion in aggregate demand. Conversely, in recession times governments collect fewer taxes and increase unemployment benefit payments, which support private income and moderate the unfavourable movements in aggregate demand. For a deeper discussion on automatic stabilizers see van den Noord (2000) and Braconier and Holden (1999).

designed to support spending during downturns. The *second* channel embraces discretionary measures. Governments can deliberately change public spending and tax instruments to offset business cycle fluctuations. The *third* channel deals with the fact that the structure of tax and transfer system can be designed to maximize economic efficiency and thereby enhance the flexibility of the economy in the face of shocks.

Nominal figures of the actual budget balance reflect both, automatic stabilizers and discretionary measures. Therefore, they are not useful when trying to assess the positioning of underlying fiscal policy and possible structural imbalances, i.e. fiscal positions generated under the potential level of output.

In order to capture the cyclical properties of the actual budget balance it has to be divided in two components: *the cyclical balance* and *the cyclically adjusted* or *structural balance* (Gali and Perotti, 2003). The cyclical budget balance requires two inputs: (1) a measure of the cyclical position of the economy, generally estimated using the output gap and (2) a measure of the link between economic cycle and budget, generally outlined by the elasticity parameters that represent a percentage change in a budgetary item associated with a percentage change in the level of economic activity. Hence by construction, the cyclical balance is zero when the output gap is closed (i.e. actual output equals the trend level of output). Subtracting the cyclical balance from the actual budget balance provides the cyclically adjusted budget balance (or structural budget balance). The latter shows a hypothetical balance that would be observed if output was on potential or trend level. Changes in the cyclically adjusted budget balance are generally interpreted as discretionary actions taken by fiscal authorities, while the cyclical budget reflects the functioning of automatic stabilizers.

According to the OECD (Giorno et al., 1995) estimates of the structural balance help to *provide a clearer picture of government's underlying fiscal situation* and can be used as a *guide to fiscal policy analysis*. Being that the fact, the cyclically adjusted budget balance started to play a crucial role for deriving concrete policy conclusions and different methodologies for its evaluation emerged, among which the most commonly used are those developed by international institutions such as the IMF, OECD, ECB and EC (for an overview of all approaches see Boije (2004)).

Given their raising popularity, measures of the cyclically adjusted balance started to reveal some shortcomings. A first set of shortcomings appeared in the late 1980s when Blanchard (1990) pointed out that the cyclically adjusted budget balance, along with its predecessor, the *full employment surplus*[3], was used as *jack-of-all-trades*. Although its original purpose was to tell what would be the balance if the economy was operating at full employment, the OECD relied on it as *index of discretionary changes in fiscal policy,*

[3]Amid the first to form and calculate an indicator, which would measure the level of the budget balance when the economy operates at a full employment level, was Brown in 1956 for the US economy and named it the full employment surplus (Brown, 1956). He showed that the assessment of fiscal policy in the US in the 1930s would have significantly changed if, instead of using the headline budget balance, it had been adjusted for the effect of unemployment.

index of sustainability, index of fiscal policy on the economy and as normative index (Blanchard, 1990). A second set of shortcomings appeared when the cyclically adjusted budget balance started to be targeted for fiscal surveillance, mainly by the European Commission in context of the SGP[4]. A fiscal surveillance based on such an indicator has to be taken with caution for several reasons. Larch and Salto (2005) point out that whenever potential output turned out to be lower or higher than assumed, observed changes in the cyclical budget balance were off the target even if budget plans were implemented accurately[5]. Additionally, the assumption of constant tax elasticities may be acceptable as long as the variations in the tax content of economic growth remains small[6]. Nevertheless, the revealed shortcomings during the EU fiscal surveillance were actually linked to a specific economic event. Therefore the European Commission did not abandon the cyclically adjusted budget balance, but strived to understand the reasons of the shortcomings and tried to look ways to improve the accuracy of the indicator[7] (Larch and Turrini, 2009). However, nowadays the main shortcoming of the structural budget balance is related to the estimation of potential output, which is taken as reference path when estimating balance measures[8].

On the other hand, empirical practice showed that targeting the cyclically adjusted, instead of the actual budget balance results in a number of benefits. For instance, such targeting facilitates the implementation of counter-cyclical fiscal policy, leads to an increase in public saving during periods of strong growth while reducing government's needs for foreign financing and ensures financial stability of social policies and facilitates their long-term planning. Fiscal rules involving the cyclically adjusted budget balance are also considered to be important when monitoring public debt sustainability.

[4]The Stability and Growth Pact (SGP) is an agreement among EU member states that are part of the Euro zone to maintain the stability of the Economic and Monetary Union. The Pact was adopted in 1997 to maintain and enforce fiscal discipline in the Euro area. Member states adopting the euro have to meet the Maastricht convergence criteria and the Pact ensures the monitoring of the same criteria.

[5]Although the IMF in its World Economic Outlook, the OECD in its Economic Outlook and, since recently, the EU in its European Economy regularly comment on fiscal positions in structural terms as measured by the cyclically adjusted balance, associating changes in structural deficit to discretionary policy interventions, in the early 2000s this practice gave rise to some disagreements in several EU member states when the cyclically adjusted budget balance was targeted for fiscal surveillance. Namely, observing a deterioration of the cyclically adjusted balance as expansionary fiscal stance, the European Commission blamed national fiscal authorities for deviations from budget plans on discretionary fiscal policy. In the same moment, national fiscal authorities maintained that the budget was implemented as firstly planned and that no increased discretionary spending was adopted. Such a disagreement pointed out one possible shortcoming of the cyclically adjusted balance because turned out to be related to two different points. On one side, national governments often overestimated their medium-term growth, while on the other side, the European Commission did not take into account that the decline in potential economic growth affect the cyclically adjusted balance.

[6]During the economic boom in the late 1990s the calculation of the cyclical component of the budget for some EU member states resulted to be overestimated, due to the assumption of constant elasticities. This fact misled national fiscal authorities to think that there was room for tax cuts and expenditure increase, which in the following years turned out to be unsustainable.

[7]The European Commission showed first steps also toward considering the fact that it is necessary to analyze the behaviour of individual tax bases in order to perform a more precisely estimation of budgetary elasticities as according to the ESCB (ECB) approach (European Commission, 2008).

[8]For potential output estimation methods see Boije (2004), Giorno et al. (1995) or Bouthevillain et al. (2001)

2.3 Automatic Stabilizers vs. Discretionary Measures: Case of Croatia

This Section focuses on disentangling the cyclical and the structural component of the budget balance in the Croatian case and analyses their implications. As a rule, the measurement of the cyclically adjusted budget balance includes *three steps*. The *first step* involves the estimation of the potential output that could be obtained in the absence of cyclical fluctuations in the economy. The difference between the actual output and the estimated potential level of output results in the output gap. The *second step* takes into account the estimated output gap and budgetary revenues and expenditure elasticities in order to evaluate the sensitivity of budgetary items and reveal what would be their size (value) in a case of closed output gap. The correction for cyclical changes is important because the budget balance tends to deteriorate (improve) during recessions (expansions) as a result of automatic stabilizers. The *third step* consists of the estimation of the cyclically adjusted budget balance (or structural budget balance) by subtracting from the actual budget balance the cyclical budget balance.

The analysis in this paper is based on quarterly data[9] for the period 1995Q1 to 2009Q4 (i.e. 60 observations) and the following two facts are important to be noticed.

First of all, empirical practice shows that the estimation of cyclically adjusted budget balance is usually based on consolidated general government data. This paper uses quarterly data at the consolidated central government level, mainly because quarterly data about total revenue and expenditures for the consolidated general government are not available for the period between 1995 and 2004. Nevertheless, this should not pose a limitation for this research principally for two reasons: firstly, in Croatia the (consolidated) central government carries all the discretionary policy actions and local governments have no *fiscal role* in this sense, and secondly, the share of local government in the general government is on average less than 10%, so its omission should not significantly influence the estimation results[10].

Secondly, in 2004 the government finance statistic in Croatia registered a structural break due to a methodological change in government accounting. Specifically, a switch from the Government Finance Statistics 1986 (GFSM 1986) to the Government Finance Statistics 2001 (GFSM 2001) methodology occurred. In order to have a more consistent series this

[9] For a detailed view of data definition and sources see Appendix C.

[10] Same data limitation as well as consistency of the results using consolidated central government data for Croatia are also emphasized by Benazić (2006), Rukelj (2009) and Vučković (2010). Boije shows the breakdown of the cyclically adjusted budget balance for Sweden and stresses that *Fiscal policy decisions are usually referred to discretionary changes in revenues or expenditures that affect the central government budget* (Boije, 2004, p. 10) while showing that discretionary fiscal policy in central government budget largely affected the structural budget balance. Moreover, there are other papers about cycilically adjusted budget balances in all Scandinavian countries and Chile, in which the estimation is obtained using central government data (see for instance Brunila and Tujula, 1998; Brunila et al., 1999; Braconier and Holden, 1999; Marcel et al., 2001.

research uses quarterly data on central government based on GFSM 1986 only. That is, data after the second quarter 2004 were reclassified from GFSM 2001 to GFSM 1986 (a broad overview of the reclassification method is presented in Appendix A). Although the newer version of GFSM is more accurate, especially because it integrates acquisition and sale flows of non-financial and financial assets in government accounting, the lack of a detailed statistics on consolidated general and central government levels prior to year 2004 excluded the possibility to have a consistent series based on GFSM 2001.

2.3.1 *Empirical Framework: Output Gap, Budget Balances and Fiscal Ratios*

In order to assess the cyclically adjusted budget balance the evaluation of the output gap, budget balances and fiscal ratios is needed. This research bases the estimation of output gaps on the Hodrick-Prescott filter[11]. Such a filtering requires an appropriate selection of the smoothing parameter λ. When the estimation is derived from quarterly data, it is empirical practice to choose the smoothing parameter being 1600 as suggested by Hodrick and Prescott (1980) in their original work. The choice of the weight parameter λ in this research is actually lower than the latter and follows the suggestion given by the ESCB (ECB) in the work of Bouthevillain et al. (2001). After a detailed analysis of a *reasonable* length of the business cycle over which budgets should be balanced the ESCB (ECB) suggests a value of λ=30 for annual data and the value of λ=480 for quarterly data[12].

After the initial and highest contraction in the beginning of the 1990s[13], output growth has been more stable in Croatia. The real GDP growth rate in the observed period resulted to be on average 3.44%, reaching the lowest rate in 2009 (-5.8%) as a spill over

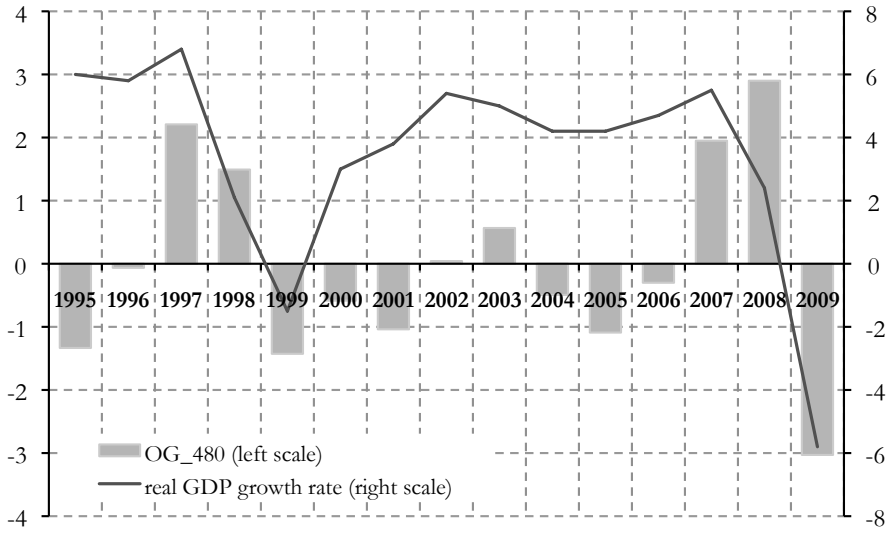
[11] As other methods for estimating potential output, so the Hodrick-Prescott filter has its shortcomings, which have to be noticed. A more detailed discussion on HP filtering and its pro and cons can be found in Guay and St-Amant (1997), Ahumada and Garegnani (1999), Ravn and Uhlig (2002) and Ivanov (2005), as well as the mentioned paper by Bouthevillain et al. (2001).

[12] Such choice follows empirical practice done by the European Commission and by the ESCB, which is based on the assumption that a business cycle in EU member states on average lasts 8 years. Therefore, the value of the smoothing parameter is set so that compression effects do not exceed 10 percent of the amplitude of cycles of up to 8 years Bouthevillain et al. (2001, p. 30). As this analysis focuses on the Croatian case it is important to evidence that empirical practice of the HP filter on Croatian data show the use of λ=300 for quarterly data (see for instance Bačić et al. (2004); Cerovac (2005); Švaljek (2003). This value is based on the assumption that a business cycle in Croatia lasts on average four years. Still, the mentioned researches for the Croatian case were based on the time series reaching the endpoint in year 2004 at most. During the period prior to 2004 business cycles were on average four year long due to high volatility of the economy, but when extending the series up to 2009 (as in this research) it can be noticed that the last business cycle is much longer and therefore increases the average business cycle length. The choice of not using λ=300 can be also validated by the fact that results obtained using such a smoothing parameter value were on average just 0.001 per cent (and at most 0.4 percent in year 2007) different from those when λ=480 was used. Being that the fact and in order for the results to be more comparable with those across European countries, λ=480 is chosen.

[13] From independence (year 1990) until 1994, Croatia was facing output declines above 7% GDP (evidenced real GDP growth rates were: -7.1% in 1990, -21.0% in 1991, -11.0% in 1992 and -8.0% in 1993).

effect of the global recession. Figure 2.1 shows output growth rates and estimated output gaps in the period between 1995 and 2009.

Figure 2.1: *Output gap (left scale) and real output growth rates (right scale) in Croatia in the period between 1995 and 2009.*



Source: CBS; Author's calculation.

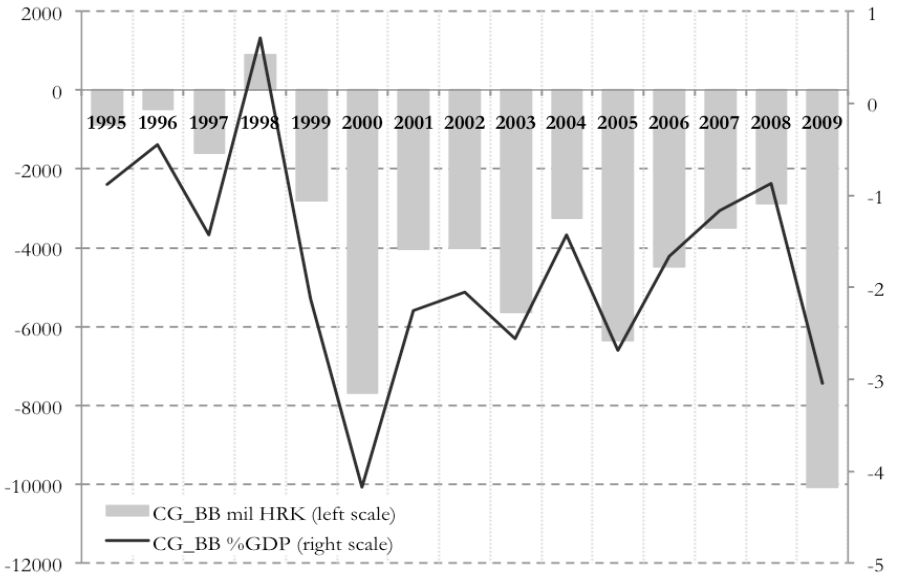
When considering the relations between the output growth and the output gap it may be concluded that in the observed period Croatia faced twice phases of late contraction and twice of late expansions[14]. The negative output gap and negative output growth rate were registered in 1999 and 2009, while a positive output gap along with positive growth rate was evidenced in 1997 and in the two-year period 2007-2008. Interesting to notice is that the early expansion phase in the period between 2000 and 2002 was not followed by a late expansion phase but by an early contraction phase in 2003, meaning that there was no boom in the Croatian economy but just a recovery phase[15].

In the observed period the central government budget balance was on average 3.8 billions kunas in deficit (see Figure 2.2). Nominally speaking, the highest deficit is registered in 2009 (10.1 billions kunas), but still, when expressing the balance in per cent of gross domestic product the highest deficit was recorded in 2000 (4.18% GDP).

[14] An *early* expansion phase is a period when the economy faces a positive growth rate with the output gap being still negative. A *late* expansion phase is registered when the positive growth rates are accompanied by a positive output gap. Similarly, an *early* contraction phase encompasses a negative growth rate and a positive output gap, while a *late* contraction phase is evidenced when both growth rate and output gap are negative.

[15] In his analysis on the Croatian economic activity from 1999 till 2010, Krznar (2011) shows that the Croatian economy faced a recession in 1999 and 2008, which is same as in this paper. This is important because he used three different methodologies (the simple analysis of quarterly growth rates of GDP, the Bry-Boschanov algorithm and the Markov model) which all yield to same conclusions.

Figure 2.2: *Central government budget balance in millions HRK (left scale) and in percent GDP (right scale) in Croatia in the period between 1995 and 2009.*



Note: Central government (CG) budget balance is expressed according to GFSM 1986
Source: MFIN (Statistical Informations)(Several issues); Author's calculation.

The central government budget balance faced a deficit through the whole observed period fluctuating around 1.75% of GDP, except in 1998 when the newly introduced value added tax (VAT) replaced the sales tax and led to a rapid growth in budgetary revenues. From then on, VAT revenues became the most abundant tax revenue in Croatia, accounting on average 12.47% of GDP in the observed period. Direct taxes add up to 6.06% of GDP on average having therefore a small contribution to total government revenues. Interesting to notice is that the personal income tax (PIT) revenue decreased its financial importance during the observed period, while the corporate income tax (CIT) revenue moved in the opposite direction (Table 2.1). Lower PIT revenues are due to numerous changes in the personal income tax legislation, that included raising the level of personal allowance, widening and adding tax brackets, reducing tax rates and introducing deductions[16].

[16]For a deeper discussion see Petrović (2007); Urban (2006a, 2009a,b).

Table 2.1: *Fiscal ratios in Croatia, percent GDP*

	1995	1997	1999	2001	2003	2005	2007	2009	Average
Total revenue	**43.96**	**43.02**	**47.33**	**37.09**	**35.67**	**35.15**	**36.26**	**34.41**	**38.89**
Taxes+SSC			**39.05**	**32.82**	**31.39**	**30.77**	**32.95**	**32.42**	**33.23**
Direct taxes	*6.82*	*6.86*	*6.99*	*4.72*	*5.04*	*5.02*	*6.74*	*5.96*	*6.06*
PIT	5.80	5.41	5.32	3.69	3.69	3.52	3.94	3.13	4.38
CIT	1.02	1.44	1.67	1.04	1.36	1.50	2.81	2.83	1.68
Indirect taxes	-	-	*18.30*	*16.22*	*15.82*	*15.22*	*15.87*	*14.42*	*16.22*
VAT	-	-	13.97	12.19	12.38	12.14	12.01	11.12	12.47
Excise	5.04	4.33	4.33	4.02	3.44	3.08	3.86	3.30	3.95
SSC	*16.25*	*16.01*	*13.76*	*11.34*	*10.53*	*10.38*	*10.34*	*12.04*	*12.36*
Total expenditure	**44.84**	**44.46**	**47.68**	**39.35**	**38.24**	**37.84**	**37.43**	**37.46**	**40.64**
Unemployment comp.	0.27	0.43	0.38	0.38	0.33	0.34	0.24	0.38	0.34
CG budget balance	**-0.88**	**-1.44**	**-2.13**	**-2.26**	**-2.57**	**-2.69**	**-1.17**	**-3.05**	**-1.75**

Notes: PIT, CIT, VAT and SSC stand for personal income tax, corporate income tax, value added tax and social security contributions respectively. The category "Taxes+SSC" embraces the sum of direct and indirect taxes with the SSC (as shown in this Table). Since the VAT predecessor was not reported this category does not show values for the 1995-1997 period. Average values in the last column include the period from 1995 till 2009, except in the case of indirect taxes, VAT and "Taxes+SSC" when the period includes years from 1998 to 2009.
Source: MFIN (Statistical Informations).

In the observed period total revenue amounted on average 38.89% of GDP, while total expenditure 40.64% of GDP[17]. When considering taxes only, Croatia has a relatively high level of indirect taxes measured in terms of GDP, which is usually a characteristic of developing (or emerging) countries, while developed countries' tax system rely mostly on revenue from direct taxation. Indirect tax revenues in Croatia on average amount to 16.22%. The important role of indirect taxes among fiscal revenues may result in a greater influence of fluctuations in private consumption on the overall budget balance.

2.3.2 *The Cyclically Adjusted Budget Balance*

As mentioned previously, a variety of approaches have been developed to decompose government revenue and expenditure into cyclical and structural components. This research is based on the European Commission approach.

[17]Important to note is the "deviation" in total revenue and expenditure in 1999, when for example total revenues were accounted for 47.33% GDP followed by a drop to 41% in 2000 (not reported in Table 2.1) and 37% GDP in 2001. This is due to a substantial increase in the category "Other revenue", due to revenue from privatization.

At the Ecofin Council meeting of May 2004, the European Commission decided that for the estimation of the output gaps the production function constitutes the reference method when assessing the cyclically adjusted budget balance. Moreover, the Hodrick-Prescott filter is to be used when assessing the stability and convergence programme for the new member states (NMS-12)[18] and remains a backup method for old member states.

The European Commission estimates budgetary elasticities for different revenue and expenditure categories according to the approach developed by the OECD and outlined in Giorno et al. (1995), van den Noord (2000) and Girouard and Andre (2005). The revenue sensitivity is a weighted average of four revenue elasticities (i.e. PIT, CIT, social security contributions and indirect taxes), whereby different components are weighted by their respective share in total revenue[19]. The expenditure sensitivity takes only into account unemployment related expenditure, which are assumed to be the only expenditure that *automatically* reacts to cycle fluctuations. However, it is important to notice that in their recent research, Darby and Melitz (2008) show that social spending like health and retirement benefits schemes are more countercyclical than generally acknowledged. The overall cyclical sensitivity of the budget to the economic cycle measured by the semi-elasticity of the budget balance (as % GDP) with respect to the output gap for Croatia is shown in Table 2.2.

Table 2.2: *Summary of elasticities and the overall budget sensitivity in Croatia*

Personal income tax	Social security contributions	Corporate income tax	Indirect taxes	Current expenditure	**Overall budget balance**
0.36	0.32	1.31	0.50	-0.01	**0.47**

Note: Estimations for the mentioned budgetary items is presented in Appendix B.
Source: Author's estimation.

The overall output elasticity of income tax in Croatia is estimated to be 0.36% of GDP[20]. This result is lower than the same in OECD countries and EU member states, where it

[18]New member states are those that joined the European Union during the 2004- and 2007-enlargement. These enlargements embrace Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia in 2004, and Bulgaria and Romania in 2007.

[19]According to the OECD approach the three categories of taxes plus social security contributions and unemployment related expenditure are weighted by their respective shares in GDP (Girouard and Andre, 2005), while according to the EC methodology weights are represented by their respective shares in total revenue.

[20]It is important to point out that in the already mentioned research on cyclically adjusted budget balance in Croatia, done by Švaljek et al. (2009), the real wage elasticity of income tax per worker resulted to be higher and precisely 1.60, while in this paper it accounts for 1.21 (refer to Table B.3 in Appendix B) mainly due to the inclusion of the personal income surtax which is levied by local authorities on the basis of the calculated personal income tax liability. Inserting their value (1.60) in the personal income tax elasticity equation (see Appendix B, equation B.1) the output elasticity of income in Croatia would result higher and precisely 0.42 (instead of 0.36, as shown in Table 2.2 of this work). Still, there would be almost no change in the overall budget elasticity, because the latter is a result of weighted average, where the weight is the share of PIT in total revenues, which in Croatia is very small.

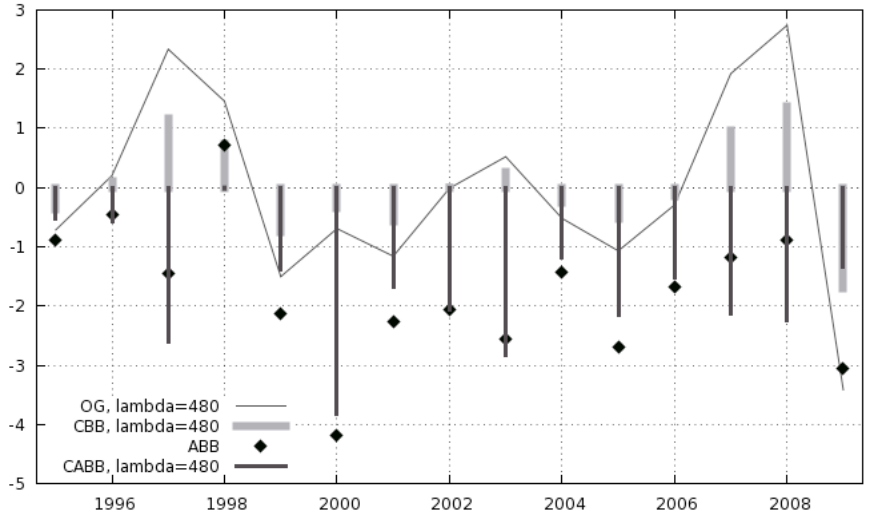
amounts to 1.0% on average. Such a result is due to a lower degree of progressiveness in the personal income taxation[21] (OECD average 1.7%, Euro area average 2,0%, Croatia 1.2%) and lower output elasticity of employment (OECD average 0.6%, Croatia 0.2%). The elasticity of social security contributions in Croatia is also below the EU and OECD average[22].

The CIT elasticity is consistent with the OECD and Euro area average (1.5% and 1.4% respectively). Although the corporate tax in Croatia is proportional (as in most countries), the elasticity above unity is due to the fact that profits are fairly elastic with respect to output (Girouard and Andre, 2005). Additionally, when interpreting this elasticity, it is important to have in mind the treatment of profits and losses, and the provisions for carrying losses forward in other tax years, which in Croatia accounts for at most to five years. Figure 2.3 shows the estimation of the cyclical and structural component along with the actual budget balance and output gap for Croatia between 1995 and 2009.

[21] According to van den Noord (2000) and showed in Appendix B, the measure of progressiveness of the personal income tax is proxied by the ratio between the marginal and average tax rates. Nevertheless, it is very important to notice that Urban (2006b) showed how the tax rates schedule in Croatia influence cause just 13% of the personal income tax progressiveness, and that what actually makes it a lot more progressive are the personal allowances (91% of the progressiveness is caused by the latter). In fact, in Croatia the basic personal allowance among tax payers highly differs upon two factors: (1) who and how many persons the tax payer is *sustaining*, as for instance children, wife, mother, sister, etc., and (2) where does the tax payer live (different regions have different level of the basic personal allowance). Additionally Urban (2006b) stress that due to this fact, changing the personal income tax to a flat tax rate a very high level of progressiveness would still hold.

[22] Although below the EU and OECD average it is important to stress that the estimated elasticities differ from those obtained by Švaljek et al. (2009) using the ESCB approach. The differences lie in methodological divergence from the two methods used as well as in the smoothing parameter used in HP filtering. Their elasticities are higher not only from those obtained in this paper but also from the EU and OECD average. Due to a particularly high elasticity obtained for personal income tax and social security contributions the authors performed also a so-called *non-econometric* approach which resulted in elasticities compared to those in this work.

Figure 2.3: *Output gap (OG) and actual, cyclical and cyclically adjusted budget balance (ABB, CBB and CABB respectively) in Croatia in the period between 1995 and 2009, percent GDP.*



Source: Author's calculation.

In the observed period the cyclically adjusted budget balance was on average in deficit by 1.74% of GDP, respectively. In the phases of late expansion and negative budget balance, the cyclical component registers a surplus, mainly because a high revenue's reaction to the increase in aggregate demand, which makes the actual budget deficit lower than the cyclically adjusted budget deficit.

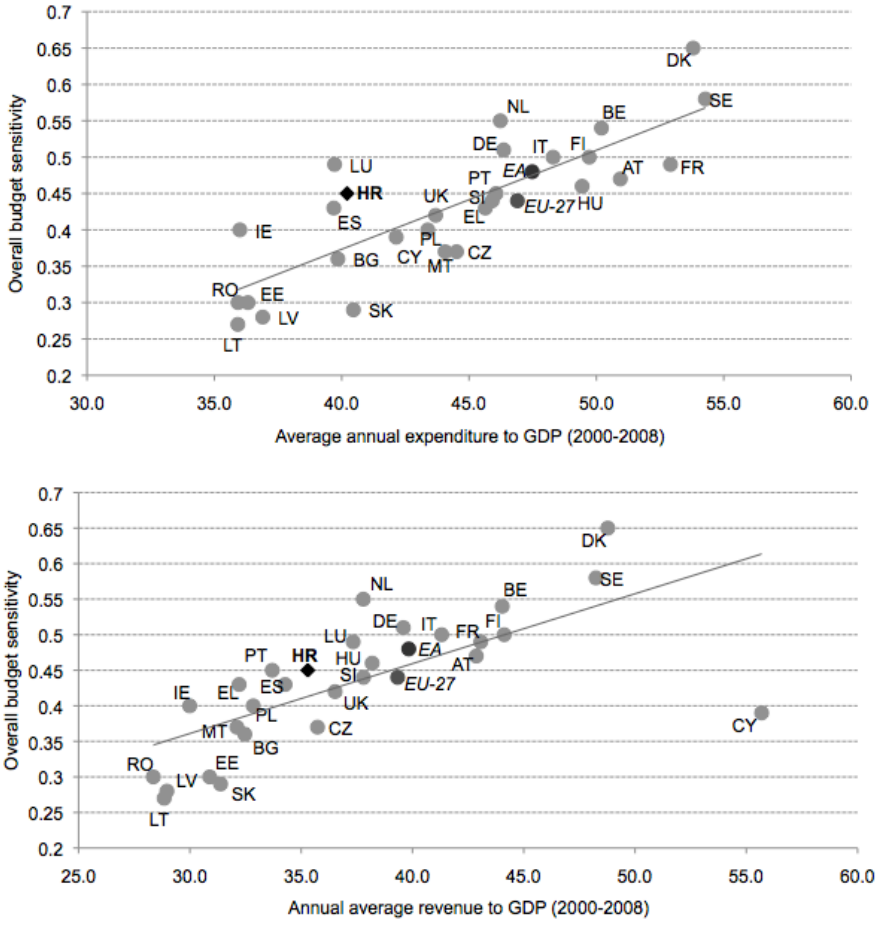
When considering the size of the cyclical component, under a level of uncertainty it may be concluded that automatic stabilizers are not so strong in Croatia. This may be due to the fact that they may be constraint by the combination of low tax elasticities and a relatively low share of taxes in GDP that tends to reduce the responsiveness of revenues to demand shocks. Additionally, the role of expenditure stabilizers may be small because of the weak and insufficient formal unemployment and social security compensation schemes[23].

Moreover, Debrun and Kapoor (2010) show that automatic stabilizers strongly contribute to output stability regardless of the type of economy (advanced or emerging), confirming the effectiveness of timely, predictable and symmetric fiscal impulses in stabilizing output. Deroose et al. (2008) argue that *it is predominantly the differences in size of governments that impact how strong automatic stabilizers are* and stress that the government size reveals sufficient information on the magnitude of automatic stabilizers in different countries. In addition, van den Noord (2000) firstly, and Girouard and Andre (2005) afterwards, suggest that the most important factor in determining the cyclical sensitivity of the fiscal position is the size of the general government sector. The larger

[23]Rubić (2013) points out that in Croatia there is continuously a gap between the needs of the unemployed and what the formal schemes assure them.

the share of government expenditure in domestic output, the greater the sensitivity of fiscal position to fluctuations in economic activity. The IMF (2009) uses for instance the aggregate tax to GDP ratio as a proxy for size of automatic stabilizers in G-20 countries.

Figure 2.4: *Overall budget sensitivity and the government size (proxied by government expenditure in upper panel and by government revenue in lower panel) in EU and Croatia.*



Notes: The revenue category includes receipts from taxes and social security contributions. Both revenue and expenditure data account for the general government.
Source: Eurostat; Eller (2009), MFIN (Ministry of Finance) (Yearbook, Several issues), Author's calculation.

With a correlation of 0.82 in case of annual expenditure (higher panel of Figure 2.4), and a correlation of 0.71 in case of annual revenue (lower panel of Figure 2.4), it may be concluded that government size is a good predictor for the amount of automatic stabilization.

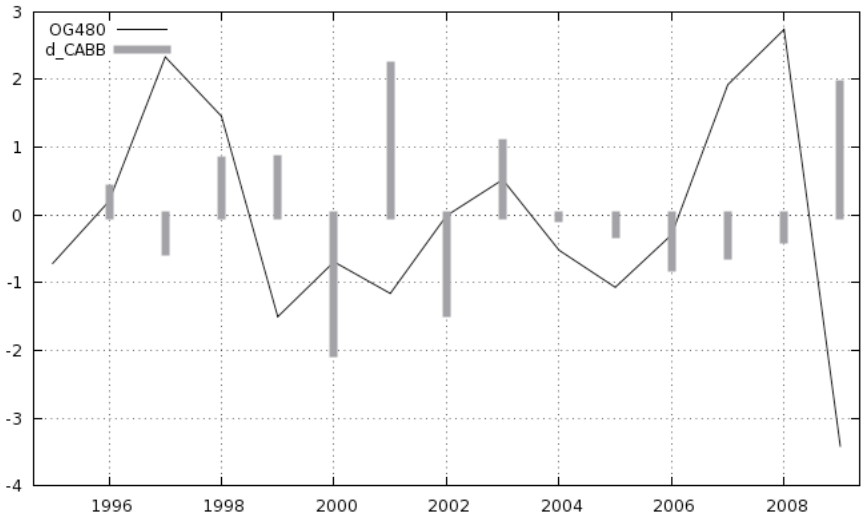
Figure 2.4 shows that automatic stabilizers (proxied by the government size) are very heterogeneous within EU member states. Lower automatic stabilizers are evidenced in NMS-12 and Croatia, although a lower average income (and wealth) registered in these countries should oppositely imply households to be more vulnerable to changes in

aggregate demand. One reason of that could be that countries with lower per capita income tend to have smaller public sectors. From this perspective, weaker automatic stabilizers in Eastern and Southern European countries can potentially be an unintended side effect of the lower demand for government activity including redistribution. Another potential explanation could be the idea that more open economies have weaker automatic stabilizers because domestic demand spills over to other countries.

Eller (2009) shows that the automatic stabilization function of tax and expenditure systems is not as strongly pronounced in the NMS-12 as in the euro area. He showed that a 1% drop in GDP reduces total government revenues by around 1%. As a consequence, the revenue (measured as percentages of GDP) remain almost constant over the business cycle in the euro area and in most of the developing European countries. The response of government expenditure to changes in output proved to be rather inelastic, because a 1% decline in GDP drives up government spending by 0.10% in the NMS-12 countries and 0.17% in the euro area. Auerbach (2002) shows that changes in the cyclical budget balance in the United States roughly offset one third of the output gap. The European Commission stresses that automatic stabilizers cushions changes in output between one tenth and one quarter depending on the degree of openness of countries and the structure of their public finance (European Commission, 2008).

Oppositely to the automatic stabilizers, some countries decide to rely on discretionary actions when stabilizing the output or designing a more efficient fiscal system. As mentioned previously, changes in the cyclically adjusted budget balance can be (with caution) seen as discretionary fiscal policy. Positive changes in the cyclically adjusted balance are usually interpreted as indicator of restrictive fiscal policy, while negative changes are related to expansionary measures. So for instance, countercyclical (and stabilizing) fiscal policy is registered when during a negative output gap fiscal authorities implement expansionary discretionary measures (showed by a deterioration in the cyclically adjusted budget balance) or when, during a positive output gap restrictive measures are taken. Oppositely, pro-cyclicality is evidenced. If changes in the cyclically adjusted balance are considered then it is possible to say that in the observed period fiscal policy in Croatia was pro- and counter-cyclical (Figure 2.5).

Figure 2.5: *Changes in the cyclically adjusted budget balance (dCABB) and output gap (OG) in Croatia for the period between 1995 and 2009, percent GDP.*



Source: Author's calculation.

Figure 2.5 shows that until year 2000, fiscal authorities carried out alternating counter- and pro-cyclical discretionary policy[24]. Kaminsky et al. (2004) emphasize that in emerging economies the often-registered pro-cyclicality of fiscal policy reflects a bias in discretionary fiscal policy, so enhancing automatic stabilizers would provide some counter-cyclical push-back. In the period between 2004 and 2008 Croatian fiscal policy was expansionary, but did not follow business cycle movements, i.e. until year 2006 expansionary fiscal policy was counter-cyclical (and thus stabilizing) due to contraction phase, but from 2006 onward the output gap results to be positive and thus expansionary fiscal policy becomes pro-cyclical. Although Švaljek et al. (2009) using the ESCB approach show lower values of the cyclically adjusted budget balance as a consequence of higher values of budgetary revenue elasticity per tax category[25], the estimated fiscal policy stance in their work reflects the same direction as in this research, except for year 1997. So, overall it is possible to emphasize that in the fourteen-years long observation period Croatian fiscal policy was merely pro-cyclical. Croatia registered a pro-cyclical fiscal policy in eight cases and a counter-cyclical fiscal policy in five cases, while in 2004 the fiscal policy stance was neutral.

Cimadomo (2005) estimates that the fiscal policy is neutral for small variations of the cyclically adjusted budget balance (between -0.2 and 0.2 percentage points). Being that the fact Figure 2.5 shows that Croatian fiscal policy may be considered neutral in 2004, when the change in cyclically adjusted budget balance respect to year 2003 amounted

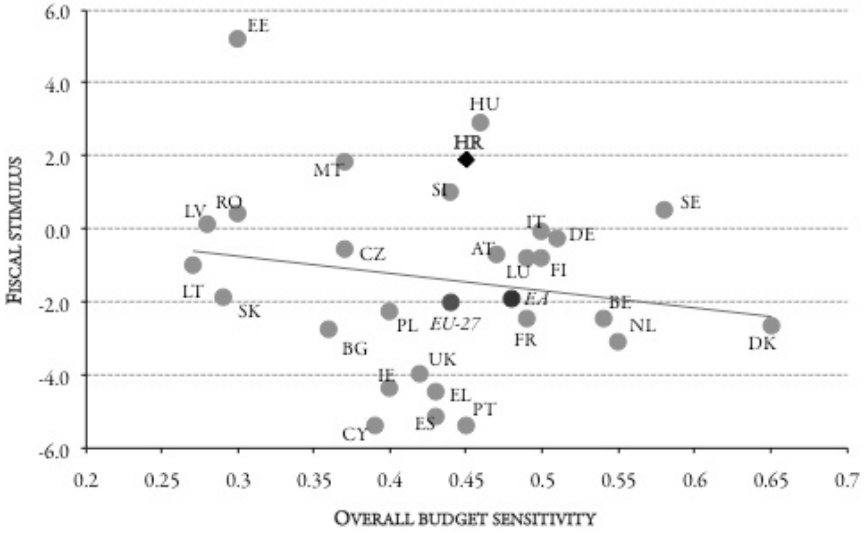
[24]Counter-cyclical was in 1996, 1998 and 2000, while pro-cyclical in 1997 and 1999.

[25]Differences in the estimation may be due to different methodological approaches, lower smoothing parameter for HP filter and shorter time series.

to -0.04% of GDP. In all other periods changes were above the range set by Cimadomo (2005).

Although international institutions point that fiscal stabilization should be mainly performed by the work of automatic stabilizers, the debate on discretionary measures arose during the latest crisis (from mid 2008 on). Some countries have even been criticized for being unwilling to enact fiscal stimulus programs in order to stabilize demand (in particular Germany). One reaction to this criticism was to point the fact that automatic stabilizers (in Germany) are more important than in other countries, so that less discretionary actions are required. This may give rise to the question whether countries with weaker automatic stabilizers did take more discretionary actions. In order to put some light on this issue, the size of fiscal stimulus (i.e. change in the cyclically adjusted budget balance in 2009 against 2008) is related to the sensitivity coefficient (Figure 2.6).

Figure 2.6: *Fiscal stimulus (as change in the structural budget balance in 2009 against 2008) and overall budget sensitivity in EU member states and Croatia, per cent GDP.*



Note: Positive values on the y-axis indicate fiscal tightening and fiscal de-stimulus, while negative values show a supportive fiscal policy.
Source: European Commission (2009a); Eller (2009) and Author's calculation.

Figure 2.6 shows that the stabilization coefficients are largely uncorrelated with the size of fiscal stimulus (-0.17)[26], meaning that countries with lower automatic stabilizers have not hired more discretionary measures.

Generally, in case of contraction a fiscal stimulus refers to tax cuts and spending increase, in order to raise the overall state of the economy. Although therefore negative values of changes in the cyclically adjusted budget balance are expected (as sign of expansionary measures), a number of countries exercised restrictive fiscal policy (positive values of the

[26]Dolls et al. (2009) prove for the US and 19 EU member states same but lower (-0.10) un-correlation.

fiscal stimulus variable) in the beginning of the current crisis in 2009, amid which Croatia registers the second highest positive value[27]. In the Croatian case, the government consciously refused to acknowledge that the global economic crises embraced Croatia prior to the first quarter in 2009, although its effects were registered even before. Additionally, instead of tax cuts, some new taxes[28] were introduced and the VAT tax rate was raised by one percentage point, which obviously results more to be a fiscal *de-stimuli*.

2.4 Practical Implications and Policy Recommendations

The important task that arises is *to what extent the fluctuations in the budget balance should be automatic or discretionary*, or *what is preferable: weak automatic stabilizers supplemented with discretionary fiscal policy or stronger automatic stabilizers?* The latter has the advantage that it is more predictable. Another advantage of automatic fiscal policy is that it avoids decision and implementation lags.

