Academy of Economic Studies
Doctoral School of Finance and Banking

The Macroeconomic Effects of Fiscal Policy in Romania

SUPERVISOR: PROFESSOR MOISĂ ALTĂR
AUTHOR: ANCA STOIAN

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Motivation

- The recent crisis, the subsequent increase in the number of liquidity constrained households and firms and the emergence of the new European Fiscal treaty, have renewed interest in how effective can fiscal policy actually be in mitigating business cycle fluctuations.
- There is only scant, mostly preliminary, evidence for the economies in emerging Europe on the economic effects of domestic fiscal shocks.
- How large are the forgone benefits of making use of a discretionary fiscal policy in stimulating the economy, if Romania were to ratify the Fiscal Compact?

Objectives

Estimating fiscal multipliers through various identification schemes and estimation techniques:

- Blanchard & Perotti identification scheme

-MLE

-IV

- Recursive identification scheme
- Sign restriction identification scheme (QR decomposition algorithm)

- Testing if fiscal policy is anticipated
- Disaggregating fiscal variables

Fiscal multipliers

How much does output increase if government spending increases by 1 monetary unit?

- >1 - Keynesian evidence: Romer and Romer (2008)
- =0 - Ricardian equivalence: Barro (1974)
- <0 – Expansionary fiscal contractions: Alesina and Ardagna (2010)

- New Classical Macroeconomics - Giavazzi and Pagano (1990)
- New Keynesian models
  - positive consumption and real wage effects if ”rule-of thumb” consumers or cash-in-advance constraints are introduced;
  - positive GDP effects, depending on monetary policy reaction – Woodford (2011)

The widely held belief among macroeconomists is that fiscal multipliers, although they might be small (in general, smaller than 1), are nonetheless positive.

Empirical approaches to calculate fiscal multipliers

- *Model simulations*: OECD's INTERLINK model; IMF's GIMF model; EC's QUEST model; NIESR's NiGEM model => estimates of fiscal multipliers lower than one, very low in the medium run, somewhat higher in the short run.
- *Case studies:* Romer and Romer (2008)
- *Vector auto-regressions (VARs)*:

-Narrative approach: Ramey and Shapiro (1998) identifiy military buildups => dummy variable.

-Identification based on short-run restrictions, using institutional information about the elasticities of fiscal variables to economic activity: Blanchard and Perotti(2002)

-Cholesky decomposition: Fatas and Mihov (2001)

-Sign restrictions identification: Canova and Pappa (2006), Mountford and Uhlig (2009)

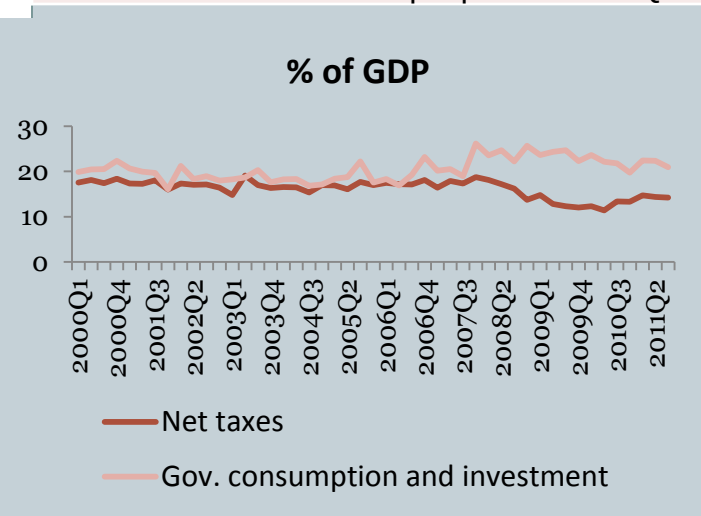
-Panel VAR: Ilzetzki, Mendoza and Végh (2010)

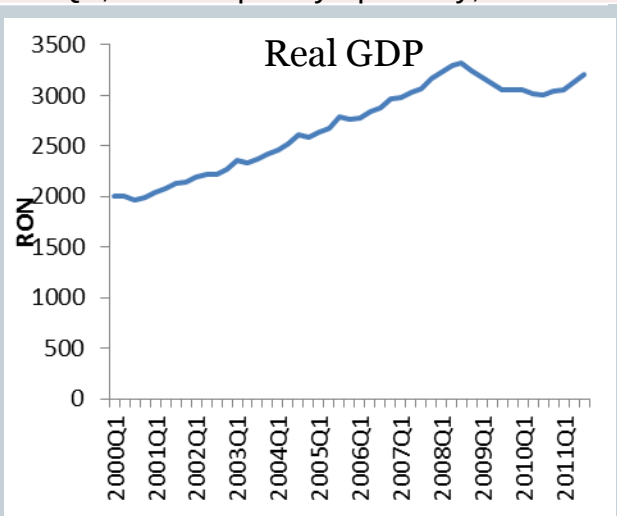
-TVAR: Baum and Koester (2011)

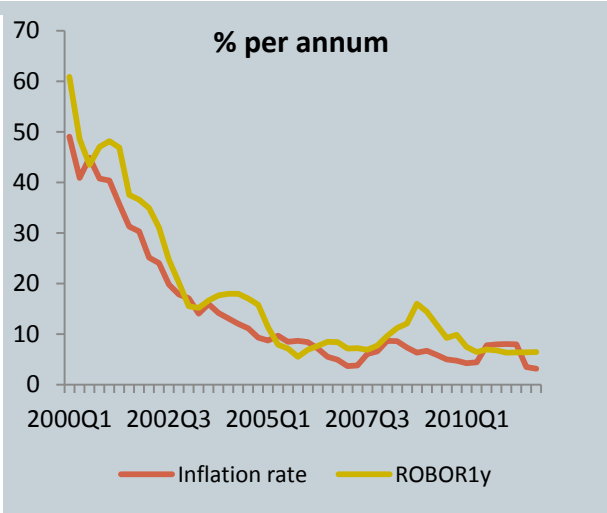
-TVP-VAR: Kirchner et al. (2010)

