National Bank of Ukraine

The impact of fiscal policy on GDP and inflation in Ukraine

Vdovychenko Artem (National Bank of Ukraine)

Disclaimer: the views expressed in this paper are those of the authors and do not represent official position of the National Bank of Ukraine or any other institution.

Outline

- Motivation and policy contribution
- Literature: What are the effects of fiscal policy on a GDP and inflation in theory?
- Literature: Estimations
- Method: SVAR, Blanchard-Perotti approach
- Method: Impact on inflation
- Data
- Results
- Key conclusions

Motivation and policy contribution

Estimation of fiscal multipliers and impact of budget parameters on inflation :

- gives more information for output and inflation forecasts
- let the policymakers to make decisions on adequate monetary policy response
- helps to make decisions on trade-offs between debt accumulation, inflation, economic growth

In this study:

- we estimate fiscal multipliers for Ukraine, applying standard Blanchard-Perotti model
- augment the model with CPI and analyze the impact of fiscal policy on inflation

Literature: What are the effects of fiscal policy on a GDP and inflation in theory?

New-Keynesian version: due to rigidities fiscal stimuli boost output growth and inflation

Proponents of fiscal stimulus argue that (Fata´s and Mihov, 2009):

- Empirical studies indicate that, on average, the fiscal multiplier is greater than one.
- Economic recessions release factors of production, which can increase the value of the fiscal multiplier.
- Under the standard Keynesian model, the fiscal multiplier is an increasing function of the marginal propensity to consume.
- Therefore, the fiscal multiplier will also be higher in low-income economies.
- When monetary policy is limited by the zero bound of the central bank's key interest rate, fiscal policy can be used to pursue countercyclical economic policy.

Literature: What are the effects of fiscal policy on a GDP and inflation in theory?

Neoclassic version: due to Ricardian and "crowding-out" effects positive impact on output via the demand side is not so large while supply side effects are weak

Arguments against fiscal stimulus:

- Economies have neoclassical economic effects in the form of the Ricardian Equivalence: economic agents treat fiscal stimulus in the current period as a sign higher fiscal pressure on the economy in future and thus do not increase consumption and investment.
- Fiscal stimulus causes crowding-out effects, pushing interest rates upwards and thereby restraining economic growth.
- Numerous studies show that fiscal consolidation is beneficial for the economy (Giavazzi and Pagano, 1990). At the same time, whereas economists differ in their views on short-term impact of fiscal stimulus, they do agree that it has a negative impact in the long-run (Alesina et al., 1999; Barro, 1991).

Literature: What are the effects of fiscal policy on a GDP and inflation in theory?

Arguments against fiscal stimulus:

- In the long-run, fiscal stimulus programs are difficult to end due to political considerations (over time, fiscal stimulus starts to threaten fiscal sustainability and affect economic trends).
- Fiscal policy can be considered ineffective for stimulating economic growth if the fiscal multiplier is below unity – and these values are fairly common in empirical studies.
- The impact of fiscal stimulus materializes with a delay, which makes it difficult to respond adequately to economic variables.
- Markets know better how to renew economic growth.
- Fiscal stimulus programs often serve the narrow political and economic interests of certain individuals and are not actually focused on macroeconomic needs.

Literature: Estimations

How do we measure fiscal policy impact on GDP?

Fiscal multiplier - the ratio of a change in output (ΔY) to a discretionary change in government spending or tax revenue (ΔG or ΔT). (Spilimbergo et. al., 2009).

$$\text{Impact multiplier} = \Delta Y_t / \Delta G_t$$

$$\text{Multiplier at horizon } i = \Delta Y_{t+i} / \Delta G_{t+i}$$

Literature: Estimations

❑ Applied methods:

- SVAR
- DSGE
- Narrative approach

❑ Conclusions from literature for advanced economies (AEs):

- Fiscal multipliers in the range |0,5| – |1,2|
- Expenditure multipliers are higher then tax multipliers
- Multipliers of capital expenditures are more persistent then current expenditures multipliers
- Fiscal multipliers in recession are significantly higher then in expansion periods

Literature: Estimations

- Fiscal multipliers for emerging markets (EM) tend to deviate significantly from estimates for advanced economies (AE).