According to the European Commission's SGP, excessive deficits must be prevented and rapidly corrected. The reference value for government deficit is 3.0% of GDP, as set by the Maastricht Treaty convergence criteria. A deficit exceeding this threshold is considered exceptional only if it results from an unusual event outside the control of the member state, or if it is the result of a severe economic downturn (negative annual output growth over a prolonged period of very low annual growth).

The main logic of the SGP provision is to ensure sound budgetary policies on a permanent basis. The SGP lays down the obligation for Member States' commitments to adhere to the their medium-term budgetary objectives for their budgetary positions of *close to balance or in surplus*, as defined under country-specific considerations. Adjusting to such positions allows Member States to deal with normal cyclical fluctuations without breaching the 3% of GDP reference value for the government deficit.

In March 2003 the Ecofin Council amended the SGP with a norm that should have a clear effect of improving counter-cyclicality during upturns (Cimadomo, 2005). It was recommended that member states with a deficit exceeding the *close to balance or surplus* requirement should improve their cyclically adjusted budget position by 0.5% of GDP per year. Cimadomo (2005) shows that the hypothesis of counter-cyclicality holds in downturn but in upturns a pro-cyclical bias is registered.

If considering a hypothetical Croatian case embraced by the SGP requirements, it is noticeable that in 2000 and 2009 the budget deficit did exceed the convergence criteria. Year 2009 may be considered as exceptional due to the global crisis' effects. Still, in year

[27] It is important to point out here, that not in all countries the shown fiscal (de)stimulus came as a reaction to the crisis. For example, in the case of Estonia the fiscal de-stimulus is registered due to the efforts toward achieving membership in EMU and thus toward not breaching the Maastricht fiscal rules.

[28] On July 31st 2009 the so-called crisis tax was introduced (levied on net income above 3.000,00 HRK) along with some new fees that increased the cost of sending SMS and MMS in mobile communications.

2000 there was no particular downturn that caused the deficit exceeding the threshold of 3% GDP. Therefore, that would be (*a posteriori*) the year when the Ecofin Council would have implemented the excessive deficit procedure and follow the Ecofin measures. Important to stress is that in order to maintain sound fiscal positions provisions according to the SGP are made *a priori*, i.e. based on estimated movements of the budget balance. Additionally, if a member state exceeds the given deficit threshold in three consecutive years, the European Commission can impose a fine up to 0.5% of that country's GDP.

From the beginning of the 1990s the Croatian fiscal system has been undergoing numerous structural changes. Still, there are a lot of remaining *structural* goals to reach (as for instance social security reforms and fiscal decentralization) and discretion is probably going to remain dominant in the Croatian fiscal policy. Nevertheless, strengthening automatic stabilizers would pose a big challenge and ensure better fiscal performance[29].

However, estimates indicate that automatic stabilizers in the Croatian case are relatively weak. Dolls et al. (2009, p. 25) emphasize that automatic stabilizers in Eastern and Southern European countries are much weaker than in the rest of Europe. They pinpoint that income tax and transfer systems in low income countries provide only weak stabilization due to rather low unemployment benefits. If this is considered, then it is worth mentioning that low unemployment related spending in Croatia[30] along with low income tax elasticities are one of the factors that affect the strength of automatic stabilizers. In this respect, one way automatic stabilizers could be enhanced is by rising shares of taxes collected from income-based taxes and increasing their respective elasticities. In Croatia for instance the PIT could be made more progressive (increase the real wage elasticity of income tax per worker). The estimated elasticity of 1.21% is below the EU average and the personal income taxation was based on four tax brackets until 2009, while from 2010 the tax brackets have been reduced to three. However, empirical practice shows that increasing income tax revenues (due to a steeper progression or higher tax rates) would lead to a small increase in automatic stabilizers. Baunsgaard and Symansky (2009) showed that a shift in the composition of tax revenue by 5 percentage points from indirect taxes to PIT across G-20 countries would increase the automatic stabilization on average by 0.05 percentage of GDP.

Another driving force of automatic stabilizers is the openness of the economy. More open economies tend to have weaker automatic stabilizers. Croatia is considered a small and open economy. The size of an economy determines the degree of economic openness as well as the size of government (Alesina et al., 1997). On one hand, smaller countries cannot afford not to trade with the rest of the world since their market size cannot ensure sufficiently high productivity, while on the other smaller countries tend to have larger governments as percentage GDP due to fixed costs in setting up governments

[29]It is important to mention that from January 1st 2011 the Croatian government introduced the so-called Fiscal Responsibility Law (hrv. Zakon o fiskalnoj odgvornosti) which requests fiscal surveillance throughout monitoring the cyclically adjusted budget balance as well.

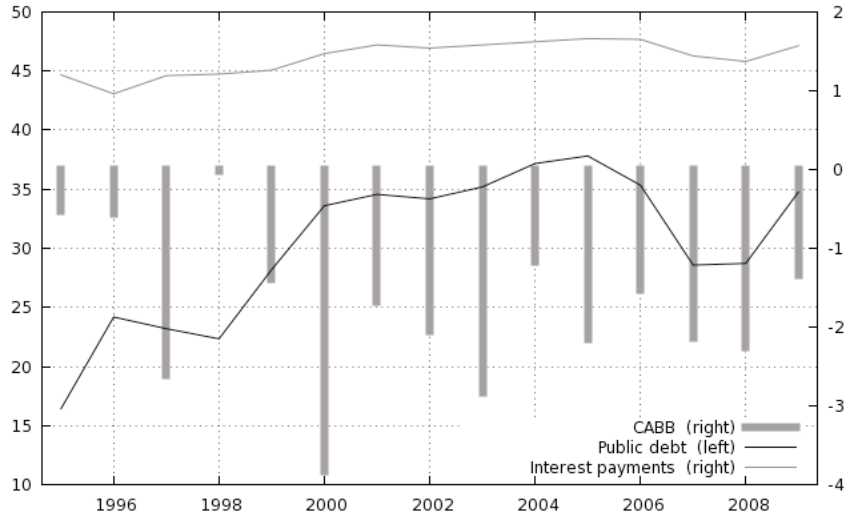
[30]Unemployment related spending in Croatia and EU on average for 0.3% and 1.3% GDP respectively.

(Alesina and Spolaore, 1997). Knowing that openness dampens the eventual strength of automatic stabilizers, a way of enlarging their role could be by designing appropriate fiscal policy rules. Because some fiscal rules can require discretionary policy changes that offset the operation of automatic stabilizers, the impact of fiscal rules will differ depending on the type of a rule (debt rule, deficit/balance rule, cyclically adjusted balance rule, expenditure rule, combination of any of those).

Targeting the cyclically adjusted balance instead of the nominal figures of actual budget balance would lead to financial sustainability of public finance, permitting a better long-term planning of social programmes and enhancing fiscal debt sustainability. The structural balance is intrinsically counter-cyclical in that it permits fiscal deficits when the economy is performing significantly below potential and surpluses when the opposite is registered. In this way it serves to attenuate both the economy's highs and lows[31].

In the Croatian case for instance, in the observed period the total public debt was on average 69.2 billions kunas large, in which external debt accounts for 32 billions kunas. On average the Croatian government interest payments per year amount to 3.2 billions kunas. Figure 2.7 shows public debt and interest payment and cyclically adjusted budget balance in Croatia, all expressed as percentage of GDP.

Figure 2.7: *Public debt (left scale), interest payments and cyclically adjusted budget balance (both right scale) in Croatia in the period between 1995 and 2009, per cent GDP.*



Source: CNB and Author's calculations.

In the observed period public debt accounts on average for 30.3% of GDP, while interest payments amount to 1.42% of GDP on average. If the cyclically adjusted balance is considered the Croatian fiscal income was through the whole period negative. It can be

[31]From the point of view of the central government's financial situation, a structural surplus can mean a drop in borrowing and in its costs, which makes possible to repay earlier borrowing, decrease new borrowing, leading to a sustained reduction in debt level.

noticed that the increase (decrease) in public debt follows the increase (decrease) of the structural budget balance. Targeting the cyclically adjusted budget balance (instead of the actual budget balance) could improve fiscal position and fiscal surveillance in Croatia and would help reduce pro-cyclicality and provide protection from external crises. Doing all that it would ensure a more balanced budget and therefore less need for public debt, which can allow for reallocation of public resources previously devoted to debt servicing. Savings from debt servicing can be used to finance social programmes and investments that stimulate economic growth. Moreover, Marcel et al. (2003) show that conducting fiscal policy based on a cyclically adjusted balance target contributes to reduce the amplitude of economic cycles and ensures an adequate dynamics in the accumulation of assets.

Fiscal rules based on fiscal balance work against the stabilizers. If cyclical balance deteriorates, a fiscal balance rule (involving a ceiling of the balance in nominal figures or per cent GDP) requires offsetting discretionary tightening. Likewise, revenue rules, including linking expenditure to some revenues will also typically involve pro-cyclicality. Avoiding pro-cyclicality in a balanced budget rule is important in a fiscal rule design. *Solutions essentially involve balance-over-the-cycle rules or rules on structural balances.* Balancing budgets over the business cycle ensures countercyclical fiscal policy by allowing the automatic stabilizers to operate freely, while discretionary countercyclical actions are also allowed. Additionally, such rules allow for better public debt management, servicing and sustainability, which lead to increase in public saving that can ensure financing social or other government programs.

2.5 Conclusion

The structure of the tax and expenditure system automatically stabilizes the business cycle in at least three ways (Eller, 2009). First, tax bases (such as income, profit or consumption) weaken/strengthen and thus the overall tax burden decreases/increases. Second, the public expenditure category with unemployment related benefits with the most pronounced countercyclical path, decreases as the number of unemployed go down. Third, many expenditure categories improve the stabilizing effects of fiscal policy as they show to be inactive in adjusting over the business cycle.

The overall responsiveness of the budget to cycle fluctuations in Croatia in the observed period is 0.47%. Countercyclical (and stabilizing) periods in the Croatian economy are observed in the period between 1998 and 2000, and then in 2005, while fiscal authorities carried out pro-cyclical discretionary policy during an expansion phase in 1997 and 2007, which amplified the actual budget deficit. When comparing these results with those in other countries, automatic stabilization in Croatia seems to be in line with those in NMS-12 or CESEE countries, but below the average of developed countries.

Results shows that there is a lot of discretion in Croatia and that automatic stabilizers are weak and comparable to those in other emerging economies. Nevertheless, there is a global tendency that fiscal stabilization should mainly be performed by the work of automatic stabilizers rather than discretionary fiscal policy. But, important to notice is that institutions traditionally seen as symbol of fiscal austerity (such as the IMF and EC) have endorsed large fiscal stimulus packages during the severe downturn occurred in 2008 and 2009, and thus opted discretionary fiscal policy. The broad agreement on the need of fiscal stimulus is undoubtedly linked to the fact that the current global crisis is not a simple cyclical downturn but a deep recession.

Discretionary fiscal stimulus in OECD and EU countries has focused on 2009, with the 2010 amounts generally representing phased implementation of spending programs initiated in 2009 and the carryover of tax measures. In 2009 fiscal stimulus amounted to 1.8% of GDP in G-20 and OECD countries, and 2.0% of GDP in EU member states. Fiscal stimulus packages in the same year in Croatia are not registered. Fiscal authorities increased tax rates and introduced new taxes in 2008 and 2009 mainly because of lower budgetary revenues without considering their side effects especially when considering that the economy faces a late contraction phase. Additionally, in 2010 the government retracted most of the tax discounts involving personal and corporate income taxation.

A key factor that can explain differences in fiscal stimulus and the need for the latter across countries is the size of automatic stabilizers. Countries in which the automatic stabilizers are larger have generally less need to rely on discretionary stimulus. Still, the recent crises proved to be a deep recession so discretionary actions were crucial in countries with both weak and strong automatic stabilizers. Although Croatia has a relatively weak automatic stabilization, there is room for enlarging the role of automatic stabilizers.

Anyhow, once again it is worth mentioning that all the obtained results should be taken with caution because, first of all, the statistical method for estimating business cycles would require a longer series, which is unavailable for transition economies as in the Croatian case. Second, the cyclically adjusted budget balance highly depends on the quality of the government revenue and expenditure data; therefore an analysis based on general government data (reclassified according to GFSM 2001 for the period prior to 2004) would yield in more precise results. Third, the analysis assumes that the policy initiatives are undertaken as planned and not delayed. Still, pursuing some of the mentioned issues is intended in the future research.

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

3.1 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 two issues: on one hand whether fiscal policy could be considered a potent stabilizing tool, and on the other hand, whether, once used, fiscal policy was effective in smoothing business cycles and boosting growth. In case of affirmative answers one question emerges: What would be an optimal fiscal policy action not only with respect to the choice of instrument but also with respect to size, timing and policy mix.

Nevertheless, comparing to the other main economic policy counterparts like monetary policy, empirical research of fiscal policy effects has not been so extensive and there is no absolute consensus on the effects of fiscal policy on the macroeconomy. 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 private consumption, while Keynesian models assume that the same increase will lead to an increase in private consumption because these models set households as non Ricardian. Moreover, Pappa (2003, p. 2) points that fiscal shocks are difficult to identify in practice due to *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.* The study of fiscal policy effects on economic activity proposes four main identification schemes for identifying fiscal policy shocks:

- the recursive approach introduced by Sims (1980),
- the sign-restrictions approach developed by Mountford and Uhlig (2005),
- the event-study approach or Dummy Variable approach proposed by Ramey and Shapiro (1998) for studying the isolated effects of unexpected increases in government spending for defense purposes, and
- the structural vector autoregression (SVAR) approach introduced by Blanchard and Perotti (2002).

[1] Earlier version presented at the 19th Dubrovnik Economic Conference, Young Economists' Seminar section. Slightly modified version published in *EFZG Working papers* WP-13-06.

Pappa (2004, p. 2) emphasize that, besides the fragility of theoretical predictions of fiscal effects on the economy, evidence of the latter is, at best, contradictory. Namely, empirical results agree on one fact only, i.e. that a positive government spending shock has a positive effect on output. Caldara and Kamps (2008, p. 28) show that, when controlling for differences in specification of the reduced-form model, all four identification schemes used in the literature *yield qualitatively and quantitatively very similar result regards government spending shocks*. 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. Although the latter can be attributed to 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.

The effects of fiscal policy in Croatia have been studied in five studies so far, Pivac and Jurun (2002), Benazić (2006), Rukelj (2009), Ravnik and Žilić (2011) and Šimović and Deskar-Škrbić (2013). The first three employ a structural vector error correction (SVEC) methodology and examine the effect of fiscal policy on economic activity, while the last two are focused on assessing fiscal multipliers using Blanchard and Perotti scheme in identifying fiscal policy shocks in Croatia. Although this research employs the same SVAR method, there are several 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 includes also the response of GDP components (private consumption and private investment), (ii) the study inspects fiscal shock effects on the labour market (employment and wages), and (iii) the investigation also includes effects of different government expenditure and revenue components on macroeconomic variables (GDP, GDP components, prices and interest rates). Moreover, this research has a different data frequency and/or longer time span, since it is based on a quarterly dataset with a time span 1996Q1 - 2011Q4.

Main results are in line with Keynesian theory. A spending shock positively affects output, private consumption and private investment, being allresponses 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 enough is 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 total tax receipts (social security contributions excluded) in Croatia. The effects of a government spending or tax shock

on the labour market is significant only in case of public sector wages, when the latter respond positively to a spending shock and negatively to a tax shock.

This paper is structured as follow: Section 3.2 gives an overview of research results in the field of fiscal policy effects. Section 3.3 explains the methodology and data, while Section 3.4 presents the results. The last Section is reserved for concluding remarks.

3.2 Literature review

The answer to the question *what is the transmission of fiscal shocks?* is conditioned by the methodology used to identify fiscal shocks and by the employed identification restrictions. The *Dummy Variable* approach considers fiscal shocks as significant exogenous episodes of unexpected increases in government expenditure for national defense. In such a setup, Edelberg et al. (1999) and Burnside et al. (2004) among others, find that a government expenditure shock for national defense decreases private consumption and real wages, while it makes employment and (nonresidential) investment rise. Such evidence are consistent with basic neoclassical RBC models which assume that increases in government consumption should reduce the real wage and crowd out the private sector.

Oppositely, evidence from a *SVAR* approach is in line with Keynesian models. The SVAR approach is based on the assumption that fiscal variables do not react contemporaneously to changes in economic conditions (Blanchard and Perotti, 2002; Perotti, 2005; among others). In such a setup an expenditure shock makes private consumption, output, employment and real wages rise.

Evidence from a *sign restriction* approach is rather mixed, although generally a government expenditure shock has the propensity to increase employment and real wages (Canova and Pappa, 2006; Pappa, 2009; Mountford and Uhlig, 2005; among others). Furthermore, using the sign restriction and SVAR approach on data for US, Canada, Japan and UK from 1970 until 2007 Bermperoglou et al. (2012) show that there is no trilemma between government consumption, investment and employment in boosting the economy. They find that in case of all three government expenditure shocks output rises, however, government employment shocks have the largest output multiplier regardless of the sample, country or identification (Bermperoglou et al., 2012, p. 3). Employment multipliers result to be always the highest among three for all horizons and in all examined countries.

Empirical research in the field of fiscal policy shocks is mainly focused on the case of developed (industrial) countries. The seminal paper by Blanchard and Perotti (2002) is based on US data, as well as the study done by Galí et al. (2004), Fatás and Mihov (2001a) and Mountford and Uhlig (2002) among others. 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. Galí et al. (2004) find very similar evidence for output, consumption and investment, while Fatás and Mihov (2001a) stress that an increase in expenditure leads to a persistent rise in output, with consumption and (residential) investment being the driving forces. Kirchner et al. (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 (2005) 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 heterogenous 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 et al. (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.

Moreover, when investigating tax shocks on private consumption and investment, Heppke-Falk et al. (2006)split the revenue category into *profit taxes* and *non-profit taxes* (wage and indirect taxes), following the intuition that profit taxes should reduce investment, while non profit taxes should have detrimental effects on private consumption. Still, they find a negative response of private consumption to a non-profit tax shock, and an insignificant response to a profit tax shock. Similarly, de Castro and de Cos (2008) inspect the effect of direct and indirect taxes (along with social security contributions) in the economic framework of Spain. They show that in the long-run private consumption decreases even more in case of a direct tax shock than in the case of an indirect tax shock. When taxes are considered as distortionary it is difficult to cause an increase in private consumption, or even harder to generate an increase in output in response to a tax-financed increase in government spending (Caldara and Kamps, 2008).

There are quite few studies that try to assess stabilization effects of fiscal policy in emerging economies. Baxa (2010) shows that the Czech economy behaves in line with Keynesian assumptions, because government expenditures positively affect economic activity, and GDP reaches the peak after about four quarter after the initial impact. Still, Baxa (2010, p. 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 (Czech Republic, Hungary, Poland, 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, Slovak Republic, Bulgaria and Romania. Jemec et al. (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 the

reaction of private consumption and investment to a tax shock is negative (being 0.05% GDP and 0.35% GDP respectively), while an expenditure shock positively affects both components (evidence show an increase of 1.1% GDP and 1.6% GDP respectively). In the case of Albania, Mancellari (2011) finds that the tax cut multiplier is higher than the government spending multiplier and reaches 1.65 after five quarters.

As mentioned earlier, the analysis of fiscal policy transmission mechanism on the Croatian case is very scarce. Benazić (2006) and Rukelj (2009) employ a structural vector error correction (SVEC) model when investigating the effects of fiscal policy on economic activity. The first concludes that a tax shock negatively affects economic activity, while an expenditure shock leads to an increase in GDP, pinpointing that the effect of a tax shock is much stronger. The second focuses the research on the interaction between monetary and fiscal policy and concludes that these policies can be thought as substitutes since they move in opposite directions.

More comparable to this study are results obtained by Ravnik and Žilić (2011) as well as Šimović and Deskar-Škrbić (2013) since the same methodology is applied. 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, they find non-common results regarding the response of output (proxied with industrial production), since they show that output increases after a tax shock and decreases after a spending shock, and therefore conclude 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) analyse fiscal multipliers in Croatia on different government consolidation levels (consolidated general government, consolidated central government and central government) using a quarterly dataset spanning from 2004Q1-2012Q4 and conclude that values of fiscal multipliers vary across government levels. If the short run is considered, they find the government spending multiplier being 2.18 at the consolidated general government level and 0.82 at the central government level. In the long run such difference is of smaller magnitude, with multipliers 1.91 and 1.60 respectively. If tax multipliers are considered, Šimović and Deskar-Škrbić (2013) show that an increase in taxes leads to a decrease in output and the highest multiplier effect in the short run is evidenced at the consolidated central government level (-2.15). Interesting enough, authors show that at the central government level during the first two years after a positive tax shock output increases, while at the both levels of consolidation (central and general) the same shock negatively affects output.

3.3 Methodology and data

3.3.1 *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 autoregression (SVAR) approach, particularly on the methodology proposed by Blanchard and Perotti (2002), which is considered the pioneering paper for fiscal policy SVAR analysis.

Blanchard and Perotti (2002) argue that governments cannot react within the same quarter to changes of 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 (Rbp_t - also referred to as taxes or net taxes in the rest of the Chapter), 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[2]. 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[3]. Moreover, all variables are in real terms, deflated by CPI.

Unit root tests[4] find conclusive evidence that only the interest rate variable is stationary in levels at the 1% significance level, while other variables present unit roots in levels, according to the Augmented Dickey Fuller (ADF) test. Moreover, results show the presence of co-integrating relations[5] and a possible specification of a vector error correction model, but as noted by Heppke-Falk et al. (2006, p. 12), when estimating models that

[2]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; Vučković, 2010; 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).

[3]Appendix D presents the original and seasonally adjusted series of output, government spending and revenue, plus prices and interest rate.

[4]See Table E.1 in Appendix E.

[5]See Table E.2 in Appendix E.

have many disaggregated time series it is difficult to find economically interpretable cointegration vectors. 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[6]. This is common empirical practice, since the estimation in levels implicitly includes all cointegration relations. Studies that estimate a SVAR in levels no matter of the stationarity in first differences are Perotti (2002); Heppke-Falk et al. (2006); de Castro and de Cos (2008); Jemec et al. (2011); Ravnik and Žilić (2011). 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[7]. This analysis will allow for dynamic interaction up to two lags as suggested by the Akaike criterion.

As mentioned previously five variables enter in 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 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[8]. The reduced form VAR model can be written as:

$$Y_t = C(L)Y_{t-1} + U_t \tag{3.1}$$

where $Y_t = [g_t \quad y_t\pi_t \quad r_t \quad i_t]'$ is a vector of endogenous variables[9], *C(L)* is an $n \times n$ autoregressive lag polynomial matrix and $U_t = [u_t^g \quad u_t^y \quad u_t^\pi \quad u_t^r \quad u_t^i]'$ is a vector of reduced form residuals[10].

[6]Tests for autocorrelation and normality of residuals U_t are presented in Appendix E.

[7]See Table E.3 in Appendix E.

[8]Caldara and Kamps (2008, p.13) base such an ordering on the following assumptions: (a) government spending is placed first because does not react contemporaneously to shocks to other variables in the system and is not affected by business cycle fluctuation; (b) output is ordered as second, which implies that it does not react contemporaneously to prices, taxes and interest rate shocks but is affected by government spending shocks; (c) prices are ordered third, meaning that it is not affected contemporaneously by taxes and interest rate shocks but it reacts to government spending shocks; (d) net taxes are placed fourth, meaning that it is contemporaneously affected by government spending, output and price shocks; (e) interest rate is assumed to be at the last, fifth, place and affected by all shocks from the system. It is worth mentioning that fiscal variables are net of interest payments and therefore not sensitive to interest rate changes. This can be taken as the justification for the last place of the interest rate in ordering the variables. Several empirical researches use the same ordering as Caldara and Kamps (2008), amid which also Ravnik and Žilić (2011) who investigate fiscal policy shocks in for Croatia. One of the reason for the same ordering of variables in this research is also to make the results even more comparable.

[9]The notation of fiscal variables is slightly changed to make it more intuitive and convenient. Recalling, government spending g_t and taxes r_t refer to variables noted as *G* and *Rbp* respectively in Appendix C and explained earlier in this Section.

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

The errors from a VAR in its reduced form are expected to be i.i.d., but correlated across equations[11]. 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 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. 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.

Reduced form residuals U_t can be written as a linear combination of structural shocks V_t:

$$AU_t = BV_t \tag{3.2}$$

where A and B are $n \times n$ matrices describing immediate relations between the reduced form residuals and the structural shocks. Therefore, the structural VAR can be obtained by multiplying 3.1 by matrix A:

$$AY_t = AC(L)Y_{t-1} + AU_t \tag{3.3}$$

and using 3.2 rewritten as:

$$AY_t = AC(L)Y_{t-1} + BV_t. \tag{3.4}$$

To make the AB system (equation 3.2) just identified 35 restrictions should be imposed[12]. The matrix representation of the mentioned system is the following:

$$\begin{bmatrix} 1 & -\alpha_y^g & -\alpha_\pi^g & -\alpha_r^g & -\alpha_i^g \\ -\alpha_g^y & 1 & -\alpha_\pi^y & -\alpha_r^y & -\alpha_i^y \\ -\alpha_g^\pi & -\alpha_y^\pi & 1 & -\alpha_r^\pi & -\alpha_i^\pi \\ -\alpha_g^r & -\alpha_y^r & -\alpha_\pi^r & 1 & -\alpha_i^r \\ -\alpha_g^i & -\alpha_y^i & -\alpha_\pi^i & -\alpha_r^i & 1 \end{bmatrix} \times \begin{bmatrix} u_t^g \\ u_t^y \\ u_t^\pi \\ u_t^r \\ u_t^i \end{bmatrix} = \begin{bmatrix} \beta_g^g & 0 & 0 & \beta_r^g & 0 \\ 0 & \beta_y^y & 0 & 0 & 0 \\ 0 & 0 & \beta_\pi^\pi & 0 & 0 \\ \beta_g^r & 0 & 0 & \beta_r^r & 0 \\ 0 & 0 & 0 & 0 & \beta_i^i \end{bmatrix} \times \begin{bmatrix} v_t^g \\ v_t^y \\ v_t^\pi \\ v_t^r \\ v_t^i \end{bmatrix} \tag{3.5}$$

The imposed restrictions include the following:

[11] For the residual analysis tests refer to Table E.4 in Appendix E.

[12] In such a set up A and B are $n \times n$ parameter matrices that require identifying restrictions to be imposed on A and B to obtain an unique relation, because reduced form residuals have no economic interpretation (and represent a linear combination of different structural innovations) and different structural forms can give the same reduced form VAR model (see for instance Gottshalk (2001)). The system needs $2n^2 - \left(\frac{n^2-n}{2} + n\right)$ restrictions, where n is the number of endogenous variables.

- values across the main diagonal of matrix A are set to one, which makes five restrictions;
- matrix B contains 18 elements set to zero, which makes additional 18 restrictions;
- 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 is assumed to be -0.5, as in Perotti (2002) among others; all these make additional four restrictions;
- 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;
- 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;
- 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 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, lets focus on the equations showing the reduced form innovations of government spending and revenues:

$$u_t^g = \alpha_y^g u_t^y + \alpha_\pi^g u_t^\pi + \alpha_i^g u_t^i + \beta_r^g v_t^r + v_t^g \tag{3.6}$$

$$u_t^r = \alpha_y^r u_t^y + \alpha_\pi^r u_t^\pi + \alpha_i^r u_t^i + \beta_g^r v_t^g + v_t^r \tag{3.7}$$

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 macroeconomic environment. The β_i^j coefficients express how the structural shock to government spending and revenue affects 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:

$$u_t^{g,CA} = u_t^g - \left(\alpha_y^g u_t^y + \alpha_\pi^g u_t^\pi + \alpha_i^g u_t^i\right) = \beta_r^g v_t^r + v_t^g \tag{3.8}$$

$$u_t^{r,CA} = u_t^r - \left(\alpha_y^r u_t^y + \alpha_\pi^r u_t^\pi + \alpha_i^r u_t^i\right) = \beta_g^r v_t^g + v_t^r. \tag{3.9}$$

Next, it is necessary to make a *decision with respect to the relative ordering of the fiscal variables*. Assuming that tax decisions come first means setting β_g^r equal to zero, while oppositely, assuming that expenditure decisions represent government priority number one 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, some of the empirical works assume that revenue decision comes first (Jemec et al., 2011) while other put forward expenditure decisions (Caldara and Kamps (2006); de Castro and de Cos (2008); Heppke-Falk et al. (2006); Mancellari (2011)). Still, 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 means that:

$$u_t^{g,CA} = v_t^g \tag{3.10}$$

$$u_t^{r,CA} = \beta_g^r v_t^g + v_t^r. \tag{3.11}$$

where β_g^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)[13]. The coefficients for the macroeconomic variables' equations are:

$$u_t^y = \alpha_g^y u_t^g + \alpha_r^y u_t^r + v_t^y \tag{3.12}$$

$$u_t^\pi = \alpha_g^\pi u_t^g + \alpha_r^\pi u_t^r + \alpha_y^\pi u_t^y + v_t^\pi \tag{3.13}$$

$$u_t^i = \alpha_g^i u_t^g + \alpha_r^i u_t^r + \alpha_y^i u_t^y + \alpha_\pi^i u_t^\pi + v_t^i \tag{3.14}$$

All mentioned produces all the necessary elements to construct the A and B matrices in the mentioned AB model $AU_t = BV_t$.

[13]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 et al., 2006; Giordano et al., 2007; among others).

3.3.2 *Exogenous elasticities*

As mentioned previously, to achieve full identification in the SVAR setup, contemporaneous effects of output, prices and interest rate on fiscal policy variables are needed. 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 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[14]. For example the elasticity of taxes is a weighted average of the elasticity of personal income taxes, corporate income taxes, indirect taxes and social security contributions weighted by their respective share in total taxes. Additionally, the elasticity of each of the mentioned to GDP is the result of multiplication of its elasticity with respect to its macroeconomic base and the elasticity of the macroeconomic base with respect to output. To sum up, the tax elasticity to output is:

$$\alpha_y^r = \sum_{i=1}^{n} \alpha_{B_i}^{\tau_i} \alpha_y^{B_i} \frac{T_i}{T}. \tag{3.15}$$

Table 3.1 shows the elasticities of different budget components to output and prices[15]. 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[16]. The elasticity of net taxes results to be 0.92, meaning that a 1% increase in output (GDP) generates 0.92% increase in taxes. This estimation is in line with results obtained by other studies covering other countries. It matches the tax elasticity with respect to output in the German case shown in Perotti (2002) but is lower than the same in the US or Canada for example. If compared to the tax elasticity obtained on the Croatian case by Ravnik and Žilić (2011) it is by 0.03 points lower and not significantly different. Calculating the elasticity of taxes with respect to prices means adjusting equation 3.15 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 is again does not deviate from results obtained by other studies in this field.

[14]For details on each tax item elasticity to its macroeconomic base, as well as the elasticity of the latter with respect to output or prices see Tables in Appendix F, where also shares of tax items in total taxes is shown.

[15]The elasticities of budgetary items with respect to other macroeconomic variables used in the non-baseline models (extended models to capture the response of GDP components and/or labour market variables) are not presented here, but in the corresponding further Section and/or Appendix F.

[16]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.

Table 3.1: *Exogenous elasticities with respect to output and prices*

Budgetary item	**w.r.t. real output** α_y^r	**w.r.t. prices** α_π^r
Net taxes	0.92	0.73
Direct taxes	0.53	-0.31
Indirect taxes	1.36	1.90
Government expenditure	0	-0.5
Current expenditure	0	-1
Capital expenditure	0	-1
Expenditure for wages	0	0
Expenditure for purchases	0	-1

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

Same as in Heppke-Falk et al. (2006) among others, this study assumes that expenditure do not respond to output within a quarter because they are predetermined in a budgetary plan and therefore not elastic in the short run. 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, their work (as well as others in this field) is based on annual data, so it is reasonable to assume that such a procyclicality vanishes in quarterly frequencies. At the end, after all the imposed restrictions and estimated exogenous elasticities, the just-identified five variable baseline SVAR model is the following:

$$\begin{bmatrix} 1 & 0 & 0.5 & 0 & 0 \\ -\alpha_g^y & 1 & 0 & -\alpha_r^y & 0 \\ -\alpha_g^\pi & -\alpha_y^\pi & 1 & -\alpha_r^\pi & 0 \\ 0 & -0.92 & -0.73 & 1 & 0 \\ -\alpha_g^i & -\alpha_y^i & -\alpha_\pi^i & -\alpha_r^i & 1 \end{bmatrix} \times \begin{bmatrix} u_t^g \\ u_t^y \\ u_t^\pi \\ u_t^r \\ u_t^i \end{bmatrix} = \begin{bmatrix} \beta_g^g & 0 & 0 & 0 & 0 \\ 0 & \beta_y^y & 0 & 0 & 0 \\ 0 & 0 & \beta_\pi^\pi & 0 & 0 \\ \beta_g^r & 0 & 0 & \beta_r^r & 0 \\ 0 & 0 & 0 & 0 & \beta_i^i \end{bmatrix} \times \begin{bmatrix} v_t^g \\ v_t^y \\ v_t^\pi \\ v_t^r \\ v_t^i \end{bmatrix} \quad (3.16)$$

3.4 Results

This section presents impulse response functions and multipliers derived from the baseline model as well as extended models. In all cases a shock corresponds to a unit shock and its path is shown for a horizon of 20 quarters i.e. five years. Moreover, the 95% percentile confidence intervals coverages are shown[17]. 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 of the responding variable.

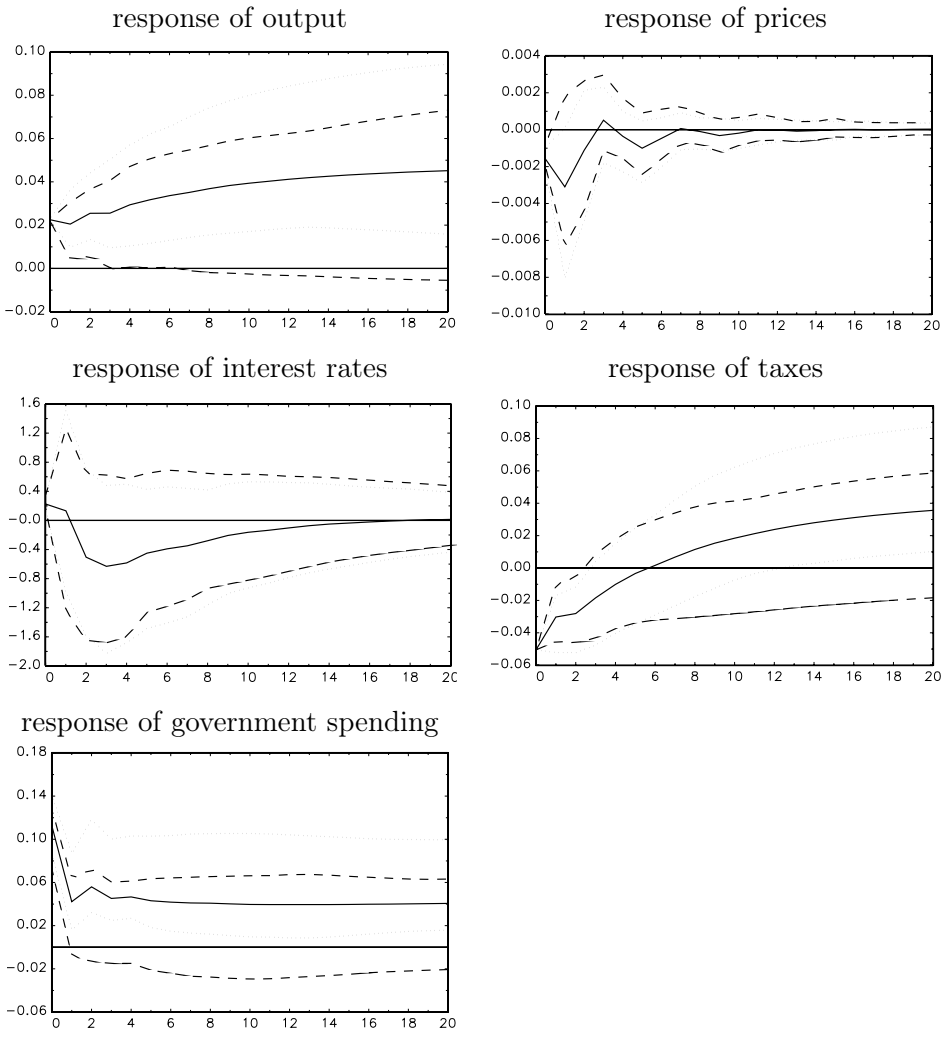
[17]Confidence intervals are obtained using the Hall and Efron Bootstrap available in the JMulTi package, which was used along with Gretl software throught the estimations in this paper.

3.4.1 *Baseline model*

The effects of government spending

Figure 3.1 shows the impulse response functions to a government spending shock in the baseline model $[g_t \;\; y_t \;\; \pi_t \;\; r_t \;\; i_t]'$. Output responds positively after a government spending shock. This positive impact is significant throughout the whole time horizon according to Efron confidence intervals, while for a year according to Hall's bootstrapping method.

Figure 3.1: *Impulse responses to an increase in government spending (baseline model).*



Note: Efron's 95% bootstrap confidence intervals on IRF figures correspond to dotted lines, while Hall's 95% bootstrap confidence intervals on IRF figures correspond to dashed lines.
Source: Author's calculations.

A long term positive effect is also evidenced in Blanchard and Perotti (2002), Perotti (2005) and Fatás and Mihov (2001a), who show that in the case of the US the government spending positively affects output for more than five years[18].

Such a development is not found in Ravnik and Žilić (2011). Proxying ouput with industrial production, they find that in Croatia output reacts negatively to a government spending shock in the short run and that the total effect vanishes after two years. Moreover, such a pattern is not in line with empirical evidence, which actually in case of fiscal policy effects concur only on the positive effect of a spending shock on economic activity. Ravnik and Žilić (2011) see a possible justification of such a negative effect in the predominance of the crowding out effect against the output effect. 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 gradually increase in Romania, Slovak Republic, Poland and Hungary, and its effects vanish only in the long term. Lonzano and Rodriguez (2009) find similar conclusion in case of Colombia. Table 3.2 shows the cumulative output multipliers in Croatia[19]. Results show a multiplier above one in all presented periods, being the highest at impact.

Table 3.2: *Cumulative output multipliers to government spending shock*

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

Source: Author's calculation.

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 for almost one percentage point lower (being 1.58), while the one corresponding for 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.

Prices respond negatively to a government spending shock in Croatia. The effect 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

[18]In case of other developed countries the positive impact is more of short and/or medium term. Perotti (2005) and Marcellino (2002) find evidence of a positive economic activity response in Germany for the first year, while Heppke-Falk et al. (2006) stress that such a positive effect disappears much later, i.e. after three years. The positive impact of a government expenditure shock fades after two years in the case of France (Biau and Girard, 2005) and Italy (Giordano et al., 2007), and moreover, in case of Spain, it becomes significantly negative after four years (de Castro and de Cos, 2008).

[19]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.

spending shock either onimpact or for a longer time period. Still, among developing countries evidence show a predominant, at least initially, positive effect[20], while in case of developed countries results are various[21]. In order to be able to provide an explanation to a negative response of prices to an innovation in spending, the effects of spending components are investigated and results discussed in Subsection 3.4.2.2.

As in Ravnik and Žilić (2011) a spending shock in this study has the largest (in magnitude) impact on the interest rate, but the response moves in the opposite direction and is insignificant. 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.

The effects of taxes

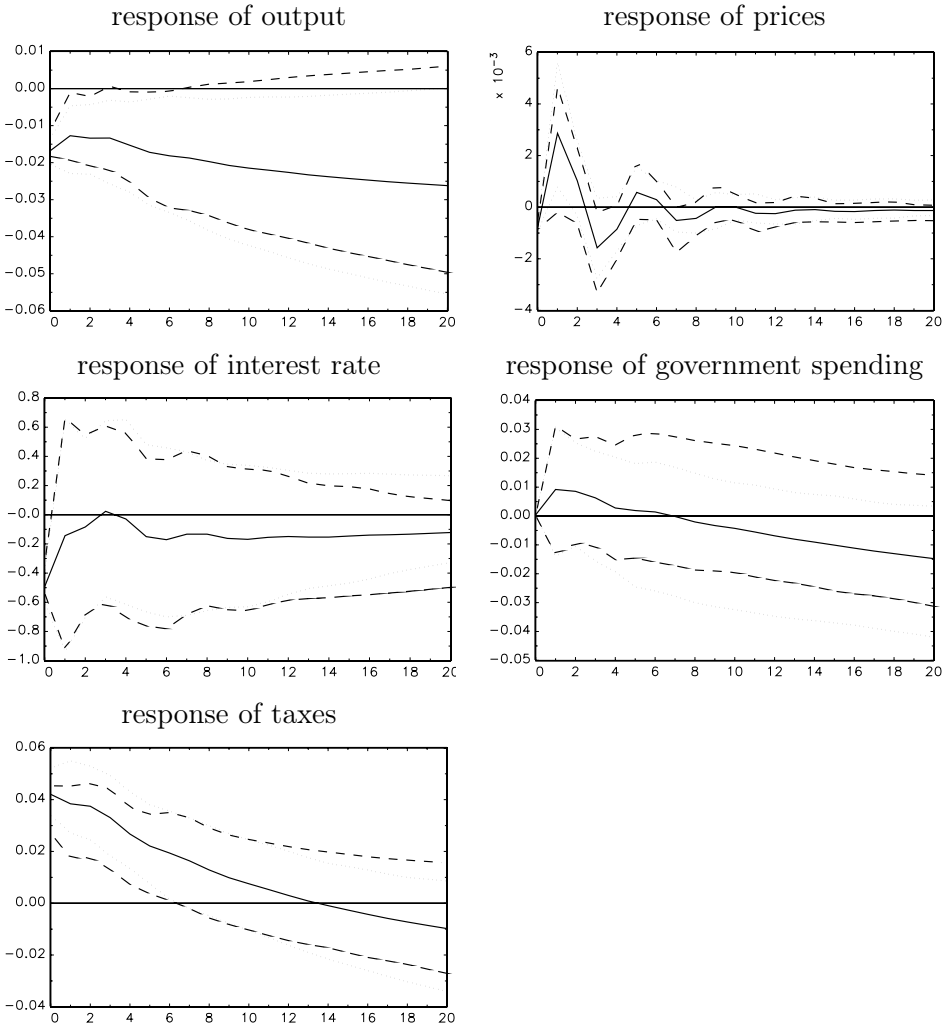
Figure 3.2 depicts the innovations of a tax shock in the baseline setup. The response of output on a tax shock is negative the whole time horizon of five years. Important to notice is that it shows to be permanent, not temporary, and moreover, as in case of a spending shock, the response is significant throughout the whole time horizon in case when Efron's intervals are considered, while for two years if Hall's confidence intervals are taken into consideration. This may be attributed to the fact that a discretionary change in taxes indeed has a permanent effect on tax revenues. If this is looked through the lenses of other empirical studies it maybe concluded that Croatia is closer to the average results of developed than developing countries, where one can find more evidence of a positive response of output initially or for a longer time horizon[22].