Input data

Variables	Description and calculation	Unit	Source	Treatment
g	Government purchases of goods and services = government consumption + government investment = compensation of public employees + intermediate consumption + government gross fixed capital formation; general government sector	log of real domestic currency per capita	Eurostat	each component was seasonal adjusted using Demetra+, TRAMO SEATS (RSA4), deflated using GDP deflator and divided by the active population
r	Net taxes = government revenues - transfers = indirect taxes + direct taxes + social security contributions – social benefits and social transfers in kind – subsidies; general government sector			
y	GDP at 2000 market prices			
π	Year-on-year change of the nationally defined consumer price index	%	INSSE	
i	Short-term interest rate corresponding to the one year interbank offered rate	% per annum	Eurostat	
Sample period: 2000Q1:2011Q3; data frequency: quarterly; number of observations: 47				







I. The model based on Blanchard and Perotti (2002)

Reduced-form VAR:

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

Yt is a N × 1 vector of endogenous variables, C(L) is a N × N matrix lag polynomial, and Ut is a N × 1 vector of reduced-form innovations

AIC => VAR(2) => Ut = $[u_t^g \; u_t^y \; u_t^\pi \; u_t^r \; u_t^i]'$; structural shocks: Vt = $[v_t^g \; v_t^y \; v_t^\pi \; v_t^r \; v_t^i]'$

I.1. Identification assumptions

$$u_t^g = a_y^g u_t^y + a_\pi^g u_t^\pi + a_i^g u_t^i + \beta_r^g v_t^r + v_t^g$$
$$u_t^r = a_y^r u_t^y + a_\pi^r u_t^\pi + a_i^r u_t^i + \beta_g^r v_t^g + v_t^r$$
$$u_t^y = a_g^y u_t^g + a_r^y u_t^r + v_t^y$$
$$u_t^\pi = a_g^\pi u_t^g + a_r^\pi u_t^r + a_y^\pi u_t^y + v_t^\pi$$
$$u_t^i = a_g^i u_t^g + a_r^i u_t^r + a_y^i u_t^y + a_\pi^i u_t^\pi + v_t^i$$

The innovations in the fiscal variables u_t^r and u_t^g can be thought of as a linear combination of three types of shocks:

i) the automatic response of government expenditure and revenue to real output, inflation, and interest rate innovations (automatic stabilizers);

ii) the systematic, discretionary response of fiscal policy to shocks to the macro variables;

iii) the random, discretionary fiscal policy shocks, which are the underlying structural shocks to be identified (v_t^g and v_t^r).

Basic identification assumption: the fiscal authorities need more than one quarter to react to macroeconomic shocks => ii) is irrelevant.

I.2. Exogenous elasticities are used to compute cyclically adjusted reduced-form fiscal policy shocks:

- $u_t^{g,CA} = u_t^g - a_y^g u_t^y - a_\pi^g u_t^\pi - a_i^g u_t^i = \beta_r^g v_t^r + v_t^g$
- $u_t^{r,CA} = u_t^r - a_y^r u_t^y - a_\pi^r u_t^\pi - a_i^r u_t^i = \beta_g^r v_t^g + v_t^r$

The elasticities of the aggregated fiscal variables are derived by weighting the elasticities of their sub-components with their relative amounts.

	Net taxes							Gov. consumption and investment			
	CIT	PIT	SSC	Indirect taxes	Social benefits and social transfers in kind	Subsidies		Compensation of public employees	Intermediate consumption	Gross fixed capital formation	
output elasticities	1.20	1.04	0.76	0.97	-0.31	0.00	1.82	0.00	0.00	0.00	0.00
price elasticities	0.00	0.80	0.00	0.00	-1.00	-1.00	0.93	-1.00	0.00	0.00	-0.44
interest rate elasticities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
average weights (%)	17.02	20.69	61.33	74.57	-68.97	-7.63	100	43.84	34.95	21.20	100

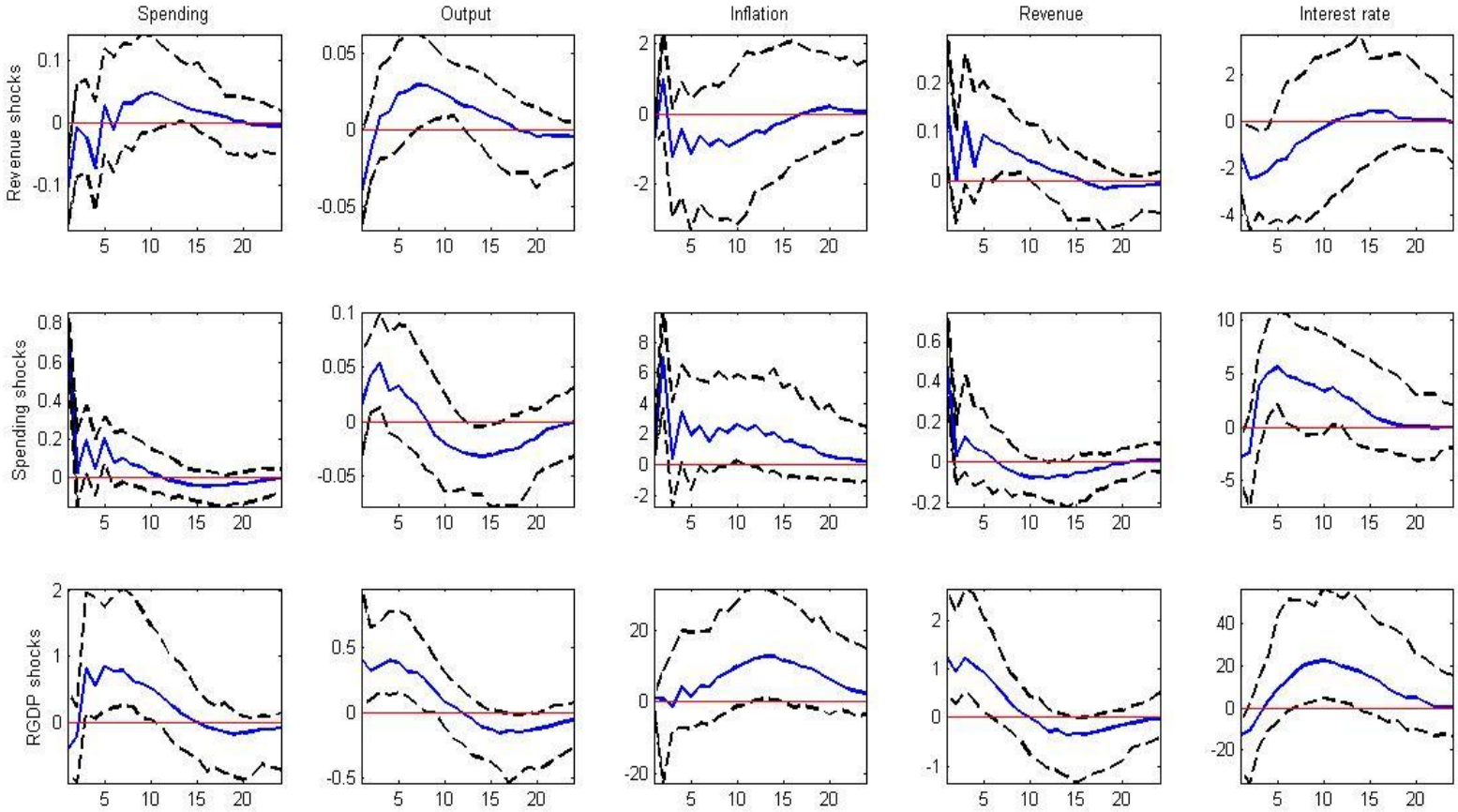
Source: Romania's Convergence Programme 2008-2011; Altar, Necula and Bobeica (2010); own calculations.