Multipliers in EMEs and LICs (Batini. al., 2014)

Factors increasing the multiplier in EMEs

- Consumption smoothing behavior is less prevalent when: (i) liquidity constraints arise in less developed financial markets; and (ii) agents are less forward looking if there is too much instability.
- Monetary policy response is less effective.
- Automatic stabilizers are lower.
- Government debt tends to be lower.

Factors decreasing the multiplier in EMEs

- Precautionary saving may be larger in a more uncertain environment.
- Inefficiencies in public expenditure management and revenue administration.
- Some LICs and EMEs may sustain lasting positive output gaps due to supply constraints.
- With higher interest spreads, there is more room for credibility and confidence effects.
- Economies are smaller and more open.

Literature: Estimations

Table A.3.2 Model-based Estimates of Short-Term Multipliers in EMEs and LICs

Study	OECD (2009)		GIMF		Ducanes and others (2006)		
Country	G*	T*	G*	T*	G (increase)	G (decrease)	T
Bangladesh					0.4	0.8	0.1
Bulgaria[1]			0.6	0.4			
China					0.3	1.6	0.4
Hungary	0.5	0.1					
Indonesia					0.2	0.8	0.2
Mexico	0.7	0.2					
Philippines					0.3	0.7	0.0
Poland	0.6	0.2					
Russia			0.8	0.3			
Turkey	0.7	0.2	0.9	0.3			
Emerging Asia[2]			1.0	0.5			

Note: Short-term refers to impact multipliers, which in DSGE models typically correspond to the first year.
*Averages of expenditure (excl. transfers) and tax instruments.
[1]Muir and Weber (2013) based on GIMF.
[2]Freedman and others (2009) based on GIMF.

Batini, N., Eyraud, L., and Weber, A., 2014, "A Simple Method to Compute Fiscal Multipliers," IMF Working Paper 14/93 (Washington: International Monetary Fund).

Literature: Estimations

Table 1. Fiscal multipliers: Robustness checks

	Impact multiplier (1 quarter)	Medium-term multiplier (8 quarters)	Quarters during which effect is significant	Cumulative multiplier (8 quarters)	Impact multiplier (1 quarter)	Medium-term multiplier (8 quarters)	Quarters during which effect is significant	Cumulative multiplier (8 quarters)
			Expenditure policies implemented first					
	Expenditure multiplier				Revenue multiplier			
Baseline model (aggregate fiscal variables)	0.43	1.36	6	2.86	-0.30	-0.49	1	-0.96
Robustness check: Using 4 lags in VAR	0.43	2.35	8	4.76	-0.30	0.20	1	0.50
Robustness check: Excluding exogenous variables from VAR	0.40	1.27	2	2.58	-0.30	-0.15	1	-0.29
			Revenue policies implemented first					
	Expenditure multiplier				Revenue multiplier			
Baseline model (aggregate fiscal variables)	0.29	1.12	16	2.40	-0.39	-0.83	2	-1.69
Robustness check: Using 4 lags in VAR	0.29	2.44	10	4.99	-0.43	-0.91	3	-1.76
Robustness check: Excluding exogenous variables from VAR	0.29	1.21	2	2.47	-0.40	-0.58	1	-1.17

Pritha, M., Poghosyan T., 2015, "Fiscal Multipliers in Ukraine," IMF Working Paper 15/71 (Washington: International Monetary Fund).