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

[21]Similar to results of this study, Fatás and Mihov (2001a), Mountford and Uhlig (2002) and Caldara and Kamps (2006) evidence that, prices react negatively through the whole time horizon. According to Perotti (2005) the effect of an expenditure shock in the US on prices is positive in the first quarter and negative afterwards, while Edelberg et al. (1999) show that the initially positive effect lasts four quarters before turning negative. On the other hand, evidence show that in Germany an expenditure shock on prices is positive (Perotti, 2005; Heppke-Falk et al., 2006) or turns positive after a year (Marcellino, 2002). Similarly, inflation rises after an expenditure shock also in case of Spain (de Castro and de Cos, 2008) and France (Biau and Girard, 2005).

[22]In case of the US Blanchard and Perotti (2002), Perotti (2005) 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. Namely, results suggest that the negative response of economic activity can last for more than five years (Perotti, 2005) or one year only (Marcellino, 2002). Additionally, Perotti (2005) shows that a revenue shock on GDP results to be positive in the first quarter before getting negative, while Heppke-Falk et al. (2006) evidence that the same shock does not affect output significantly. Similarly, evidence show that in 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 Czech Republic, Hungary, Poland, Slovak Republic, Bulgaria and Romania, being positive throughout the whole time horizon in all cases except Poland. Same is evidenced for Albania (Mancellari, 2011), while in Colombia the positive response vanishes after two years.

Figure 3.2: *Impulse responses to an increase in net taxes (baseline model).*



Note: Efron's 95% bootstrap confidence intervals on IRF figures correspond to dotted lines, while Hall's 95% bootstrap confidence intervals on IRF figures correspond to dashed lines.
Source: Author's calculations.

If tax multipliers are considered than it is possible to conclude that their size on impact is very similar to the same obtained by a spending increase except the direction of output response, which is opposite (Table 3.3). Moreover, the effect is highly comparable to Šimović and Deskar-Škrbić (2013, p. 67).

Table 3.3: *Cumulative output multipliers to tax shock*

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

Source: Author's calculation.

The response of prices to a tax shock is positive the first two quarters and then oscillates around zero. Moreover, as in case of a spending shock, the effect is very minimal in sense of magnitude (units of measurement). Similar evidence can be found in other studies. The effect of a revenue shock on prices in the US is initially positive and then turns negative. According to Perotti (2005) 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 (2005), 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 differing intensity and durability in both cases) (Mirdala, 2009, p.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, Slovak Republic and Bulgaria and remained permanent through 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 et al., 2006), while in Spain, interest rates tend to increase persistently (de Castro and de Cos, 2008).

3.4.1.1 Robustness checks

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 elasticities obtained by Ravnik and Žilić (2011) are used to estimate the model and extract the impulse response functions. The results do not change substantially. The pattern of response is the same in case of all variables to both fiscal shocks, thus the effect of both fiscal shocks on interest rates on impact (in the first quarter) are slightly higher, but converge to the baseline results in the following period.

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 extreme cases of α_π^g are tested. The results do not change substantially.

3. Assuming that a government tends to decide on taxes first, i.e. defining that $\beta_g^r = 0$. Doing so means changing equations 3.10 and 3.11 in $u_t^{r,CA} = v_t^r$ and $u_t^{g,CA} = \beta_r^g v_t^r + v_t^g$ respectively. Results do not change substantially. The response on impact is the same for all variables and in case of both shocks, except for the

response of interest rate on a spending shock. Namely, under the baseline results, the effect of the spending shock on interest rate in the first period was positive, while under the assumption that taxes come first it is negative in the same period. Still, its magnitude and pattern are almost identical throughout the rest of the time horizon.

4. Using a first order lag polynomial as suggested by Schwarz and Hannan-Quinn criteria[23]. Results again prove to be robust to those obtained from the baseline model, which adopted the Akaike suggestion.

Moreover, a simple three variable VAR 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 government 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 of 2000.[24]

3.4.2 *Alternative models*

3.4.2.1 The effects on private consumption and private investment

In order to examine the effects of fiscal shocks on GDP components (private consumption and private investment) the baseline five variable VAR model was extended to a six variable VAR. In such a setup the vector of endogenous variables Y_t is now $[g_t \;\; y_t \;\; z_t \;\; \pi_t \;\; r_t \;\; i_t]'$ 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 8 on page 51). 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:

$$u_t^g = \alpha_y^g u_t^y + \alpha_z^g u_t^z + \alpha_\pi^g u_t^\pi + \alpha_i^g u_t^i + \beta_r^g v_t^r + v_t^g and \tag{3.17}$$

$$u_t^r = \alpha_y^r u_t^y + \alpha_z^r u_t^z + \alpha_\pi^r u_t^\pi + \alpha_i^r u_t^i + \beta_g^r v_t^g + v_t^r \tag{3.18}$$

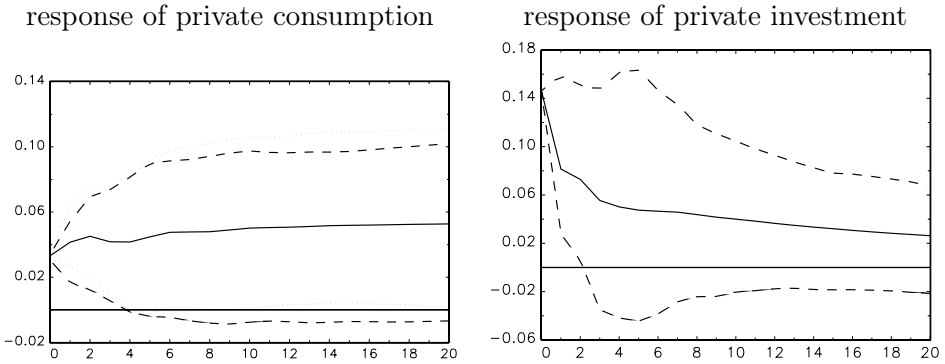
[23](see Table E.3 in Appendix E).

[24]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 by the Croatian Bureau of Statistics and Mikulić and Lovrinčević (2000), which is commonly and widely used in empirical studies on the Croatian case.

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[25]. Figure 3.3 shows the effect of a spending shock on private consumption and private investment in Croatia. It is possible to notice that in both cases a spending shock exercise a positive effect with a slightly different development throughout the time horizon. Interesting enough is the fact that the effects are significant within a year only according to Hall's confidence intervals and while the significance is much longer in case of the private consumption increase according to Efron's bootstraping .

Figure 3.3: *Impulse responses to an increase in government expenditure (alternative model).*



Note: Efron's 95% bootstrap confidence intervals on IRF figures correspond to dotted lines, while Hall's 95% bootstrap confidence intervals on IRF figures correspond to dashed lines.
Source: Author's calculations.

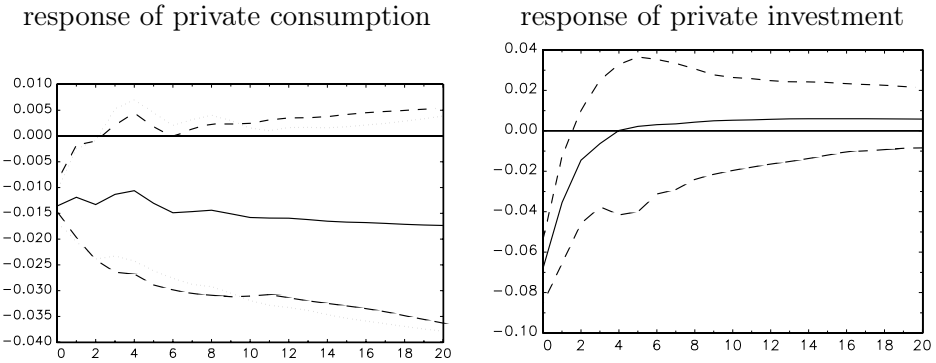
Fatás and Mihov (2001a), Blanchard and Perotti (2002) and Caldara and Kamps (2006)

[25]To see the sub-elasticities of tax components used to construct the aggregate tax elasticity refer to the corresponding Table in Appendix F.

outline that a positive government spending shock in the US increases significantly private consumption[26]. In case of Germany and Spain private consumption increases initially after the expenditure shock, falling subsequently to levels below the initial one (Heppke-Falk et al., 2006; Tenhofen and Wolff, 2007; 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 respectively is hump-shaped, i.e. after the initial stimulation the effect decreases progressively in the medium term. Still, Kirchner et al. (2010) find evidence that in the Euro area the reaction of private consumption is positive and significant. A 1% GDP increase in expenditure raises private consumption by 1.1% GDP. Although both responses are persistent, the positive response of private investment to a spending shock is higher (in terms of units of measurment) throughout the whole time horizon. Kirchner et al. (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% GDP. Oppositely, Fatás and Mihov (2001a) show that investment does not react significantly to increases in government spending in the US. 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 GDP (Giordano et al., 2007).

When investigating tax shocks of private consumption and private investment it is noticeable that the effect on impact is negative in both cases, but with a different development afterwards (see Figure 3.4).

Figure 3.4: *Impulse responses to an increase in taxes (alternative model).*



Note: Efron's 95% bootstrap confidence intervals on IRF figures correspond to dotted lines, while Hall's 95% bootstrap confidence intervals on IRF figures correspond to dashed lines.
Source: Author's calculations.

[26]Moreover on the case of the US, Mountford and Uhlig (2005) report that the response of private consumption is close to zero and statistically insignificant, while Ramey (2008) presents that private consumption will fall in response to a government spending shock. Similarly, Tenhofen and Wolff (2007) show that private consumption reacts positively to an expenditure shock, but when they extend the SVAR to allow for one period ahead anticipation of the shock, results change from being Keynesian to neoclassical, and private consumption falls one period before the shock.

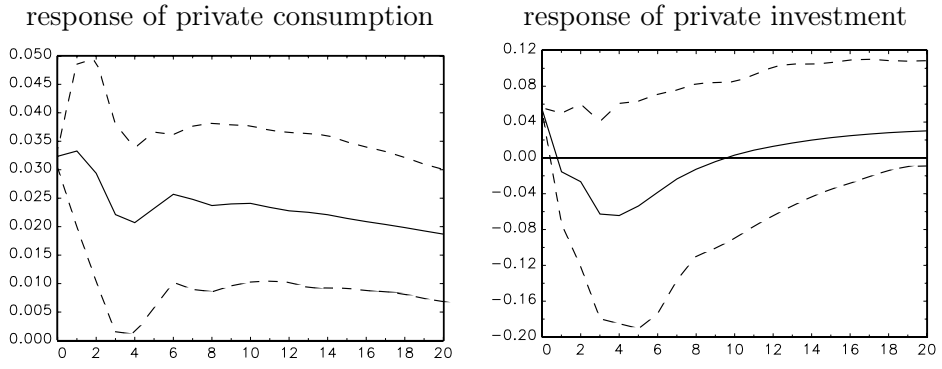
After a tax shock private consumption drops and remains permanent and negative throughout the whole time horizon. On the other hand, the effect of the same shock on investment is much larger but it stabilizes after the first year. Blanchard and Perotti (2002) reveal that both increases in taxes and increases 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 et al. (2006); and de Castro and de Cos (2008); respectively). In the Croatian case it can be concluded that results go in favor of Keynesian assumptions because on one hand a spending shock affects positively private consumption, and on the other hand the response of private investment to a spending shock is opposite of its response to a tax shock.

3.4.2.2 The effects of government spending components

Different government spending components can affect economic activity in a different manner. In order to inspect the effects of government consumption and government investment shocks on the macroeconomic environment in Croatia, 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 $\begin{bmatrix} g_t^j & y_t & z_t & \pi_t & r_t & i_t \end{bmatrix}'$, being g_t^j a spending component. Government consumption is defined as in Heppke-Falk et al. (2006), i.e. the sum of personnel and operating budget expenditure, while government investment corresponds to capital spending.

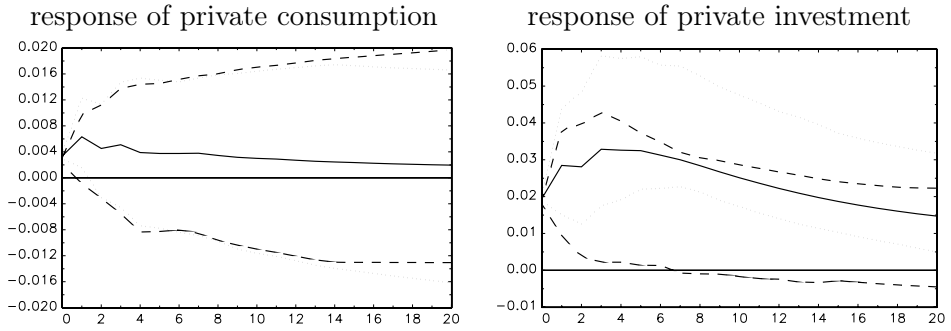
As mentioned, private consumption reacts in a Keynesian manner after a government spending shock; still the effect is not the same when the spending shock occurs due to increase in government consumption or due to government investment (Figures 3.5 and 3.6).

Figure 3.5: *Impulse responses to an increase in government consumption (alternative model).*



Note: Efron's 95% bootstrap confidence intervals on IRF figures correspond to dotted lines, while Hall's 95% bootstrap confidence intervals on IRF figures correspond to dashed lines.
Source: Author's calculations.

Figure 3.6: *Impulse responses to an increase in government investment (alternative model).*



Note: Efron's 95% bootstrap confidence intervals on IRF figures correspond to dotted lines, while Hall's 95% bootstrap confidence intervals on IRF figures correspond to dashed lines.
Source: Author's calculations.

Both (government consumption and investment) shocks increase private consumption, but the effect of government consumption is significant, permanent and larger throughout the whole period (Figures 3.5 and 3.6). If private investment is considered it can be concluded that a shock in government consumption doesn't affect it since the response is insignificant. Oppositely government and private investment seem to have a significant positive relationship since an increase in government investment results in an increase in private investment, which is permanent and significant for at least two years. Similarly, Heppke-Falk et al. (2006) find that in Germany after a government investment shock private investment increase[27]. However, the crowding out effect is merely evidence in developed than developing countries. On a panel of eleven East European countries (Croatia included), Gjini and Kukeli (2012) show no crowding out effect of public investment on private investment[28].

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[29]. A government consumption shock makes prices fluctuate around zero (after an initial positive impact) and stabilize after a year, 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.

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

[28]Important to point out is that Ganić (2005) shows that government spending for defense do crowd out private investment, mainly due to expectations and performance of the economy.

[29]These responses are not shown here in order to preserve space but are available upon request.

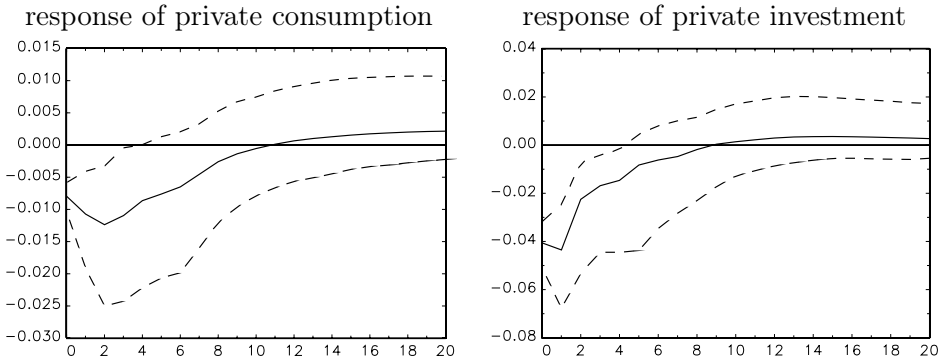
3.4.2.3 The effects of government revenue components

According to the similar rationale as in case of governments spending components' shocks, this Section offers the overview of the effects of the main tax shocks by component on the economic activity in Croatia. The vector of endogenous variables in this case is $Y_t = \begin{bmatrix} g_t & y_t & z_t & \pi_t & r_t^j & i_t \end{bmatrix}'$, being rt^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 3.1 of this work. Since it is important to inspect different tax components' effect on 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[30]. On the other hand, the elasticities of indirect taxes with respect to private consumption and private investment are 1.53 and 0.7 respectively.

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 expectations, since one would expect that, due to its high share in total taxes, it is the indirect taxes category that mainly affects economic activity. Results show that an indirect tax shock negatively affects output and private consumption for three years, when the effect stabilizes around zero (Figure 3.7). de Castro and de Cos (2008) for instance show that in the long-run private consumption decreases even more in case of a direct tax shock than in the case of an indirect tax shock. Such a development is characteristic for developed countries and/or those that collect the majority of tax revenues through direct taxes. Moreover, in the Croatian case, private investment also reacts negatively after an indirect tax shock, but the effect fades out after second year.

[30]Refer to Appendix F for a detailed view of the sub-elasticities.

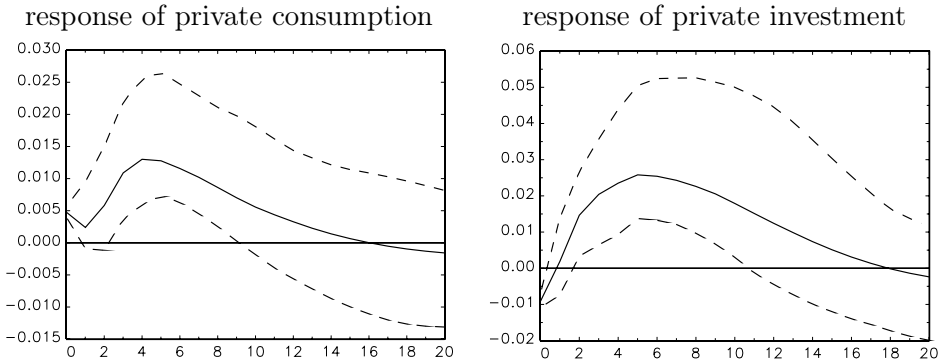
Figure 3.7: *Impulse responses to an increase in indirect taxes (alternative model).*



Note: Efron's 95% bootstrap confidence intervals on IRF figures correspond to dotted lines, while Hall's 95% bootstrap confidence intervals on IRF figures correspond to dashed lines.
Source: Author's calculations.

The impact of direct taxes on GDP components is lower (in magnitude) than the impact of indirect taxes. At time of impact the response of private investment differs from the response of private consumption, being negative the first and positive the second. However, after the first quarter, in both cases a direct tax shock implies a positive response in a long term and the effect is significant for more than two years (Figure 3.8).

Figure 3.8: *Impulse responses to an increase in direct taxes (alternative model).*



Note: Efron's 95% bootstrap confidence intervals on IRF figures correspond to dotted lines, while Hall's 95% bootstrap confidence intervals on IRF figures correspond to dashed lines.
Source: Author's calculations.

When comparing the effects of spending and tax shocks on the Croatian case, it is possible to notice that the responses after a tax shock on macroeconomic variables are much more significant than in the case of a spending shock.

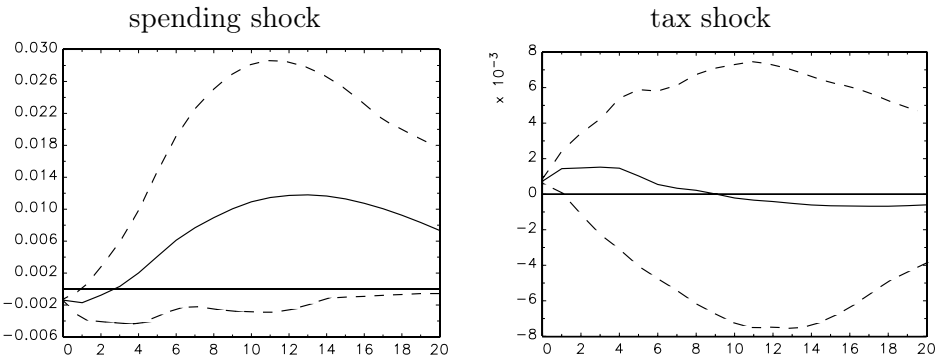
3.4.2.4 The effects of fiscal policy on the labour market

In order to account for the transmission mechanism of fiscal shocks to the labour market the baseline five variable model is extended for a labour market variable. The labour market variables that are taken into consideration are employment L_t and wages w_t.

In case of employment measured as number of persons employed, the vector of endogenous variables Y_t becomes $[g_t \;\; y_t \;\; \pi_t \;\; L_t \;\; r_t \;\; i_t]'$ meaning that employment does not react contemporaneously to taxes and interest rates. In case of wages two different categories are taken into account, i.e. average wages in the private and public sector. When assessing fiscal policy effects on wages, the latter is ordered fifth in the model and the vector of endogenous variables results in $\left[g_t \;\; y_t \;\; \pi_t \;\; r_t \;\; w_t^j \;\; i_t\right]'$, where w_t^j are wages represented by three variables: average wages in the private sector, average wages in the public sector and the minimal wage. This implies that wages are affected contemporaneously by all variables in the model except the interest rate.

In order to fully identify the SVAR model, again in the fiscal equation regarding taxes there is need of additional exogenous elasticity. In case of tax elasticity with regard to employment a unitary elasticity is imposed as suggested by ECB and OECD studies. When considering the tax elasticity of wages then the estimated elasticity of the personal income tax with respect to its macroeconomic base (i.e. wage bill) is used. Figure 3.9 shows the impulse responses of the labour market. Results show that employment reacts negatively to a government spending shock only in the first two quarters (small units of measurement), while afterwards it shows a persistent increasing trend, which lasts for more than four years. This result is in line with those presented by Fatás and Mihov (2001a) with the exception that in their case the response is positive at time of impact as well. Still, the effect is not significant in the case of Croatia. Furthermore, employment reacts positively to a tax shock for the first two years, but the response results to be as well insignificant.

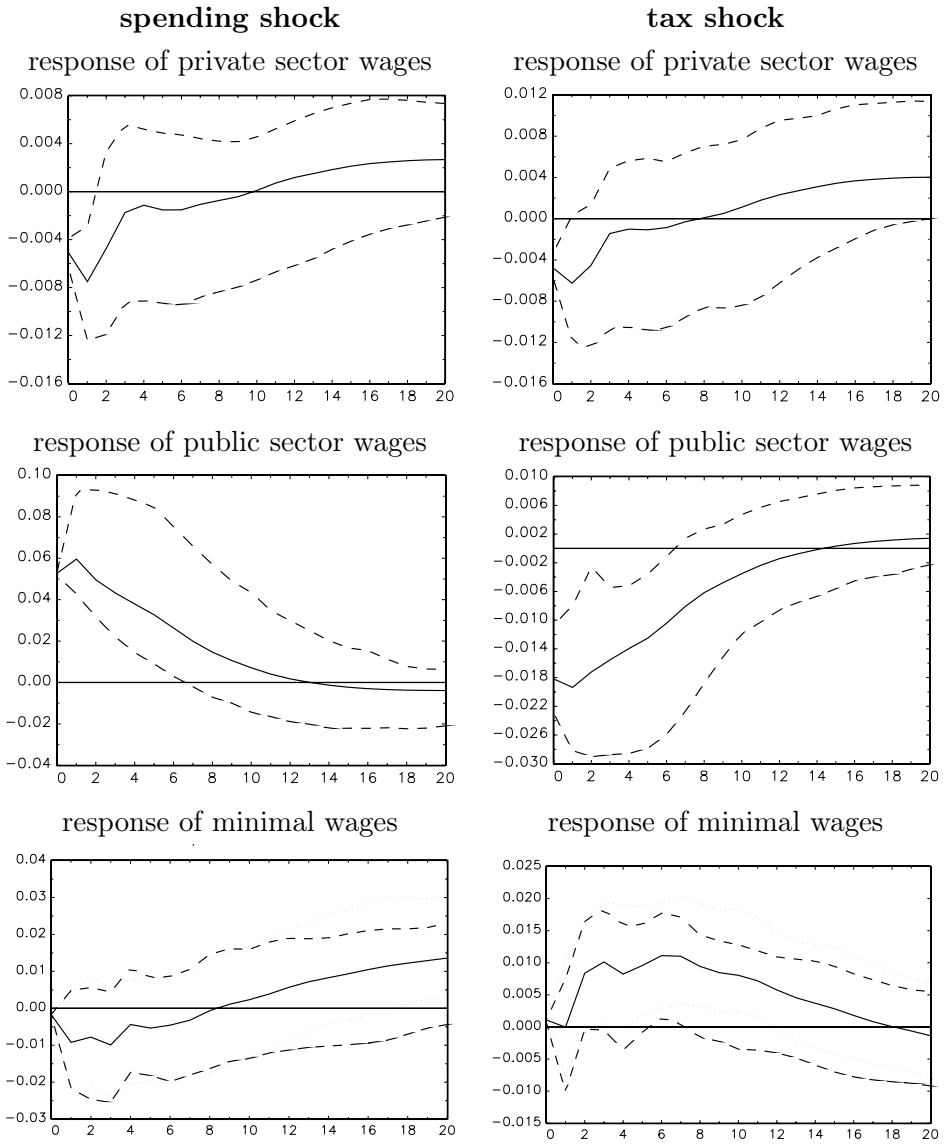
Figure 3.9: *Impulse responses of employment to an increase in government spending and taxes (alternative model).*



Note: Efron's 95% bootstrap confidence intervals on IRF figures correspond to dotted lines, while Hall's 95% bootstrap confidence intervals on IRF figures correspond to dashed lines.
Source: Author's calculations.

Interesting is the response of wages. Fatás and Mihov (2001a) show that real wages respond positively to a government spending shock in the US. Croatia does not present such unanimous overall results. After differentiating the effect on private and public wages, public sector wages increase after a government spending shock and the effect is significant within two years while it fades out after three years; on the other hand private sector wages decrease after the same shock and the effect is insignificant, similar effects are visible in case of the minimal wage. The findings that a government spending shock increases employment and wages is consistent with Keynesian and RBC theories. In case of a tax shock wages decrease no matter of the sector, although the negative response is much higher and significant in the case of public sector wages and even lasts almost two years longer than the same negative response of private sector wages before stabilizing. Moreover, it seems that an increase in taxes does not affect minimal wage setup, as the response is, as expected, not significant.

Figure 3.10: *Impulse responses of wages (public, private and minimal)to an increase in government spending and taxes (alternative model).*



Source: Author's calculations.

3.5 Conclusion

This paper assesses the stabilization effects of fiscal policy in Croatia in the period 1996-2011 using the Blanchard and Perotti structural vector autoregression model. In the five variable (government spending, output, prices, taxes, interest rate) baseline VAR setup, results show that output moves in line with Keynesian propositions, 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 the long term. When extending the model to additional variables, 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 and government investment lead to an increase in private consumption significantly, being the effect of government investment on private investment even more important, (c) a drop in output and private consumption after a tax shock is mainly driven by indirect (not direct) taxes, (d) public sector wages respond significantly to a spending and tax shock, showing a rise and drop respectively.

When considering these 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 Croatian governments during the last four 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 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 empirically investigate, once the crisis period ends and the data become available, it is already noted that Croatia, among EU countries, seems to register the longest recessionary period. Moreover, the assigned excessive deficit procedure proves that taken measures were a leading force in creating the 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 taxes.

Nevertheless, a deeper discussion is needed with respect to labour market effects of fiscal policy. As already pointed out, this research did not find proof of a significant effect of fiscal policy on employment and wages in the private sector. It may be the case that fiscal shock could trigger a significant response of unemployment (measured either in persons or percentage) in Croatia, particularly due to the big difference between the registered and labour force survey (LFS) unemployment rate (see for instance Tomić and Grdović Gnip (2011)). This implies that the employment measure taken in this research does not give the *"full picture"* since it seems that a relevant number of persons that work are not registered and therefore omitted in the data series. The limitation of investigating such an issue in this research is the data span and frequency of the registered and LFS unemployment rates have a shorter time span[31].

[31]Data available for a short time of period in a 6 SVAR model would substantially decrease the degrees of freedom and power of tests.

4. THE POWER OF FISCAL MULTIPLIERS IN CROATIA[1]

4.1 Introduction

The recent global financial crisis refocused the attention of policy makers and economists onto fiscal policy as a potentially strong tool in stimulating economic growth. Although since decades there was a global tendency that fiscal stabilization should mainly be performed by the work of automatic stabilizers rather than discretionary fiscal policy, governments as well as institutions traditionally seen as symbol of fiscal austerity (such as the International Monetary Fund or European Commission) opted for large fiscal stimuli during the latest economic downturn.

Still, eventual effects of a stimulus package are uncertain and empirical research shows no absolute consensus on the effects of fiscal policy on the macroeconomics. Most of the studies prove a positive multiplier for an exogenous government spending shock and a negative multiplier for an exogenous government tax shock. Nevertheless, the size (and sign) of a fiscal multiplier is country-, time-, estimation method- and regime-dependant. A revealing example of how differences in size of a fiscal multiplier affect potential fiscal stimuli effectiveness was recently brought by Robert Barro (2009). In an article for the Wall Street Journal Barro discusses the recovery program proposed by Cristina Romer, Chair of President Obama's Council of Economic Advisers. Namely, when estimating the overall job gains for the proposed 787 billion USD stimulus package, Cristina Romer used the government spending multiplier being of size 1.5. Barro's opinion was that the size of the same multiplier was essentially zero and therefore, as pointed by Ilzetzki et al. (2010, p. 2) *"the difference between Romer's and Barro's views of the world amounts to a staggering 3.7 million jobs by the end of 2010"*.

Diverging predictions of the effectiveness of fiscal stimuli can be found in theoretical literature as well. Real Business Cycle (RBC) models assume that an increase in government consumption will be completely neutralized by the reduction of private consumption (Baxter and King, 1993; Fatás and Mihov, 2001a). Keynesian models argue that a government consumption increase leads to an increase in private consumption and output (Blanchard, 2003)[2]. However, Pappa (2003, p. 2) indicates that differences in predicting fiscal policy effects arise because fiscal shocks are difficult to identify in practice due to *"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"*.

[1] Published in *Financial theory and practice*, 38(2), June 2014.

[2] The disagreement about fiscal policy effects on private consumption is part of a broader topic whether consumers are set as Ricardian or non-Ricardian. In the standard neoclassical model an increase in government spending tends to crowd out private consumption due to the negative wealth effect on consumer induced by expectations of higher tax payments in future.

This paper studies fiscal multipliers in Croatia using two different frameworks for estimation. On one hand a linear structural vector autoregression (SVAR) model as proposed by Blanchard and Perotti (2002) is used to estimate the overall sign and size of a government spending and tax shock on output, private consumption and private investment. The novelty of the SVAR model in this paper with respect to other works published in the field of fiscal policy on the Croatian case (i.e. Ravnik and Žilić (2011) and Šimović and Deskar-Škrbić (2013)) are the following: (1) the data set is based on a longer time span (1996Q1-2011Q4), (2) estimated multipliers involve not only the effect of total government spending and taxes but government spending components as well, (3) fiscal policy effects are investigated not only with respect to output, but also with respect to private consumption and private investment, and (4) multipliers are converted into monetary values (in kunas), which facilitates interpretability.

On the other hand a smooth transition vector autoregression (STVAR) model is used to investigate whether the size of a fiscal multiplier is different in *good* and *bad* times. This analysis as well embraces the effects (multipliers) of different government spending components on output, private consumption and investment.

The main results are in line with Keynesian theory. A spending shock positively affects output, private consumption and private investment and the response is significant within a year. Moreover, when investigating the effect of government consumption versus government investment, the positive effect of the first with respect to output and private consumption is persistent and significant throughout the whole time horizon. A tax shock leads to a drop in output, private consumption and private investment. If the regime-switching models are considered results are conclusive in the fact that fiscal multipliers tend to be larger in times of economic downturn than in times of expansion when they are mostly insignificant. Such results are in line with similar research conducted for other (developed and developing) countries.

This paper is structured as follows. Section two gives some insight into the theoretical and empirical background about fiscal multipliers. The third section is devoted to a brief explanation of the methodologies and data used in the analysis. Section four presents the results, while the last, fifth section, is reserved for concluding remarks.

4.2 Theoretical and empirical background

In general, a fiscal multiplier refers to a change in output ΔY that occurs after an exogenous one unit change in a fiscal policy instrument ΔFI (the fiscal instrument FI can be represented by total government spending G, total taxes T or their subcomponents - transfers G^{tr} or direct taxes T^d for instance). For example, in the case when a one kuna increase in government spending in Croatia causes a 50 lipas increase in GDP, then

the government spending multiplier is said to be 0.5. Such a multiplicative effect varies across time horizon, so it is important to give the following definitions:

The **impact multiplier** measures the ratio of a contemporaneous change in output to an exogenous change in fiscal policy instrument at time of impact (occurrence of shock) i.e. time t_0:

$$\frac{\Delta Y_{t_0}}{\Delta FI_{t_0}} \tag{4.1}$$

The **multiplier in a** future **period** n is the ratio of change in output in time $t_0 + n$ to an exogenous change in the fiscal policy instrument at time of impact t_0:

$$\frac{\Delta Y_{t_0+n}}{\Delta FI_{t_0}} \tag{4.2}$$

The **cumulative multiplier** is defined as the cumulative change in output over the cumulative change in fiscal policy instrument at some time horizon n:

$$\frac{\sum_{i=1}^{n} \Delta Y_{t_0+i}}{\sum_{i=1}^{n} \Delta FI_{t_0+1}} \tag{4.3}$$

where i goes from 1 to n.

The **peak multiplier** represents the largest change in output after a change in fiscal policy instrument over any time horizon n:

$$\max_{n} \frac{\Delta Y_{t_0+n}}{\Delta FI_{t_0+n}} \tag{4.4}$$

Empirical and theoretical studies show that fiscal multipliers vary in sign and size, being also country-, time-, methodology- and economic conditions-specific. In fact, there is no absolute consensus on the effects of fiscal policy on the macroeconomics and empirical results agree on one fact only, i.e. that a positive government spending shock has a positive (and significant) effect on output[3].

Additionally, Spilimbergo et al. (2009, p. 2) point out that the size of the multiplier is larger if (i) "leakages" are few (i.e., only a small part of the stimulus is saved or

[3]It is important to point out that the agreement about the government spending effect on output is mainly due to the fact that much of the literature and research investigate fiscal policy on US data. Fiscal policy transmission mechanism is known to be country specific (since there are no two equal tax and/or fiscal systems on the world) and therefore there are works based on the same country case that do not find such unambiguous results as in case of the US. For example, investigation on the case of Germany is not as much conclusive as in the US case with respect to the size and statistical significance of the effect of government spending on output Höppner 2001; Perotti 2005; Marcellino 2002; Heppke-Falk et al. 2006.

spent on imports), (ii) monetary conditions are accommodative (i.e., the interest rate does not increase as a consequence of fiscal expansion), and (iii) country's fiscal position after the stimulus is sustainable. Moreover, authors signal that the degree of financial market development and intermediation, as well as institutional features and the general macroeconomic and financial conditions in the domestic economy and externally, also have influence on the size and sign of a fiscal multiplier[4].

Although there was a predominant view that fiscal policy should mainly operate through automatic stabilizers, the latest economic crisis showed that a growing number of governments opted for *discresionarism* to boost economic activity[5]. Therefore, fiscal policy is in focus of academic and policy makers' debating mainly around one question: *what is the transmission of fiscal shocks?* Especially in the case of an economic downturn, policymakers should be able to predict how a discretionary change in a fiscal instrument (or a set of instruments) would affect economic activity, in order to be as efficient and effective as possible in smoothing business cycles.

As already mentioned, the answer is conditional on the methodology used for identifying fiscal shocks. Still, much of the empirical research in this area is based on two methodologies: (i) linear structural vector autoregression (SVAR) models and (ii) linearized dynamic stochastic general equilibrium (DSGE) models[6,7]. Although largely applied, both methodologies have two main shortcomings outlined by Parker (2011, p. 6): first, the government spending multiplier is time-invariant and independent of the state of the economy, and second, a linear model forces a multiplier being independent of the size of the stimulus.

The SVAR approach in investigating fiscal multipliers was newly introduced by Blanchard and Perotti (2002) on quarterly data about government spending, taxes and output in the US. Subsequently, much of the empirical research, as well as this one, relies on the Blanchard and Perotti (2002) SVAR method when investigating fiscal multipliers[8]. Table 4.1 summarizes main findings about spending and tax multipliers in developed and developing countries using such a methodological framework.

[4]For a detailed explanation of the mentioned determinants see Spilimbergo et al. (2009).

[5]Spilimbergo et al. (2009) point out that countries turned to fiscal policy as their primary stabilization tool either because of changes in their monetary regime (such as currency board or participation in a monetary union) or because financial conditions deteriorated to the point of making monetary policy ineffective.

[6]Moreover, the study of fiscal policy effects on economic activity proposes additional three identification schemes for identifying fiscal policy shocks: (i) the recursive approach introduced by Sims (1980), (ii) the sign-restrictions approach developed by Mountford and Uhlig (2005), and (iii) the event-study (narrative or "Dummy approach") proposed by Ramey and Shapiro (1998) for studying the isolated effects of unexpected increases in government spending for defense purposes.

[7]Broad surveys of the literature on fiscal multipliers are provided in Parker (2011); Ramey (2011).

[8]Hebous for instance shows that, when investigating government spending effects amid a total of 42 country cases 22 of them employ the Blanchard and Perotti SVAR, 9 the sign restriction approach, 5 the recursive framework while the narrative and expectation augmented setups are presented in 4 and 2 cases respectively (2009, pp. 13-15).

Table 4.1: *SVAR based government spending and net taxes multipliers in selected studies*

Study	Sample	Spending multiplier		Tax multiplier	
		Short-term	*Medium-term*	*Short-term*	*Medium-term*
DEVELOPED COUNTRIES					
Blanchard and Perotti (2002)	US 1947Q1-1997Q4	0.50	0.50	(-0.7,-1.3)	(-0.4,-1.3)
Biau and Girard (2005)	FR 1978Q1-2003Q4	1.90	1.50	-0.5	-0.8
International Monetary Fund (2005)	PT 1995Q3-2004Q4	1.32	1.07		
Perotti (2005)	US 1960Q1-1979Q4	1.29	1.40	-1.41	-23.87
	US 1980Q1-2001Q4	0.36	0.28	0.70	1.55
	DE 1960Q1-1974Q4	0.36	0.28	0.29	-0.05
	UK 1963Q1-1979Q4	0.48	0.27	-0.23	-0.21
	UK 1980Q1-2001Q2	-0.27	-0.60	0.43	0.7
Heppke-Falk et al. (2006)	DE 1974Q1-2004Q4	0.67	1.27	no effect	no effect
Giordano et al. (2007)	IT 1982Q1-2004Q4	1.20	1.70	0.16	
de Castro and de Cos (2008)	ES 1980Q1-2004Q4	1.30	1.00	+	−
Burriel et al. (2010)	EA 1981Q1-2007Q4	0.87	0.85	-0.63	-0.49
Baum and Koester (2011)	DE 1976Q1-2009Q4	0.62	1.27	-0.66	-0.53
de Castro and Fernandez-Caballero (2011)	ES 1981Q1-2008Q4	0.94	0.55		
DEVELOPING COUNTRIES					
Lonzano and Rodriguez (2009)	CO 1980Q1-2007Q4	1.12	1.20	+	
Mirdala (2009)	CZ 1980Q1-2007Q4	+		no effect	
	SK 2000Q1-2008Q4	+		+	
	HU 2000Q1-2008Q4	+		−	
	BG 2000Q1-2008Q4	+		+	
	RO 2000Q1-2008Q4	+		+	
	PL 2000Q1-2008Q4	+		no effect	
Crespo Cuaresma et al. (2011)	CZ 1995Q1-2009Q4	no effect	-0.04	no effect	0.03
	SK 1996Q1-2009Q4	-0.01	0.00	-0.02	-0.1
	HU 1995Q1-2009Q4	0.01	0.01	no effect	-0.01
	PL 1995Q1-2009Q4	no effect	-0.02	no effect	0.02
	SI 1996Q1-2009Q4	-0.01	-0.01	0.01	0.02
Jemec et al. (2011)	SI 1995Q1-2010Q4	1.61	no effect	-0.38	no effect
Mancellari (2011)	AL 1998Q1-2009Q4	0.36		1.4	
Ravnik and Žilić (2011)	HR 2001M1-2009M12	−		+	
Šimović and Deskar-Škrbić (2013)	HR 2004Q1-2012Q4	2.18	1.91	-1.32	-0.81

Note: Short-term multiplier ranges from time of impact to one year span; *Medium-term* multiplier refers to the time span going from one to two years, except in case of Crespo Cuaresma et al. (2011) and Mancellari (2011) when it goes to two years, i.e. maximum reported. Tax multipliers in Blanchard and Perotti (2002) are shown as range/interval. In case of Šimović and Deskar-Škrbić (2013) shown results refer to multipliers at the consolidated general government level. Blank cells indicate that the author(s) did not provide any results (or that the mentioned was not part of the research), + and − stand for a positive and negative multiplier respectively, while "no effect" means that the author(s) did investigate the topic but found no significant effects.
Source: Author's systematization.