I.3. The relative ordering of the fiscal variables: Government decisions on revenue are taken before decisions on spending => $\beta_g^r = 0$

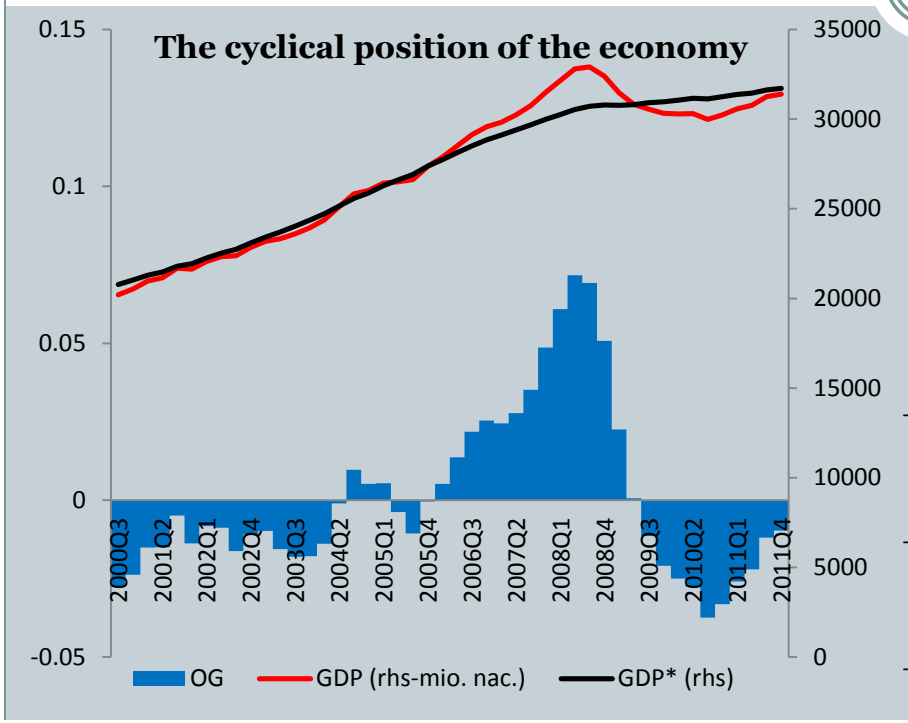
- Taxes data series Granger causes the expenditure data series
- Government spending adjusts in order to return to the cointegration relationship between taxes and spending

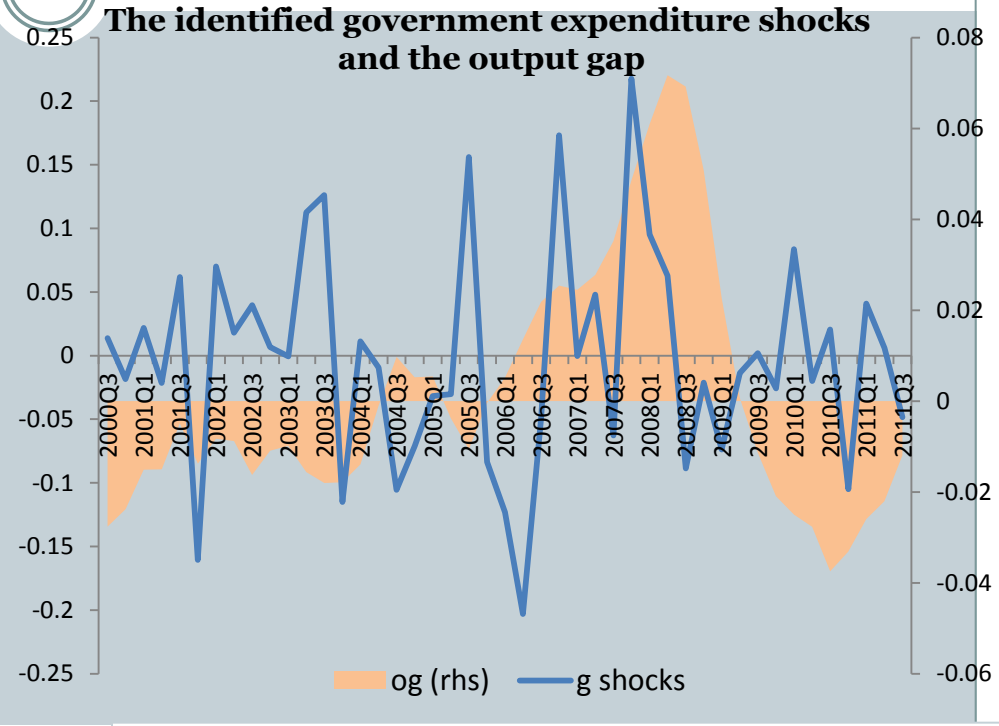
I.4. a.) MLE – involves maximizing the *Likelihood function* through numerical optimization; $2N^2 - \frac{N(N+1)}{2} = 35$ restrictions were imposed for the model to be just-identified.