Method: SVAR, Blanchard-Perotti approach

$$Y_t = \sum_{i=1}^{k} C_i Y_{t-i} + \sum_{j=1}^{p} D_p Z_t + u_t$$

- $Y_t \equiv [G_t, T_t, X_t]'$- vector of endogenous variables: budget expenditures, taxes, output
- Z_t- vector of exogenous variables: linear and quadratic trends, seasonal dummies, dummies to control for structural breaks or outliers, economic controls
- $U_t \equiv [g_t, t_t, x_t]'$ – vector of normally distributed residuals with nonzero cross-correlation

Method: SVAR, Blanchard-Perotti approach

System of structural equations:

$$\begin{cases} g_t = a_1 x_t + a_2 e_t^t + e_t^g \\ t_t = b_1 x_t + b_2 e_t^g + e_t^t \\ x_t = c_1 t_t + c_2 g_t + e_t^x \end{cases}$$

Identification assumptions:

- $a_1 = 0$ – budget expenditures don't respond to output instantaneously
- b_1 - estimated exogenously (DOLS estimator gives b_1=1,2 for Ukraine)
- c_1, c_2, - estimated by TSLS with g_t and $\widehat{t_t} = t_t - b_1 x_t$ as instruments
- (a_2 =0, b_2- estimated) or (a_2 - estimated, b_2=0) – ordering of decision making in fiscal policy

Method: SVAR, Blanchard-Perotti approach

- VAR(4) in levels
- Restrictions on the coefficients of VAR: System Sequential Elimination of Regressors (SER) procedure based on AIC
- Estimation of structural coefficients by ML (Scoring Algorithm (Amisano & Giannini (1992)))
- b_1 for different taxes: VAT – 1.8, customs – 1.6, CIT – 1.8, PIT – 0.6, social security contributions – 0.9
- Restriction: a_2 =0, b_2- estimated – decisions on expenditures go first

Method: impact on inflation

$$\begin{bmatrix} 1 & 0 & 0 & \alpha_\pi^g \\ 0 & 1 & -1{,}2 & \alpha_\pi^t \\ \alpha_g^x & \alpha_t^x & 1 & \alpha_\pi^x \\ \alpha_g^\pi & \alpha_t^\pi & \alpha_x^\pi & 1 \end{bmatrix} \begin{bmatrix} g_t \\ t_t \\ x_t \\ \pi_t \end{bmatrix} = \begin{bmatrix} \beta_g^g & 0 & 0 & 0 \\ \beta_g^t & \beta_t^t & 0 & 0 \\ 0 & 0 & \beta_x^x & 0 \\ 0 & 0 & 0 & \beta_\pi^\pi \end{bmatrix} \begin{bmatrix} e_t^g \\ e_t^t \\ e_t^x \\ e_t^\pi \end{bmatrix}$$

- VAR augmented with CPI (π)
- Taxes and expenditures transformed in constant prices by CPI index
- Three additional restrictions on α_π^g, α_π^t, α_π^x
- Following Perotti (2002): α_π^g = -0,8, α_π^t = -0,3, α_π^x = -0,3
- Restrictions for α^g: wages in the public sector (-1), expenditures on goods and services (-0.5), capital expenditures (-0.5), and current transfers to the population (-1).
- Restrictions on α^t for different taxes: VAT (– 0.6), customs – (-1), CIT - 0, PIT – (-0.7), social security contributions – (-0.7)

Method: impact on inflation

Variants of restrictions on elasticity of real variable to inflation

Elasticity	Treating
$\varepsilon_{z,\pi} < -1$	Variable z decreases when inflation increases
$\varepsilon_{z,\pi} = -1$	Variable z doesn't react
$\varepsilon_{z,\pi} \in (-1,0)$	Variable z increases with growth rate lower then growth rate of inflation
$\varepsilon_{z,\pi} = 0$	Variable z increases with the same growth rate as inflation
$\varepsilon_{z,\pi} > 0$	Variable z increases with growth rate higher then growth rate of inflation

Data

Dataset:

- Period: 2001-2016
- Data frequency: quarterly
- All variables are in logs, real terms and seasonally adjusted
- Variables transformed in constant prices by GDP deflator and by CPI index for model with inflation