It is possible to observe from Table 4.1 that fiscal multipliers are controversial. In developed countries spending multipliers are positive in all cases no matter of the time horizon under investigation, except in Perotti (2005) for the case of United Kingdom. Same multipliers in developing countries are mostly positive in the short run and above unity in Slovenia (Jemec et al., 2011) and Croatia (Šimović and Deskar-Škrbić, 2013). On the other hand, tax shocks do not exhibit a uniform effect on output. It is noticeable that not in all cases an increase in taxes leads to a decrease in output. Moreover the magnitude of the effect quite differs among studied cases.

Recent theoretical and empirical studies emphasize that one of the reasons why there is no conclusive evidence of fiscal policy effects may be found in the fact that government spending (and tax) multipliers may change over the business cycle, i.e. be larger in recessions than in expansions (Christiano et al., 2009; Woodford, 2010; Auerbach and Gorodnichenko, 2012, 2011, among others)[9]. These findings appear to be in line with Keynesian arguments in favor of using discretionary government spending in downturn periods to stimulate aggregate demand. Table 4.2 summarizes the spending and tax multipliers during recessions and expansions for selected studies. Among all it is worth noting that the highest negative short-term effect on output after a positive tax shock is evidenced in France, being 1.6 in bad times and 0.7 in good times (Baum et al., 2012), while a positive government spending shock in bad times mostly increases output in the short term in the Euro area and the US (Batini et al., 2012) with multipliers of 2.6 and 2.2, respectively[10].

[9]It is important to point out that works in the field of fiscal policy when investigating state-dependent multipliers employ non-linear approaches, mainly STVAR and TVAR (threshold vector autoregressive) models. The main difference is that in a TVAR setup the economy discretely changes from one state to the other, i.e. it *jumps* from regime to regime, while a STVAR model allows such a switch to occur smoothly. Moreover, within a STVAR approach all observations are used for the estimation of parameters under both regimes.

[10]Worth noting is that Baum et al. (2012) use a threshold SVAR for the analysis of state dependent fiscal multipliers. In doing so, they compare multipliers obtained within models where GDP growth is selected as the threshold variable with those obtained when output gap is used as threshold variable. Baum et al. (2012, p. 17) conclude that their "study confirms the state dependency of fiscal multipliers and shows that multipliers, and especially spending multipliers, are significantly larger in downturns than in expansions". However, they accent that negative spending multipliers during recessions in case of France when GDP growth is used as a threshold variable (see Table 4.2), could be biased by data limitations, since same is not evidenced when output gap is used as threshold. On the other hand, negative spending multipliers evidenced in case of Canada are not dependent upon the threshold variable, but authors do not propose a discussion, since they are mostly focussed on the average multipliers of G-7 economies.

Table 4.2: *Government spending and net taxes multipliers in non-linear approaches in selected studies across developed countries*

Study	Sample	Spending multiplier		Tax multiplier	
		Short-term	*Medium-term*	*Short-term*	*Medium-term*
Baum et al. (2012)	CA 1966Q1-2011Q2	R: -2.7	R: -3.3	R: -0.2	R: -0.2
		E: -0.8	E: -1.1	E: 0.2	E: 0.2
	FR 1970Q4-2010Q4	R: -0.7	R: -1.1	R: -1.6	R: -2.2
		E: 1.7	E: 2.1	E: -0.7	E: -0.9
	DE 1975Q3-2009Q4	R: 1.0	R: 1.3	R: -0.5	R: -0.6
		E: 0.4	E: 0.4	E: -0.6	E: 0.8
	JP 1970Q1-2011Q2	R: 1.6	R: 1.8	R: 0.2	R: -0.2
		E: 0.9	E: 1.3	E: 0.6	E: 0.4
	UK 1970Q1-2011Q2	R: -0.1	R: -0.1	R: 0.1	R: 0.1
		E: 0.1	E: 0.1	E: 0.0	E: -0.1
	US 1965Q2-2011Q2	R: 1.9	R: 2.4	R: -0.2	R: -0.3
		E: 1.6	E: 2.4	E: -0.4	E: -0.5
Batini et al. (2012)	US 1975Q1-2010Q2	R: 2.2	R: 2.2	R: 0.2	R: 0.7
		E: 0.3	E: -0.5	E: 0.2	E: 0.7
	JP 1981Q1-2009Q4	R: 2.0	R: 2.0	R: -0.2	R: 0.2
		E: 1.4	E: 1.1	E: -0.3	E: -0.1
	FR 1970Q1-2010Q4	R: 2.1	R: 1.8	R: 0.0	R: -0.3
		E: 1.6	E: 1.9	E: -0.1	E: -0.2
	IT 1981Q1-2007Q4	R: 1.6	R: 1.8	R: 0.2	R: 0.2
		E: 0.4	E: 0.5	E: 0.1	E: 0.1
	EA 1985Q1-2009Q4	R: 2.6	R: 2.5	R: 0.4	R: 0.4
		E: 0.4	E: 0.1	E: -0.2	E: -0.1
Auerbach and Gorodnichenko (2012)	US 1947Q1-2008Q4	R: 1.4	R: 1.8		
		E: 0.0	E: -0.1		
Auerbach and Gorodnichenko (2011)	OECD 1985-2010	R: 0.5	R: 0.4		
		E: -0.3	E: -0.3		

Note: Short-term multiplier ranges from time of impact to one-year span; *Medium-term* multiplier refers to the time span going from one to two years. R stands for recession, while E for expansion. In case of Baum et al. (2012) reported multipliers refer to the threshold SVAR with GDP growth being the threshold variable. In case of Auerbach and Gorodnichenko (2011) the dataset is based on semiannual data with a time span from 1985 to 2010 for "old" OECD members, and from 1990 to 2010 for the "newer" OECD members. Blank cells indicate that the author(s) did not provide any results (or that the mentioned was not part of the research).
Source: Author's systematization.

Moreover, Romer and Bernstein (2009) estimate that a spending multiplier during the latest global financial crisis in US is at least 3. Similarly, Christiano et al. (2009), Auerbach and Gorodnichenko (2012, 2011) and Bachman and Sims (2012) find that spending multipliers on output and private consumption in US tend to rise during periods of economic downturns (up to the size of 3) while being around zero during expansions. Empirical studies show that output multipliers of government consumption are larger in

recessions. Moreover, they are even larger when monetary policy is highly accommodative, like in the case of the recent financial crisis when the monetary policy rate of most central banks is at its lower bound level. Christiano et al. (2009) and Woodford (2010) show that when interest rates are at their effective low level, fiscal shocks tend to have amplified effects because government spending does not crowd out private spending, with multipliers as large as 10.

Most papers that investigate fiscal multipliers in *special* times focus on the case of developed countries (mainly US), while there is almost no evidence whether similar conclusion would hold in case of developing/emerging countries. Keeping in mind that fiscal policy in developing economies tends to be overwhelmingly pro-cyclical, partly because of political incentives for governments to spend more generously and thus run large deficits in *good* times (see Kaminsky et al., 2004; Alesina et al., 2008, among others), then fiscal actions should be less effective regardless of the state of the business cycle.

4.3 Data and methodology

The empirical analysis of fiscal multipliers in this paper is based on two methodologies. On one hand the Blanchard and Perotti SVAR setup is chosen from the set of linear approaches, while on the other hand, in order to investigate whether fiscal multipliers differ in Croatia in good and bad times, the smooth transition vector autoregression (STVAR) of Auerbach and Gorodnichenko (2011) is applied.

4.3.1 *The SVAR specification*

The baseline specification includes three variables: the log of real government spending g_t, the log of real output y_t and the log of real government revenue r_t (referred to also as "net taxes" or "taxes")[11]. Denoting the vector of endogenous variables by X_t and the vector of reduced form innovations by U_t, reduced form VAR model can be written as:

$$X_t = C(L)X_{t-1} + U_t \tag{4.5}$$

where $X_t = [g_t \quad y_t \quad r_t]'$, $C(L)$ is an $n \times n$ autoregressive lag polynomial matrix and $U_t = [u_t^g \quad u_t^y \quad u_t^r]'$[12].

The reduced form residuals u_t^g and u_t^r can be though as a linear combination of three components (Perotti, 2005, p. 3): (i) the *automatic response* of taxes and government spending to innovations in output, (ii) the *systematic discretionary response* of policymakers to output, and (iii) the *random discretionary* shocks to fiscal policy. The latter

[11] Important to point is that the mentioned fiscal variables correspond to G and Rbp in Appendix C.

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

encompasses the structural fiscal shocks, which unlike the reduced form residuals are mutually uncorrelated.

Defining the vector of spending, output and tax structural shocks as $V_t = [v_t^g \quad v_t^y \quad v_t^r]'$, U_t can be written as a linear combination of structural shocks V_t in the following way:

$$AY_t = BV_t \tag{4.6}$$

where A and B are $n \times n$ matrices describing immediate relations between the reduced form residuals and the structural shocks[13]. Therefore, the structural VAR can be obtained by multiplying K.1 by matrix A and using K.2, which leads to the following:

$$AX_t = AC(L)X_{t-1} + BV_t \tag{4.7}$$

The matrix representation of the latter is:

$$\begin{bmatrix} 1 & -\alpha_y^g & -\alpha_r^g \\ -\alpha_g^y & 1 & -\alpha_r^y \\ -\alpha_g^r & -\alpha_y^r & 1 \end{bmatrix} \times \begin{bmatrix} u_t^g \\ u_t^y \\ u_t^r \end{bmatrix} = \begin{bmatrix} \beta_g^g & 0 & \beta_r^g \\ 0 & \beta_y^y & 0 \\ \beta_g^r & 0 & \beta_r^r \end{bmatrix} \times \begin{bmatrix} v_t^g \\ v_t^y \\ v_t^r \end{bmatrix} \tag{4.8}$$

Blanchard and Perotti (2002) argue that governments cannot react within the same quarter to changes of macroeconomic setting mainly because fiscal policy decisions involve many agents (parliament, government and society) and therefore need a long period of time for implementation. Hence the *systematic discretionary response* is absent in quarterly data. Therefore the reduced form fiscal shocks capture only the *automatic response* of fiscal variables to economic activity (meaning that $\alpha_r^g = \alpha_g^r = 0$).

Without loss of generality one can write:

$$u_t^g = \alpha_y^g u_t^y + \beta_r^g v_t^r + \beta_g^g v_t^g, \tag{4.9}$$

$$u_t^y = \alpha_g^y u_t^g + \alpha_r^y u_t^r + \beta_y^y v_t^y, \tag{4.10}$$

$$u_t^r = \alpha_y^r u_t^y + \beta_g^r v_t^g + \beta_r^r v_t^r, \tag{4.11}$$

where α_i^j's capture the other two components and v_t^g and v_t^r are the structural fiscal shocks.

Being that the case, Blanchard and Perotti (2002) use available exogenous information on the elasticity of spending and taxes with respect to GDP to compute the appropriate

[13]In such a set up A and B are $n \times n$ parameter matrices that require identifying restrictions to be imposed on A and B to obtain an unique relation, because reduced form residuals have no economic interpretation and different structural forms can give the same reduced form VAR model (see for instance Gottshalk (2001)).

value of the coefficients α_i^j. These elasticities allow for constructing fiscal shocks in cyclically adjusted terms as follows:

$$u_t^{g,CA} = u_t^g - \left(\alpha_y^g u_t^y\right) \tag{4.12}$$

$$u_t^{r,CA} = u_t^r - \left(\alpha_y^r u_t^y\right). \tag{4.13}$$

As mentioned earlier, this study assumes that expenditure does not respond to output within a quarter because they are predetermined in a budgetary plan and therefore not elastic in the short run. Thus, α_y^g is set to zero according to the assumption that government spending is solely under the control of fiscal authority.

In line with Blanchard and Perotti (2002) the coefficient α_y^r is estimated as the weighted average of different revenue components' output elasticity. The output elasticity of net taxes results to be 0.92 in the Croatian case (see Appendix F for a detailed view about the exogenous elasticities estimations), meaning that a 1% increase in output (GDP) generates 0.92% increase in taxes. This estimation is in line with results obtained by other studies covering other countries. It matches the tax elasticity with respect to output in the German case shown in Perotti (2002) but is lower than the same in the US or Canada for example. If compared to the tax elasticity obtained on the Croatian case by Ravnik and Žilić (2011) it is by 0.03 percentage points lower and not significantly different.

The recovered cyclically adjusted reduced form fiscal shocks represent a linear combination of the two structural fiscal policy shocks, i.e.

$$u_t^{g,CA} = \beta_r^g v_t^r + \beta_g^g v_t^g \tag{4.14}$$

$$u_t^{r,CA} = \beta_g^r v_t^g + \beta_r^r v_t^r. \tag{4.15}$$

Assuming that a government tends to decide on expenditure first means that $\beta_r^g = 0$, and therefore:

$$u_t^{g,CA} = \beta_g^g v_t^g \tag{4.16}$$

$$u_t^{r,CA} = \beta_g^r v_t^g + \beta_r^r v_t^r. \tag{4.17}$$

where β_g^r is estimated by OLS to retrieve the structural shocks to the fiscal variables. The two estimated structural shocks are orthogonal to the structural shock of output and therefore can be used as instruments when estimating equation 4.10 using the instrumental variables approach.

So the just-identified three variable baseline SVAR model is the following:

$$\begin{bmatrix} 1 & 0 & 0 \\ -\alpha_g^y & 1 & -\alpha_r^y \\ 0 & -0.92 & 1 \end{bmatrix} \times \begin{bmatrix} u_t^g \\ u_t^y \\ u_t^r \end{bmatrix} = \begin{bmatrix} \beta_g^g & 0 & 0 \\ 0 & \beta_y^y & 0 \\ \beta_g^r & 0 & \beta_r^r \end{bmatrix} \times \begin{bmatrix} v_t^g \\ v_t^y \\ v_t^r \end{bmatrix} \tag{4.18}$$

where OLS is adopted in estimating β_g^r and IV in estimating α_g^y and α_r^y. The estimates are presented in the following Table.

Table 4.3: *Estimated contemporaneous coefficients in the baseline SVAR model*

	β_g^r	α_g^y	α_r^y
	OLS	IV	IV
Coefficient	-0.079	0.018	-0.3537
(standard errors)	(-1.277)	(0.048)	(0.125)
$[p-value]$	[0.208]	[0.698]	[0.005]

Source: Author's calculation.

Signs of the contemporaneous effects of spending and taxes on output are, as expected, positive and negative respectively. Moreover, the correlation between cyclically adjusted fiscal shocks results to be very low (-0.14) yielding very low estimates of β_g^r[14].

Important to notice is that in alternative specifications the baseline model is extended for a GDP component (private consumption or private investment) to a four variable SVAR, where private consumption or investment in turn is ordered third[15]. Moreover, when investigating the effects of particular government spending component variable g_t is replaced by the component in question in the extended four variable VAR[16,17].

4.3.2 *The STVAR specification*

Auerbach and Gorodnichenko (2012) extend the Blanchard and Perotti (2002) setup by allowing for responses differentiated across recessions and expansions in a regime switching vector autoregression framework, where transitions across states occur smoothly. The main advantage of the STVAR over the SVAR is that it effectively utilizes more information by exploiting variation in the degree of being in a particular regime so that estimation and inference for each regime is based on a larger set of observations (Auerbach and Gorodnichenko, 2012, p. 4). Estimating a SVAR for each regime separately

[14]The correlation between cyclically adjusted fiscal shocks results to be very low also in case when taxes are ordered first. Therefore, small values of β_g^r and β_r^g imply that the choice between ordering spending or taxes first does not influence impulse responses and proves the robustness of the results.

[15]This order follows the suggestion by Caldara and Kamps (2008), same as in the case of the baseline model. For a detailed discussion on the assumptions behind such ordering refer to their work. To recall, placing private consumption or private investment at the third place means it does not react contemporaneously to taxes, but is contemporaneously affected by government spending and output shocks.

[16]Specific budget component elasticities to output and/or GDP components are reported in Appendix F.

[17]Additional details about alternative models are given in Appendix G.

may seriously limit the amount of observations in a regime, which makes estimates unstable and imprecise. According to Auerbach and Gorodnichenko (2012) the baseline smooth transition vector autoregression (STVAR) specification is:

$$X_t = (1 - F(z_{t-1}))\,\Pi_E(L)\,X_{t-1} + F(z_{t-1})\,\Pi_R(L)\,X_{t-1} + u_t \tag{4.19}$$

where

$$u_t \sim (0, \Omega) \tag{4.20}$$

$$\Omega_t = \Omega_E(1 - F(z_{t-1})) + \Omega_R F(z_{t-1}) \tag{4.21}$$

$$F(z_t) = \frac{exp(-\lambda z_t)}{1 + exp(-\lambda z_t)}, \quad \lambda \geq 0, \tag{4.22}$$

$$var(z_t) = 1, \quad E(z_t) = 0 \tag{4.23}$$

where X_t is the vector of endogenous variables, ordered again by taking into account the assumed contemporaneous effects amid variables, u_t a normal error term, and z_t is the indicator of the state of an economy, i.e. an index of the business cycle, normalized to have unit variance so that λ remains scalar invariant. A positive z indicates an expansion phase, while oppositely a negative z indicates a contractionary phase of the business cycle. The matrices Π_i and Ω_i (where $i = R$ in recession and $i = E$ in expansion) represent the coefficients and variance-covariance matrix of disturbances in two regimes being the system in a sufficient deep recession (when $F(z_t) \approx 1$) and in sufficient strong expansion (when $1 - F(z_t) \approx 1$). The weights assigned to each regime (expansion and recession) for a given weighting function $F(\cdot)$ vary between 0 and 1 according to the contemporaneous state of the economy z_t[18].

Following Auerbach and Gorodnichenko (2012), this study employs the four quarter moving average of output growth rates as indicator of the state of the economy, and λ is calibrated on the level of 1.5, making the economy spend 20 percent of time in recessionary regimes[19].

Such a model allows for two ways for differences in the propagation of structural shocks (Auerbach and Gorodnichenko, 2012, p. 5): (i) contemporaneous via differences in

[18] Auerbach and Gorodnichenko set z equal to a four- (2012) and seven- (2011) quarter moving average of the real output growth rate

[19] See Appendix H for a plot of the transition function between regimes of expansions and recessions on the Croatian case. Moreover, it is important to stress that the growth rate data span used in estimating the weighting function is longer than the observation period in the models, i.e. it ranges from 1995Q1 to 2013Q1. In that way there is no loss of the first observations due to the four-quarter moving average representation.

covariance matrices for disturbances Ω_E and Ω_R, and (ii) dynamic via differences in lag polynomials $\Pi_E(L)$ and $\Pi_R(L)$.

In their original work (2012), Auerbach and Gorodnichenko implement a STVAR approach on a US dataset available on high frequency. Such a dataset characteristic allows to carry out highly nonlinear estimation for a large number of parameters[20]. However, a generous dataset is not available for most countries, and, as pinpointed by Auerbach and Gorodnichenko (2011, p. 3) ,such an approach for OECD countries would be very challenging due to short time series with lower frequencies[21].

Given the importance of expectations in identifying fiscal shocks, Auerbach and Gorodnichenko (2011), extend the model and control for expectations by using real time forecasts and thus augmenting the equations with the unanticipated component of government spending and/or revenue (FE_t^{FI}, with FI being the fiscal instrument under examination). This unanticipated component was not accounted for in the SVAR approach, it is newly introduced and measured by the ratio between actual spending (or actual revenue) and its forecasted value one period earlier (spending t in time $t-1$, or revenue t in time $t-1$)[22]. Therefore, the first step is to estimate the SVAR for $X_t = [FE_t^g \quad g_t \quad y_t \quad r_t]'$[23].

Being that the case, Auerbach and Gorodnichenko (2011) modify the previously mentioned approach and follow an approach advocated by Jorda (2005) and Stock and Watson (2007), among others, i.e. rather than estimating the entire system of equations in the STVAR and using these to estimate the impulse response functions, they estimate the impulse responses directly by projecting a variable of interest on its own lags and lags of other variables entering the VAR. As pinpointed by Auerbach and Gorodnichenko (2011, p. 4), this direct projection approach provides a flexible estimation method, which does not impose dynamic restrictions implicitly embedded in VARs and which can conveniently accommodate nonlinearities in the response function.

For example, if the interest is to determine the response of output y_t at horizon h after a government spending shock, having in mind the vector $X_t = [FE_t^g \quad g_t \quad y_t \quad r_t]'$, then

[20]To inspect in detail the nonlinear estimation approach, see the Appendix in Auerbach and Gorodnichenko (2012).

[21]Although the time span of observations on the Croatian case used in this analysis goes back in history as much as possible, it can be considered relatively short, not only with respect to the available statistics in case of the US, but also with respect to (older and newly) OECD member states.

[22]To obtain values of the unanticipated component Auerbach and Gorodnichenko (2011, p. 3) rely on several sources, such as surveys prepared by professional forecasters, projections prepared by governmental or international agencies, or other credible sources. In the Croatian case the sources and calculation of unanticipated components is presented in Appendix C.

[23]For simplicity of notation the unanticipated component of government spending in the equations is denoted by FE_t^g, which corresponds to the variable defined in Appendix C as $FEgspend$.

the estimation equation is:

$$\begin{aligned} y_{t+h} = & \left(1 - F\left(z_t\right)\right) \Theta_{E,h} FE_t^g + F\left(z_t\right) \Theta_{R,h} FE_t^g \\ & + \left(1 - F\left(z_t\right)\right) \Phi_{E,h}\left(L\right) g_{t-1} + F\left(z_t\right) \Phi_{R,h}\left(L\right) g_{t-1} \\ & + \left(1 - F\left(z_t\right)\right) \Psi_{E,h}\left(L\right) y_{t-1} + F\left(z_t\right) \Psi_{R,h}\left(L\right) y_{t-1} \\ & + \left(1 - F\left(z_t\right)\right) \Pi_{E,h}\left(L\right) r_{t-1} + F\left(z_t\right) \Pi_{R,h}\left(L\right) r_{t-1} + u_t \end{aligned} \tag{4.24}$$

with $F\left(z_t\right)$ as defined in equation 4.22 and $h = 0, 1, \ldots, H$. The unanticipated component of government spending (FE_t^g) represents the forecast error, i.e. the difference between forecasted and actual government spending in time $t-1$ for period t. Thus FEs can be interpreted as the "surprise government spending shock" (Auerbach and Gorodnichenko, 2011, p. 4).

The lag polynomials ($\Phi_{E,h}\left(L\right)$, $\Phi_{R,h}\left(L\right)$, $\Psi_{E,h}\left(L\right)$, $\Psi_{R,h}\left(L\right)$, $\Pi_{E,h}\left(L\right)$, $\Pi_{R,h}\left(L\right)$) in equation 4.24 are used to control for the history of shocks rather than to compute the dynamics, while the coefficients in $\Theta_{E,h}$ and $\Theta_{R,h}$ can be interpreted as multipliers that show the response of output to a structural shock in government spending in expansions and recessions respectively.

A linear tantamount to equation 4.24 is the following:

$$y_{t+h} \quad = \Theta_{lin,h} FE_t^g + \Phi_{lin,h} g_{t-1} + \Psi_{lin,h} y_{t-1} + \Pi_{lin,h} r_{t-1} + u_t \tag{4.25}$$

where the response of Y is constrained to be the same for all z_t's[24].

The estimation method as set in equation 4.24 has the following main advantages (Auerbach and Gorodnichenko, 2011, p. 6): (1) it involves only linear estimation if the parameter λ is fixed, (2) it allows to estimate just the equation related to the variable of interest (output, for example), and (3) it does not constrain the shape of the impulse response functions, rather than imposing the pattern generated by the SVAR.

4.3.3 *The data*

The baseline dataset includes a quarterly dataset from 1996Q1 to 2011Q4 for the log of real government spending g_t, the log of real output y_t and the log of real government revenue r_t (referred to also as "net taxes" or "taxes"). Important to stress is that fiscal variables are defined as in Blanchard and Perotti (2002), i.e. both net of transfers, and

[24] Such a constraint implies that $\Theta_{lin,h} = \Theta_{E,h} = \Theta_{R,h}$, $\Phi_{lin,h} = \Phi_{E,h} = \Phi_{R,h}$, $\Psi_{lin,h} = \Psi_{E,h} = \Psi_{R,h}$ and $\Pi_{lin,h} = \Pi_{E,h} = \Pi_{R,h}$ for all L and h.

at the consolidated central government level[25]. All variables are in logarithms, real terms (CPI deflated 2000=100) and seasonally adjusted using the ARIMA X12 algorithm.

According to the Augmented Dickey Fuller (ADF) test results, all variables contain unit roots in levels and are stationary in first differences (Table 4.4).

Table 4.4: *Augmented Dickey Fuller Test values*

Variable	*Deterministic component*	test statistics	Variable	*Deterministic component*	test statistics
y_t	c, t	-1.8110	Δy_t	c, t	-9.4757^{***}
	c	-1.8825		c	-9.2081^{***}
g_t	c, t	-0.3815	Δg_t	c, t	-8.7127^{***}
	c	-1.3053		c	-8.4404^{***}
r_t	c, t	-1.1244	Δr_t	c, t	-7.9141^{***}
	c	-1.8792		c	-7.7397^{***}

Note: Variables' definition and symbols explained in Appendix C; Δ refers to first differences; variables are seasonally adjusted; constant included; maximum number of lags used is 12; *** null hypothesis rejected on 1% level of significance; ** null hypothesis rejected on 5% level of significance; * null hypothesis rejected on 10% level of significance; test statistics' critical values according Davidson and MacKinnon (1993).
Source: Author's calculation.

As in case of the five variable SVAR from the previous Chapter (Chapter 3, Section 3.3.1) results show the presence of co-integrating relations and the system is stationary in first differences. However, motivated by the same reasons as in the mentioned Chapter, the analysis embraces a vector autoregression specification using variables in levels. To choose the appropriate lag length the judgment is based on information criteria results, the length of the sample and economic sense. To be as parsimonious as possible the VAR lag selection tests included a maximum of four lags. The Akaike criterion (AIC) and final prediction suggest two lags, while the Schwarz Bayesian (SC) and Hannan-Quinn (HQC) criteria indicate one lag as optimal. This analysis will allow for dynamic interaction up to one lags as suggested by the Schwarz and Hannan-Quinn criteria.

[25]See Appendix C for details about all variables used throughout the analysis. Moreover, it is important to point out that generally it is common empirical practice to analyze fiscal policy effects using consolidated general government data (Refer to footnote 2). Moreover, Šimović and Deskar-Škrbić (2013) show that fiscal multipliers in Croatia differ amid different government levels, but this is mainly true for the short-run, while the cumulative multiplier of government spending across 8 quarters results to be 1.80 and 1.91 at the consolidated central and general government respectively. Same authors report also the peak government spending multiplier being of size 1.20 and 1.39 at the consolidated central and general government, respectively, while the lowest spending multiplier is 0.19 no matter of the consolidation level.

4.4 Results

According to the level specification, structural shocks represent one percentage point increase in the policy variables, while impulse responses represent the percent change of the responding variable. Still, all fiscal multipliers shown are expressed in kunas[26]. To do so, the estimated multiplier value is multiplied by the ratio of the mean of the response variable (in kunas) to the mean of the respective impulse variable (in kunas)[27]. Reported fiscal multipliers for the SVAR approach include the impact multiplier, two cumulative multipliers (on at the horizon of 12 quarters and one at 20 quarters) and the peak multiplier, which additionally in parenthesis shows the quarter in which the peak occurs. For the STVAR, i.e. regime switching and no-regime switching model, average multipliers are reported over three horizons (eight, twelve and twenty quarters)[28] [29]. Important to note is that, not only due to different methodological approaches, presented fiscal multipliers may not be directly comparable, but such a reporting strategy highlights better the differences between obtained regime-switching and linear models, which is the main point of this paper. The main point of the STVAR is estimating multipliers in the expansionary and recessionary phases of the business cycle. Moreover, in all STVAR specifications a linear representation of the corresponding model has been estimated as

[26] As mentioned, this Section reports multipliers "monetarized" in kunas, while the impulse response functions are presented in Appendix I.

[27] For example: say that the estimated impact multiplier of government spending on output is 0.15 and the ratio of the mean of GDP to the mean of government spending is 2.5, then at impact a one kuna increase in government spending leads to an increase in output of 38 lipas ($= 0.15 \times 2.5$). Additionally, it is important to point that Ramey and Zubairy (2013) discuss on the US case how such a procedure in converting percentage changes into dollar changes is not precise and leads to higher values of fiscal multipliers. The authors stress that the ratio of the mean of output to the mean of government spending on the US case depends upon the time span of the sample, varying from 2 to 24 in the 1889-2009 sample or from 4-7 in the post WWII sample. Therefore, Ramey and Zubairy (2013, p.9-10) suggest an *ex ante* conversion of output and government spending to the same units using the value of G/Y in each point of time without averaging. However, such a conversion can be omitted in the Croatian case, since the already limited time-span in case of shortening does not lead to significantly different response ratios of the mean of GDP to the mean of government spending.

[28] The average multipliers in recession and expansions are calculated as $\frac{1}{1+H}\sum_{h=0}^{H}\Theta_{R,h}$ and $\frac{1}{1+H}\sum_{h=0}^{H}\Theta_{E,h}$ respectively

[29] Important to point out is that Ramey and Zubairy (2013) as well as Owyang et al. (2013) provide a detailed discussion about pitfalls in reporting fiscal multipliers in normal and recessionary times. In doing so, they focus on the Auerbach and Gorodnichenko (2011) direct projection method as the most widely implemented during the last years. Owyang et al. (2013) point out that Auerbach and Gorodnichenko's multipliers are overestimated due to their fundamental assumption how a positive shock to government spending during a low-growth state does not help the economy escape that state. Moreover, they add that the second Auerbach and Gorodnichenko's assumption about the recession lasting 20 quarters is unrealistic since the data provide information about shorter recessionary periods in the US. Above that, the authors conclude that spending multipliers calculated as in Auerbach and Gorodnichenko (2012, 2011) show the response of output after a government spending shock without being rescaled for the effects the same shock exercises on the development in government spending. In line with Auerbach and Gorodnichenko this work also reports the average multiplier across 8, 12 or 20 periods (quarters), being these the average response of output in time $t+h$ (where h equals to 8, 12 or 20) after the initial shock in government spending.

in equation 4.25, but these results are not reported since there is no case where they significantly differ from those obtained using the SVAR.

4.4.1 *Baseline model results*

Table 4.5 shows the multiplier effects of government spending and net taxes on output in Croatia according to both methodological frameworks.

Table 4.5: *Fiscal multipliers in the baseline SVAR and STVAR models*

	Spending multiplier (G)	Tax multiplier (R)
SVAR Blanchard and Perotti		
Impact multiplier	0.33	-0.03
Cumulative multiplier ($h = 12$)	1.84	0.34
Cumulative multiplier ($h = 20$)	2.66	0.65
Peak multiplier (q)	0.33(0)	0.04(8)
STVAR - regime switch: recession		
Average multiplier ($h = 8$)	2.12	-0.02
Average multiplier ($h = 12$)	2.18	0.02
Average multiplier ($h = 20$)	2.21	0.40
STVAR - regime switch: expansion		
Average multiplier ($h = 8$)	*0.40*	*-0.02*
Average multiplier ($h = 12$)	*1.00*	*-0.02*
Average multiplier ($h = 20$)	*0.58*	*-0.03*

Note: Numbers in *italic font* mean that the estimate is not significant at the 5% confidence level.
Source: Author's calculation.

Regardless of the methodological framework, a positive spending shock positively affects output, while a positive tax shock negatively affects output in Croatia. These findings are in line with those shown in Chapter 3 Section 3.4.1 of this work when using a five variable SVAR Blanchard and Perotti approach. Next, it is possible to observe that macroeconomics reacts according to the Keynesian assumption of higher multiplier effect in downturn times, with a significant average multiplier above 2, meaning that a one kuna increase in government spending would lead to an increase in output of more than 2 kunas in the medium to long term.

In the SVAR approach output reacts negatively to a tax shock only on impact, while in the STVAR setting the reaction follows the same pattern in recession times, while in expansion times it results to be negative and insignificant, regardless of the time horizon. Moreover, all multipliers in expansion times are insignificant.

4.4.1.1 Robustness check

Robustness of the baseline models was checked by means of several alternatives. In case of the SVAR approach the estimation was redone by:

1. assuming that taxes come first, and
2. using different output elasticity of taxes, i.e. those obtained by Ravnik and Žilić (2011).

In case of the STVAR approach the robustness was checked by means of:

1. replacing the transition variable output growth rates with output gap[30], and
2. trying a different calibration of lambda (i.e. 0.8 as Auerbach and Gorodnichenko (2012) calibrate for the US, plus 3 and 5 to make the transition between regimes even smoother or abrupted.

None of the mentioned alternatives presents significantly different results. According to all means (SVAR and STVAR) an increase in government spending positively affects output, while in case of the regime switch models only the effect is more significant and higher during recessions. Similarly, an increase in taxes leads to a downturn in output in the short run, but the negative effect vanishes within three years.

4.4.2 *Alternative models' results*

As mentioned earlier alternative models are extended by one variable, i.e. private consumption and private investment in turn, ordered after output and before the government revenue (tax) variable. In case when the effects of different spending components are analyzed, the component under investigation replaces the government spending variable in the extended model. Similarly, when direct and indirect taxes' effects are studied, the net taxes variable is replaced[31].

4.4.2.1 Effects on private consumption and private investment

Government spending as well as tax shock exercise a Keynesian effect on private consumption. As shown in Table 4.6 a positive government spending shock increases private consumption, while a positive tax shock decreases the same macroeconomic variable.

[30]HP filtered output gap with $\lambda = 1600$ and $\lambda = 480$ (the first is standard for quarterly data, while for the latter refer to Bouthevillain et al. (2001)).

[31]It is important to notice that in case of an extended SVAR model the equation regarding net taxes needs of additional exogenous elasticities, which are shown in Appendix F.

Table 4.6: *Private consumption multipliers to fiscal shocks in the alternative SVAR and STVAR models*

	Spending multiplier (G)	Tax multiplier (R)
SVAR Blanchard and Perotti		
Impact multiplier	0.04	-0.02
Cumulative multiplier ($h = 12$)	0.73	-0.29
Cumulative multiplier ($h = 20$)	1.22	-0.46
Peak multiplier (q)	0.06(8)	-0.02(0)
STVAR - regime switch: recession		
Average multiplier ($h = 8$)	1.07	-0.08
Average multiplier ($h = 12$)	1.09	*0.05*
Average multiplier ($h = 20$)	1.02	*0.13*
STVAR - regime switch: expansion		
Average multiplier ($h = 8$)	0.77	*0.04*
Average multiplier ($h = 12$)	0.58	*0.07*
Average multiplier ($h = 20$)	*0.35*	*0.03*

Note: Numbers in *italic font* mean that the estimate is not significant at the 5% confidence level.
Source: Author's calculation.

Moreover, it is possible to observe that the multiplier is much higher (and significant) in recessions, while fiscal multipliers in expansion times seem to be mostly insignificant. According to the SVAR approach a one kuna government spending increase will on impact increase private consumption for four lipas, but in the long term the effect will reach 1.22 kunas. Oppositely, a one kuna increase in taxes will on impact decrease private consumption for just two lipas, but in the long term the decrement is of about 46 lipas.

If the regime-switch model is considered then in downturn times the effect of the multiplier is much stronger and has a bigger effect on the economy. This means that, if during recessions an increase in government spending of one kuna occurs, private consumption will rise by 1.07 kunas on average per quarter during the first two years. On the other hand the effect on private investment is meager and merely insignificant (Table 4.7).

Table 4.7: *Private investment multipliers to fiscal shocks in the alternative SVAR and STVAR models*

	Spending multiplier (G)	Tax multiplier (R)
SVAR Blanchard and Perotti		
Impact multiplier	0.05	-0.03
Cumulative multiplier ($h = 12$)	*0.35*	-0.11
Cumulative multiplier ($h = 20$)	*0.47*	*-0.15*
Peak multiplier (q)	0.05(0)	0.00(10)
STVAR - regime switch: recession		
Average multiplier ($h = 8$)	0.56	-0.19
Average multiplier ($h = 12$)	0.39	*-0.14*
Average multiplier ($h = 20$)	0.30	*-0.03*
STVAR - regime switch: expansion		
Average multiplier ($h = 8$)	0.39	*0.15*
Average multiplier ($h = 12$)	0.30	*0.13*
Average multiplier ($h = 20$)	*0.20*	*0.12*

Note: Numbers in *italic font* mean that the estimate is not significant at the 5% confidence level.
Source: Author's calculation.

It is possible to notice that fiscal policy effects on private investment are mostly significant at impact when a positive spending shock raises private investment and a positive tax shock leads to a negative effect on private investment. The multiplier effect is thus stronger in recessions than in expansions, when the average tax multiplier not significant in the medium- and long-term.

4.4.2.2 Effects of different spending components

As mentioned in Section 4.1 a number of countries implemented fiscal stimuli packages during the latest financial crisis. In order to investigate what spending category would be at most effective in the Croatian case this Section presents fiscal multipliers with respect to output, private consumption and private investment for three main government spending categories, i.e. spending for purchases of goods and services, spending for wages and capital spending.

Table 4.8 presents multipliers of spending for purchases of goods and services and it is noticeable that in case of regime-switching model the multipliers are higher than in case of the linear approach. If considering the latter a one kuna increase in spending for purchases of goods and services on impact decreases output and private consumption for three and one lipa respectively, being the effect much larger in three years, i.e. increase of 33 and 24 lipas respectively.

On the other hand during recessions the average multiplier is higher in the first eight quarters, meaning that a one kuna increase in this spending component will rise output,

private consumption and private investment for 3.89, 2.16 and 0.61 kunas respectively. In all these cases the effect is significant. Captivating is the fact that the impact of a spending shock in expansionary times results also to be high but statistically insignificant.

Table 4.8: *Government expenditure for purchases of goods and services multipliers in the alternative SVAR and STVAR models*

Effect on:	**Output**	**Private consumption**	**Private investment**
SVAR Blanchard and Perotti			
Impact multiplier	-0.03	-0.01	0.01
Cumulative multiplier ($h = 12$)	0.33	0.24	*0.06*
Cumulative multiplier ($h = 20$)	*0.67*	*0.44*	*0.09*
Peak multiplier (q)	0.04(10)	0.02(11)	0.01(4)
STVAR - regime switch: recession			
Average multiplier ($h = 8$)	3.89	2.16	0.61
Average multiplier ($h = 12$)	3.04	1.73	0.35
Average multiplier ($h = 20$)	2.21	1.27	*0.24*
STVAR - regime switch: expansion			
Average multiplier ($h = 8$)	4.42	2.65	*1.07*
Average multiplier ($h = 12$)	*3.31*	*1.89*	*0.77*
Average multiplier ($h = 20$)	*2.26*	*1.16*	*0.45*

Note: Numbers in *italic font* mean that the estimate is not significant at the 5% confidence level.
Source: Author's calculation.

The macroeconomic effects of spending for wages are not that important (in terms of size) as those exhibited in case of spending for purchases of goods and services did. Besides that, the effect often registers to be insignificant (Table 4.9). During recessions the effect on output, private consumption and private investment is significant in the short term, while during expansions it is insignificant in all cases and across all horizons. In a linear setting, on impact a one kuna increase in spending for wages raises output, private consumption and private investment on impact for four, two and nine lipas respectively. In recession times the same impact is 4.04, 2.22 and 0.58 kunas respectively on average for the first eight quarters.

Table 4.9: *Government expenditure for wages multipliers in the alternative SVAR and STVAR models*

Effect on:	**Output**	**Private consumption**	**Private investment**
SVAR Blanchard and Perotti			
Impact multiplier	0.04	0.02	0.09
Cumulative multiplier ($h = 12$)	*0.01*	*0.01*	*0.31*
Cumulative multiplier ($h = 20$)	*-0.06*	*-0.05*	*0.31*
Peak multiplier (q)	0.04(0)	0.02(0)	0.09(0)
STVAR - regime switch: recession			
Average multiplier ($h = 8$)	4.04	2.22	0.58
Average multiplier ($h = 12$)	3.29	*1.71*	0.37
Average multiplier ($h = 20$)	*2.26*	*1.20*	*0.17*
STVAR - regime switch: expansion			
Average multiplier ($h = 8$)	*1.68*	*0.94*	*0.47*
Average multiplier ($h = 12$)	*1.26*	*0.70*	*0.35*
Average multiplier ($h = 20$)	*0.78*	*0.40*	*0.20*

Note: Numbers in *italic font* mean that the estimate is not significant at the 5% confidence level.
Source: Author's calculation.

A one kuna increase in capital spending will increase output and private consumption on impact by 47 and 12 lipas respectively. In the medium term the effect much prominent for output because according to the SVAR approach output will increase 1.20 kunas in three years (Table 4.10).

Table 4.10: *Government capital expenditure multipliers in the alternative SVAR and STVAR model*

Effect on:	**Output**	**Private consumption**	**Private investment**
SVAR Blanchard and Perotti			
Impact multiplier	0.47	0.12	*-0.01*
Cumulative multiplier ($h = 12$)	*1.20*	*0.04*	*-0.02*
Cumulative multiplier ($h = 20$)	*0.95*	*0.41*	*-0.03*
Peak multiplier (q)	0.47(0)	0.12(0)	0.00(3)
STVAR - regime switch: recession			
Average multiplier ($h = 8$)	2.50	1.40	0.61
Average multiplier ($h = 12$)	2.23	1.26	0.42
Average multiplier ($h = 20$)	1.83	1.03	0.20
STVAR - regime switch: expansion			
Average multiplier ($h = 8$)	*0.58*	*0.33*	*0.19*
Average multiplier ($h = 12$)	*0.35*	*0.22*	*0.17*
Average multiplier ($h = 20$)	*0.20*	*0.06*	*0.10*

Note: Numbers in *italic font* mean that the estimate is not significant at the 5% confidence level.
Source: Author's calculation.