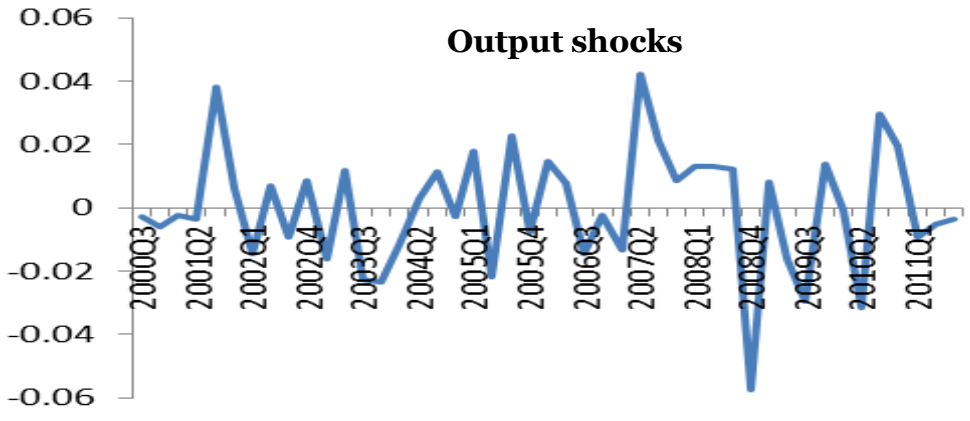
Impulse response functions to 1% structural shock (one-standard deviation bands, computed by Monte Carlo simulations)