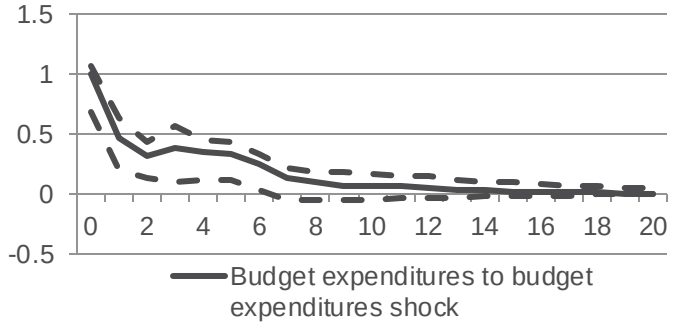
Variables:

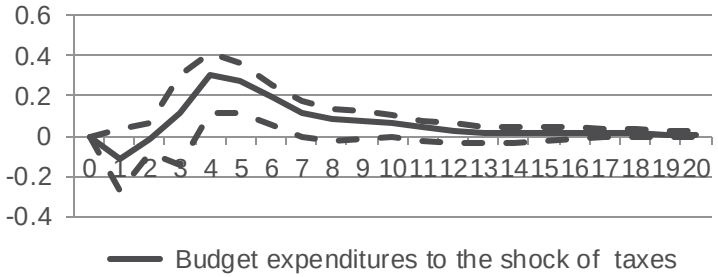
- G – Primary budget expenditures – funding of pension fund deficit – current transfers
- T – Tax revenues
- X – GDP
- π - CPI
- Economic controls – current account ratio, money supply (M3), public debt ratio

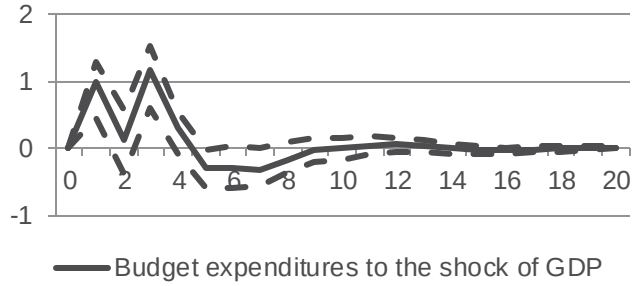
Model:

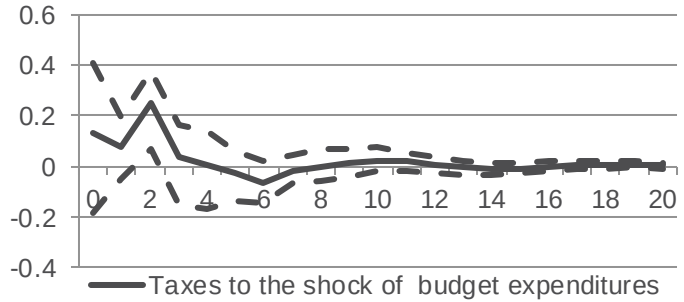
- Deterministics – linear and quadratic trend
- Dummies for outliers to eliminate non-normality from the residuals
- Residuals are not autocorrelated

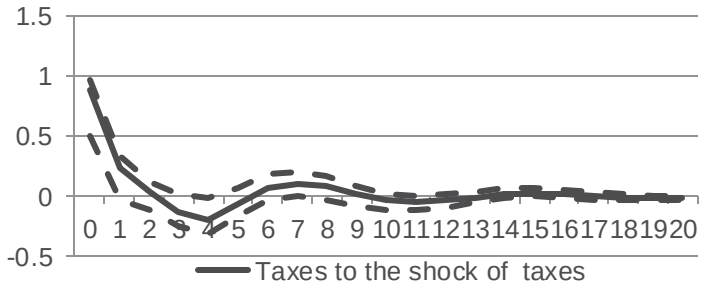
IRFs for the VAR with 3 endog. variables