Like in the case of other spending components, the effect of a capital spending shock is remarkably higher during economic downturns than in expansions when it additionally results to be insignificant. Recalling the results from previous Chapter, one can expect that government investment would increase private investment. Still, the SVAR approach in this case is not conclusive regard this fact, while the multiplier in case of recession in the regime-switch model is lower than one.

If compared to Chapter 3 Section 3.4.2 , where spending components where disaggregated into current and capital in a five variable Blanchard and Perotti SVAR approach, results are similar and in line with the significance time horizon.

4.5 Concluding remarks

During the latest financial crisis economic authorities relied on fiscal policy measures in boosting the economic activity. This paper investigates the effectiveness of fiscal multipliers for the Croatian case and shows that an expansionary fiscal policy during recessions could be a powerful stabilization tool. This follows from a regime-switch model whose multipliers are much larger than in a no-regime switch approach (in recessions that is).

A one kuna increase in government spending would lead to an increase in output of more than 2 kunas in the medium and long term in times of economic downturns. According

to the SVAR approach a government spending of one kuna will on impact rise private consumption for four lipas, but in the long term the effect will be 1.22 kunas. Oppositely an increase in taxes of one kuna will on impact decrease private consumption for just two lipas, but in the long term the decrement is of about 46 lipas. If during recessions an increase in government spending of one kuna occurs, private consumption will rise by 1.07 kunas on average per quarter during the first two years.

When investigating the possible *trilemma* between spending for purchases of goods and services, wages or capital goods, there are actually no doubts in times of recessions. The effect of a shock to the purchasing of goods and services is significant throughout the whole time horizon and a one kuna increase in this component will rise output, private consumption and private investment for 3.89, 2.16 and 0.61 kunas respectively.

Nevertheless, there is a necessity for further extending the research in two main directions. On one hand effects of different taxes (direct and indirect) in a regime-switching model should be investigated. The Croatian government took a number of discretionary changes (mainly on the parts of taxes and not spending) during the latest recession (starting with the crisis tax, VAT tax rate increment and so on), which according to the literature could not be considered as counter-cyclical. Since this research shows that the effects of taxes (as well as spending) are larger and more significant in recessionary times such government decisions may have deepened the recession. This may be one of the key issues why Croatia registers one of the longest recession periods amid EU countries.

Important to point out is the fact that no research in the field of fiscal multipliers provides information about possible driving forces in the Croatian case so far. There is no evidence of the effects of indebtedness or openness to trade on the size and propagation of fiscal shocks, neither in linear nor non-linear models. This extension would show the effect of particular economic factors on fiscal multipliers and would reveal whether the magnitude of the multipliers depends (and by how much) on these factors.

5. CABB - THE *BLUE-EYED* INDICATOR[1]

5.1 Introduction

The sovereign debt crisis questioned the economic and fiscal governance of the European Union (EU) and emphasized the need for more effectiveness in economic and fiscal coordination. The institutional setting of EMU consists of a single monetary policy coupled with a set of decentralized (national) fiscal policies subject to supra-national fiscal rules. The latter were designed to ensure fiscal discipline (Maastricht Treaty on European Union - TEU) and maintain sound fiscal stance (Stability and Growth Pact - SGP), but revealed to be ineffective already before the crisis[2], thus intensifying after 2008 the need for a shift in economic governance.

The EU recently strengthened its fiscal framework and SGP through two cornerstones: the *Six-Pack* and *Fiscal compact*. Despite the fact that a large body of literature questions the appropriateness of the cyclically adjusted budget balance (CABB) as a gauge of discretionary fiscal policy (Blanchard, 1990; Chouraqui et al., 1990) together with its estimation shortcomings (Alberola et al., 2003; Larch and Salto, 2003; Larch and Turrini, 2009, among others), it remains one of the key targets in the reinforced economic and fiscal governance framework. Namely, the main provision of both cornerstones involves the balanced budget rule with the cyclically adjusted budget balance still left as the reference criterion. This implies that also in the reinforced EU fiscal framework the question whether the CABB is a reliable gauge of fiscal policy stance still remains. Consequently, the effectiveness of the framework in terms of fostering fiscal discipline, while simultaneously allowing member countries to use fiscal policy as a tool of macroeconomic stabilization, continues to be an open issue.

The main goal of this study is to confer about the efficiency of the cyclically adjusted budget balance as the *blue-eyed* indicator used by the European Commission (EC) in evaluating fiscal discipline and determining a member's fiscal policy stance. We do this by means of a simulation experiment. We use an estimated medium-scale DSGE model to generate artificial macroeconomic variables. Using an estimated structural macroeconomic model as the data-generating process has one important advantage. It includes a structural equation for government expenditure, which describes the discretionary changes in government spending. In addition, the model directly accounts for automatic adjustment of government expenditure (through unemployment benefits) and

[1] Joint with Igor Masten.

[2] Already in 2008, the ECB concluded that it has not been effective in fortifying fiscal discipline and lacked sufficient rigour and political will. European Central Bank (2012, p. 81) points that in times before the crisis, member states were spending revenue windfalls instead of using them to foster fiscal consolidation, violations in the deficit criterion were only slowly corrected while the debt criterion was largely ignored. Moreover, as pointed by van Riet (2010) the lacking enforcement of the SGP was one of the reasons why public finances of many EMU members were incompetent and deficient when the financial crisis erupted in 2007.

tax revenue to the cyclical fluctuations in output. In sum, with a structural model we can directly distinguish between automatic and discretionary fiscal policy. Moreover, because the model is estimated on real data - Austrian data in our case - the generated data replicate realistic macroeconomic dynamics and thus also delivers realistic description of the mix between automatic and discretionary fiscal policy changes.

With the artificially generated macroeconomic data we can subject the official European Commission methodology of estimating the CABB and determining the fiscal policy stance to a simple test: Is it able to recover the true automatic and discretionary fiscal policy? In addition to measuring the precision in determining the fiscal policy stance, we can use the analysis to assess the macroeconomic implications of the two most important targets used in the EU fiscal framework. The first is the Maastricht 3% GDP limit on the fiscal deficit. In this respect, we assess whether the limit is sufficient to allow for full operation of automatic stabilizers in case of normal cyclical variation. The second is the 0.5% of GDP limit on structural deficit. A breach of the latter is considered to be a violation of the SGP's "close to balance or in surplus over the business cycle" provision due to overly expansionary fiscal policy. With our experimental setup we are able to measure the efficiency of the official European Commission methodology in monitoring this key provision of the SGP and thus surveilling the long-run sustainability of public finances in the EU member states.

Main results show that a DSGE based conclusion of the character of fiscal policy (expansive *versus* restrictive) is in more than 45% of cases different from the same conclusion obtained using the official measurement. Moreover, according to the official methodology in over 17%of cases the actual deficit breaches the Maastricht criterion while the structural deficit remains below the set threshold. This is somehow in contrast with the Resolution to the European Council on the SGP, that specifies how *"adherence to the objective of sound budgetary positions close to balance or in surplus will allow member states to deal with normal cycle fluctuations while keeping the government deficit within the value of 3 per cent of GDP"*. Furthermore, if the official methodology in estimating the CABB is compared to the DSGE model based results, then in more than 20% of cases they do not coincide in signaling the violation of the SGP fiscal rule. If fiscal rules (Maastricht deficit rule and SGP structural deficit rule) are compared pairwise it is possible to note that the dis-accordance between official and model-based results if fairly small in cases when only one rule is violated, while it is substantial (almost 50% of cases) when official methodology points that both fiscal rules have been breached in a point of time. The latter leads to the conclusion that the dissent is due to the official structural deficit definition and emphasizes that in a substantial number of cases breaching the Maastricht deficit rule actually is due to the cyclical deterioration of budget figures.

The rest of the paper is organized as follows: Section 5.2 gives an overview of the economic and fiscal governance framework within the E(M)U in the pre- and post-crisis period, focussing on the SGP preventive arm and the cyclically adjusted budget balance.

Section 5.3 explains the methodological approach of the paper, the DSGE and the data. Moreover it inspects the approaches in measuring the structural balance and motivates an alternative view of estimating the cyclical and structural components within a DSGE model. Section 5.4 commences with the estimation results regarding fiscal policy stances and the probabilities of breaching the E(M)U fiscal rules, while Section 5.5 continues with the results conferring about the EU fiscal framework and welfare implications in case of alternative methods in measuring fiscal policy. Section 5.6 is reserved for concluding remarks.

5.2 The EU fiscal framework

Theoretical and empirical literature emphasize the importance of effective fiscal rules and frameworks in conducting sound fiscal policy[3]. The primary need for fiscal rules relates to the evidence that fiscal policies are subject to deficit and spending biases[4]. In Europe fiscal rules are legislated at the supra-national level and oblige member states to avoid excessive government deficits (by means of the deficit and debt criteria set at 3 and 60 percent GDP respectively in the Maastricht TEU) and to maintain *sound and sustainable public finance*. The latter is regulated within the Stability and Growth Pact (SGP) that demands from member states to achieve a budgetary position that will allow them to respect the Maastricht criteria even during periods of unfavorable growth. The core of the SGP embraces strengthening the surveillance of budgetary positions (*preventive arm*) and explicating the implementation of the excessive deficit procedure (*dissuasive* or *corrective arm*). Furthermore, the preventive arm of the SGP bind member states to maintain or adjust toward their medium-term budgetary objective (MTO), while the corrective arm is designed to ensure the correction of excessive deficits in case they still occur.

The MTO is a country-specific reference value for medium-term budgetary positions defined in cyclically adjusted (structural) terms, outlined in order to ensure *healthy* budgetary positions. Initially, the preventive arm of the original SGP required member states to target *close to balance or in surplus* budgetary positions, i.e. provide a safety margin that will allow the fulfillment of the deficit criterion under normal circumstances while enabling the free operation of automatic stabilizers[5]. A numerical quantification of the structural deficit rule entered into force after the reform of the SGP in 2005. The intention for such a rule is threefold: (i) to preserve a safety margin against breaching the 3 percent deficit-to-GDP threshold, (ii) to ensure rapid progress toward sound

[3]For a deeper discussion refer to the works of Debrun and Kumar (2007) or Schaechter et al. (2012).

[4]Economic literature shows evidence of such biased fiscal performance of most industrialized countries. See for instance the works of Alesina and Perotti (1995b); Balassone and Francese (2004); Schuknecht (2005).

[5]More on the choice of a MTO in Dalsgaard and de Serres (1999); Artis and Buti (2001); Barrel and Dury (2001)

public finances and prudent debt level, and (iii) to allow adequate room for budgetary maneuver, in particular with respect to public investment needs.

Despite its aims, the SGP is considered unsuccessful in securing fiscal discipline in European countries and its full implementation in practice showed to be problematic (Verhelst, 2011; European Central Bank, 2012). During the pre-crisis period, the ECB highlighted on several occasions that the preventive arm can't be fully effective, until the corrective arm fulfills its role[6]. Subsequently, the deep economic downturn exacerbated the problematic by leading to a significant deterioration in fiscal positions due to the work of automatic stabilizers, to the need of fiscal stimuli packages and financial sector support.

As underlined by the EC, such developments *"have in particular highlighted the need for strengthening national ownership and having uniform requirements as regards the rules and procedures forming the budgetary frameworks of the Member States"*[7]. In order to strengthen economic governance in EMU (and EU), the EC has initiated a set of enforced fiscal policy coordination tools, considerably narrowing down the discretionary powers of the member states in economic policy at the national level. This set of tools embraces the so-called Six- and Two-Packs, the Treaty on Stability, Coordination and Governance in the Economic and Monetary Union (Fiscal compact), the European Semester and the Euro Plus Pact.

Before the new governance framework, fiscal governance within the Union was restricted to the *European level* and did not set out requirements for national fiscal governance in order to ensure consistency with the requirements at the European level (although the SGP as well as the TEU stressed the relevance of national rules for sound budgetary discipline for the Union as a whole)[8]. Frankel and Schreger (2013) show that national budget balance rules or independent fiscal institutions that provide their own independent forecasts help to reduce the bias of over-optimistic forecasts when they are most in danger of breaching the deficit criterion.

In order to improve national fiscal planning and avoid further neglecting of fiscal rules by member states, the EC, inter alia, opted for several measures that intervene for the first time at the national level. Member states are obliged to implement numerical fiscal rules in their national law throughout provisions of *"binding force and permanent character, preferably constitutional"* (Fiscal compact), to adopt multi-annual budgetary perspectives in order to attain to the MTO, and to discuss their budgetary plans with

[6]On May 5th 2006, for example, José Manuel González-Páramo, member of the Executive Board of the ECB, demanded a more rigorous implementation of the newly reformed SGP rules.

[7]Point 1 of the preamble within the Council directive 2011/85/EU.

[8]It is important to point out that, although not imposed by European institution, national fiscal rules existed in a large sample of countries. For a survey on fiscal rules see Ayuso–i–Casalas et al. (2007) and Schaechter et al. (2012).

other EU members enabling the EC to give policy guidances before decisions are made at the national level (European Semester)[9].

Nevertheless, the cornerstones in the field of fiscal policy represent the Six-Pack and the Fiscal compact. The aim of the first is to strengthen the existing SGP through five new regulations and one directive, while the scope of the second is to foster fiscal discipline and enhance the underpinned SGP. Although both are running in parallel, some provisions included in the Fiscal compact are mirroring concepts existing in the Six-Pack, while some are more rigorous than in the Six-pack[10]. The main provision tackled by both is regarding the balanced budget rule and, in spite of the fact that the Fiscal compact explicitly refers to the MTO of the SGP, the structural deficit ceilings set by the two do not coincide. On one hand the SGP requires the structural balance to be close to balance or in surplus and sets a structural deficit limit of 1% GDP for euro area and ERM II countries,[11] while on the other hand the Fiscal compacts legislates the same ceiling at a lower level of 0.5% GDP.[12]

According to the EC, the structural budget balance is a measure of the underlying trend in the budget and refers to the balance net of the *cyclical component* and *one-off and other temporary measures*,[13]. In such a framework the cyclically adjusted budget balance (CABB) is derived as follows:

$$CABB_t = BB_t - CC_t = BB_t - \eta OG_t \tag{5.1}$$

[9]Before the crisis, the EU institutions discussed each member states' economic policy separately as well as examined fiscal policies and developments. So. there was a lack of comprehensive view of the effort made at national level about budgetary and economic policy planning and member states had no opportunity to discuss joint EU strategy. Moreover, Beetsma et al. (2011) highlight that fiscal plans are on average too optimistic relative to the first-release outcomes, and first-release figures are overly optimistic relative to the ex post figures. Being the SGP surveillance based on first-release figures, authors conclude that there is an incentive for governments to bias fiscal figures (making them less useful for fiscal surveillance) and suggest that surveillance at the European level should be combined with enhanced fiscal transparency at the national level.

[10]For a deeper discussion and a detailed comparison refer to European Central Bank (2012).

[11]The reinforced SGP sets the structural deficit limit to 1% GDP, although in practice the EU regulation already demanded from euro area countries to equal their MTO in structural terms to 0.5% GDP or less.

[12]Moreover, a member state can set the MTO structural deficit higher than 0.5 percent if its debt-to-GDP ratio is significantly below the 60 percent threshold and the risks for running into unsustainable public finances are low.

[13]As pointed by Larch and Turrini (2009, p. 27) finding a common understanding about one-off and temporary measures was in practice not always easy. Whether specific measures are to be considered one-off or temporary inevitably involves judgements, but in order to avoid arbitrary decision making, the EC has agreed a number of guiding principles to make sure that a case- by-case assessment of one-off measures corresponds to consistent and transparent principles (for the guidelines refer to Larch and Turrini (2009, p. 28)). However, the following indicative list of deficit-reducing one-off measures has emerged from the implementation of the EU fiscal surveillance framework: tax amnesties involving one- off payment by tax payers; sales of non-financial assets (real estate, publicly owned licences and concession) securitisation operations with a positive impact on the general government budget balance; temporary legislative changes in the timing of outlays or revenues with a positive impact on the general government budget balance, exceptional revenues from State owned companies with a positive impact on the general government budget balance; exceptional revenues linked to the transfer of pensions obligations; Changes in revenues or expenditure consecutive to a Court or other authorities rulings.

where BB represents the actual (nominal budget) in year t, CC the cyclical component of the budget in year t, obtained as the product of the budgetary sensitivity parameter (η)[14] and the output gap OG in year t. Important to point out is that the cyclical component should reflect the effect of automatic stabilizers, while the cyclically-adjusted (structural) component underlines discretionary fiscal policy. In this respect, changes in the $CABB$ indicate the fiscal policy stance. If the difference of $CABB$ in time t and $t-1$ is positive then fiscal policy is said to be restrictive, while, oppositely, a negative change in the CABB may be considered as the indicator of expansive fiscal policy.

The budgetary sensitivities (η) used by the EC are based on OECD estimates of budgetary elasticities, while the linkage to the output gap is then performed by the EC.[15] Since the OECD performs the elasticities estimation for its members only, for the non-OECD EU members the elasticities are estimated by the EC. The OECD basically follows the methodology developed in Giorno et al. (1995) and van den Noord (2000)[16]. The elasticities produced in the latter were up-to-date until 2005 when Girouard and Andre (2005) published a new and updated elasticities taking into account changes from the policy environment (such as tax reforms) and changes in the methodology.[17]

For the estimation of the output gap the production function (PF) approach constitutes the reference method when assessing the stability and convergence programmes, while the Hodrick-Prescott (HP) filter serves as a backup method.

The cyclically adjusted budget balance as a single-number measure of discretionary fiscal policy has often been subject to economic policy discussions and criticism. Already in the 1990s Blanchard (1990) provides an important survey of its limitations. A large body of literature analyzed the limitations of the output gap and elasticitities' estimations. Alberola et al. (2003) show that CABBs tend to be systematically overestimated during downturns and underestimated during expansion, mainly due to the computation of elasticities. Larch and Salto (2003) as well as Larch and Turrini (2009) confer that diverging estimates of the CABB are due to shortcomings in the uncertainty of the output gap estimation as well as the assumption of constant tax elasticities. Namely,

[14]The budgetary sensitivity parameter η is the semi-elasticity that measures the change of the budget balance, as a per cent of GDP, for a 1% change in GDP. It is obtained as a weighted sum of different tax and spending elasticities.

[15]At the Ecofin Council meeting of May 2004, the European Commission decided that for the estimation of the output gaps the production function constitutes the reference method when assessing the cyclically adjusted budget balance. Moreover, the Hodrick-Prescott filter is to be used when assessing the stability and convergence programme for the new member states (NMS-12) and remains a backup method for old member states. Moreover, although the production function method is preferable in that it allows to identify the different supply components of potential output, statistical filters might be the best or the only alternative in case of serious problems related to data quality or data availability.

[16]See the refereed works for a detailed description of the OECD method applied to each of the four revenue (personal income tax, corporate income tax, indirect taxes, social security contributions) and one expenditure (unemployment related benefits) budgetary item elasticity estimation procedure.

[17]In order to ensure a greater cross-country consistency in the estimates of the tax base elasticities, they introduce a GLS estimator for each country, and then based on these results and on economic and geographic criteria, they create a subset of countries for each equation and apply the SURE procedure in estimating the needed parameters (Girouard and Andre, 2005, p. 14). Previous elasticities estimations (i.e. up to year 2005) were based on van den Noord (2000) using just the OLS estimator.

the link between the cyclical component of the GDP and the budget is taken to be invariant over time[18]. Hallett et al. (2012) find that real time CABBs are not better at forecasting the ex post figures than simpler benchmarks. Additionally, they find that CABBs are less reliable under conditions of poor or deteriorating public finances, meaning that they are more fallible when are needed most. Barrios and Fargnoli (2010) show that discretionary measures significantly affect tax elasticities and can therefore alter the link between tax revenues and the business cycle, resulting in discretionary changes (especially in direct taxes) to often be pro-cyclical. Although criticisms on the CABB were extreme, it remained one of the key indicators in the field of fiscal policy, proving that in fact there was no better alternative available (Larch and Turrini, 2009, p. 18). In particular, in surveilling fiscal policy at the EU level, the CABB, despite its flaws, provides a better guidance than the nominal deficit. After all, it was the volatility of the latter that motivated the decision to target the cyclically adjusted budget balance under the preventive arm of the SGP.

5.3 The simulation experiment

We run a simulation experiment by estimating a medium-scale small open economy DSGE model to generate macroeconomic data used for the purpose of the analysis. The DSGE model is based on Adolfson et al. (2007) where the stochastic trend of the economy is driven by permanent technology shocks. This feature of the model is important for our purpose. A stochastic technology trend (essentially a random-walk with drift process) represents the trend output or potential output. The remaining exogenous shocks in the model (16 in number) induce only cyclical movements around the stochastic trend. This way we can directly distinguish between trend and cyclical variation in generated data. Moreover, trend output in the model is not a smooth process. Such a feature is shared by most of modern estimated DSGE models. The concept of trend output in the Hodrick-Prescott is different as it is a smooth process. The official EC methodology based on the production function approach (see D'Auria et al. (2010)) assumes a non-smooth unit-root process for trend employment. To determine trend total factor productivity, however, the HP filter with a smooth trend is frequently applied in practice. For these reasons we can expect different properties of estimated cyclical component of macroeconomic variables across methods. A non-smooth trend output in the DSGE implies also that the cyclical component of output retrieved directly from the DSGE as the data-generating process will be more volatile than the cyclical component obtained with the production function approach or the HP filter.

We made several alterations to the model of Adolfson et al. (2007). Besides adjusting it for a small open economy as part of a monetary union, the key differences involve

[18]The EU gives ground for such a simplification by stressing that the best predictor for tax elasticities in the future is their average of the past.

the fiscal part, which has been endogenized and extended[19]. We discerned different tax components such as the value added tax, personal income tax, corporate and capital income taxes as well as social security contributions, and singled out social transfers and benefits from the total government spending. These modifications were necessary in order to conduct our study. Adolfson et al. (2007) do not allow for social transfers and benefits, which are essential for the automatic stabilization of the economy. Moreover, they assume that tax rates and government spending are given exogenously (by a simple VAR model), while we set tax rates to be fixed when generating tax data.

Furthermore, Adolfson et al. (2007) set the budget constraint equation in the way that there is no fiscal imbalance (i.e. deficit or surplus) and therefore no government debt. In our case we assume that the budget balance is not equal to zero and thus there is public debt. The *fiscal rule* is set as follows:

$$g_t = \rho_g g_{t-1} - \rho_\pi \left(\hat{\pi}_t - \hat{\bar{\pi}}_t^c\right) - \rho_y \hat{y}_t - \rho_b \left(b_t - \bar{b}\right) - \rho_{def} \left(def_t - \bar{def}\right) + \varepsilon_{g,t} \qquad (5.2)$$

and it retains feedback from government spending (g_t) inflation (π_t), output (y_t), public debt (b_t) and government deficit (def_t).

We estimate the model with Bayesian MCMC estimation techniques on Austrian data, using 10.000 posterior draws. Austria was selected as as one of the most fiscally stable countries among the EU members. Our choice was based on three main criteria:

1. *Tax system stability*, i.e. tax legislation stability, particularly unvarying tax rates. In this respect Austria can be considered as one of the most stable EU countries, as it did not change the top personal income tax rate and the standard VAT rate in the last two decades, while the top corporate income tax rate was changed once. Moreover, Austria experienced smallest changes in all three implicit tax rate categories from 1995 to 2010 on one hand, while on the other, if the fiscal stimulus (just tax cuts) in the latest crisis is considered, Austria opted mainly for tax reliefs without changing any tax rate.

2. *Fiscal discipline and prudence*, i.e. compliance of fiscal rules set in the Maastricht TEU. On average, Austria registered a deficit of the general government budget of 2.2 and 2.4 percentage points of GDP in the period 1995-2007 and 1995-2011 respectively, which is below the the EU or EMU average. Same is true for the debt criterion.[20]

[19] Detailed expressions of the model and its estimation results are available from authors upon request.

[20] Moreover, Forsberg et al. (2011) analyze fiscal prudence in 26 countries (EU and non-EU countries) in the period between 1980 and 2007. They find that from the EU just Netherlands, Ireland and Finland may be considered *successful* because they did not exceed Maastricht's rules, where they define a country *successful* if a balanced budget and the appropriate level of debt have been achieved for ten consecutive years in a row. In the aforementioned research Austria was classified as a *"not quite successful"* country because, although it registered ten-year periods of compliance to a Maastricht rule, it was unable to maintain them both for the same period of ten years.

3. *Fiscal projection accuracy*, i.e preciseness of budget planning. Unbiased and realistic macroeconomic and budgetary projections are essential for sound fiscal planning. Given that budgetary revenue are strongly conditional on macroeconomic developments the European Central Bank (2013) shows Austria as one of the EU countries with the lowest government revenue projection errors, where the latter are proxied by the average annual difference between government revenue projections one year ahead and actual government revenue for the corresponding year for the period 2000-2007 and 2000-2011.

The DSGE model is estimated on quarterly data on 14 variables from 1996:1 to 2010:3[21] The data are generated as follows. The model contains 17 structural shock, including shock to the fiscal rule $\varepsilon_{g,t}$. Assuming that the structural shocks are mutually independent and normally distributed with estimated posterior standard deviations, we take within each iteration 300 random draws of structural shocks and feed them to the solution of the DSGE model to get times series of macroeconomic data. These data include all the necessary variables to apply the EC methodology to estimate the CABB, ranging from GDP to employment and fiscal deficit. Initial 200 generated observations are discarded to eliminate the effect of initial values. This way we get artificial time series of length 100, corresponding to 25 years of quarterly data.

Within each replication the generated data is used for the estimation of the budget elasticities according to the OECD official methodology presented in Girouard and Andre (2005), the estimation of output gaps, the estimation of cyclically adjusted budget balances and fiscal policy stances according to the official EC methodology and for proposing alternative methods in disentangling the cyclical and structural part from budgetary figures.

5.3.1 *Approaches in measuring fiscal policy*

In order to assess the compliance to fiscal rules and fiscal policy stances on annual basis this work inspects four different approaches for estimating the CABB. Equation 5.1 shows that the EC official methodology depends on the sensitivity parameter (η) and the output gap (OG).[22]

[21] See Appendix J for the list of observables and Section C.2 of Appendix C for their definition and sources.

[22] Even though the EC shows the CABB additionally net of one-off and temporary measures as well, the latter were omitted in our simulation experiment, i.e. the cyclically adjusted budget balance is equalized with the structural budget balance, obtained as the difference between the actual budget balance and the cyclical component only. However, as explained previously, we base our experiment on the Austrian case and when observing the official estimates of the cyclically adjusted budget balance reported by the EC (European Commission, 2012a) during the observation time span, the cyclically adjusted budget balance is additionally corrected for temporary measures only in the 2003-2004 period by 0.1 percentage points GDP, due to expenditures in wake of the flood from 2002 (Grossmann and Prammer, 2005).

When estimating the sensitivity parameter of the budget (η) we rely on the OECD method updated in Girouard and Andre (2005), which involves estimating a set of equations related to different budget revenue and expenditure components in order to calculate respective elasticities on one hand and the overall budget sensitivity parameter on the other hand, as noted in Section 5.2. The output gap is evaluated according to official and backup method, i.e. according to the production function method and HP filtering, respectively.[23]. When estimating the output gap according to the production function approach we follow the official procedure presented in D'Auria et al. (2010).

Given the aforementioned, the cyclical component of the budget (CC) was estimated by means of four alternatives as follows:

1. as the product of the budget sensitivity η following Girouard and Andre (2005) and the HP filtered output gap $OGhp$, denoted as CC_OGhp;

2. as the product of the budget sensitivity η following Girouard and Andre (2005) and the production function based output gap $OGpf$, denoted as CC_OGpf;

3. as the product of the budget sensitivity η and a DSGE consistent measure of cyclical variation obtained as a deviation from the permanent technology trend, denoted as CC_OGdsge; In this case the budget sensitivity parameter is obtained through the same set of equations as in Girouard and Andre (2005) but made compatible with the DSGE measure of output gap. Namely, when estimating the mentioned set of equations, Girouard and Andre rely on the HP filtering technique in need of potential level of a variable. Recalling the fact that our model allows us to directly distinguish between trend and cyclical variation in generated data, we estimated the same set of equations and respective elasticities without involving the HP filtering and using trend levels retrieved directly from the model (we refer to it as *DSGE-based sensitivity* further in text).

4. as a purely automatic trajectory of deficit, obtained when the endogenous responses of government consumption and fiscal shock were excluded[24] within the simulation routine, denoted as CC_model.

The first two options (CC_OGhp and CC_OGpf) can be thought of as official EC methodologies to be compared with two *non-official* alternative methods. While CC_OGdsge mainly differs from the official methods in definition of output gap, CC_model omits any exogenous estimation in assessing the cyclical component of the budget and is directly retrieved from the estimated DSGE model. The cyclically adjusted (or structural)

[23]Important to point out is that in the production function approach, some factors at their potential level are still determined using the HP filter ($\lambda = 100$) showing anyhow a dominant use of statistical filtering.

[24]The following relies on the theoretical and empirical assumption that government spending are mostly discretionary. Additionally, it is important to point out that according to the model, discretionary fiscal policy measure is represented by the $\varepsilon_{g,t}$ shock (refer to equation 5.2 in Section 5.3).

budget balance according to first three alternatives is obtained as the difference between the actual budget balance and the corresponding cyclical component (as in equation 5.1), while in case of the DSGE framework (fourth alternative) the structural component is retrieved differently. Namely, discretionary government interventions are defined as the difference between the deficit variable obtained during the baseline simulation and its purely automatic trajectory. The purely automatic trajectory excludes the reactions of government spending through 5.2, which reflects the discretionary part of fiscal policy.

Therefore, the model based structural component corresponds to $\varepsilon_{g,t}$ and the reaction of spending to endogenous variables from equation 5.2 in Section 5.3. A relevant digression needs to be emphasized here. Namely, automatic stabilizers refer to the influence of fiscal policy instruments on the rate of GDP growth and countering swings in the business cycle. Their measurement is still subject to debate and dependent on the purpose of the research as well as data quality. When automatic stabilizers are proxied by the cyclical component, as introduced by (van den Noord, 2000),[25] discretionary policy embraces the *"non-automatic actions"* through the CABB within the official EC methodology. In the DSGE framework it additionally comprises the fiscal rule. When fiscal policy reacts by following a specific rule, the stabilization occurs not only because automatic stabilizers are at work but also due to the automatic reaction of the rule. This is particularly important in the context of the SGP, where empirical evidence show that government budget forecasts in many countries are on average over-optimistic due to a optimistic growth forecast, but the bias gets decreased in case of a co-existing national fiscal rule[26]. Frankel and Schreger (2013) underline that the relationship between the actual budget balance and over-optimism is stronger for deficits than surpluses. Furthermore, the authors show that SGP makes EMU members less willing to forecast deficits greater than 3% of GDP even though they actually violated the limit more frequently. They highlight that EMU and non-EMU forecasts are comparable except in cases of violation of the excessive deficit procedure when EMU members register very large over-optimistic forecasts.

5.4 Assessing the fiscal policy stance

This and the following section present the results of our simulation experiment. In terms of the notation we use, it is worth repeating at this point that the expressions *model* or *model-based* apply to results obtained directly with the DSGE model, i.e. without using the official EC procedures for estimating the cyclical and structural component of the

[25] The second most widely used method in proxying automatic stabilizers is the so-called *normalized tax change* as introduced by Auerbach and Feenberg (2000).

[26] Jonung and Larch (2006) and Marinheiro (2010) find that budget agencies in the EU systematically overestimate the economic growth rate. Brück and Stephan (2006) emphasize that EMU governments manipulated deficit forecasts before elections since the introduction of the SGP.

budget. Moreover, when comparing results across alternatives, we often set these results to be as *true* or *benchmarks*.

The cyclical component of the budget is defined as the product of the budget sensitivity and the output gap. We estimate the overall budget sensitivity parameter (η) from generated data in each iteration following Girouard and Andre (2005). On average the resulted budget sensitivity for Austria is 0.53% GDP[27]. In case the same sensitivity is estimated following the official methodology but without involving HP filtering when looking for trend levels (as explained ad 3. in Section 5.3.1) its value amounts to 0.89% GDP. As supposed, the DSGE-based sensitivity is higher since it encompasses trend variables measured as deviations from the stochastic trend.

Estimation results of the output gap according to different methods are shown in Table 5.1. It is possible to observe that the two official alternatives (HP and production function) give quite similar estimates with an output gap ranging on average from -5 to 5 % of GDP. As expected, the output gap measured as deviation from the permanent technology trend results to be more volatile and ranges from -26 to 20 % of GDP.

[27]The official estimate of the overall budget balance sensitivity in Girouard and Andre (2005) and used by the EC in the Austrian case amounts to 0.47% GDP. Our estimate is fairly close to the latter. Moreover, in order to check the stability of our results, we estimated the budget components' elasticities and the overall budget sensitivity parameter following van den Noord (2000) as well. In this case our results show a budgetary sensitivity of 0.32% GDP on average, while van den Noord reports the same to be 0.31% GDP in the case of Austria.

Table 5.1: *Sensitivity parameter, output gaps, cyclical and cyclically-adjusted budget component according to different estimation alternatives, in percent GDP*

	η	OG	CC	$CABB$
EC official method with HP	0.53	$(-5.42, 5.50)$ [1.0757]	$(-3.72, 4.13)$ [0.5739]	$(-8.37, 6.05)$ [1.0325]
EC official method with PF	0.53	$(-5.07, 5.09)$ [1.0392]	$(-3.77, 3.73)$ [0.5542]	$(-8.13, 5.71)$ [0.9299]
EC method within the DSGE	0.89	$(-26.83, 20.31)$ [3.7183]	$(-24.08, 18.35)$ [3.3247]	$(-15.20, 18.58)$ [2.6848]
Model-based			$(-6.94, 3.63)$ [0.7280]	$(-2.54, 2.00)$ [0.3763]

Notes: HP stands for Hodrick-Prescott filtered output gap; PF denotes the output gap estimated using the production function approach (as developed by D'Auria et al. (2010)); CC and $CABB$ denote the cyclical and cyclically-adjusted (structural) budget balance component, respectively; Numbers in round brackets correspond to range; Numbers in square brackets show the average standard deviation. *EC method according to DSGE* involves (i) the sensitivity parameter η estimated according to the official methodology procedure adjusted for trend variables being retrieved directly from the DSGE (instead of HP filtering), and (ii) the output gap estimated as the deviation from the permanent technology trend; *Model-based* results do not involve exogenous estimation of the sensitivity parameter and output gap, because the cyclical and structural component are retrieved directly from the model as explained in Section 5.3.1.
Source: Authors' calculation.

Table 5.1 shows that the cyclical component according to the official alternatives is on average of size -3 and 4 % of GDP, while the structural ranges between -8 and 6 % of GDP. If these are to be compared with model-based results it is possible to observe that the official methodology on average underestimates the cyclical component, while overestimating the structural component. Model-based estimates show that the development of actual deficit figures are merely (more than 70%) due to movements in cyclical component of the budget, while according to the official methods the same is merely attributable to discretionary fiscal policy measures. The second model alternative that involves the same set of official equations and methods but replaces the HP and production function values in the sensitivity and output gap estimation with DSGE based trend and cyclical variables, shows a similar conclusion as the model-based, although of greater size. It displays that the cyclical component of the budget influences actual budget figures more than discretion does.

The cyclical component of the budget, often used as a proxy of automatic stabilizers when analyzing a country's fiscal policy, is obtained using the given sensitivity parameter η and different output gap measures, along with the model-based measure that does not involve exogenous estimation. When these are compared across alternatives it is possible to observe that the correlation is positive and relatively low (Table 5.2).

Table 5.2: *Cyclical components' correlation matrix*

	CC_OGhp	CC_OGpf	CC_OGdsge	CC_model
CC_OGhp	1.0000	-	-	-
CC_OGpf	0.9470	1.0000	-	-
CC_OGdsge	0.4048	0.4914	1.0000	-
CC_model	0.2542	0.3896	0.8742	1.0000

Notes: CC_OGhp stands for cyclical component obtained as product of the sensitivity parameter η and HP filtered output gaps; CC_OGpf denotes the cyclical component computed as product of the sensitivity parameter η and output gap estimated using the production function approach (as developed by D'Auria et al. (2010)); CC_OGdsge represents the cyclical component determined as the product of the DSGE-based sensitivity parameter η and the DSGE measure of output gap, defined as deviations from the permanent technology trend; CC_model represents the model based cyclical component, i.e the purely automatic trajectory of deficit.
Source: Authors' calculation.

The highest correlation (0.95) is observed among cyclical components obtained using the two EC official methodologies (CC_OGhp and CC_OGpf). The relatively low correlation between the model-based cyclical component (CC_model) and the two official alternatives could pinpoint the methodological drawbacks of the way official estimates are determined. However, although the range of the cyclical component retrieved according to the two *non-official* alternatives is quite different (see Table 5.1) the correlation among them is positive and high (0.87).

In the SGP context, the agreement between fiscal discipline (avoiding EDP) and fiscal flexibility (stabilizing output through fiscal policy) is more straightforward when cyclically adjusted deficits are kept at low levels. This depends on the fiscal policy stance, meaning that it should be counter-cyclical in good and bad times (improving during expansions and deteriorating in recessions). In view of that we examine and compare the fiscal policy stances resulting from the four identification schemes. We define the *restrictive* and *expansive* fiscal stance in the usual manner as the change in the cyclically adjusted budget balance. The first as a result of a period-to-period increase and the second as a result of a year-to-year decrease in the CABB. Moreover, following the work of Cimadomo (2005) we consider fiscal policy stance to be *neutral* for small variations in the structural budget balance that range from -0.2 and 0.2 percentage points. Table 5.3 shows the average share of cases when fiscal policy resulted to be restrictive, expansive and neutral, across four different alternatives.

Table 5.3: *Average share of cases when fiscal policy was restrictive, expansive, or neutral according to different alternatives*

	FPS_OGhp	**FPS_OGpf**	**FPS_OGdsge**	**FPS_Model**
Restrictive FP	43.91%	44.19%	46.59%	29.09%
Expansive FP	44.03%	44.29%	46.55%	29.48%
Neutral FP	12.06%	11.53%	6.86%	41.43%

Notes: Fiscal policy stance (FPS) is the change in the cyclically adjusted budget balance (CABB); FPS_OGhp represents changes in the CABB when the cyclical component is retrieved as the product of the budget sensitivity and HP filtered output gaps; FPS_OGpf stands for changes in the CABB when the cyclical component is determined as the product of the budget sensitivity and output gaps according to the production function approach; FPS_OGdsge indicates the change in CABB when the cyclical component is represented by the product of the DSGE-based budgetary sensitivity and DSGE output gaps (deviations from the permanent technology trend). FPS_Model indicates the change in CABB when the structural component is defined directly from the fiscal rule. *Restrictive* fiscal policy occurs when the CABB improves, while *expansive* fiscal policy when it deteriorates.
Source: Authors' calculation.

It is possible to observe that the two official alternatives (FPS_OGhp and FPS_OGpf) show almost the same structure. Namely, restrictive and expansive fiscal policies are evidenced in more than 44% of cases, while neutral developments are exhibited in more than 11% of cases on average. A similar structure is evidenced in case of the official methodology adjusted by DSGE trend and cyclical variables (FPS_OGdsge). However, model-based results (FPS_Model) point to another conclusion, since the largest portion of fiscal policy stance is defined as neutral (on average more than 41% of cases).

Table 5.4 compares the fiscal policy stances obtained by means of the three alternatives with our benchmark model-based results, reporting only the average share of cases when the comparison showed disagreement, i.e. the cases when for example one official methodology would define the fiscal stance being restrictive while according to the model-based estimates it resulted to be either expansive or neutral.

Table 5.4: *Fiscal policy stance dis-accordance among model-based results and respective alternatives, in percent*

model wrt	**FPS_OGhp**	**FPS_OGpf**	**FPS_OGdsge**
Restrictive FP	46.41%	46.39%	49.26%
Expansive FP	46.57%	46.52%	49.38%
Neutral FP	43.33%	43.39%	42.53%

Notes: Fiscal policy stance (FPS) is the change in the cyclically adjusted budget balance (CABB); FPS_OGhp represents changes in the CABB when the cyclical component is retrieved as the product of the budget sensitivity and HP filtered output gaps; FPS_OGpf stands for changes in the CABB when the cyclical component is determined as the product of the budget sensitivity and output gaps according to the production function approach; FPS_OGdsge indicates the change in CABB when the cyclical component is represented by the product of the DSGE-based budgetary sensitivity and DSGE output gaps (deviations from the permanent technology trend). *Restrictive* fiscal policy occurs when the CABB improves, while *expansive* fiscal policy when it deteriorates. *Source:* Authors' calculation.

Evidence show that substantial dis-agreement happens no matter of the fiscal policy stance under analysis. A change in the CABB between -0.2 and 0.2% GDP in the model-based estimates occurs much more often than in case of official methodologies. However, evidence show a significant and high level of dissent when defining expansive and restrictive fiscal stances. Namely, in more than 45% of the cases the model-based fiscal stance does not concord with either of the alternative. For example, it means that in more than 45% of cases when the official methodology signals a deterioration in the cyclically adjusted budget balance in time t, a model-based estimation would disagree and show either its improvement or a neutral development. This is very important in the context of fiscal discipline and surveillance, since it can trigger correction mechanisms in inappropriate times[28].