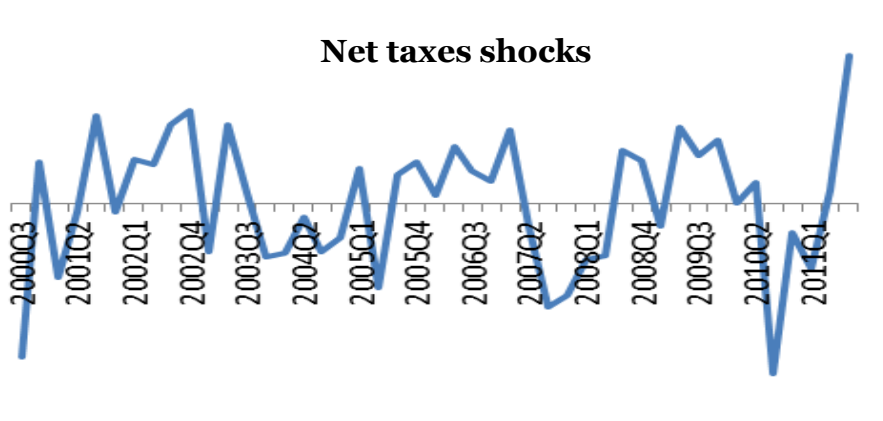


Fiscal policy pro-cyclicality





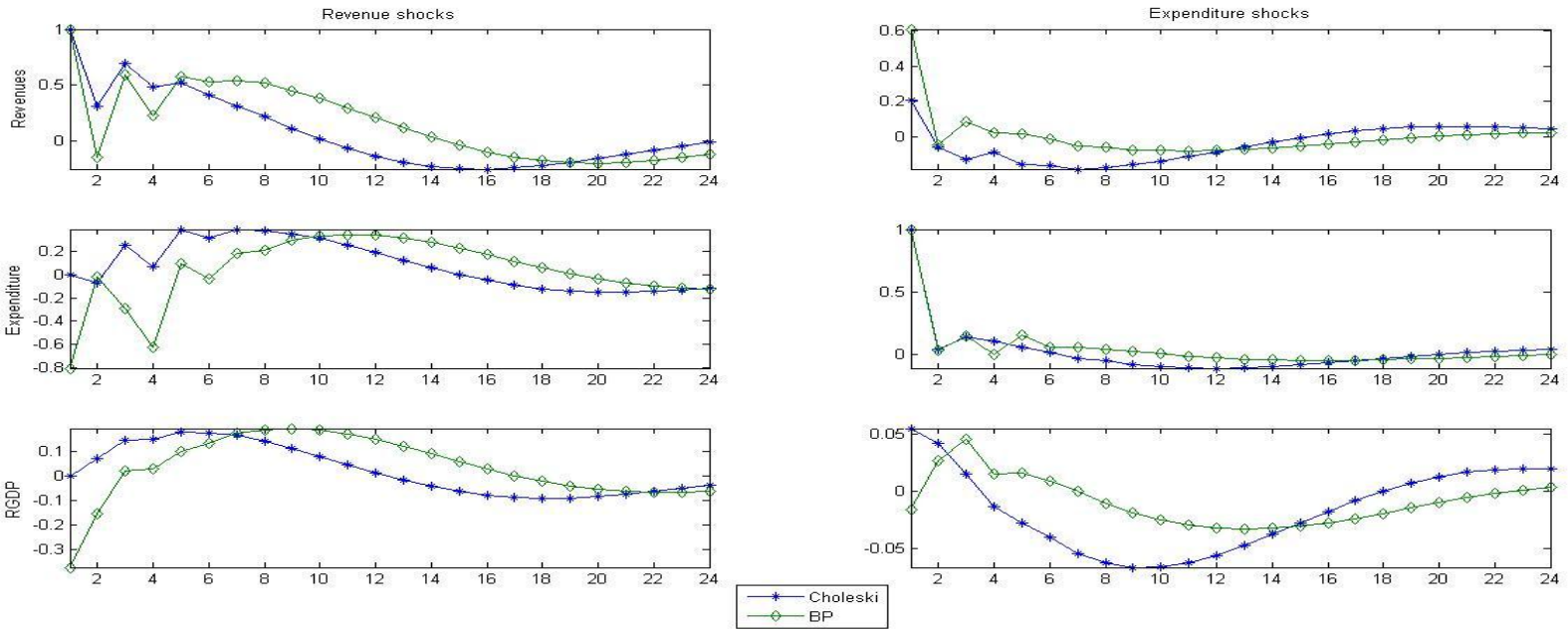




MLE Caveats

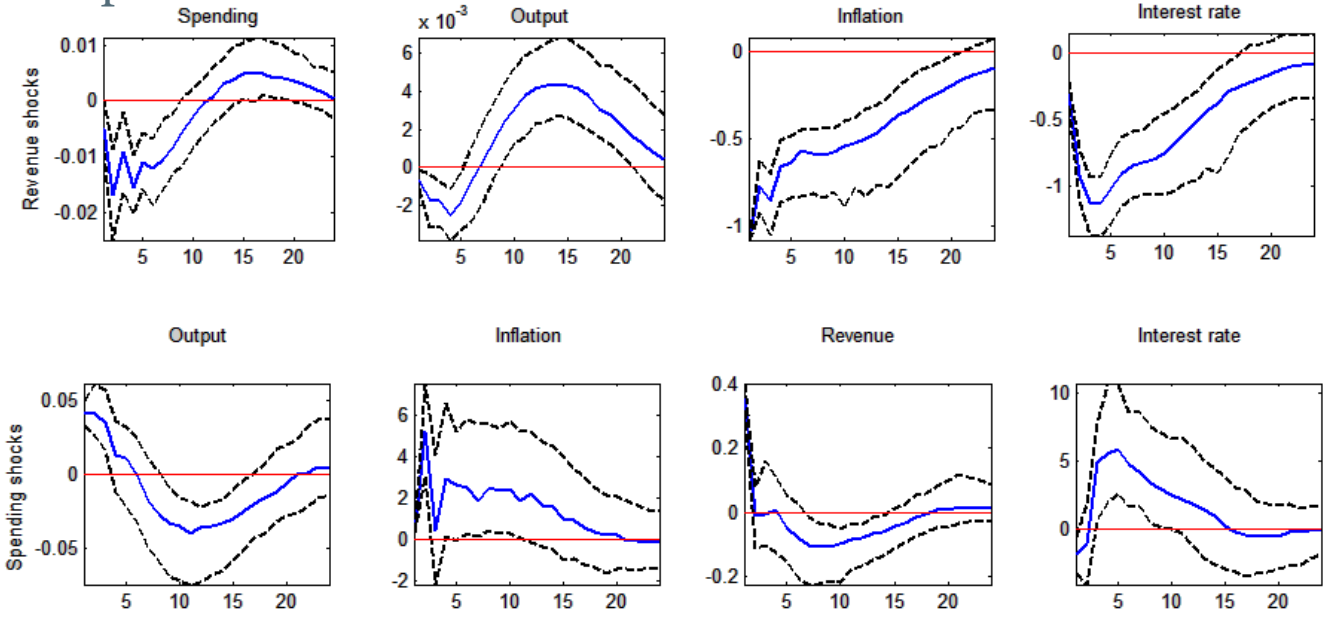
- Maximum likelihood estimator can be biased in small samples.
- The numerical optimization routine can yield a local maximum.
- ML estimator can be sensitive to the choice of starting values if the likelihood function is very flat:

Cholesky versus Blanchard-Perotti scaled impulse response functions to fiscal variables shocks



I.4. b) IV – involves estimating the coefficients of the equations for real GDP, inflation and interest rate recursively, by means of instrumental variables regressions in order to account for the correlation of the respective regressors and error terms. Since the structural shocks are orthogonal, they can be used as instruments.

Responses of model variables to 1% structural fiscal shocks

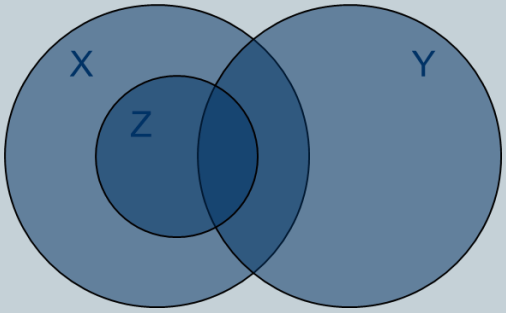


$$\widehat{\alpha_{IV}} = (Z'X)^{-1}Z'Y$$
$$v_{IV} = Y - X\widehat{\alpha_{IV}}$$

Disadvantages of the IV estimator:

- Like the MLE, the IV estimator is biased in finite-sample

- IV does not work well if the instrument Z has low correlation with the regressor X or if the part of X that is explained by Z does not overlap much with Y



Correlation of structural residuals with reduced-form res.				
g	y	π	r	i
0.9504	0.8247	-0.0282	-0.1563	0.9230

Model weaknesses

- After estimating the parameters of the VAR using exogenous information regarding the size of automatic stabilizers, discretionary fiscal policies are supposedly captured by the residual. But the residual contains everything that is not modeled, including not least the models' errors in capturing the relationship being estimated

- Considering the elasticities of fiscal variables to the macro variables constant over the time horizon covered by my analysis or that they are the same, no matter the type of shock affecting the economic activity, is a strong assumption

II. The sign-restrictions based SVAR

- This approach involves finding the region of the parameter space which satisfies the imposed restrictions, not a point
- It doesn't impose linear restrictions on the contemporaneous relation between reduced-form and structural disturbances

Identifying sign restrictions

	Net taxes	Gov. spending	GDP	Interest rate	Prices
Business cycle shock	>0		>0		
Gov. revenue shock	>0				
Gov. spending shock		>0			

- **The QR decomposition**: I start from the Cholesky decomposition: $U_t = DV_t$; I draw an N × N matrix G from N(0,1) and find G = QR (Q'Q=I); I compute the impulse response functions using the companion matrix of the reduced-form VAR and the relation: $U_t = DQV_t$, and check if the restrictions are satisfied. If they are, I retain the IRF; I repeat the above steps until L~1000 draws are accepted.