Moreover, it is worth mentioning that, if we consider the comparison of fiscal policy stances between two official methodologies, i.e. when HP filtered and production function output gaps are employed in estimating the cyclical part of the budget, the level of dissent about restrictive and expansive fiscal policy is registered in 4% of cases.

5.5 The EU fiscal framework

As mentioned earlier, the main scope of the MTO within the preventive arm of the SGP is to provide a safety margin against breaching the Maastricht 3% deficit criterion. In this respect we investigate whether the defined 0.5% GDP threshold within the SGP is a

[28]Important is to point that empirical evidence shows that the prime source of fiscal forecast error lies in mistaken output growth (and gap) projections (Artis and Marcellino, 2000).

good signal for the actual deficit, i.e. whether it fulfills the purpose of providing a safety margin.

If we single out from our simulated time series just the cases when a deficit occurs, then it is possible to observe that on average it breaches the Maastricht criteria in 30.39% of cases. If, on the other hand, we inspect only cases when a structural deficit is registered, then there is almost a fifty-fifty chance it violates the SGP rule according to the official methodology (Table 5.5).

Table 5.5: *Average share of cases when the structural deficit violates the SGP according to different alternatives*

	SC_OGhp	SC_OGpf	SC_OGdsge	SC_model
Structural deficit $\geq 0.5\%GDP$	47.26%	47.31%	47.24%	40.13%

Notes: SC denotes the structural component (i.e. the CABB) as a result of different estimation approaches of the cyclical component. SC_OGhp, SC_OGpf and SC_OGdsge are structural components obtained when the cyclical part is estimated using HP filtered, production function and DSGE (deviation from permanent technology trend) output gaps, respectively.
Source: Authors' calculation.

Based on the results in Table 5.5 it can be concluded that there are no significant outliers amid the official methodologies and estimates based on DSGE output gaps. If the model-based results are considered, then it is possible to observe a lower probability of breaching the SGP fiscal rule. However, if we compare both (Maastricht and SGP) deficit rules with respect to the time of occurrence, important facts emerge (Table 5.6).

Table 5.6: *Comparison of meeting the two fiscal criteria within each alternative, average share of cases*

	$OGhp$	$OGpf$	$OGdsge$	$model$
Deficit $\leq 3\%GDP$ **Structural deficit** $\leq 0.5\%GDP$	51.65%	51.63%	25.22%	53.99%
Deficit $\geq 3\%GDP$ **Structural deficit** $\leq 0.5\%GDP$	17.56%	17.59%	44.00%	15.23%
Deficit $\leq 3\%GDP$ **Structural deficit** $\geq 0.5\%GDP$	1.09%	1.06%	26.14%	5.88%
Deficit $\geq 3\%GDP$ **Structural deficit** $\geq 0.5\%GDP$	29.69%	29.72%	4.64%	24.90%

Notes: $OGhp$, $OGpf$ and $OGdsge$ denote the alternative methodological approaches which use HP filtered, production function and DSGE output gaps, respectively, when estimating the cyclical component and CABB; *model* stands for the model-based measures of cyclical and structural components.
Source: Authors' calculation.

The official methodologies show that on average neither fiscal rule is breached in 51% of the cases, while both are violated in more than 29% of cases. Model-based results do not differ substantially with respect to this conclusions. However, cases when just one fiscal rule is breached are fairly interesting. Results show that on average according to the official methodologies, in only 1% of cases infringing the SGP rule has not meant violating the Maastricht criteria as well. On the other hand, in more than 17% of cases the Maastricht deficit-to-GDP rule is violated without an infraction signal coming from the cyclically adjusted budget deficit. The latter is very important in the excessive deficit procedure framework, since it is enacted when the Maastricht deficit rule is infringed. According to the model-based estimates there is a larger portion of cases when breaching the structural deficit does not lead to the violation of the deficit-to-GDP rule.

Recalling again the main purpose of the SGP rule to keep actual deficits underneath the set 3% GDP threshold, it is possible to conclude that it is quite *successful* in doing so. When the structural deficit breaches the 0.5% GDP threshold there is a 89% chance to breach the Maastricht deficit rule as well. Nevertheless, in more than 17% of cases the SGP rule fails to detect and signal the violation of the Maastricht criteria according to the official methodologies, while in the model-based framework this non-fulfillment equals to 15% of cases on average.

Furthermore, we focus on cases when one or both fiscal rules are violated. Focusing only on cases when the SGP limit is violated, while considering our model-based results as benchmarks, we firstly inspect whether breaching the 0.5% GDP structural deficit threshold occurs at the same point of time among different alternatives. Table 5.7 reports the average share of cases when breaching the SGP limit does not coincide between the model based estimates and the respective official methodology alternative.

Table 5.7: *Not meeting the SGP fiscal rule: comparison among model-based and alternative methodologies, average share of cases that evidence dis-accordance*

model wrt	*OGhp*	*OGpf*	*OGdsge*
	23.08%	23.84%	54.81%

Notes: OGhp, *OGpf* and *OGdsge* denote the alternative methodological approaches which use HP filtered, production function and DSGE output gaps, respectively, when estimating the cyclical component and CABB; *model* stands for the model-based measures of cyclical and structural components.
Source: Authors' calculation.

Although on average a structural deficit larger than 0.5% GDP occurs in approximately half of the cases across methodologies that involve exogenous output gap measures and 40% of cases in case of purely model-based estimates (Table 5.5), it is evident from Table 5.7 that its time of occurrence varies across applied methodologies. Namely, results show that, when the SGP rule is infringed according to one of the official alternative, then its time of occurrence does not coincide on average in 23% of cases with respect

to model-based results[29]. This means that the disagreement comes when the official methodology reports breaching the SGP criteria and the model-based estimate does not concord.

We go one step further and consider both fiscal rules (SGP and Maastricht deficit rule) pair-wise as in Table 5.6 and compare their timing of occurrence (Table 5.8). It is possible to observe that the model-based and official estimates concord merely about cases when the SGP rule is violated while Maastricht deficit rule not breaching the set threshold. However, it is important to recall from Table 5.6 that there is on average less than five percent of cases when such a *fiscal situation* transpire.

Table 5.8: *Not meeting EU fiscal rules: comparison among model-based and alternative methodologies, average share of cases that evidence dis-accordance*

model wrt	$OGhp$	$OGpf$	$OGdsge$
Deficit $\geq 3\%GDP$ **Structural deficit** $\leq 0.5\%GDP$	7.33%	7.64%	2.87%
Deficit $\leq 3\%GDP$ **Structural deficit** $\geq 0.5\%GDP$	5.44%	5.51%	1.02%
Deficit $\geq 3\%GDP$ **Structural deficit** $\geq 0.5\%GDP$	48.34%	48.37%	74.78%

Notes: $OGhp$, $OGpf$ and $OGdsge$ denote the alternative methodological approaches which use HP filtered, production function and DSGE output gaps, respectively, when estimating the cyclical component and CABB; *model* stands for the model-based measures of cyclical and structural components.
Source: Authors' calculation.

If we consider the last row of Table 5.8 and cases when both fiscal rules are violated, then it is possible to point that in almost half of the cases the official and model-based estimates do not coincide. Among all cases when one of the official methodologies signals that both fiscal rules are breached, the model-based results would not coincide on average in 46% of cases. Their dissent is substantially smaller in cases when just one fiscal rule violated the legislated threshold.

Still, one important point emerges from Table 5.8. First of all, lets recall that the deficit variable (in terms of size and timing) is equal across methodologies and does not suffer from estimation biases. Second, if we consider cases when both fiscal deficit criteria breach the set threshold, then the official methodology does not concord with the model-based results in more than 50% of cases[30]. This leads to the conclusion that disagreement mainly appears due to the definition of the cyclically-adjusted (structural)

[29]Moreover, although not reported, it is important to point that when comparing the two official methodologies (i.e. those that involve HP filtered and production function output gaps) the same dissent in signaling the breaching of the structural deficit limit happens in 3%.

[30]Recall that mis-signal is defined as cases when the official methodology spots a violation of a rule, while same is not evidenced according to our (benchmark) model specification.

deficit definition. All the mentioned emphasize that breaching the Maastricht criteria according to the model-based measures occurs more often due to the cyclical slump of the economy rather than abundant discretionary spending, signaled by the official methodology. Being that the fact, means that there could be a substantial number of cases when the European Commission triggers the preventive and/or corrective arm, although the slump is not due to discretionary but cyclical variations.

5.6 Conclusion

E(M)U decentralized fiscal policies are subject to common fiscal rules. The Maastricht Treaty requires member states not to violate the 3% GDP deficit limit, while the Stability and Growth Pact (SGP) demands from member states a structural deficit of 0.5% GDP at most, in order to be able to fully attain the Maastricht deficit rule. The SGP, legislated in order to complement and tighten fiscal requirements laid down in the Maastricht Treaty, represents the pillar of fiscal discipline in EMU. However, both fiscal rules share the same goal, i.e. the reduction of budget deficits to close to balance or in surplus after which the automatic stabilizers should be left to work freely.

When assessing the structural budget balance, the European Commission relies on the cyclically adjusted budget balance and the underlying fiscal policy stance. This paper investigates the effectiveness of the CABB as a measure of discretionary fiscal policy and compares the official method of computation with a DSGE model-based measure, obtained directly from the model with no need of exogenous estimations. We build on a model of Adolfson et al. (2007) by adjusting its government sector. On one hand, we discerned different tax components as well as social security contributions, and singled out social transfers and benefits from the total government spending. On the other hand, the assumption that the budget balance is not equal to zero allows for public deficit and debt. Such a structural representation of fiscal policy (i.e. fiscal policy rule) allows for measurement of fiscal shocks and reactions of policy to the cycle. It is worth emphasizing that the official methodology contains a structural model in the sense that it combines the production function with the Phillips curve for example, but does not contain a structural representation of what it is craving for: fiscal policy.

We believe that, given a list of fragilities of the *blue-eyed* CABB as a key measure in fiscal policy, and the availability of DSGE models (at national levels of EU members as well as the EU supra-national level), the EC would gain in fiscal surveillance and discipline by examining fiscal policy through the lenses of such a model.[31]

[31]Some shortcomings of CABB are presented in Section 5.2 of this work, but these are not all (see Larch and Turrini (2009), Reiss (2013) or papers presented at the workshop organized by the Banca d'Italia in Perugia in November 1998). Moreover, Bouthevillain et al. (2001, p. 9) point that CABB indicators developed by international institutions do not adequately take into account budget effects of fluctuations in the composition of aggregate demand and national income. In light of that the authors propose a more disaggregated approach often referred to as the *ESCB (or ECB) method*.

Our results indicate that in more than 45% of the cases the fiscal policy stance is misidentified by the official methodology with respect to the model-based conclusion. Meaning that in the given portion of cases the official methodology signals expansive fiscal policy when model-based measure would point to a restrictive or neutral path. If this is considered through the lenses of the EU fiscal framework than it is possible to conclude that fiscal tightening is *unnecessarily* triggered in a substantial portion of cases. Such a development affects not only fiscal policy decisions but the macroeconomic environment as well.

Moreover, breaching the SGP rule across methods occurs in 47% and 40% of cases according to the official and model-based estimation procedures, respectively. When considering both fiscal rules in the same point of time t, it is possible to observe that member states do not breach neither rule in roughly 50% of cases no matter of the methodology (official or alternative) under examination, while breaching both rules occurs in around 25% of the cases on average. When comparing whether the time of occurrence of structural deficit violation happens in the same point of time across methodologies, important facts emerge. The official methodology and model based estimates do not concord about time of occurrence of the SGP violation in almost 30% of cases. Meaning that there is almost one third of cases when the official methodology signals a structural deficit above 0.5% GDP not evidenced within the model based results. When comparing cases that signal the violation of both fiscal deficit rules in the same point of time, even higher dissent is evidenced. Namely, in around 50% of cases the official estimates do not concord with model based results. This has important policy implications since it proves that the official methodology is often unable to spot that the slump in actual deficit is due to cyclical variation and not due to expansionary fiscal policy.

Above all it is possible to conclude that the well designed fiscal rules lack of enforcement and reliability due to the computation of the cyclically adjusted budget balance, taken as reference criterion when assessing fiscal discipline. Although even before the crisis the given indicator suffered from a number of drawbacks largely discussed in empirical and theoretical works, it remained a key measure in the reinforced economic and fiscal governance of the EU, legislated recently. We believe that, when assessing fiscal policy of its members, the EC would gain in effectiveness in an eventual case of considering our alternative (model-based) approach, at least as a back-up or comparison method.

6. CONCLUSION

Fiscal policy has two main macroeconomic goals: stabilization of aggregate demand and sustainability of public finances. In respect to the first, a large body of theoretical and empirical works in the field disagree even on the fundamental effects of fiscal instruments on the economy. Therefore, the stabilization of aggregate demand has been predominantly left to monetary policy, emphasizing that fiscal policy should be mainly led by the work of automatic stabilizers and as least as possible by discretionary actions. However, during the latest economic and financial crisis a shift occurred and governments seem to have regained trust (or increased hope) into fiscal policy instruments as effective stabilizing tools.

Nevertheless, the role of governments in reducing business cycle fluctuations (and thus improving its macroeconomic implications) is indeed important. The volatility of an economy influences budget figures through the work of automatic stabilizers. For example, during higher economic growth, budget balance should be in surplus mainly due to higher tax payments. Such a higher tax burden, apparently keeps consumers away from a rise in income and an imprudent increase in personal spending, thus allowing a *control* of their individual demand. The OECD (1993) pinpoints that in case of European economies the work of automatic stabilizers reduces the magnitude of the business cycle by 25%, while in case of more closed economies such as the US and Japan the dampening effect is smaller in size but even more significant.

The magnitude of automatic stabilizers depends on many factors amid which the progressiveness of the tax system, the existence of social security schemes and public employment, the structure of taxes and spending, the degree of openness of the economy. A government can fully rely on their work and let them operate freely over the business cycle, or can tighten and/or strengthen their intensity *via* discretionary fiscal policy.

Usually, discretionary fiscal policies are asymmetric to business cycle fluctuations and lead to an increase in the debt-to-GDP ratio, even in periods of above-average growth rates. When analyzing the 1997-1990 period, the European Commission (1997) shows that in case of moderate contractions (i.e. negative output gap up to 2% of potential GDP) there was a tendency of European governments to opt for (counter-cyclical) expansionary fiscal policies. But, in case of a strong contraction (i.e. negative output gap over 2% of potential GDP), the same governments went for pro-cyclical policies giving priority to short-term goals of creditworthiness rather than regulation. Furthermore, European Commission (1997) emphasizes that in acute recessions it is very likely that the tendency to reduce the deficit adversely affects the functioning of the economy.

In order to limit the discretionary actions of governments and enhance economic governance the European Union has legislated a rule-based framework for the coordination of

national fiscal policies between its members. Fiscal discipline is expressed in the Maastricht Treaty, complemented by the Stability and Growth Pact (SGP). In order to gauge fiscal performance and discipline, the SGP fiscal rule targets the cyclically adjusted budget balance when assessing the achievement of fiscal goals and fiscal consolidation. It is considered the backbone of fiscal discipline in EMU, but has however been disappointing since its introduction, mainly due to its weak power in the "preventive" part. Main slippages in this respect showed that European governments have not resisted to the *temptation* to spend cyclically induced surpluses. For Keynesians, fiscal policy should ensure surpluses in upturns and deficits in downturns, giving a zero average balance over the cycle. The Keynesian view implicitly embeds fiscal responsibility, that was not evidenced within EU countries. Corsetti and Roubini (1996) evidence that the SGP allows for a more flexible interpretation of the Maastricht golden rule[1] since it accepts higher (although limited) deficits due to transitory cyclical components.

This doctoral dissertation focuses mainly on two aspects of fiscal policy. On one hand it tackles the cyclically adjusted budget balance as indicator of discretionary fiscal policy, while on the other it investigates the effects of such policies on the macroeconomy.

Chapter two introduces the cyclically adjusted budget balance as indicator of discretionary fiscal policy and focuses on its estimation on Croatian data. The main goal of the work presented in this Chapter is to evaluate discretionary actions and automatic stabilizers for Croatia within the EU governance framework. In order to do so the official European Commission method is used, showing that the overall responsiveness of the Croatian budget to cycle fluctuations in the 1995-2009 period was 0.47% GDP. If such a cyclical component is perceived as the size of automatic stabilizers it may be stressed that these are relatively weak in the Croatian case. This may be so due to a number of factors, but budget elasticities of respective tax components point that there is a relatively low level of tax progressiveness as well as a low sensitivity of unemployment to business cycle fluctuations. Moreover, weak formal social security schemes may be reducing the strength of automatic stabilization as well. Furthermore, results point that the Croatian fiscal policy was mainly pro-cyclical and discretionary, being the cyclically adjusted budget balance on average in deficit by 1.74% GDP.

The next chapter (Chapter three) deals with the fiscal policy effects on the macroeconomy in Croatia. By employing the Blanchard and Perotti structural vector autoregression model the effects of government spending and tax shocks are investigated. Results show that the Croatian economy moves in a Keynesian manner after a fiscal shock. An increase in output is registered after a positive government spending shock or a negative tax shock. In both cases the multiplier is above two, but of different sign, and the effect on output is permanent and significant in the long-term. When investigating the effect of same shocks on private investment and private consumption similar conclusions arise. A

[1]The Maastricht deficit-to-GDP fiscal rule can be thought of as a *golden rule*, since the historical average rate of public investment in Europe has been 3% GDP, set as a reference value for the deficit-to-GDP rule (Corsetti and Roubini, 1996).

government spending shock permanently increases private consumption, while oppositely a tax shock decreases the same macro-variable, being the effect in both cases significant and permanent in the long-run. The effect on private investment by both shocks is of similar path but it stabilizes in the short-run. Additionally, the results point that there government investment spending does not crowd out private investment, while the pattern of private consumption is mainly driven by indirect taxes. The latter was however expected since indirect taxes account for around 70% of all tax revenues.

In the light of the strand of literature that recently advocated Keynes' proposition of fiscal policy effectiveness during economic downturns, Chapter four deals with the effects of fiscal policy across different business cycles phase in Croatia. Namely, during the latest economic crisis a substantial portion of works dealing with fiscal multipliers in *good* and *bad* times arose. Most of those prove that fiscal policy is especially effective during economic slumps and actually ineffective during expansionary times. In order to differentiate across phases of the business cycle the smooth transition vector autoregression along with linear direct projections is employed, with the structural vector autoregression being the linear comparable. Overall, fiscal multipliers in recessionary times seem to be much more significant and higher, since for example a one kuna increase in government spending leads to an increase in output of more than 2 kunas in the medium and long term in case the shock occurs during bad times. Oppositely an increase in taxes of one kuna will on impact decrease output for three lipas only, but in the long-term the effect amounts to 40 lipas. If private consumption and private investment are considered, it is possible to conclude that the spending multiplier during recessions amounts to 1.09 and 0.39 respectively. However, if government spending are disentangled between government expenditure for purchases of goods and services, government expenditure for wages and government capital expenditures, interesting results are observed. A one kuna increase in government spending for purchases during *bad* times leads to an increase in output, private consumption and private investment of 3.04, 1.73 and 0.35 kunas, respectively. A bit higher multiplier with respect to output (3.29) is evidenced in case the shock comes from an increased government spending for wages, which i on average in the short-run the highest when comparing different spending components' effects.

After the assessment of stabilization effects of discretionary fiscal policy in Chapter 3 and 4, the analysis in Chapter 5 again refocuses the attention on the cyclically adjusted budget balance. As mentioned earlier, CABB is one of the key pillars of the E(M)U fiscal surveillance framework, although its shrinking (methodological) popularity. In order to investigate the effectiveness of this indicator, a simulation experiment is employed by estimating a medium-scale open economy DSGE model as a data generating process. Generated data is used to serve the scope of the analysis, i.e. on one hand to estimate the overall budget sensitivity, output gap, as well as cyclical and cyclically-adjusted budget balances according to official methods employed by the OECD and EC; on the other hand, same data is used to propose a *model-based* measure of cyclical and cyclically adjusted budget figure and compare official and model-based estimates within the E(M)U

fiscal framework. To avoid any bias that could arise from investigating the mentioned issues on a fiscally *un-stable* country, such as Croatia, the analysis focuses on Austria. When searching for a fiscally stable country, Austria fulfilled among EU members the set criteria of tax system stability, fiscal discipline and fiscal projections accuracy. Therefore the steady state of the DSGE model is calibrated on Austrian data.

When comparing the model-based results with those obtained following the EC official methodology it is possible to note several important facts. On average the official methodology underestimates the cyclical, while overestimating the cyclically-adjusted component of the budget. The character of fiscal policy is according to the official methodology thus mainly restrictive or expansive, while model-based results on average indicate the predominancy of a neutral fiscal policy stance. Moreover, when comparing the fiscal policy stance of official estimates with respect to the model-based results evidence shows that a different conclusion occurs on average in more than 45% of cases. If this is to be considered within the E(M)U fiscal governance framework, then it is possible to note that fiscal tightening is *unnecessarily* triggered in a substantial number of cases. Moreover, breaching the Maastricht deficit-to-GDP rule occurs in 30.39% of cases and does not vary across different methodologies. On the other hand, the structural deficit, legislated through the SGP, is dependent of the method used when assessing its size. Results show that it occurs in 47% of cases when the official method is employed, while the portion is a bit smaller (40%) within the model-based framework. If compliance to both rules in a point of time is evaluated it is possible to stress that both are violated in around 25% of cases on average. However, the official methodology and model based estimates do not concord about time of occurrence of the SGP violation in almost 30% of cases. Meaning that there is almost one third of cases when the official methodology signals a structural deficit above 0.5% GDP not evidenced within the model based results. Such a dissent raises when both fiscal rules are infringed, reaching around 50% of cases on average. The latter has important policy implications since it shows that the official methodology is often unreliable in capturing the reasons behind a deficit-to-GDP ratio above 3%. Namely, according to the official method the violation occurs due to discretionary fiscal policy, while model.based result indicate the same is due to the cyclical movement of budget figures.

Above all it is worth pointing out that counter-cyclical fiscal policies are not an *easy task* in practice. These can be due to a number of factors[2]. However, when assessing issues in

[2]Although empirical practice show that developed countries mainly conduct counter-cyclical fiscal policies Gali and Perotti (see 2003, among others), it can not be similarly concluded in case of developing economies that mostly carry out pro-cyclical fiscal policies. However, the literature emphasizes that there is a number of factors that influences such a behaviour. According to Calvo and Reinhart (2000) it is due to external borrowing constraints, according to Caballero and Krishnamurthy (2004) the reasons lie under the shallow domestic financial system, while according to Yakhin (2008) substantial destabilizing behaviour is due to the lack of financial integration. Moreover, counter-cyclical policies are largely dependent upon the country's institutional framework. Acemoglu et al. (2003) show that countries which do not strive particularly for *responsible* fiscal policies also have a weak institutional setting, i.e. suffer from corruption, weak property rights for investors and predominance of political institutions that do not constraint their politicians.

the field of fiscal policy, such as the fiscal policy stance or the stabilization feature of fiscal instruments, results can be also highly methodology-dependent. As already mentioned, both of these issues (i.e. the fiscal stance and fiscal stabilization) are main pillars of this dissertation. When looking at the stabilization effects of fiscal policy, Croatia shows Keynesian responses in both (linear and non-linear) methodological settings. This can even lead to the conclusion that the Croatian economy could have *necessitated* higher deficits in the period of the recent economic crisis in order to stimulate recovery, but deficits due to fiscal stimuli actions not as a results of macroeconomic performance due to the attempt of fiscal consolidation.

With respect to the fiscal stance, it can be overall concluded that Croatia is not much different from other developing countries and empirical works based on their case. On one hand, it is showed that it finds it challengeable to run counter-cyclical fiscal policies and on the other, that automatic stabilization is weaker when compared to developed economies. Nevertheless, this dissertation draws the attention to (and questions) the methodological aspects by which the fiscal policy stance and cyclical component of the budget are assessed in the first place. A purely endogenous model-based estimation would often lead to a different fiscal policy conclusion and therefore to a different cyclical behaviour of fiscal policy. A more structural approach is warranted, but not necessarily the one considered in this work. However, the proposed model points to serious issues, which clearly need for further research.

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APPENDICES

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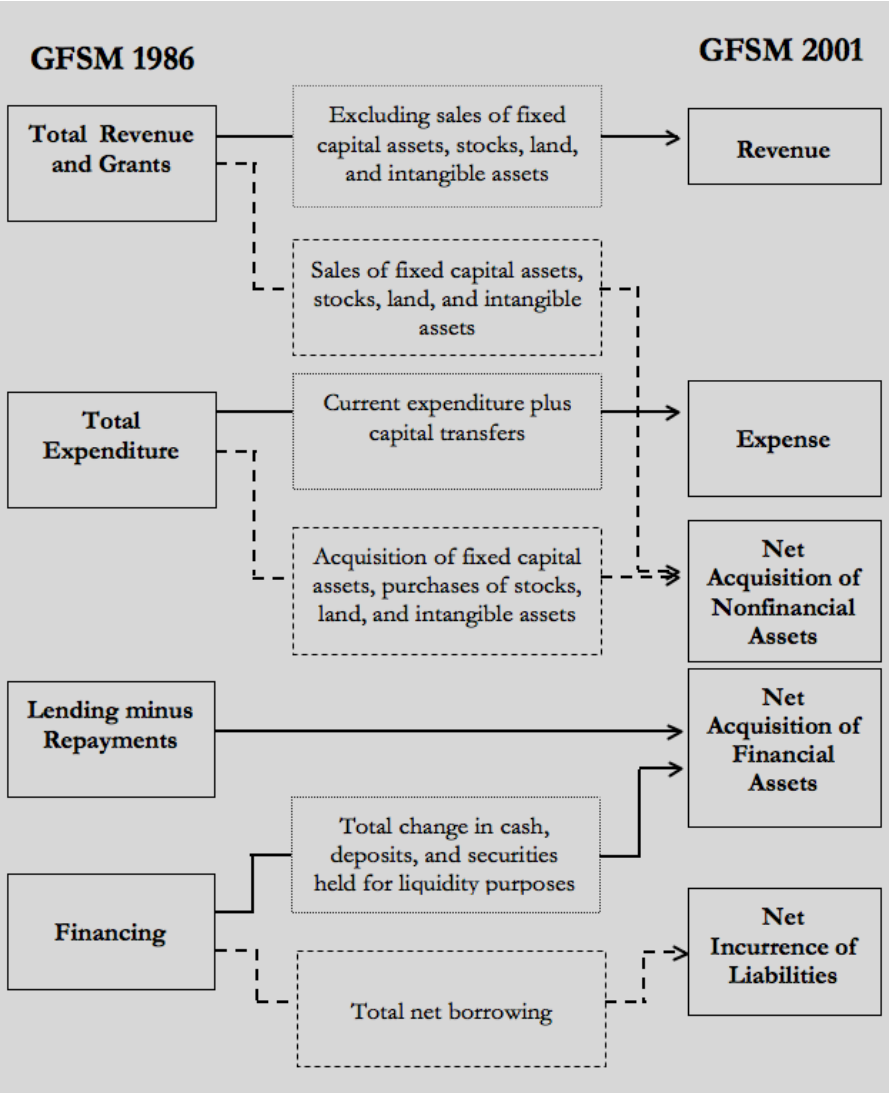
Appendix A. Government Finance Statistics

The GFSM 2001 analytic framework differs considerably from the GFSM 1986 framework (see the Government Finance Statistics Manual 1986 and 2001; IMF (1986, 2001)). Figure A.1 shows a broad overview of the relationship between GFSM 1986 and GFSM 2001 classification systems.

Figure A.1: *Broad overview of reclassification between GFSM 1986 and GFSM 2001.*



Source: Wickens (2002); IMF (1986, 2001).

Appendix B. Budgetary item's elasticity - EC approach

All estimations are done according to the European Commission's approach and use quarterly data that span the period from 1995Q1 to 2009Q4, except revenue from VAT which span from 1998Q1 to 2009Q4. In all cases the OLS estimator was applied to obtain the parameter values, as the chosen methodology suggests. Moreover, equations presented in this Appendix follow van den Noord (2000) and Girouard and Andre (2005). Variables result to be stationary in logs and first differences, except in the case of indirect taxes and consumption, which are stationary in logs only. There is no autocorrelation at the 95% significance level.

B.1 Elasticity of PIT

The **elasticity of the personal income tax (PIT)** α can be disaggregated as:

$$\begin{aligned} \alpha &= \frac{\delta T}{\delta Y}\frac{Y}{T} = \frac{\delta\left[(T/L)\,L\right]}{\delta Y}\frac{Y}{T} \\ &= \left(\frac{\delta L}{\delta Y}\frac{Y}{L}\right)\left[1+\left(\frac{\delta\,(T/L)}{\delta w}\frac{w}{T/L}\right)\left(\frac{\delta w}{\delta L}\frac{L}{w}\right)\right] \end{aligned} \tag{B.1}$$

where, Y, T, L and w, denote respectively output, tax proceeds, employment and wage rate. The first term $(\frac{\delta L}{\delta Y}\frac{Y}{L})$ of equation B.1 represent the *output elasticity of employment*. The term $(\frac{\delta(T/L)}{\delta w}\frac{w}{T/L})$ reflects the *wage elasticity of personal income tax yield per worker*. This elasticity is calculated as a ratio of the marginal and average tax rates for an average taxpayer (Giorno et al., 1995) and captures the progressivity of the tax system. The last term in the elasticity equation $(\frac{\delta w}{\delta L}\frac{L}{w})$ denotes the *employment elasticity of wages*, which should be interpreted as the Phillips' curve effect on wages.

Output elasticity of employment

The estimated equation corresponds to:

$$\Delta log(L/L^*) = \alpha_0 + \alpha_1 t + \alpha_2 \Delta log(Y/Y^*) \tag{B.2}$$

where Δ stands for first differnces (to preserve stationarity), L and Y represent actual employment and output, while L^* and Y^* potential level of employment and output. Estimation results are presented in the following Table.

Table B.1: *Estimated short-run output elasticity of employment*

	α_2	$t-stat$	$p-value$	$AdjustedR^2$
$\lambda = 480$	0.16	14.70	0.000^{***}	0.79

Source: Author's calculation.

Real wage elasticity of income tax per worker in Croatia

This elasticity represents the average ratio between marginal tax rates and average tax rate in the personal income taxation. The marginal and average tax rates are calculated for income that amounts from half of the average gross wage to the income that amounts to three average gross wages in Croatia. Moreover, they are calculated for each quarter independently in order to incorporate the numerous changes in the personal income tax legislation (changes in personal allowance, tax brackets, tax rates). The obtained result shows that for an 1% increase in real wages, the income tax per worker will increase by 1.21%.

Employment elasticity of wages

The estimated equation corresponds to:

$$\Delta log(wL/Y^*) = \beta_0 + \beta_1 t + \beta_2 \Delta log(L/L^*) \tag{B.3}$$

where w corresponds to real wage, while other notations as in equation B.2. Estimation results are presented in the following Table.

Table B.2: *Estimated short-run employment elasticity of wages*

	β_2	$t-stat$	$p-value$	$AdjustedR^2$
$\lambda = 480$	1.03	2.59	0.012^{**}	0.09

Source: Author's calculation.

The overall elasticity of income tax in Croatia

Table B.3: *Elasticity of PIT in Croatia*

Real wage elasticity of income tax per worker	Output elasticity of employment	Employment elasticity of wages	Output elasticity of personal income tax
A	B	C	D=B(1+AC)
1.21	0.16	1.03	0.36

Source: Author's calculation.

B.2 Elasticity of SSC

The **elasticity of the social security contributions** follow the same equation B.1, just the real wage elasticity of income tax per worker is substituted by the real wage elasticity of social security contributions per worker. This elasticity is set to 1%, in accordance with the proportional rate applied on the wage.

Table B.4: *Elasticity of social security contributions in Croatia*

Real wage elasticity of social security contributions per worker	Output elasticity of employment	Employment elasticity of wages	Output elasticity of social security contributions
A	B	C	D=B(1+AC)
1.00	0.16	1.03	0.32

Source: Author's calculation.

B.3 Elasticity of CIT

The **elasticity for the corporate income tax (CIT)** can be broken down in two sub-elasticity as:

$$\begin{aligned}\alpha &= \frac{\delta T}{\delta Y}\frac{Y}{T} = \frac{\delta Z}{\delta Y}\frac{Y}{Z} = \frac{\delta\left(Y - wL\right)}{\delta Y}\frac{Y}{Z} \\ &= \left[1 - \left(1 - \frac{Z}{Y}\right)\left(\frac{\delta L}{\delta Y}\frac{Y}{L}\right)\left(1 + \frac{\delta w}{\delta L}\frac{L}{w}\right)\right]\frac{Y}{Z}\end{aligned} \tag{B.4}$$

where, Y, T, L, Z and w denote respectively output, tax proceeds, employment, corporate income and wage rate.

Because the proportionality assumption implies that the tax elasticity is equal to the elasticity of the tax base (gross corporate profits) to output. The latter elasticity is the function of the elasticity of the wage bill with respect to output, which again, as in the case of PIT elasticity, can be decomposed in the output elasticity of employment ($\frac{\delta L}{\delta Y}\frac{Y}{L}$) and employment elasticity of wages ($\frac{\delta w}{\delta L}\frac{L}{w}$). For this reason equation B.4 can be rewritten as:

$$\alpha = \left[1 - \left(1 - PS\right)\epsilon_{wL,Y}\right]/PS \tag{B.5}$$

where, PS is profit share in GDP and $\epsilon_{wL,Y}$ the elasticity of the wage bill.

Table B.5: *Elasticity of CIT in Croatia*

Gross corporate profits' share in GDP	Output elasticity of employment	Employment elasticity of wages	Output elasticity of corporate income tax
A	B	C	D=[1-(1-A)B(1+C)]/A
68%	0.16	1.03	1.31

Source: Author's calculation.

B.4 Elasticity of indirect taxes

The **elasticity for indirect taxes** is based on the assumption that the relevant tax base fluctuates in proportion with private consumption, so:

$$\alpha = \frac{\delta C}{\delta Y}\frac{Y}{C} \tag{B.6}$$

where C is private consumption and Y output. The estimated equation corresponds to:

$$log(C/Y^*) = \gamma_0 + \gamma_1 t + \gamma_2 SD_2 + \gamma_3 SD_3 + \gamma_4 SD_4 + \gamma_5 log(Y/Y^*) \tag{B.7}$$

where w corresponds to real wage, while other notations as in equation B.2. Estimation results are presented in the following Table.

Table B.6: *Estimated short-run output elasticity of real private consumption*

	γ_5	$t-stat$	$p-value$	$AdjustedR^2$
$\lambda = 480$	0.50	2.42	0.019^{**}	0.61

Source: Author's calculation.

Regression estimation showed this elasticity to be 0.5% of GDP.

B.5 Unemployment related expenditure elasticity

Current budgetary expenditures are assumed to fluctuate in proportion to *unemployment related expenditures*. The **elasticity of expenditures** can be decomposed as follows:

$$\begin{aligned}\beta &= \frac{\delta E}{\delta Y}\frac{Y}{E} = \left(\frac{UB}{E}\right)\left(\frac{\delta UB}{\delta Y}\frac{Y}{UB}\right) \\ &= \left(\frac{UB}{E}\right)\left(\frac{\delta U}{\delta Y}\frac{Y}{U}\right) = \left(\frac{UB}{G}\right)\left(\frac{\delta Ls - \delta L}{\delta L}\frac{\delta L}{\delta Y}\frac{Y}{U}\right) \\ &= -\left(\frac{UB}{E}\right)\left(\frac{\delta L}{\delta Y}\frac{Y}{L}\right)\left\{\left[\frac{1-\left(\frac{\delta Ls}{\delta L}\frac{L}{Ls}\right)}{\frac{U}{Ls}}\right]-1\right\}\end{aligned} \tag{B.8}$$

where, U, UB, E, L and Ls denote respectively unemployment, unemployment related expenditure, total government expenditure, employment and labour supply. It is assumed that unemployment related expenditure is strictly proportional to unemployment, whose variations are broken into (a) variations in employment ($\frac{\delta L}{\delta Y}\frac{Y}{L}$) and (b) variations in the labour force ($\frac{1-\left(\frac{\delta Ls}{\delta L}\frac{L}{Ls}\right)}{\frac{U}{Ls}}$).

Employment elasticity of labour supply in Croatia

The estimated equation corresponds to:

$$\Delta log(Ls/L^*) = \delta_0 + \delta_1 t + \delta_2 \Delta log(L/L^*) \tag{B.9}$$

where Ls denotes labour supply. Estimation results are presented in Table B.7.

Table B.7: *Estimated short-run employment elasticities of labour supply*

	δ_2	$t-stat$	$p-value$	$AdjustedR^2$
$\lambda = 480$	0.20	3.13	0.003^{***}	0.21

Source: Author's calculation.

Given that, the overall elasticity of budgetary expenditure according to equation B.8 is the following:

Table B.8: *Elasticity of current primary expenditure*

Output elasticity of employment	Employment elasticity of labour supply	Trend unemployment rate	Share of unemployment related expenditure in total expenditure	Output elasticity of unemployment related expenditure	Output elasticity of current primary expenditure
A	B	C	D	E=-A[(1-B)/C - 1]	F=DE
0.16	0.20	17.22%	0.85%	-0.58	-0.01

Source: Author's calculation.

Appendix C. Data definition and sources

This Appendix embraces the definition of data used across all Chapters. The definition also includes the unit of measurement, source and time span. If one variable is used throughout more than one Chapter and its timespan or unit of measurement differs, then it is made clear when explaining the timespan.

C.1 Data definition and sources for Chapter 2-4: case of Croatia

Real output – Y_t
Definition: Real gross domestic products. The series spans from 1995Q1-2009Q4 in Chapter 2, from 1995Q1-2011Q4 in Chapter 3 and 4.
Units: HRK (national currency), 1997 reference prices in Chapter 2, 2000 reference prices in Chapter 3 and 4.
Source: For the period 1994-1997 Mikulić and Lovrinčević (2000); For the period 1998-2011 CBS (First Releases) (sues).

Private consumption – C_t
Definition: Real household final consumption. The series spans from 1995Q1-2009Q4 in Chapter 2, from 1995Q1-2011Q4 in Chapter 3 and 4.
Units: HRK (national currency), 1997 reference prices in Chapter 2, 2000 reference prices in Chapter 3 and 4.
Source: For the period 1994-1997 Mikulić and Lovrinčević (2000); For the period 1998-2011 CBS (First Releases) (sues).

Private investment – I_t
Definition: Real private investment. The series spans from 1995Q1-2011Q4.
Units: HRK (national currency), 2000 reference prices.
Source: For the period 1994-1997 Mikulić and Lovrinčević (2000); For the period 1998-2011 CBS (First Releases) (sues).

Prices – p_t
Definition: Consumer price index. *Note: In order to capture inflation this variable is obtained by differentiating the logarithms of the Consumer price index. The series spans from 1995Q1-2011Q4.*
Units: Index, 2000=100
Source: IFS

Interest rate – i_t
Definition: Interest rate on interbank demand deposit trading on overnight credits (short-term MMR). The series spans from 1995Q1-2011Q4.
Units: Rate
Source: CNB.

Employment – L_pers_t
Definition: Total employment as the sum of persons employed in legal entities, persons employed in crafts and trades and free lances, and private farmers. The series spans from 1995Q1-2009Q4 in Chapter 2 and from 1995Q1-2011Q4 in Chapter 3.
Units: Persons.
Source: CBS (First Releases) (sues).

Labour supply – Ls_t
Definition: Total labour force. The series spans from 1995-2009.
Units: Persons.
Source: CBS (First Releases) (sues).

Potential labour supply – Lsp_t
Definition: HP filtered total labour force. The series spans from 1995-2009.
Units: Persons.
Source: CBS (First Releases) (sues).

Real aggregated wage bill – wL_t
Definition: The aggregated wage bill is obtained by multiplication of the number of persons in employment and their respective gross wage. This series is built in the following way: (1) for persons employed in legal entities: the number of persons employed in sectors according to the National Classification of Activities is multiplied by the respective average gross wage per sector; (2) for persons employed in crafts and trades and free lances: up to year 1998 the number of persons employed in this group is multiplied by the average gross wage resulted from employment in legal entities because the unavailability of gross wage data for crafts and trades and free lances. For the period after 1998 the number of persons employed in crafts and trades and free lances classified according to the National Classification of Activities is multiplied by their respective gross wage according to the same Classification; (3) private farmers: the number of employed as private farmers is multiplied by the gross wage of those employed in legal entities in the agricultural sector. The series spans from 1995-2009.
Units: Originally in current prices, HRK (national currency), but deflated by the GDP deflator.
Source: CBS (First Releases) (sues).

Real wage – w_t
Definition: Real gross wage per employee, i.e. the real aggregated wage bill divided by the employment. The series spans from 1995-2009.
Units: Originally in current prices, HRK (national currency), but deflated by the GDP deflator.

Source: CBS (First Releases) (sues).

Real gross wages in the private sector – $wpri\_r_t$
Definition: Gross wages in the private sector, proxied by the average gross wage in sectors from A to N plus sectors R and S of the National classification of activities (NKD2007) for the period 2000Q1-2011Q4. For the period 1997Q1-1999Q4 the average corresponds to sectors from A to K, plus sectors O-Q according to the "old version" of the National classification of activities (NKD2002). The series spans from 1997Q1-2011Q4.
Units: HRK, 2000 reference prices
Source: CBS (First Releases) (sues).

Real gross wages in the public sector – $wpub\_r_t$
Definition: Gross wages in the public sector, proxied by the average gross wage in sectors from O to Q of the National classification of activities (NKD2007) for the period 2000Q1-2011Q4. For the period 1997Q1-1999Q4 the average corresponds to sectors from L to N according to the "old version" of the National classification of activities (NKD2002). The series spans from 1997Q1-2011Q4.
Units: HRK, 2000 reference prices
Source: CBS (First Releases) (sues).

Minimal wage – $wmin\_r_t$
Definition: Minimal wage as defined by the Law of the minimal wage published by the Official Gazette. The series spans from 1995Q1-2011Q4.
Units: HRK, 2000 reference prices
Source: RRiF (2009)

Gross corporate profits – Z_t
Definition: Gross corporate profits are obtained by subtracting the real aggregated wage bill from the real gross added value. The series spans from 1997-2009
Units: 1997 reference prices, HRK (national currency).
Source: CBS (First Releases) (sues).

Unemployment – U_t
Definition: Total unemployment. The series spans from 1995-2009.
Units: Persons
Source: CBS (First Releases) (sues)

Government spending – E_t
Definition: Total consolidated central government expenditure classified according to GFSM 1986. The series spans from 1995-2009.
Units: Originally in current prices, HRK (national currency), but deflated by the GDP deflator.
Source: MFIN (Statistical Informations) and Author's estimation.

Net government spending according to Blanchard and Perotti (2002) – G_t
Definition: Government expenditure as in Blanchard and Perotti (2002), i.e. total purchases of goods and services plus capital spending at the consolidated central government level in real terms according to GFS 1986. As in the referred work, this variable express expenditure net of transfers. *Note: (a) For convenient purposes this variable is denoted as g_t in the equations. (b) GFS 1986 was the official Croatian government finance statistics methodology until 2004, when the new IM's methodology, i.e. the GFS 2001 was adopted. Since that would pose a structural break in the data, aggregated fiscal data for the period 2004-2011 were reclassified according to the GFS 1986 methodology (for details see Appendix A or Grdović Gnip (2011, p. 48 and 67) and listed references).* The series spans from 1996Q1-2011Q4.
Units: HRK, 2000 reference prices.
Source: MFIN (Statistical Informations) and Author's estimation.

Government revenue – R_t
Definition: Total consolidated central government revenue classified according to GFSM 1986. The series spans from 1995-2009.
Units: Originally in current prices, HRK (national currency), but deflated by the GDP deflator.
Source: MFIN (Statistical Informations) and Author's estimation.

Net taxes according to Blanchard and Perotti (2002) – Rbp_r_t
Definition: Net taxes in the sense of Blanchard and Perotti (2002), i.e. personal income tax plus corporate income tax plus indirect taxes plus social security contributions minus transfers to persons and minus interest payments, in real terms according to GFS 1986. Still, transfers to persons are proxied by the unemployment related expenditure only due to the unavailability of the data for the period prior to year 2004. *Note: (a) For convenient purposes this variable is denoted as r_t in the equations. (b) GFS 1986 was the official Croatian government finance statistics methodology until 2004, when the new IMF's methodology, i.e. the GFS 2001 was adopted. Since that would pose a structural break in the data, aggregated fiscal data for the period 2004-2011 were reclassified according to the GFS 1986 methodology (for details see Appendix A or Grdović Gnip (2011, p.48, 67) and its references).* The series spans from 1996Q1-2011Q4.
Units: HRK, 2000 reference prices.
Source: MFIN (Statistical Informations) and Author's estimation.

Direct taxes – Td_r_t
Definition: Consolidated central government budget revenue from personal income and corporate income tax in real terms. The series spans from 1996Q1-2011Q4.
Units: HRK, 2000 reference prices
Source: Ministry of Finance, Republic of Croatia.

Indirect taxes – $Tind\_r_t$
Definition: Consolidated central government budget revenue from sales taxes (single stage sales tax until 1998, VAT from 1998, excise duties) in real terms. The series spans from 1996Q1-2011Q4.
Units: HRK, 2000 reference prices

Source: Ministry of Finance, Republic of Croatia.

Corporate income tax – CIT_t
Definition: Consolidated central government revenue from corporate income taxation. The series spans from 1995-2009.
Units: Originally in current prices, HRK (national currency), but deflated by the GDP deflator.
Source: Ministry of Finance, Republic of Croatia

Personal income tax – PIT_t
Definition: Consolidated central government revenue from personal income taxation. The series spans from 1995-2009.
Units: Originally in current prices, HRK (national currency), but deflated by the GDP deflator.
Source: Ministry of Finance, Republic of Croatia

Social security contributions – SSC_t
Definition: Consolidated central government revenue from social security contributions. The series spans from 1995-2009.
Units: Originally in current prices, HRK (national currency), but deflated by the GDP deflator.
Source: Ministry of Finance, Republic of Croatia

Value-added tax – VAT_t
Definition: Consolidated central government revenue fromVAT. The series spans from 1995-2009.
Units: Originally in current prices, HRK (national currency), but deflated by the GDP deflator.
Source: Ministry of Finance, Republic of Croatia

Excise duties – EX_t
Definition: Consolidated central government revenue from excise duties. The series spans from 1995-2009.
Units: Originally in current prices, HRK (national currency), but deflated by the GDP deflator.
Source: Ministry of Finance, Republic of Croatia

Current expenditure – $Ecur\_r_t$
Definition: Consolidated central government budget current expenditure in real terms. The series spans from 1996Q1-2011Q4.
Units: HRK, 2000 reference prices
Source: MFIN (Statistical Informations) .

Expenditure for wages – $Ewages\_r_t$
Definition: Current expenditure for gross wages and social contributions from the central government budget in real terms. It is used as proxy for public employment. *Note: Data for all expenditure subcategories, therefore expenditure for employees as well, for the period from June 2003 to October 2003 are not available in the Statistical Reports of the Ministry of Finance on a*

monthly basis. Still, there is an available data of the cumulative sum of this expenditure for the period January-November 2003. Available data from January to June were subtracted from the available cumulative sum, and then missing data are obtained by interpolating the residue sum between missing months using as pattern the monthly growth rates of current expenditure. The series spans from 1997Q4-2011Q4.
Units: HRK, 2000 reference prices
Source: MFIN (Statistical Informations) .

Expenditure for purchases of goods and services – $Epur\_r_t$
Definition: Current expenditure for purchases of goods and services from the central government budget in real terms. It is used as proxy for public consumption. *Note: Data for all expenditure subcategories, therefore expenditure for purchases of goods and services as well, for the period from June 2003 to October 2003 are not available in the Statistical Reports of the Ministry of Finance on a monthly basis. Still, there is an available data of the cumulative sum of this expenditure for the period January-November 2003. Available data from January to June were subtracted from the available cumulative sum, and then missing data are obtained by interpolating the residue sum between missing months using as pattern the monthly growth rates of current expenditure.* The series spans from 1997Q4-2011Q4.
Units: HRK, 2000 reference prices
Source: MFIN (Statistical Informations) .

Capital expenditure – $Ecap\_r_t$
Definition: Consolidated central government budget capital expenditure in real terms. It is used as proxy for public investment as well. *Note: Data for all expenditure subcategories, therefore capital expenditure as well, for the period from June 2003 to October 2003 are not available in the Statistical Reports of the Ministry of Finance on a monthly basis. Still, there is an available data of the sum between capital and current expenditures, so capital expenditure is obtained by subtracting current to total expenditure. The series spans from 1996Q1-2011Q4.*
Units: HRK, 2000 reference prices
Source: MFIN (Statistical Informations) .

Unemployment related benefits – UB_t
Definition: Unemployment support payments from the Consolidated general government budget. The series spans from 1995-2009.
Units: Originally in current prices, HRK (national currency), but deflated by the GDP deflator.
Source: Ministry of Finance, Republic of Croatia

PIT wage elasticity – wL_PIT_t
Definition: Wage elasticity of personal income tax is the ratio between the marginal personal income tax rate and the average personal income tax rate. The marginal and average tax rates are calculated for income that amounts from half of the average gross wage to the income that amounts to three average gross wages. Marginal and average tax rates are calculated for each quarter independently in order to incorporate the numerous changes in the personal income tax legislation (changes in personal allowance, tax brackets, tax rates). The series spans from 1995-2009.

Units: Index
Source: Author's calculation according to Croatian Bureau of Statistics' data on wages and Personal income tax Legislation.

SSC wage elasticity – wL_SSC_t
Definition: Wage elasticity of social security contributions is the ratio between the marginal social contribution tax rate and the average social contribution tax rate. The marginal and average tax rates are calculated for income that amounts from half of the average gross wage to triple average gross wages. Marginal and average tax rates are calculated for each quarter independently in order to incorporate the changes in applied social security tax rates. The series spans from 1995-2009.
Units: Index
Source: Author's calculation according to Croatian Bureau of Statistics' data on wages and Social security contribution Legislation.

Unanticipated component in net government spending – $FEgspend_t$
Definition: Ratio between the outturn (realization) of net government spending and the one-quarter-ahead forecast (plan). *Note: Planned values of net government spending are usually presented in the Croatian Official gazette in December of year t for year $t+1$ (or exceptionally in January of year $t+1$ for year $t+1$) for the central budget level. Since forecast values of government spending are available on an annual basis only, interpolation is used to get a quarterly series and the procedure is based on quarterly growth rates of government spending outturn.* The series spans from 1995Q2-2011Q4.
Units: Ratio
Source: MFIN (Statistical Informations), Ministry of Finance, Zakon o izvršavanju državnog proračuna Republike Hrvatske [Croatian State Budget Act]. Author's estimation.

Unanticipated component in net taxes – $FEtaxes_t$
Definition: Ratio between the outturn (realization) of net taxes and the one-quarter-ahead forecast (plan). *Note: Planned values of taxes are usually presented in the Croatian Official gazette in December of year t for year $t+1$ (or exceptionally in January of year $t+1$ for year $t+1$) for the central budget level. Since forecast values of taxes are available on an annual basis only, interpolation is used to get a quarterly series and the procedure is based on quarterly growth rates of total taxes outturn.* The series spans from 1995Q2-2011Q4.
Units: Ratio
Source: MFIN (Statistical Informations), Ministry of Finance, Zakon o izvršavanju državnog proračuna Republike Hrvatske [Croatian State Budget Act]. Author's estimation.

Unanticipated component in current government spending – $FEcurE_t$
Definition: Ratio between the outturn (realization) of current government spending and the one-quarter-ahead forecast (plan). *Note: Planned values of current government spending are usually presented in the Croatian Official gazette in December of year t for year $t+1$ (or exceptionally in January of year $t+1$ for year $t+1$) for the central budget level. Since forecast values of current government spending are available on an annual basis only, interpolation is used to get a quarterly series and the procedure is based on quarterly growth rates of current government*

spending outturn. The series spans from 1995Q2-2011Q4.
Units: Ratio
Source: MFIN (Statistical Informations), Ministry of Finance, Zakon o izvršavanju državnog proračuna Republike Hrvatske [Croatian State Budget Act]. Author's estimation.

Unanticipated component in government spending for purchases of goods and services – $FEpurE_t$
Definition: Ratio between the outturn (realization) of expenditure for purchases of goods and services and the one-quarter-ahead forecast (plan). *Note: Planned values of government spending for purchases of goods and services are usually presented in the Croatian Official gazette in December of year t for year t+1 (or exceptionally in January of year t+1 for year t+1) for the central budget level. Since forecast values are available on an annual basis only, interpolation is used to get a quarterly series and the procedure is based on quarterly growth rates of government spending for purchases of goods and services outturn.* The series spans from 1997Q4-2011Q4.
Units: Ratio
Source: MFIN (Statistical Informations), Ministry of Finance, Zakon o izvršavanju državnog proračuna Republike Hrvatske [Croatian State Budget Act]. Author's estimation.

Unanticipated component in government spending for wages – $FEwagesE_t$
Definition: Ratio between the outturn (realization) of expenditure for wages and the one-quarter-ahead forecast (plan). *Note: Planned values of government spending for wages are usually presented in the Croatian Official gazette in December of year t for year t + 1 (or exceptionally in January of year t + 1 for year t + 1) for the central budget level. Since forecast values are available on an annual basis only, interpolation is used to get a quarterly series and the procedure is based on quarterly growth rates of government spending for wages outturn.* The series spans from 1997Q4-2011Q4.
Units: Ratio
Source: MFIN (Statistical Informations), Ministry of Finance, Zakon o izvršavanju državnog proračuna Republike Hrvatske [Croatian State Budget Act]. Author's estimation.

Unanticipated component in capital government spending – $FEcapE_t$
Definition: Ratio between the outturn (realization) of capital expenditure and the one-quarter-ahead forecast (plan). *Note: Planned values of capital government spending are usually presented in the Croatian Official gazette in December of year t for year t+1 (or exceptionally in January of year t + 1 for year t + 1) for the central budget level. Since forecast values are available on an annual basis only, interpolation is used to get a quarterly series and the procedure is based on quarterly growth rates of capital government spending outturn.* The series spans from 1995Q2-2011Q4.
Units: Ratio
Source: MFIN (Statistical Informations), Ministry of Finance, Zakon o izvršavanju državnog proračuna Republike Hrvatske [Croatian State Budget Act]. Author's estimation.

C.2 Data definition and sources for Chapter 5: case of Austria

Output – Y_t
Definition: Real gross domestic product.
Units: In millions of euro, chain-linked volumes, reference year 2000, seasonally adjusted.
Source: Eurostat: namq_gdp_k Code: B1GM

Private consumption – C_t
Definition: Household and NPISH final consumption expenditure.
Units: In millions of euro, chain-linked volumes, reference year 2000, seasonally adjusted.
Source: Eurostat: namq_gdp_k Code: P31_S14_S15

Government consumption – G_t
Definition: Final consumption expenditure of general government.
Units: In millions of euro, chain-linked volumes, reference year 2000, seasonally adjusted.
Source: Eurostat: namq_gdp_k Code: P3_S13

Investment – I_t
Definition: Gross fixed capital formation.
Units: In millions of euro, chain-linked volumes, reference year 2000, seasonally adjusted.
Source: Eurostat: namq_gdp_k Code: P51

Exports – X_t
Definition: Exports of goods and services.
Units: In millions of euro, chain-linked volumes, reference year 2000, seasonally adjusted.
Source: Eurostat: namq_gdp_k Code: P6

Imports – M_t
Definition: Imports of goods and services.
Units: In millions of euro, chain-linked volumes, reference year 2000, seasonally adjusted.
Source: Eurostat: namq_gdp_k Code: P7

Real exchange rate – x_t
Definition: Real Effective Exchange Rate, consumer price deflator.
Units: Indices deflator, 2000=100, 17 trading partners, Euro Area.
Source: Eurostat: ert_eff_ic_q Code: NEEREA17

Wages – W_t
Definition: Labour cost index for wages and salaries in industry and services (except public administration and community services; activities of households and extra-territorial organizations).
Units: Indices, 2000=100, seasonally adjusted.

Source: Eurostat: lc_lci_r1_q Code: D11

Inflation – π_t^d
Definition: GDP deflator.
Units: GDP price index, 2000=100, seasonally adjusted.
Source: Eurostat: namq_gdp_p Code: B1GM, CPI00_NAC

Short term interest rate – R_t
Definition: 3˘month short term interest rates in percent.
Units: GDP price index, 2000=100, seasonally adjusted.
Source: Eurostat: irt_h_mr3_q Code: 3MR

Employment – E_t
Definition: Total employment (residence population concept –LFS).
Units: Persons, in 1000.
Source: Eurostat: lfsi_emp_q Code: EMP_LFS

Foreign output – Y_t^f
Definition: Real gross domestic product.
Units: In millions of euro, chain-linked volumes, reference year 2000, seasonally adjusted.
Source: Eurostat: namq_gdp_k Code: B1GM

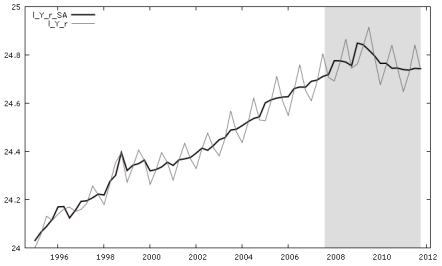
Foreign inflation – $\pi_t^{d,f}$
Definition: GDP price index.
Units: Index, 2000=100, seasonally adjusted.
Source: Eurostat: namq_gdp_p Code: B1GM, CPI00_NAC

Foreign interest rate – R_t^f
Definition: EA 3–month money market interest rate.
Units: In percent.
Source: Eurostat: irt_st_q Code: MAT_M03

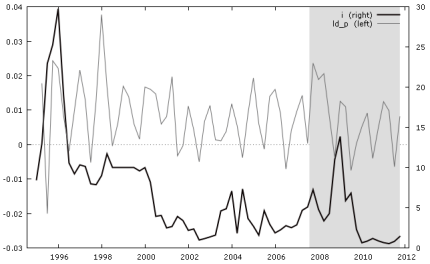
Appendix D. Macroeconomic and fiscal variables in Croatia (Chapter 2)

Figure D.1: *Macroeconomic variables in Croatia in the period 1995Q1-2011Q4: baseline model*

Panel A: Real GDP (original and seasonally adjusted), 2000=100 in logarithms



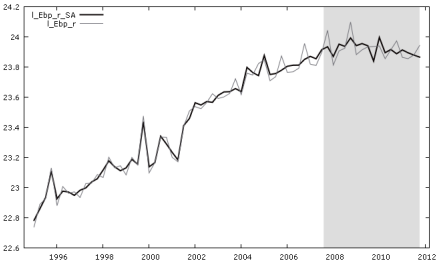
Panel B: CPI (2000=100, left scale) and short-term interest rate on the interbank deposit trading (right scale)



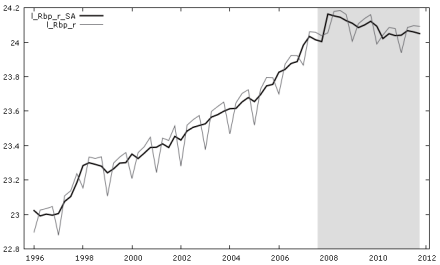
Note: X12 ARIMA seasonal adjustment; "shading" in the period 2007Q3-2011Q4 correspond to the global financial crisis;
Source: Croatian Bureau of Statistics, Croatian National Bank.

Figure D.2: *Fiscal variables in Croatia in the period 1995Q1-2011Q4: baseline model*

Panel A: Real consolidated central government expenditure (Ebp_r, original and seasonally adjusted), 2000=100 in logarithms



Panel B: Real consolidated central government taxes (Rbp_r, original and seasonally adjusted), 2000=100 in logarithms



Note: X12 ARIMA seasonal adjustment; "shading" in the period 2007Q3-2011Q4 correspond to the global financial crisis; fiscal variables values are according to the GFS 1986 methodology. Source: Ministry of finance.

Appendix E. Baseline model tests (Chapter 2)

This Appendix presents the ADF and Johansen cointegration test, as well as the lag length criteria and unit root circle.

Table E.1: *Augmented Dickey Fuller Test values (baseline model)*

Variable	*Deterministic component*	*test statistics*	*Lags* (*AIC*)	Variable	*Deterministic component*	*test statistics*	*Lags* (*AIC*)
LY_r	c, t	-1.8110	0	ΔLY_r	c, t	-9.4757^{***}	0
	c	-1.8825	1		c	-9.2081^{***}	0
$LEbp\_r$	c, t	-0.3815	2	$\Delta LEbp\_r$	c, t	-8.7127^{***}	1
	c	-1.3053	2		c	-8.4404^{***}	1
$LRbp\_r$	c, t	-1.1244	0	$\Delta LRbp\_r$	c, t	-7.9141^{***}	0
	c	-1.8792	0		c	-7.7397^{***}	0
Lp	c, t	-3.1001	4	$\Delta LRbp\_r$	c, t	-5.1666^{***}	3
	c	-1.4882	4		c	-4.0552^{***}	3
i	c, t	-4.1536^{***}	0	Δi	c, t	-6.8582^{***}	2
	c	-3.4415^{***}	0		c	-6.6657^{***}	0

Note: $Y_$r is real GDP, Ebp_r and Rbp_r correspond to consolidated central government expenditure and revenue as in Blanchard and Perotti (2002), while p and i are prices (CPI index) and interest rate (on interbank demand deposit trading on overnight credits) respectively; L is used to denote logarithms, while Δ refers to first differences; budget variables (Ebp_r and Rbp_r) and output (Y_r) are seasonally adjusted; constant included; maximum number of lags used is 12; optimal lag chosen according to Akaike Information Criterion (AIC); *** null hypothesis rejected on 1% level of significance; ** null hypothesis rejected on 5% level of significance; * null hypothesis rejected on 10% level of significance; test statistics' critical values according Davidson and MacKinnon (1993).
Source: Author's calculation.

Table E.2: *Johansen cointegration test (baseline model)*

r0	LR	p-value
0	150.53	0.0000
1	72.89	0.0003
2	38.07	0.0221
3	20.63	0.0428
4	4.57	0.3454

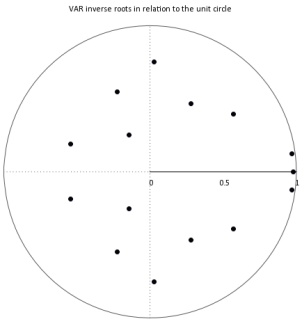
Source: Author's calculation.

Table E.3: *Lag length criteria (baseline model)*

lags	logL	AIC	BIC	HQC
1	418.72773	−12.79094	−11.5692*	−12.31305*
2	453.34255	−13.11141*	−11.01707	−12.29220
3	470.27845	−12.84261	−9.87562	−11.68206
4	485.95960	−12.53198	−8.69235	−11.03009

Source: Author's calculation.

Figure E.1: *Inverse Roots of AR Characteristic Polynomial*



Source: Author's calculation.

Table E.4: *Reduced form VAR diagnostics tests (baseline model)*

	test statistic	p-value		
Portmanteau test	259.960	0.1931		
Portmanteau test (adjusted)	286.571	0.1146		
Test for nonnormality				
Doornik and Hansen joint test	15.6251	0.1402		
Doornik and Hansen skewness only	7.2193	0.1348		
Doornik and Hansen kurtosis only	9.2533	0.0994		
Lütkepohl joint test	14.6921	0.1437		
Lütkepohl skewness only	6.7912	0.2366		
Lütkepohl kurtosis only	7.9008	0.1618		
Jarque-Bera test				
variable	test statistic	p-value (χ^2)	skeweness	kurtosis
u1	4.2109	0.1897	-0.4046	4.5417
u2	2.1679	0.3382	0.5187	3.2346
u3	0.8870	0.6418	-0.0255	2.3216
u4	3.3576	0.2295	0.6773	5.1477
u5	5.1041	0.0915	0.9824	3.4975
ARCH-LM test				
variable	test statistic	p-value (χ^2)	F statistic	p-value (F)
u1	7.8702	0.0965	2.4213	0.0656
u2	0.4660	0.9767	0.1178	0.9753
u3	1.1078	0.8930	0.2844	0.8862
u4	3.7205	0.4452	1.0205	0.4095
u5	2.5658	0.6329	0.6832	0.6081

Note: $u1$, $u2$, $u3$, $u4$ i $u5$ correspond to residuals in government spending, output, prices, net taxes and interest rates, respectively.
Source: Author's calculation.

Appendix F. Exogenous sub-elasticities

The exogenous elasticities of a budgetary item with respect to output, private consumption or private investment 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 private consumption or private investment, respectively. If the elasticity of a budgetary item is constructed as an average value of two or more sub-components' elasticities, then respective shares of the budgetary items under examination in the budget's volume are used as weights.

Table F.1: *Exogenous sub-elasticities with respect to real GDP and share of tax item in total taxes (baseline model)*

Budgetary item	Elasticity of budgetary item to "macrobase"	Elasticity of "macrobase" to real GDP	Elasticity of budgetary item w.r.t. real GDP	Share in total taxes
	$\alpha_{B_i}^{\tau_i}$	$\alpha_y^{B_i}$	$\alpha_{B_i}^{\tau_i}\alpha_y^{B_i}$	T_i/T
PIT	1.77	0.49	0.87	0.126
CIT	3.62	0.33	1.19	0.048
SSC	0.68	0.49	0.33	0.357
IndT	1.53	0.89	1.36	0.468

Note: PIT - Personal income tax; CIT - Corporate income tax; SSC - social security contributions; IndT - Indirect taxes. For details on respective "macrobases" (macroeconomic bases) see for instance Bouthevillain et al. (2001).
Source: Author's calculation.

Table F.2: *Exogenous sub-elasticities with respect to prices and share of tax item in total taxes (baseline model)*

Budgetary item	Elasticity of budgetary item to "macrobase"	Elasticity of "macrobase" to prices	Elasticity of budgetary item w.r.t. prices	Share in total taxes
	$\alpha_{B_i}^{\tau_i}$	$\alpha_\pi^{B_i}$	$\alpha_{B_i}^{\tau_i}\alpha_\pi^{B_i}$	T_i/T
PIT	1.77	-0.29	-0.51	0.126
CIT	3.62	-0.20	-0.72	0.048
SSC	0.68	-0.29	-0.20	0.357
IndT	1.53	1.24	1.90	0.468

Note: PIT - Personal income tax; CIT - Corporate income tax; SSC - social security contributions; IndT - Indirect taxes. For details on respective "macrobases" (macroeconomic bases) see for instance Bouthevillain et al. (2001).
Source: Author's calculation.

Table F.3: *Exogenous sub-elasticities with respect to private consumption and investment*

Budgetary item	Elasticity of "macrobase" to private consumption	Elasticity of "macrobase" to investment	Elasticity of budgetary item w.r.t. private consumption	Elasticity of budgetary item w.r.t. private investment
	$\alpha_C^{B_i}$	$\alpha_I^{B_i}$	$\alpha_{B_i}^{\tau_i}\alpha_C^{B_i}$	$\alpha_{B_i}^{\tau_i}\alpha_I^{B_i}$
PIT	0.21	0.27	0.37	0.48
CIT	0.14	0.19	0.51	0.69
SSC	0.21	0.27	0.14	0.18
IndT	-	0.46	1.53	0.70

Note: PIT - Personal income tax; CIT - Corporate income tax; SSC - social security contributions; IndT - Indirect taxes. For details on respective "macrobases" (macroeconomic bases) see for instance Bouthevillain et al. (2001).
Source: Author's calculation.

Appendix G. Alternative models from Chapter 4

SVAR approach

Alternative SVAR models represent a four variable VAR model extended for an output component y_t^i, i.e. private investment or private consumption, placed third in the system[1]. Having four endogenous variables in the system means 22 restrictions in order to have a the just-identified SVAR model:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ -\alpha_g^y & 1 & 0 & -\alpha_r^y \\ -\alpha_g^{y^i} & -\alpha_y^{y^i} & 1 & -\alpha_r^{y^i} \\ 0 & -0.92 & -\alpha_{y^i}{}^r & 1 \end{bmatrix} \times \begin{bmatrix} u_t^g \\ u_t^y \\ u_t^{y^i} \\ u_t^r \end{bmatrix} = \begin{bmatrix} \beta_g^g & 0 & 0 & \beta_r^g \\ 0 & \beta_y^y & 0 & 0 \\ 0 & 0 & \beta_{y^i}^{y^i} & 0 \\ \beta_g^r & 0 & 0 & \beta_r^r \end{bmatrix} \times \begin{bmatrix} v_t^g \\ v_t^y \\ v_t^{y^i} \\ v_t^r \end{bmatrix}. \quad \text{(G.1)}$$

Equation G.1 shows the matrix representation of an alternative SVAR model with 20 restrictions out of the total needed 22. One more restriction comes out from the tax shock equation, since, in order to be able to formulate cyclically adjusted taxes, there is need of another exogenous elasticity, i.e. the elasticity of taxes with respect to the GDP component in question ($\alpha_{y^i}^r$). Needed values of sub-components elasticities to construct the latter are shown in Appendix F.

The last restriction again comes out of the assumption whether government decides first on taxes or spending. Since the results proved to be robust in the baseline model under the assumption that spending come first in the Croatian case, all alternative models are in line with that choice and therefore again β_r^g.

For example, a just-identified SVAR model extended for private consumption, would be the following:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ -\alpha_g^y & 1 & 0 & -\alpha_r^y \\ -\alpha_g^{y^i} & -\alpha_y^{y^i} & 1 & -\alpha_r^{y^i} \\ 0 & -0.92 & -0.84 & 1 \end{bmatrix} \times \begin{bmatrix} u_t^g \\ u_t^y \\ u_t^{y^i} \\ u_t^r \end{bmatrix} = \begin{bmatrix} \beta_g^g & 0 & 0 & 0 \\ 0 & \beta_y^y & 0 & 0 \\ 0 & 0 & \beta_{y^i}^{y^i} & 0 \\ \beta_g^r & 0 & 0 & \beta_r^r \end{bmatrix} \times \begin{bmatrix} v_t^g \\ v_t^y \\ v_t^{y^i} \\ v_t^r \end{bmatrix}. \quad \text{(G.2)}$$

In case when under investigation are the effects of a particular sending component, like government expenditure for wages for instance, then the latter replaces the (total) government spending in the model ordered first.

[1] Recall Caldara and Kamps (2008) for a detailed insight into assumptions behind such ordering.

STVAR approach

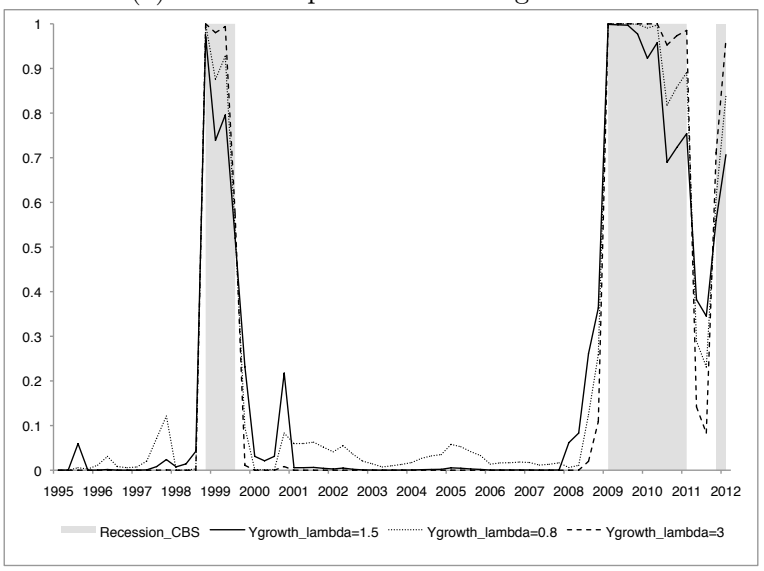
Alternative STVAR models represent a five variable model (since in the baseline specification in comparison with SVAR models there is already an extra variable, i.e. the unanticipated component of the fiscal instrument) extended again for an output component y_t^i. If we again consider the example of the extended model for private consumption, then the response of the latter after a government spending shock would be extending equation 4.24 from Chapter 4 in the following way:

$$\begin{aligned} y_{t+h} = & \left(1 - F\left(z_t\right)\right) \Theta_{E,h} F E_t^g + F\left(z_t\right) \Theta_{R,h} F E_t^g \\ & + \left(1 - F\left(z_t\right)\right) \Phi_{E,h}\left(L\right) g_{t-1} + F\left(z_t\right) \Phi_{R,h}\left(L\right) g_{t-1} \\ & + \left(1 - F\left(z_t\right)\right) \Psi_{E,h}\left(L\right) y_{t-1} + F\left(z_t\right) \Psi_{R,h}\left(L\right) y_{t-1} \\ & + \left(1 - F\left(z_t\right)\right)_{E,h}\left(L\right) c_{t-1} + F\left(z_t\right)_{R,h}\left(L\right) c_{t-1} \\ & + \left(1 - F\left(z_t\right)\right) \Pi_{E,h}\left(L\right) r_{t-1} + F\left(z_t\right) \Pi_{R,h}\left(L\right) r_{t-1} + u_t \end{aligned} \tag{G.3}$$

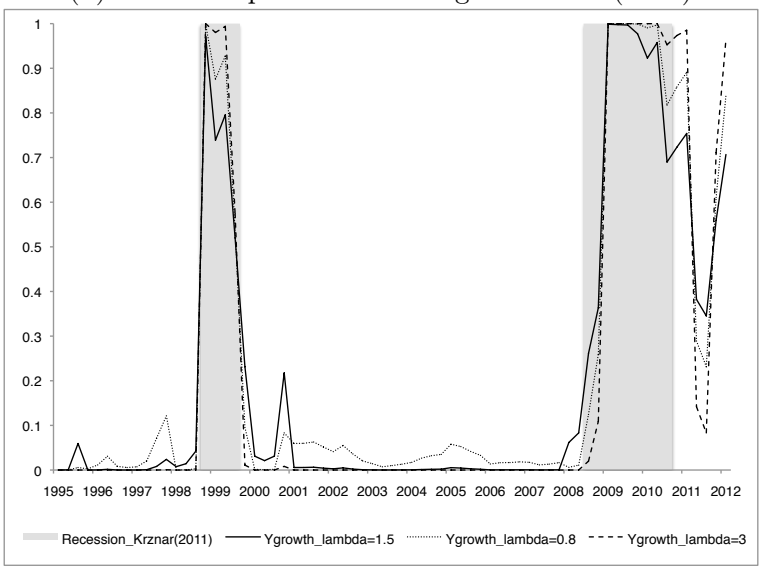
Appendix H. Smooth transition function

Figure H.1: *Smooth transition function $F(z_t)$ with different values for λ*

(a) Recession periods according to CBS



(b) Recession periods according to Krznar (2011)

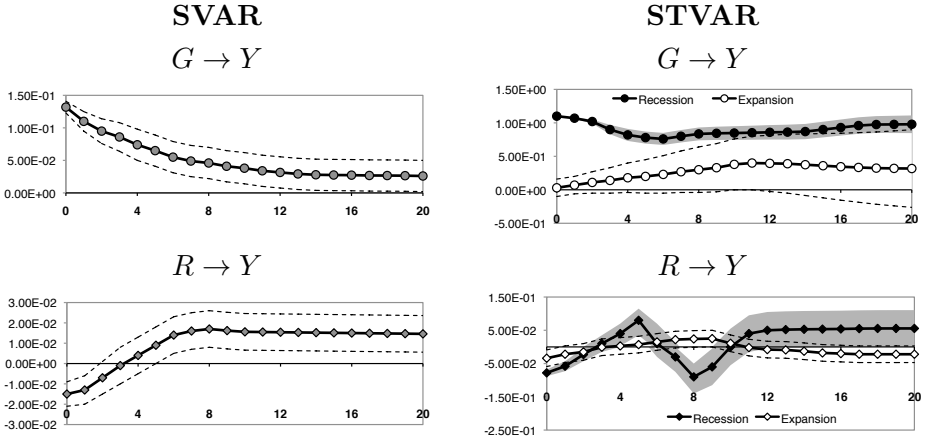


Note: On both figures the grey surface corresponds to recession periods. However, in panel (a) these periods correspond to occurrence of two or more consecutive periods (quarters) of negative real GDP, while panel (b) shows recession periods as identified in Krznar (2011). It is important to point out that in the latter case the last observation used in the estimation was 2010Q4.

Source: Author's estimation.

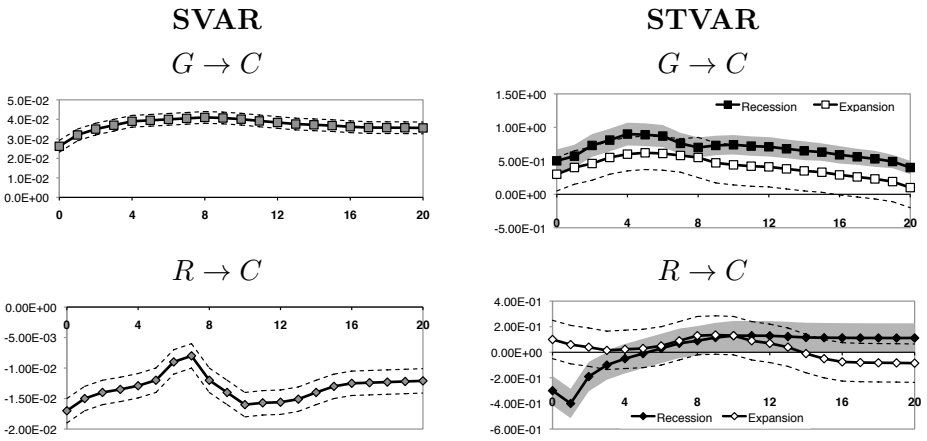
Appendix I. Impulse response functions (Chapter 4)

Figure I.1: *Impulse responses of output after a spending and tax shock*



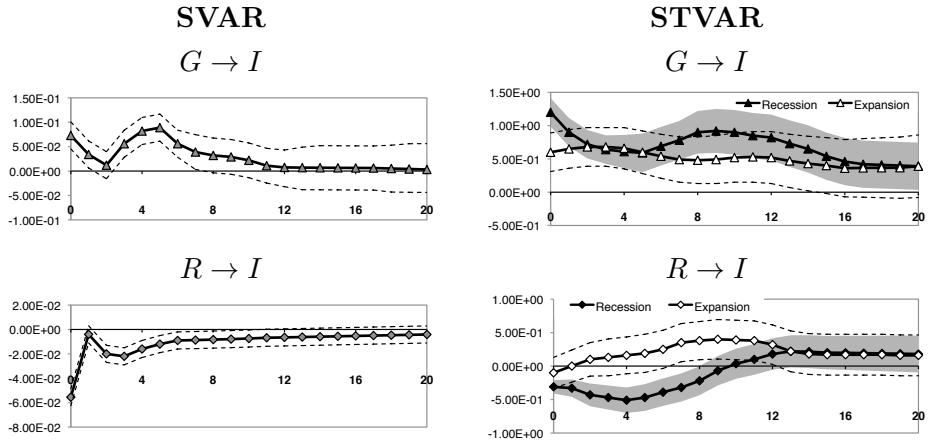
Note: SVAR panels - dashed lines show 95% confidence intervals. STVAR panels - grey shadow area shows 95% confidence intervals in case of recession IRF, while dashed lines the same in case of expansion IRF.
Source: Author's calculations.

Figure I.2: *Impulse responses of private consumption after a spending and tax shock*



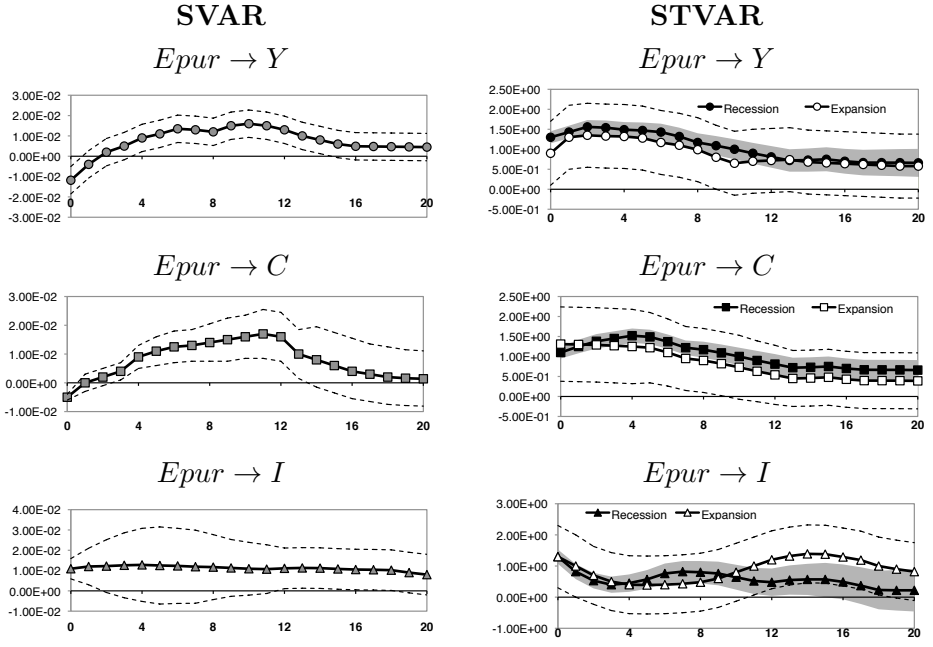
Note: SVAR panels - dashed lines show 95% confidence intervals. STVAR panels - grey shadow area shows 95% confidence intervals in case of recession IRF, while dashed lines the same in case of expansion IRF.
Source: Author's calculations.

Figure I.3: *Impulse responses of private investment after a spending and tax shock*



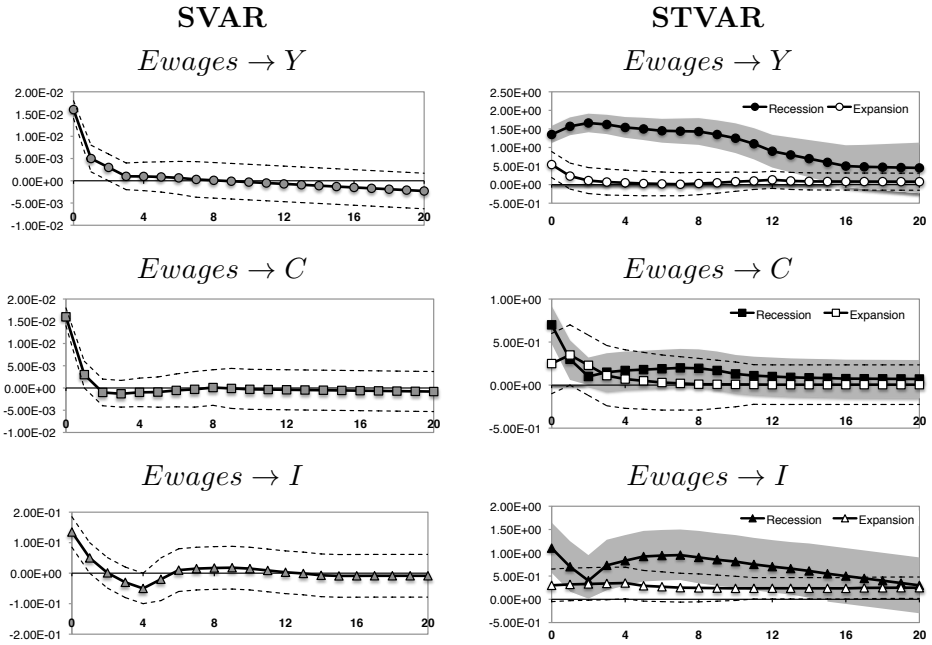
Note: SVAR panels - dashed lines show 95% confidence intervals. STVAR panels - grey shadow area shows 95% confidence intervals in case of recession IRF, while dashed lines the same in case of expansion IRF.
Source: Author's calculations.