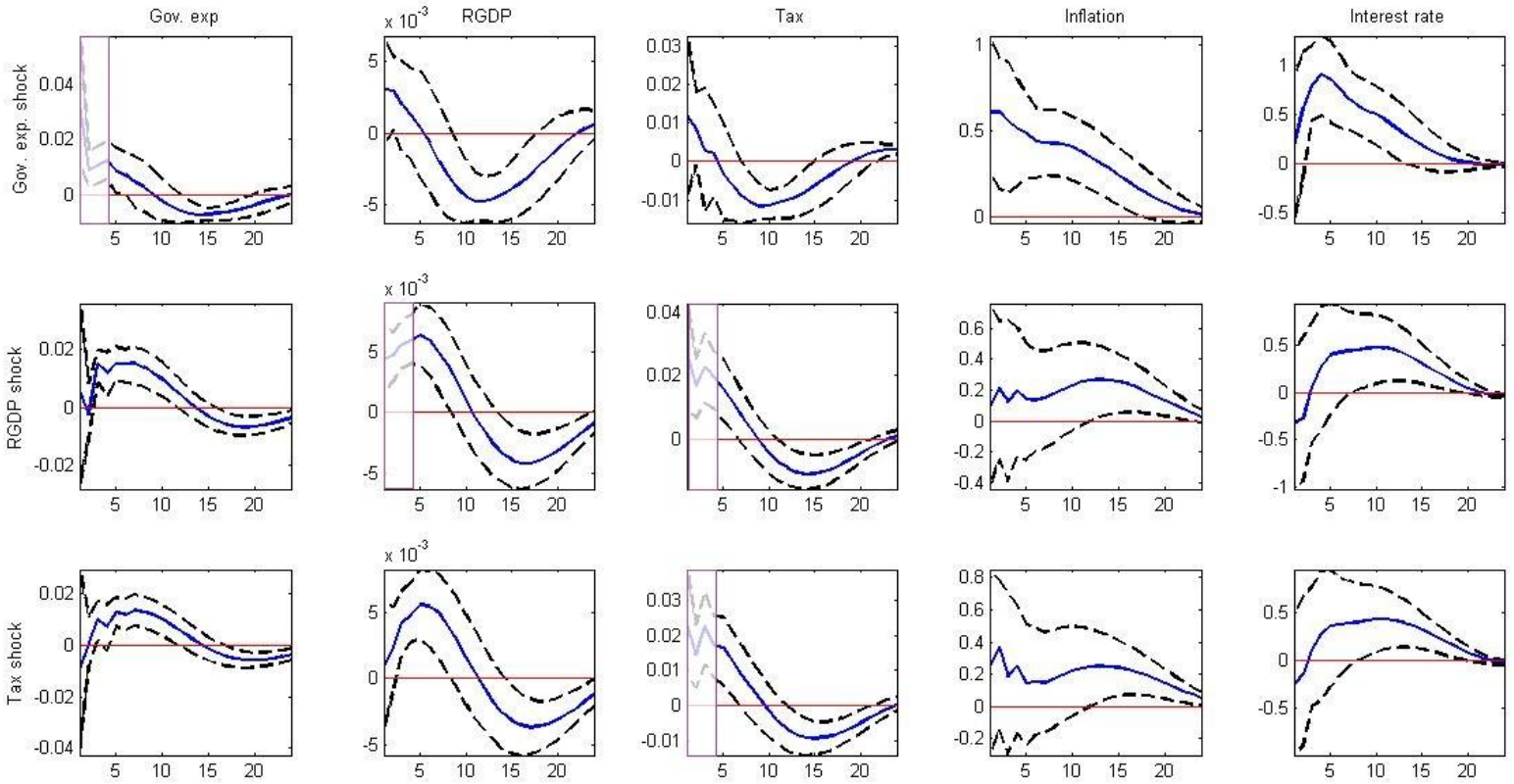
- **Econometric problems** in implementing the sign restriction methodology – Dungey and Fry (2009):

-The impulses presented represent results from a mixture of models

-Taking the median response across the set of impulses no longer guarantees that the shocks of the system are orthogonal

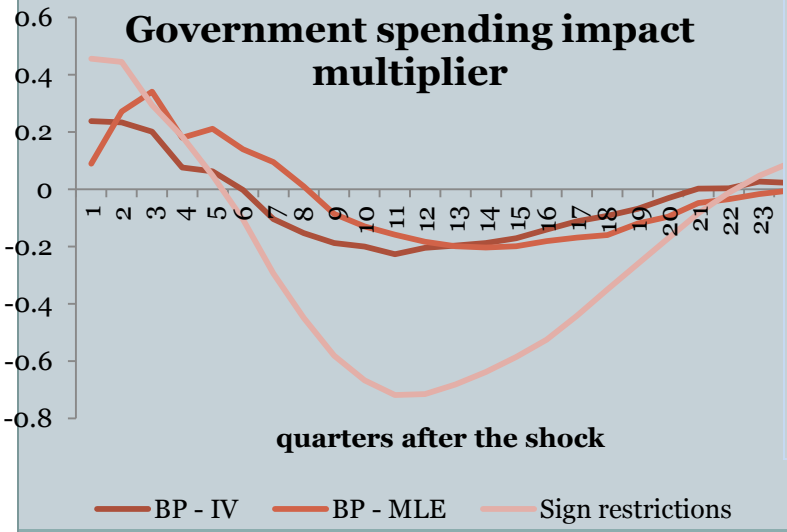
- It may imposes features not consistent with the data - Caldara and Kamps (2008)

Median, 16th percentile and 84th percentile impulse responses to one standard deviation government spending shock, business cycle shock and tax revenue shock (error bands capture model identification uncertainty, not parameter estimates uncertainty)



Results

$$m_{impact} = \frac{\frac{GDP\ response}{Fiscal\ shock\ at\ lag\ 0}}{(Average\ fiscal\ variable\ share\ of\ GDP)}$$



Fiscal multipliers

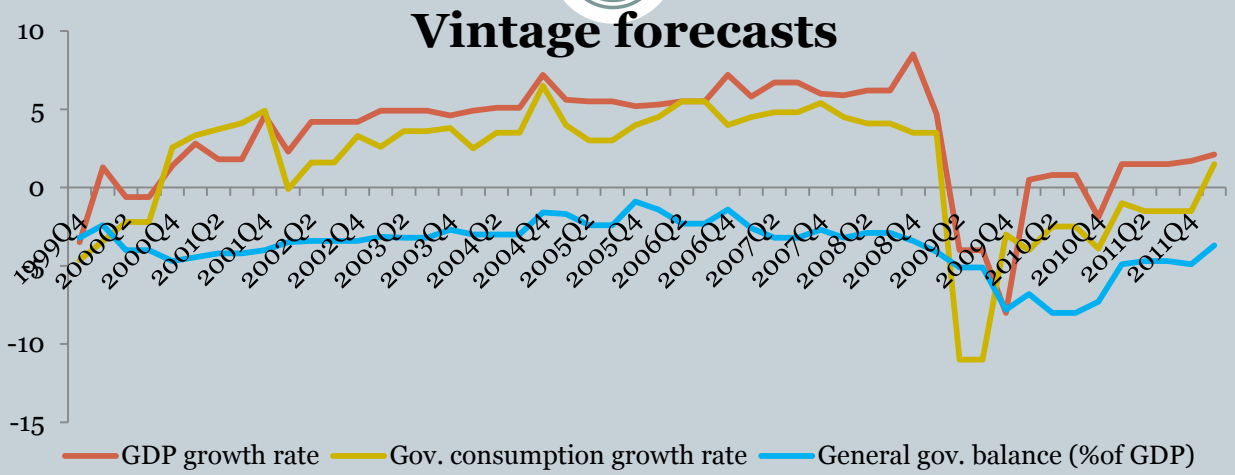
Impact multipliers		quarters					peak multiplier	
		1	4	8	12	20	value	quarter
Gov. spending increase	BP-MLE	0.09	0.18	0.01	-0.18	-0.10	*0.34	III
	BP-IV	*0.24	0.08	-0.15	*-0.20	-0.03	*0.23	I
	sign-restr.	0.46	0.18	-0.45	*-0.71	-0.17	0.46	I
Tax cut	BP-MLE	*1.60	-0.44	-1.07	-0.58	0.18	*1.60	I
	BP-IV	*0.51	*1.92	-1.03	*-3.14	*-1.68	*1.92	IV
	sign-restr.	-0.24	*-1.28	*-1.03	0.21	*0.83	*0.98	XVII

Cumulative multipliers

		Cumulative multipliers					Present value cumulative multipliers				
		quarters									
		1	4	8	12	20	1	4	8	12	20
Gov. spending increase	BP-MLE	0.09	0.66	0.69	0.38	-0.33	0.09	0.62	0.67	0.45	0.08
	BP-IV	*0.24	*0.57	0.34	-0.18	-1.14	*0.24	*0.56	0.37	0.02	-0.40
	sign-restr.	0.46	0.69	0.21	-0.89	-6.14	0.14	0.82	*1.38	1.65	1.82
Tax cut	BP-MLE	*1.60	0.72	-0.69	-1.23	-1.54	*1.60	0.78	-0.51	-0.96	-1.17
	BP-IV	*0.51	*0.94	1.29	27.31	*4.68	*0.51	*0.92	1.21	-0.97	8.09
	sign-restr.	-0.24	-0.99	*-1.66	-2.07	-1.59	-0.24	-0.96	*-1.56	-1.86	-1.61

*The value 0 is outside the region between two one-standard error bands for the response in output.

Anticipated fiscal policy



Source: EC, IMF

Predictability of VAR-based innovations

Explanatory variables / Reduced-form residuals	const.	government consumption real growth rate	economic growth	general government budget (%GDP)	R-squared
Government spending	-0.03	-0.01	0.01	0.00	0.05
	(0.52)	(0.16)	(0.19)	(0.71)	
Net taxes	-0.02	0.01	0.00	0.00	0.05
	(0.68)	(0.20)	(0.67)	(0.62)	

*p-value in parentheses.

Further robustness checks

- Sensitivity analysis – I vary the exogenous elasticities by +/- 0.5; the results are not significantly different; for changes greater than 0.5, the higher the GDP elasticity of net taxes, the higher the tax multiplier
- Different assumption on fiscal variables ordering: if government spending decisions come first, the results are slightly different with respect to the GDP response to a structural shock in net taxes, due to the relative high correlation between tax and spending innovations (0.29)
- Price stickiness – I assume that inflation does not respond within a quarter to innovations in fiscal variables => specification not well-suited for the data.