Figure I.4: *Impulse responses of output, private consumption and private investment, after a shock in government spending for purchases of goods and services*



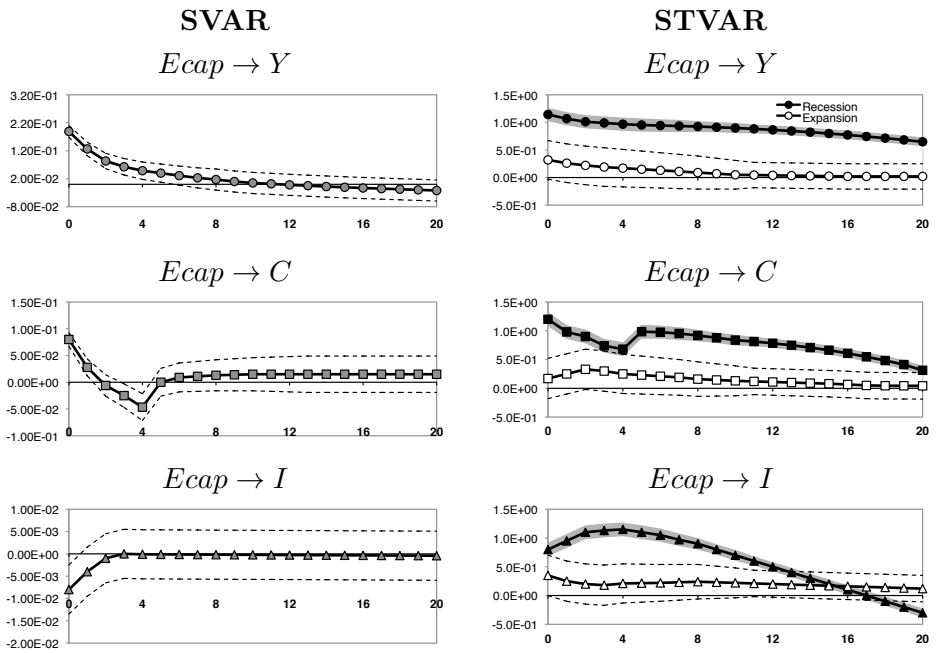
Note: SVAR panels - dashed lines show 95% confidence intervals. STVAR panels - grey shadow area shows 95% confidence intervals in case of recession IRF, while dashed lines the same in case of expansion IRF.
Source: Author's calculations.

Figure I.5: *Impulse responses of output, private consumption and private investment, after a shock in government spending for wages*



Note: SVAR panels - dashed lines show 95% confidence intervals. STVAR panels - grey shadow area shows 95% confidence intervals in case of recession IRF, while dashed lines the same in case of expansion IRF.
Source: Author's calculations.

Figure I.6: *Impulse responses of output, private consumption and private investment, after a shock in capital government spending*



Note: SVAR panels - dashed lines show 95% confidence intervals. STVAR panels - grey shadow area shows 95% confidence intervals in case of recession IRF, while dashed lines the same in case of expansion IRF.
Source: Author's calculations.

Appendix J. Data in detail (Chapter 5)

Our set of observables include the following vector of Austrian data

$$\tilde{Y}_t = [\Delta \ln Y_t \ \Delta \ln C_t \ \Delta \ln G_t \ \Delta \ln I_t \ \Delta \ln X_t \ \Delta \ln M_t \ \ln x_t \ \Delta \ln W_t \ \Delta \ln \pi_t^d \ R_t \ \ln E_t]' \quad \text{(J.1)}$$

and the following vector of foreign data

$$\tilde{Y}_t^f = [\Delta \ln Y_t^f \quad \Delta \ln \pi_t^{d,f} \quad R_t^f]'. \quad \text{(J.2)}$$

As shown, the complete dataset includes fourteen variables, i.e. GDP (Y_t), private consumption (C_t), government consumption (G_t), investment (I_t), exports (X_t), imports (M_t), real exchange rate (x_t), wages (W_t), the GDP deflator (π_t^d), the short run interest rate (R_t) and employment (E_t) for Austrian data, plus the Euro area GDP (Y_t^f) as foreign output , Euro area GDP deflator ($\pi_t^{d,f}$) as foreign inflation and the Euro area 3˘month money market rate (R_t^f) as foreign interest rates. All variables are retrieved from the Eurostat and explained in detail in Section **??** of Appendix C.

Appendix K. Summary in Slovenian language / Daljši povzetek disertacije v slovenskem jeziku

Učinkovitost stabilizacijskih inštrumentov fiskalne politike se vedno pojmuje z nekoliko skepticizma. Auerbach (2012) je poudaril, da takšno nezaupanje izhaja iz štirih glavnih vzrokov: (i) fiskalna politika lahko deluje prek avtomatskih stabilizatorjev, oziroma tudi brez neposredne intervence države, (ii) kratkoročna diskrecijska fiskalna politika "boleha" za celo vrsto t.i. časovnih zamikov, ki nastanejo od trenutka uvajanja fiskalnega inštrumenta do upoštevanja in izvajanje le-tega, (iii) učinkovitost fiskalne politike se lahko zmanjša zaradi negotovosti iz gospodarskega okolja, ki niso znane ob sprejemanju le-te (Brainard, 1967) ter (iv) stabilizirajoči učinek je lahko ogrožen s pričakovanji in ukrepi finančnih agentov, ki skrbno spremljajo proces sprejemanja odlokov vlade (Lucas, 1976).

Zaradi teh razlogov je v XX. stoletju pomen uporabe fiskalne politike rasel in upadal. Smithies (1946) e poudaril da je fiskalna politika v 30-ih letih XX stoletja bila pravzaprav "stvar slučajnosti". Tri desetletja pozneje, v zgodnjih 60-tih, se je pravzaprav vse vrtelo okrog fiskalne politike, medtem ko je denarna politika padla v drugi plan (Blinder, 2006, str. 25). Blinder poudarja da se v omenjenem obdobju denarna politika ni smatrala za pretirano uspešno v stabiliziranju poslovnih ciklov. Solow (2002, str. 1) štiri desetletja pozneje poudarja, da vsi makroekonomski postopki zahtevajo obstoj enega in edinega cilja ekonomske politike, ki je dodeljen denarni politiki. Gre za cilj kontrole inflacije, vendar Solow ob tem poudarja, da je svojčas "resna obravnava fiskalne politike skorajda izginila". Čeprav danes pravladuje stališče, da interakcija denarne in fiskalne politike vodi k stabilizaciji gospodarstva, se povečanje pomena fiskalne politike v glavnem beleži med (hudimi) ekonomskimi krizami, kar je potrjeno tudi med zadnjo globalno finančno krizo.

a disertacija je zbirka štirih esejev s področja fiskalne politike. Poglavitni cilj disertacije je razširiti obstoječe empirične raziskave na področju avtomatskih stabilizatorjev ter diskrecijskih ukrepov na primeru majhnega tranzicijskega gospodarstva, kot je Hrvaška, ter preučiti učinke fiskalne politike v takšnem gospodarstvu med "normalnimi", "dobrimi" in "kriznimi" ekonomskimi obdobji. Poleg tega disertacija daja vpogled v fiskalno politiko skozi okvir Pakta o stabilnosti in rasti (engl. Stability and Growth Pact) Evropske denarne unije ter fiskalnih pravil, ki jih le-ta nalaga, in ob tem raziskuje primernost in učinkovitost takšnega ekonomskega okvira, oziroma njegovo učinkovitost v uresničitvi in vzdrževanju stabilne fiskalne politike posameznih članic.

DISKRECIJSKI UKREPI IN AVTOMATSKI STABILIZATORJI HRVAŠKE FISKALNE POLITIKE

Stabilizacija poslovnega cikla s fiskalno politiko zajema uporabo avtomatskih stabilizatorjev in diskrecijskih ukrepov. Evropska Komisija poudarja, da naj bi se pri omejujočem strukturnem (ciklično-prilagojenem) proračunskem saldu fiskalna politika izvajala z uporabo avtomatskih stabilizatorjev, medtem ko bi se diskrecijski ukrepi uporabljali v izrednih situacijah (Buti and van den Noord, 2004).

Cilj te naloge je ugotavljanje strukturnega proračunskega salda skladno z uradno metodologijo Evropske Komisije, ki se upošteva ob nadzoru fiskalne politike v okviru programa konvergence. S tem v zvezi je cilj priti do odgovorov na naslednja vprašanja:

1. Ali se ciklično-prilagojeni proračunski saldo Republike Hrvaške nahaja znotraj dovoljenih 0,5% BDP-ja definiranih v Paktu o stabilnosti in rasti? Ali neupoštevanje tega pravila avtomatično pomeni tudi neupoštevanje Maastrichtskega fiskalnega pravila za proračunski deficit?
2. Kakšna je velikost in vloga avtomatskih stabilizatorjev na Hrvaškem?
3. Ali je hrvaška fiskalna politika bolj prociklična ali anticiklična?

Kot je že navedeno, diverzifikacija fiskalne politike na avtomatske stabilizatorje in diskrecijske ukrepe je izvedena z uporabo uradne metodologiji Evropske komisije. Avtomatski stabilizatorji so odraz gibanja ciklične komponente proračunskega salda, medtem ko so diskrecijski ukrepi rezultat strukturnega (ali ciklično-prilagojenega) proračunskega salda. Takšna razčlemba proračunskega salda je možna v treh korakih. Prvi korak zajema oceno potencialnega outputa (BDP), oziroma presojo tiste ravni proizvodnje, do katere bi prišlo, če bi se izločil vpliv poslovnih ciklov. Drugi korak upošteva oceno proizvodne vrzeli (oziroma razliko med dejanskim in potencialnim outputom) ter elastičnost posameznih davkov in prispevkov za nezaposlene pri presoji skupne proračunske občutljivosti, oziroma pri evalvaciji gibanja prihodkovnih in odhodkovnih kategorij v primeru zaprte proizvodne vrzeli. Zmnožek skupne proračunske občutljivosti in proizvidne vrzeli tvori ciklični saldo proračuna. Takšno "ciklično prilagajanje" proračunskih komponent je zelo pomembno glede na to, da ima proračunski saldo tendenco slabšanja (izboljšanja) v obdobjih recesije (ekspanzije). Tretji korak zajema oceno ciklično-prilagojenega proračunskega salda kot razliko med dejanskim proračunskim saldom in precenjenim cikličnim proračunskim saldom.

V tem delu empirična analiza temelji na kvartalnih podatkih za obdobje od 1995Q1 do 2009Q4. Fiskalne kategorije se nanašajo na konsolidirani proračun osrednje države po GFS metodologiji iz 1986.

Ocena potencialnega BDP-ja je izvedena s Hodrick-Prescottovim statističnim filtrom z uporabljenim parametrom λ v višini 480 skladno s priporočilom Bouthevillain et al.

(2001). Rezultati kažejo, da je v navedenem obdobju Republika Hrvaška trikrat dosegla pozitiven razkorak outputa, oziroma v obdobju od 1997 do 1998, zatem od leta 2002 in 2003 ter pred začetkom globalne finančne krize v obdobju od 2007 do 2008. leta. Če se ob navedenem upošteva realna stopnja rasti BDP-ja, je možno sklepati, da je v obdobju od 1995 do 2009 Hrvaška dvakrat bila v fazi globoke recesije in dvakrat v fazi močne ekspanzije.

Elastičnosti posameznih proračunskih komponent kažejo da je elastičnost davka na dohodke na Hrvaškem pomembno nižja od tiste v državah OECD-ja ali v državah EMU, najbolj zaradi nižje progresivnosti davka na dohodek ter nizke dohodovne elastičnosti zaposlenosti. Elastičnost ostalih proračunskih komponent (davka na dobiček, socialnih prispevkov, indirektnih davkov ter prispevkov za nezaposlene) je podobna povprečju leteh v državah OECD in EMU, dobljena skupna proračunska občutljivost pa znaša 0,36%, kar je nižje od povprečja OECD in EM prav zaradi pomembno nižje elastičnosti davka na dohodke.

Navedeno pomeni, da vloga avtomatskih stabilizatorjev na Hrvaškem ni prav velika, in sicer ne samo zaradi relativno nizkih elastičnosti posameznih davkov, temveč tudi zaradi njihovega relativno nizkega deleža v BDP-ju, kar zmanjšuje variacijo prihodkovne strani proračuna po šokih povpraševanja.

Po vpogledu v ciklično-prilagojen (ali strukturni) proračunski saldo, je možno sklepati, da je le-ta na Hrvaškem v analiziranem obdobju v povprečju v primankljaju, in sicer povprečno 1,7% BDP letno. Sprememba tega indikatorja iz obdobja v obdobje kaže značilnost fiskalne politike, oziroma pozitivna sprememba ciklično-prilagojenega proračunskega salda kaže restriktivno fiskalno politiko, medtem ko je negativna sprememba odraz ekspanzivne fiskalne politike. Na primer, anticiklična (stabilizirajoča) fiskalna politika se udejani kadar v primeru negativne proizvidne vrzeli država izvaja ekspanzivno fiskalno politiko, ali kadar v primeru pozitivne proizvodne vrzeli izvaja restriktivne ukrepe. V kontekstu navedenega je moč sklepati, da je bila fiskalna politika na Hrvaškem stabilizirajoča, oziroma primerna v samo petih od skupaj petnajstih obravnavanih obdobij, medtem ko je bila v osmih primerih celo bila prociklična, oziroma destabilizirajoča v svojem delovanju.

Če se primer Hrvaške pretehta v kontekstu dveh temeljnih fiskalnih pravil Evropske unije, oziroma v kontekstu strukturnega proračunskega deficita, ki ne sme biti višji od 0,5% BDP ter dejanskega proračunskega deficita, ki ne sme presegati 3% BDP, se lahko sklepa, da z ene strani Hrvaška ni izpolnila slednjega v dveh primerih: leta 2000 in 2009, ko je proračunski deficit presegal 3% BDP, medtem ko je prekoračitev v z vidika strukturnega primankljaja razvidna v skoraj vseh obdobjih (izjeme so leta 1995, 1996 ter 1998). Upoštevajoč dejstvo, da je fiskalno pravilo iz Pakta o stabilnosti in rasti uvedeno s ciljem, da bi se dejanska raven proračunskega primankljaja obdržala znotraj Maastrichtske meje, navedeni rezultati kažejo na potencialne probleme fiskalnega okvira

E(M)U-ja, glede na to, da ni dokazano, da neupoštevanje meje strukturnega deficita ne implicira avtomatično neupoštevanje postavljene meje dejanskega deficita.

EMPIRIČNA OCENA STABILIZACIJSKIH UČINKOV FISKALNE POLITIKE NA HRVAŠKEM

To poglavje bolj podrobno ocenjuje vlogo in moč diskrecijskih ukrepov fiskalne politike na Hrvaškem z vidika glavnih makroekonomskih spremenljivk z glavnim ciljem definiranja "vzorcev" stabilizacijskih učinkov. Cilj tega poglavja je, med ostalim, dati odgovore na naslednja vprašanja:

1. Ali hrvaško gospodarstvo deluje ustrezno Keynezijanskim predpostavkam s vidika stabilizacije BDP?
2. Ali se potrošniki na Hrvaškem glede na giabnje zasebne potrošnej lahko opredeljujejo poglavitno kot Ricardijanski ali kot ne-Ricardijanski?
3. Ali so javni odhodki učinkovitejši od davkov pri spodbujanju zasebnih naložb?
4. Ali obstaja povezava med diskrecijsko fiskalno politiko in učinki na trgu dela?

Empirična analiza vplivov fiskalne politike na makroekonomsko okolje temelji na strukturnem vektorskem avtoregresivnem modelu (angl. Structural vector autoregression, SVAR) in sicer na tistem, ki sta ga predlagala Blanchard in Perotti leta 2002. Takšen model je najpogostejši med empiričnimi deli, ki obravnavajo to tematiko. Ta metoda je bila izbrana, da bi rezultati analize primerljvi z rezultati iz drugih držav.

Blanchard in Perotti (2002) trdita, da nosilci fiskalne politike nimajo možnosti odgovoriti s fiskalnimi inštrumenti v tekočem kvartalu, v katerem se zaznajo spremembe v makroekonomskem okolju, ker takšne odločitve vključujejo več odločevalcev in korakov, in je zato nosilcem fiskalne politike potrebno daljše obdobje za uvajanje potrebnih ukrepov (zaradi že navedenih fiskalnih časovnih odmikov).

Analiza uporablja kvartalne podatke za obdobje 1996Q1 - 2011Q4. Osnovni model zajema BDP (Y_t), javne odhodke (G_t), javne prihodke (Rbp_t), inflacijo (π_t) ter obrestne mero (r_t). Do strukturnega Blanchard in Perotti VAR modela pridemo začenši z reduciranim VAR-om, ki se ga lahko zapiše kot:

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

kjer je Y_t vektor predhodno navedenih endogenih spremenljivk, *C(L)* matrika polinomov avtoregresivnih odlogov, U_t pa vektor ostankov reducirane oblike modela. Perotti (2005) poudarja, da se ostanki fiskalnih spremenljivk U lahko obravnavajo kot linearna kombinacija treh strukturnih šokov[1] in s ciljem identifikacije tistega šoka, ki nas zanima, je

[1] To so (1) samodejno delovanje fiskalnih spremenljivk kot reakcija na spremembe v BDP-ju, nivoju cen in obresti, (2) sistemski diskrecijski ukrepi nosilcev ekoonomske politike kot reakcija na spremembe istih makroekonomskih spremenljivk, ter (3) slučajni diskrecijski šoki fiskalne politike

potrebno navedeni VAR model "strukturirati", oziroma opredeliti povezavo med strukturnimi šoki in reziduali reduciranega modela. Navedena linearna kombinacija implicira naslednje:

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

kjer so U_t ostanki reduciranega modela, V_t strukturni šoki, matrike A in B pa opisujejo njihove medsebojne povezave. Če se enačba K.1 pomnoži z matriko A ter izkoristi enakost prikazana v enačbi K.2, tedaj strukturni VAR izgleda kot sledi:

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

Da bi se navedeni sistem lahko ocenil, je potrebno vnesti 35 omejitev, med katerimi so najvažnejše tiste, ki pojasnjujejo povezave med fiskalnimi spremenljivkami. Če se upoštevajo enačbe ostankov fiskalnih spremenljivk reduciranega modela, se lahko zapiše kot sledi:

$$u_t^g = \alpha_y^g u_t^y + \alpha_\pi^g u_t^\pi + \alpha_i^g u_t^i + \beta_r^g v_t^r + v_t^g \tag{K.4}$$

$$u_t^r = \alpha_y^r u_t^y + \alpha_\pi^r u_t^\pi + \alpha_i^r u_t^i + \beta_g^r v_t^g + v_t^r \tag{K.5}$$

kjer v_t^g in v_t^r predstavljata strukturne šoke javnih odhodkov in javnih prihodkov. Koeficienti α prikazujejo samodejne reakcije makroekonomskih spremenljivk na spremembe v fiskalnih spremenljivkah, medtem ko koeficienti β opredeljujejo, kako strukturni šok v javnih odhodkih vpliva na javne prihodke, in obratno, kako strukturni šok v javnih prihodkih vpliva na javne odhodke. Z namenom da bi se pravilno ocenili ostanki reduciranega modela, so uporabljene eksogeno determinirane elastičnosti javnih prihodkov na proizvod in cene. Glede na navedno osnovni SVAR izgleda takole:

$$\begin{bmatrix} 1 & 0 & 0.5 & 0 & 0 \\ -\alpha_g^y & 1 & 0 & -\alpha_r^y & 0 \\ -\alpha_g^\pi & -\alpha_y^\pi & 1 & -\alpha_r^\pi & 0 \\ 0 & -0.92 & -0.73 & 1 & 0 \\ -\alpha_g^i & -\alpha_y^i & -\alpha_\pi^i & -\alpha_r^i & 1 \end{bmatrix} \times \begin{bmatrix} u_t^g \\ u_t^y \\ u_t^\pi \\ u_t^r \\ u_t^i \end{bmatrix} = \begin{bmatrix} \beta_g^g & 0 & 0 & 0 & 0 \\ 0 & \beta_y^y & 0 & 0 & 0 \\ 0 & 0 & \beta_\pi^\pi & 0 & 0 \\ \beta_g^r & 0 & 0 & \beta_r^r & 0 \\ 0 & 0 & 0 & 0 & \beta_i^i \end{bmatrix} \times \begin{bmatrix} v_t^g \\ v_t^y \\ v_t^\pi \\ v_t^r \\ v_t^i \end{bmatrix} \tag{K.6}$$

Rezultati kažejo, da BDP reagira pozitivno in statistično značilno na dolgi rok na povišanje javnih odhodkov, kar je v skladu s Keynezijanskim predpostavkami. Fiskalni multiplikator v navedenem slučaju znaša 2.45 v prvem letu, znotraj štirih let pa 1,33. V primeru, košok izhaja iz povečanja davkov, je odziv BDP prav tako značilen, vendar negativen, kar pomeni, da zaradi povišanja davčne obremenitve na Hrvaškem gospodarska aktivnost pada. Fiskalni multiplikator je v tem primeru ravno tako večji od 2 v prvem letu (-2,35), medtem ko v seštevku po štirih letih znaša nekaj manj od 1 (-0,81).

V primeru analize učinka fiskalne spremenljivke na osebno potrošnjo ali zasebne naložbe, je navedeni model razširjen na šest spremenljivk. Rezultati kažejo nekaj pomembnih dejstev: 1) rast javnih odhodkov pozitivno vpliva in na osebno potrošnjo in na zasebne naložbe, vendar je vpliv na osebno potrošnjo statistično pomembnejši; (2) rast davkov povzroči upad tako osebne potrošnje kot tudi zasebnih naložb, toda vpliv na osebno potrošnjo je veliko bolj pomemben.

Če se odhodki razdleijo na tekoče in kapitalske, davki pa na direktne in indirektne lahko ugotovimo, da: (1) tekoča javna potrošnja pomembno vpliva na osebno potrošnjo, nima pa značilnega vpliva na dinamiko zasebnih naložb, medtem ko rast kapitalske javne potrošnje vodi k rasti zasebnih naložb; (2) povečanje indirektnih davkov vodi k zmanjšanju tako zasebne potrošnje kot tudi zasebnih naložb, toda učinek na slednje je nominalno veliko večji, medtem ko povišanje direktnih davkov na Hrvaškem ne vpliva statistično zanačilno niti na gibanje osebne potrošnje niti na gibanje zasebnih naložb.

POTENCIAL FISKALNIH MULTIPLIKATORJEV NA HRVAŠKEM

Med zadnjo ekonomsko krizo je večina držav posegla po diskrecijskih ukrepih oziroma t.i. paketih fiskalnih stimulusov s ciljem spodbujanja gospodarske rasti. Da bi se učinki diskrecijske politike primerno ocenili in ovrednotili, je potrebno fiskalne multiplikatorje razlikovati glede na fazo poslovnega cikla, v katerem se gospodarstvo nahaja. To pomeni potrebo razločevanja fiskalnih multiplikatorjev v obdobjih ekspanzije in recesije. Empirična raziskovanja kažejo, da so diskrecijski ukrepi znatno učinkovitejše in pomembnejše v času ekonomske krize (Auerbach and Gorodnichenko, 2011; Ilzetzki et al., 2010; Batini et al., 2012, med ostalimi). Osrednji cilj tega poglavja je raziskati ali navedeni sklepi veljajo tudi v primeru hrvaškega gospodarstva, oziroma na primeru majhne odprte države v razvoju. V poglavju se želi priti do odgovorov na naslednja glavna vprašanja:

1. Ali so multiplikatorji javnih odhodkov in davkov višji v fazi recesije ?
2. Ali so tekoči ali kapitalski odhodki učinkovitejši v stimuliranju BDP-ja, osebne potrošnje in zasebnih naložb?
3. Ali javni odhodki za plače lahko pomembno stimulirajo proizvid in osebno potrošnjo?

Kot navedeno, to poglavje analizira fiskalne multiplikatorje na Hrvaškem v fazah recesije in ekspanzije, vendar da bi se le-ti lahko primerjali s tistimi v "normalnih" časih, sta uporabljeni dve metodologiji. Prvič, linearni multiplikatorji, oziroma tisti, ki so dobljeni brez upoštevanja faze poslovnega cikla oz. tisti, ki so dobljeni po isti metodologiji, ki je uporabljena tudi v drugem poglavju disertacije (Blanchard in Perotti (2002) metoda strukturnega vektorskega avtoregresivnega modela). Drugič, nelinearni multiplikatorji, oziroma tisti, ki ločijo učinek fiskalnih diskrecijskih ukrepov, upoštevajoč pri tem fazo poslovnega cikla, v katerem se gospodarstvo nahaja, in so dobljeni z uporabo vektorskega

avtoregresivnega modela z gladkim prehodom (angl. Smooth transition vector autoregression, STVAR), ki ga predlagata Auerbach in Gorodnichenko 2011.

Obravnavano obdobje vključuje, kot tudi v drugem delu te disertacije, kvartalne podatke od 1996Q1 do 2011Q4. Zaradi primerljivosti rezultatov je obdobje preučevanja enako, kot v predhodnem poglavju. Računska zahtevnost ocenjevanja STVAR modela ob omejitvi količine podatkov narekuje uporabo relativno enostavnega modela. Zato so v osnovni STVAR model tega poglavja vključene le tri spremenljivke: BDP, javni prihodki in javni odhodki. Enako velja za linearni SVAR model.

Blanchard in Perotti SVAR model iz tega dela z vključenimi omejitvami izgleda takole:

$$\begin{bmatrix} 1 & 0 & 0 \\ -\alpha_g^y & 1 & -\alpha_r^y \\ 0 & -0.92 & 1 \end{bmatrix} \times \begin{bmatrix} u_t^g \\ u_t^y \\ u_t^r \end{bmatrix} = \begin{bmatrix} \beta_g^g & 0 & 0 \\ 0 & \beta_y^y & 0 \\ \beta_g^r & 0 & \beta_r^r \end{bmatrix} \times \begin{bmatrix} v_t^g \\ v_t^y \\ v_t^r \end{bmatrix} \tag{K.7}$$

Auerbach in Gorodnichenko 2011 sta razširila Blanchard in Perottijev SVAR model tako, da sta dovolila diverzifikacijo ocene fiskalnih multiplikatorjev v fazah recesije in ekspanzije, kjer se prehod med navedenimi fazami odvija "gladko".

Po Auerbachu in Gorodnichenku 2011 bazni STVAR model izgleda takole:

$$X_t = (1 - F(z_{t-1}))\,\Pi_E(L)\,X_{t-1} + F(z_{t-1})\,\Pi_R(L)\,X_{t-1} + u_t \tag{K.8}$$

kjer so

$$u_t \sim (0, \Omega) \tag{K.9}$$

$$\Omega_t = \Omega_E(1 - F(z_{t-1})) + \Omega_R F(z_{t-1}) \tag{K.10}$$

$$F(z_t) = \frac{exp(-\lambda z_t)}{1 + exp(-\lambda z_t)}, \quad \lambda \geq 0, \tag{K.11}$$

$$var(z_t) = 1, \quad E(z_t) = 0 \tag{K.12}$$

kjer je X_t vektor endogenih spremenljivk (in sicer javnih odhodkov G_t, BDP-ja Y_t in javnih prihodkov R_t), u_t reziduali, z_t pa indikator faze gospodarskega cikla gospodarstva, tj. indeks poslovnega cikla normaliziran na varianco enote tako, da λ ostane invariantna na enoto mere. Pozitivna vrednost spremenljivke z označuje fazo ekspanzije, negativna pa fazo recesije. Matriki Π_i in Ω_i (kjer je $i = R$ za fazo recesije, $i = E$ pa za fazo ekspanzije) označujeta koeficiente ter variančno-kovariančno matrikorezidualov v dveh režimih tako, da je gospodarstvo v globoki recesiji, ko je $F(z_t) \approx 1$, oziroma v močni ekspanziji, ko je $1 - F(z_t) \approx 1$. Ponderji dodeljeni posameznem režimu, dobljeni s

funkcijo $F(\cdot)$, se gibajo v razponu od 0 do 1 odvisno od spremenljivke z_t. V tem delu je, kot tudi pri Auerbachu in Gorodnichenku (2010), parameter λ kalibriran na 1,5. Obenem je model razširjen tako, da je v vektor endogenih spremenljivk dodana spremenljivka t.i. nepričakovane komponente (FE) pripadajočega fiskalnega inštrumenta. Če je, na primer, v modelu analiziran vpliv skupnih odhodkov na gospodarsko aktivnost v fazah ekspanzije in recesije, tedaj omenjena nepričakovana komponenta zajema nepričakovanost v skupnih javnih odhodkih, oziroma razmerje med dejansko uresničenimi skupnimi javnimi odhodki v letu t in istimi načrtovanimi skupnimi javnimi odhodki v obdobju $t-1$, ko je bil sprejet proračun za leto t. Če se pa analizira vpliv javnih kapitalskih odhodkov, tedaj je nepričakovana komponenta le-teh predstavljena kot razmerje med uresničenimi javnimi kapitalskimi odhodki v letu t in načrtovanimi javnimi kapitalnimi odhodki v obdobju $t-1$, ko se je sprejemal proračun za leto t.

Ocenjevanje modela je potekalo z uporabo metode neposredne projekcije (Jorda, 2005). Pri tem se impulzni odzivi ocenjujejo tako, da se spremenljivka, ki nas zanima, projecira na lastne odloge in odloge ostalih spremenljivk iz modela, koeficient, ki priprada nepričakovani komponenti fiskalnega inštrumenta, pa meri vrednost impulznega odziva. Na primer, če se želi ugotoviti reakcija BDP-ja v obdobju h po diskecijskem šoku v javnih odhodkih v obdobju t, cenilka impulznih odzivov izgleda takole:

$$\begin{aligned} y_{t+h} = {} & (1-F(z_t))\,\Theta_{E,h} FE_t^g + F(z_t)\,\Theta_{R,h} FE_t^g \\ & + (1-F(z_t))\,\Phi_{E,h}(L)\,g_{t-1} + F(z_t)\,\Phi_{R,h}(L)\,g_{t-1} \\ & + (1-F(z_t))\,\Psi_{E,h}(L)\,y_{t-1} + F(z_t)\,\Psi_{R,h}(L)\,y_{t-1} \\ & + (1-F(z_t))\,\Pi_{E,h}(L)\,r_{t-1} + F(z_t)\,\Pi_{R,h}(L)\,r_{t-1} + u_t \end{aligned} \tag{K.13}$$

kjer je funkcija $F(\cdot)$ definirana z enačbo K.11, razpon ocen $h = 0, 1, ..., H$ pa odraža časovni razpon v prihodnosti, do katere želimo analizirati impulzni odziv. Nepričakovana komponenta javnih odhodkov FE predstavlja napako napovedi, zato se lahko vrednosti FE interpretirajo kot "nepričakovani šoki javnih odhodkov" (Auerbach in Grodnichenko, 2011, str.4).

Rezultati analize kažejo, da je fiskalna politika na Hrvaškem bistveno učinkovitejša v fazah recesije, oziroma takrat, ko je to najpomembneje.Fiskalni multiplikatorji so v fazah ekspanzije statistično večinoma neznačilni.. V fazah recesije je povprečni fiskalni multiplikator javnih odhodkov večji od 2 na dolgi rok, oziroma v obdobju daljšem od 5 let. To pomeni, da bi v času krize, če nosilci ekonomske politike reagirajo pravočasno, povišanje javnih odhodkov za eno kuno privedlo do povišanja BDP-ja za več kot dve kuni. Če se pa v istem obdobju uporabijo ukrepi povečanja davkov, negativen vpliv le-teh deluje v znatno manjši meri.

Glede na to, da v seštevku skupnih odhodkov vsaka kategorija omenjenih tvori poseben fiskalni inštrument, ta analiza zajema vpliv treh odhodkovnih kategorij na BDP, zasebno potrošnjo in zasebne naložbe. Analiza je pokazala, da imajo tekoči javni izdatki za nakup

materialnih dobrin in storitev v fazi recesije pomemben multiplikativen učinek tako na BDP kot tudi na osebno potrošnjo. Oziroma, ena kuna povečanja javnih izdatkov za nakup dobrin in storitev vodi v povečanje BDP in zasebne potrošnje za 3,89 oziroma 2,16 kun v okviru dveh let. Enako povišanje javnih izdatkov za plače v fazi recesije vodi do še večjega multiplikativnega učinka, ker povečuje BDP za 4,04, oziroma osebno potrošnjo za 2,22 kune. Z druge plati, kapitalski javni odhodki prav tako delujejo stimulativno, vendar je velikost njihovega učinka manjša v primerjavi s tekočimi javnimi odhodki. Ena kuna zvečanja kapitalskih javnih odhodkov bi v fazi recesije zvečala BDP za 2,50 kun oziroma osebno potrošnjo za 1,40 kun. Pomembno je poudariti, da zvečanje kapitalskih izdatkov tako v primeru linearnih kot nelinearnih fiskalnih multiplikatorjev povečuje zasebne naložbe, kar vodi do sklepa o neobstoju učinka izrinjanja zasebnega trošenja na Hrvaškem. Enak rezultat se je pokazal tudi v analizi iz drugega poglavja te disertacije.

CIKLIČNO-PRILAGOJENI PRORAČUNSKI SALDO - *MODROOKI* KAZALEC

Ciklično prilagojeni proračunski saldo je eden izmed temeljnih indikatorjev za države članice Evropske unije glede na to, da je nadzor njihovih fiskalnih politik odvisen predvsem od ocene tega indikatorja. Čeprav se je o pomanjklivostih ciklično prilagojenega proračunskega salda obširno obravnavalo tako s teoretičnega kot tudi z empiričnega vidika, je njegova glavna prednost, da kaže dejanski trud nosilcev fiskalne politike k uravnoteženju proračuna ter vzdrževanju "zdravja" javnih financ.

Kot je navedeno v prvem delu te disertacije, se ciklično-prilagojeni proračunski saldo določa s pomočjo ocene potencialnega BDP ter ocene skupne proračunske občutljivosti na poslovnih cikel, zato leži prav v teh dveh količinah največ pomankljivosti. Po eni strani, potencialni BDP ni merljiv ter je njegova ocena izredno občutljiva na upobljeno metodologijo. Obene so vse ocene podvržene napaki. Po drugi strani skupna proračunska občutljivost (elastičnost), razen tega da je konstantna v času, zahteva tudi oceno vrste enačb, ki v večini primerov neustrerno rešujejo problem endogenosti fiskalnih spremenljivk.

Glavni cilj tega poglavja je analiza uporabnosti ciklično-prilagojenega proračunskega salda ter fiskalnega pravila o strukturnem deficitu iz Pakta o stabilnosti in rasti. Da bi navedeni cilj bil dosežen na kar se da objektiven način, analita ne temelji na podatkih o hrvaškem, temveč o avstrijskem gospodarstvu. Glede na vrsto problemov značilnih za hrvaško fiskalno politiko, kot je dostopnost podatkov, nekonzistentne statistike, nestabilnost davkov in številne spremembe v vseh davčnih oblikah, bi to lahko pomembno vplivalo na rezultate analize. Zato se je analiza opravila na podlagi podatkov ene izmed fiskalno stabilnih držav, kot je to Avstrija[2].

Analiza skuša nuditi odgovore na naslednja vprašanja:

[2]V izboru fisklano stabilne države, so upoštevani naslednji kriteriji: (i) stabilnost davčnega sistema, (ii) fiskalna disciplina oziroma upoštevanje fiskalnih pravil iz Maastrichtske pogodbe, ter (iii) natančnost v projekciji gibanja (proračunskih) spremenljivk.

1. Ali je strukturni (ciklično-prilagojeni) proračunski saldo ovrednoten znotraj DSGE modela pomembno drugačen od ocenjenega z uradno metodologijo Evropske komisije?

2. Ali je značilnost fiskalne politike značilno različna, če ocene ne temeljijo na uradni metodologiji Evropske komisije?

3. Ali je 0,5% BDP-ja kot meja strukturnega deficita opredeljena v sklopu Pakta o stabilnosti in rasti dobro definirana, oziroma ali njeno upoštevanje avtomatično pomeni tudi upoštevanje Maastrichtskega fiskalnega pravila o deficitu?

4. Ali alternativni način ocenjevanja ciklično-prilagojenega proračunskega salda vodi k učinkovitejši fiskalni politiki? Ali vodi k boljšim makroekonomskim dosežkom v smislu gospodarske rasti, zaposlenosti ali inflacije?

Analiza temelji na simulacijski eksperiment. Uporabljen je ocenjeni DSGE model, oziroma dinamični stohastični model splošnega ravnotežja (angl. dynamic stohastic general equilibrium, DSGE), s katerim se lahko generira poljubno število naborov sintetičnih makroekonomskih spremenljivk. Uporaba ocenjenega DSGE modela za generiranje podatkov ima pomembno prednost, saj DSGE model vsebuje strukturne enačbe javnih odhodkov, ki direktno kažejo diskrecijske spremembe v državni potrošnji.

Ocenjeni DSGE model izhaja iz Adolfson et al. (2007), v katerem je trendni proizvod gospodarstva definiran kot proces s trajnimi tehnološkimi šoki. Preostalih 16 šokov, ki so v modelu prisotni, povzročajo le ciklična gibanja okoli stohastičnega trenda. Na ta način model dovoljuje neposredno razčlembo med potencialnimi in cikličnimi nivoji makroekonomskih spremenljivk.

Na modelu iz Adolfson et al. (2007) je bilo narejenih nekaj sprememb. Poleg tega, da je model prilagojen za malo, odprto gospodarstvo, ki deluje v monetarni uniji, se glavne spremembe nanašajo na fiskalni del, ki je razširjen in endogeniziran. Adolfson et al. (2007) predpostavljajo, da so javni in davčni prihodki, kot tudi javni odhodki eksogeni. Za potrebe analize so se javnofinančni prihodki in odhodki endogenizirali. Dodane so enačbe za prihodke od davka na dohodek, prihodke od davka na dobiček in kapitalski dobiček, prihodke od prispekov za socialno varstvo ter prihodke od DDV-ja. Na strani odhodkov model loči me državno potrošnjo in socialnimi transferi. Slednji so ključni za avtomatsko fiskalno stabilizacijo gospodarstva.

Adolfson et al. (2007) ne dopuščajo proračunskega deficita in s tem javnofinančnega dolga. Naš model to dopušča. Nadalje vključuje fiskalno pravilo, definirano na naslednji način:

$$g_t = \rho_g g_{t-1} - \rho_\pi \left(\hat{\pi}_t - \hat{\overline{\pi}}_t^c\right) - \rho_y \hat{y}_t - \rho_b \left(b_t - \bar{b}\right) - \rho_{def} \left(def_t - \bar{def}\right) + \varepsilon_{g,t} \quad \text{(K.14)}$$

kar pomeni, da se državna potrošnja g_t odziva na inflacijo π_t, BDP y_t), javni dolga b_t in proračunski deficit def_t.

Model je ocenjen z bayesijanskimi simulacijskimi metodami na podlagi kvaratalnih podatkov za avstrijsko gospodarstvo za obdobje 1996Q1 - 2010Q3 z uporabo 10.000 Monte Carlo ponovitev.

Rezultati kažejo, da v več kot 45% primerih značilnost fiskalne politike, ki se dobi z neposrednim ocenjevanjem v modelu, ni enaka tisti, ki bi se dobil z uporabo uradne metodologije Evropske komisije. To, naprimer, pomeni, da v pomembnem številu primerov, ko Evropska komisija opredeljuje fiskalno politiko članice kot ekspanzivno, gre pravzaprav za nevtralno ali restriktivno fiskalno politiko. Navedeno ne vpliva samo na nadaljne korake v fiskalni politiki, temveč tudi na celotno makroekonomsko okolje, saj so v veliko primerih članice dolžne uporabiti restriktivne ukrepe v situacijah, ko jim tega sicer ne bi bilo potrebno.

Zatem model kaže da se fiskalno pravilo iz Pakta o stabilnosti in rasti, v povprečju ne spoštuje v 47% primerov, če se za izračun uporabi uradna metodologija, oziroma v 40% primerih, če se ocena strukturnega salda fiskalne politike meri neposredno iz modela. V primeru, ko se upoštevata oba EU fiskalni pravili glede proračunskega deficita (tako Maastrichtsko kot SGP pravilo), simulacije kažejo, da se obe pravili upoštevata v več kot 50% primerov, medtem ko se neupoštevanje obeh pravil zgodi v 25% primerov. Vendar je mogoče pomembne razlike zaznati, če se analizira trenutek v času, ko se enega od pravil (ali obeh pravil) ne upošteva. Namreč, čeprav je podoben povprečen delež primerov nespoštovanja pravil, se 30% kršenj po obeh pravilih zgodi v različnih časovnih obdobjih. Oziroma, v več kot 30% primerov, ko Evropska komisija opozarja na strukturni deficit večji od 0,5% BDP-ja, bi le-ta po DSGE modelu bil v mejah, oziroma pod 0,5% BDP-ja. Če se obravnavajo izključno primeri, ko sta obe fiskalni pravili prekršeni, tedaj v več kot 50% takšnih primerov sklep po uradni metodologiji ni ustrezen tistemu, do katerega bi se prišlo z uporabo predloženega DSGE pristopa. Navedeno vodi do zelo pomembnega sklepa, oziroma dejstva, da uradna metodologija zelo pogosto ni sposobna ugotoviti, da je vzrok povečanega dejanskega proračunskega deficita ne le v poslabšanju strukturnega, temveč tudi cikličnega deficita.