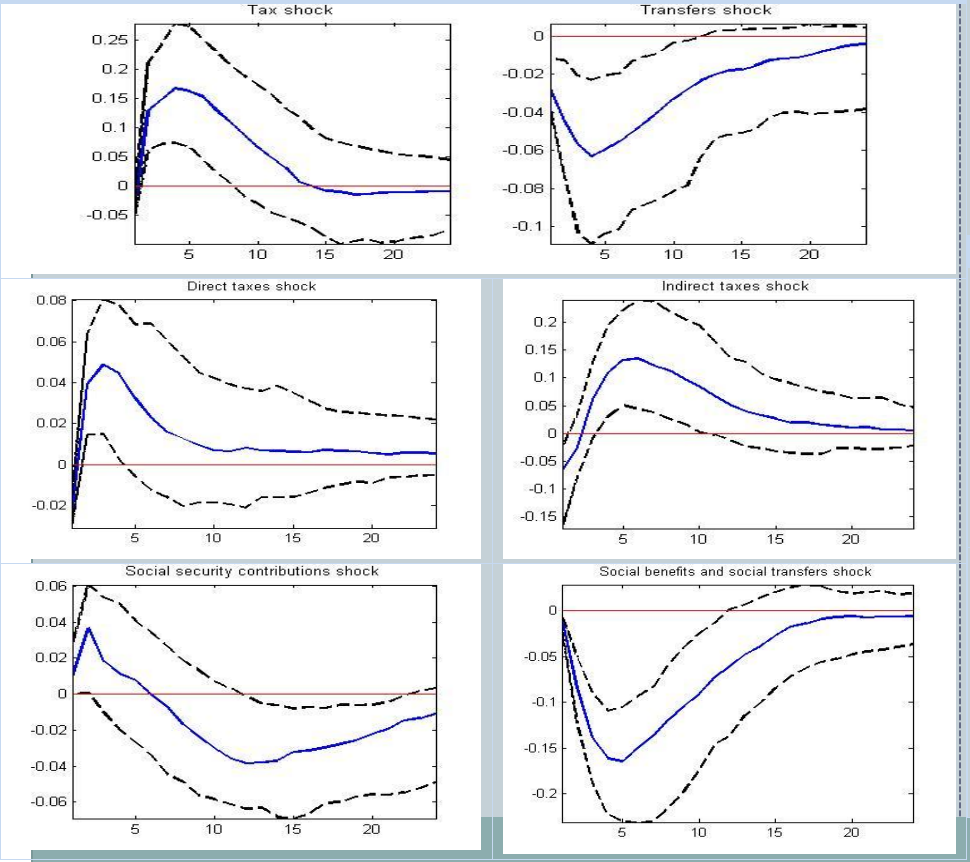
- Weaker identifying restrictions - the responses are restricted for fewer quarters (2): the identified space of GDP responses to a government spending shock is not located outside the zero bound any more.

- Including several exogenous variables:
- the vintage forecasts for real government consumption growth, economic growth and for the budget deficit as percent of GDP ;
- euro area economic growth and euro area fiscal deficit;
- the oil price;
- the change in the stock of public debt (expressed as percent of GDP), with a lag;

Disaggregating fiscal variables

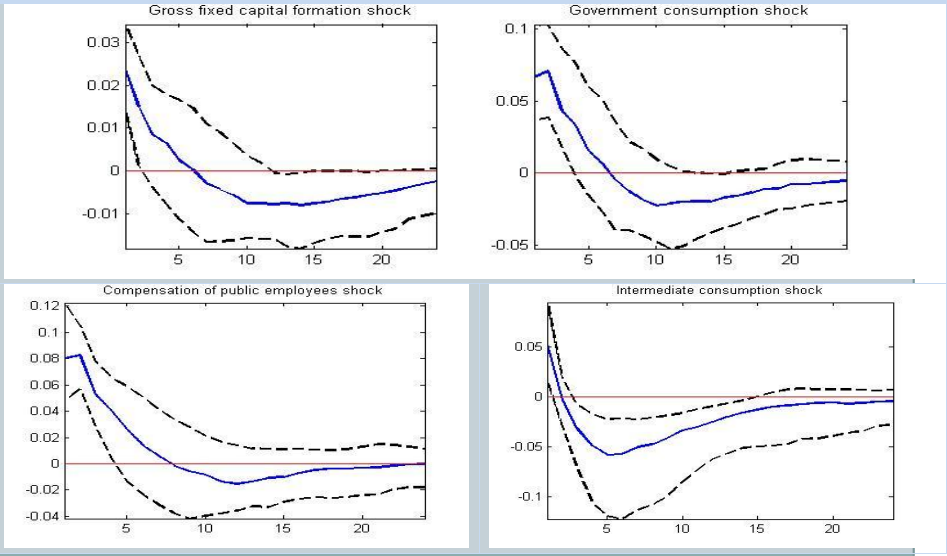
Mountford and Uhlig (2009): "there is no such thing as a fiscal policy shock per se. Fiscal policy encompasses a wide variety of policies: there is an endless list of types of incomes, for which the tax rules could be changed, or categories of government spending, where changes could occur."

GDP response to 1% structural shock in net taxes components



I follow Tenhofen et al. (2010)

GDP response to 1% structural shock in government expenditure components



Concluding remarks

- Fiscal policy was procyclical in Romania during the economic boom, but also in recession, especially on the expenditure side => this is one of the reasons why fiscal multipliers are small: discretionary fiscal policy and automatic stabilizers move in opposite directions.
- The monetary authority did not accommodate fiscal policy actions.
- It is possible that the capital account liberalization (2005) added to the diminishing of fiscal multipliers.
- Regarding the government spending multiplier, its measure varies for the first year around the value of 0.25.
- However, effects of taxes on economic activity represent a very complex issue and instability of their estimates is an inherent feature of empirical literature on fiscal policy. Identification of tax shocks separates the correlation between the residuals in the GDP equation and the residuals in the tax equation (0.26) into two components: the automatic response of taxes to unexpected changes in GDP (automatic stabilizers) and the response of GDP to unexpected changes in taxes not related to the business cycle (the output effects of discretionary tax changes).The positive correlation could a priori be compatible with very different views about the relation between taxes and output, depending on the size of automatic stabilizers (the higher the GDP elasticity of net taxes, the higher the tax multiplier).

Policy recommendations

- On the tax revenue side, indirect tax cuts have greater impact in stimulating the economy. Regarding government expenditure, compensation of public employees has the strongest and more persistent effect on output. But fiscal expansion decision must be made in accordance with the medium-term objectives set in accordance with the budgetary consolidation path, upon which Romania has agreed with the EC/IMF and World Bank.

- Auerbach (2005) : "The working within the SVAR context limits the capacity to engage in counterfactual exercises (…) the results depend very much on how policy was practiced during the period of estimation. We can estimate the effects of policy shocks, given their average permanence during the estimation period. But these effects will not apply to new shocks, should they have a different time profile; nor will they apply to predictable policy changes, i.e. to changes in policy rules or in automatic stabilizers."

- Given the relative small size of fiscal multipliers in Romania, the fiscal authority may try to enhance the automatic fiscal stabilizers - Baunsgaard and Symansky (2009).

Future research directions

- Consistency with general equilibrium modeling; deriving additional restrictions from general equilibrium modeling to be imposed during estimation.
- Refinement of the way taxes are adjusted for the effects of the business cycle in structural VAR models (TVP-VAR).
- Fiscal policy effects on GDP components.

Thank you for your attention!

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