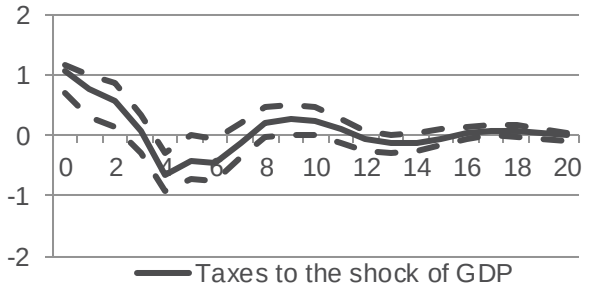


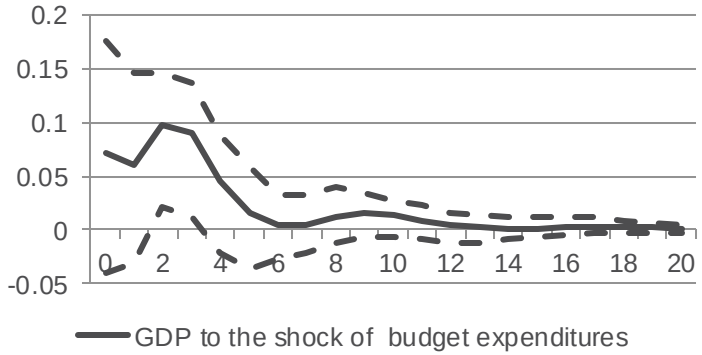


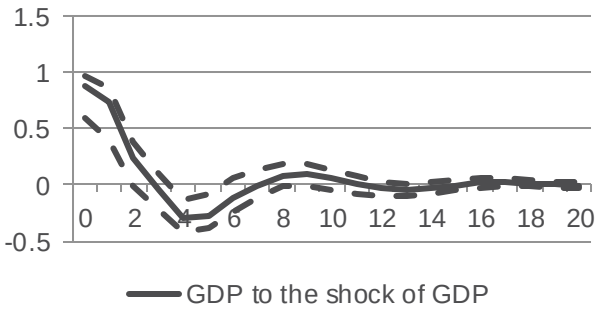








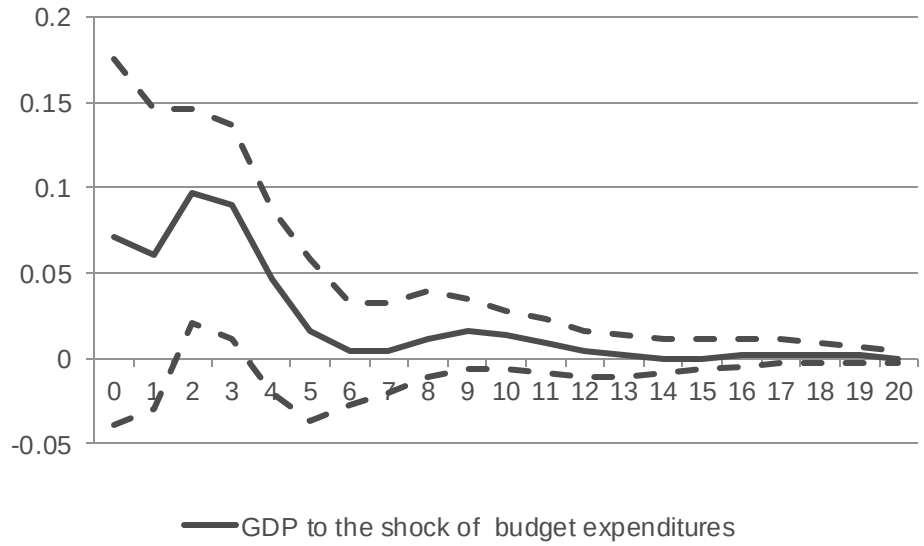


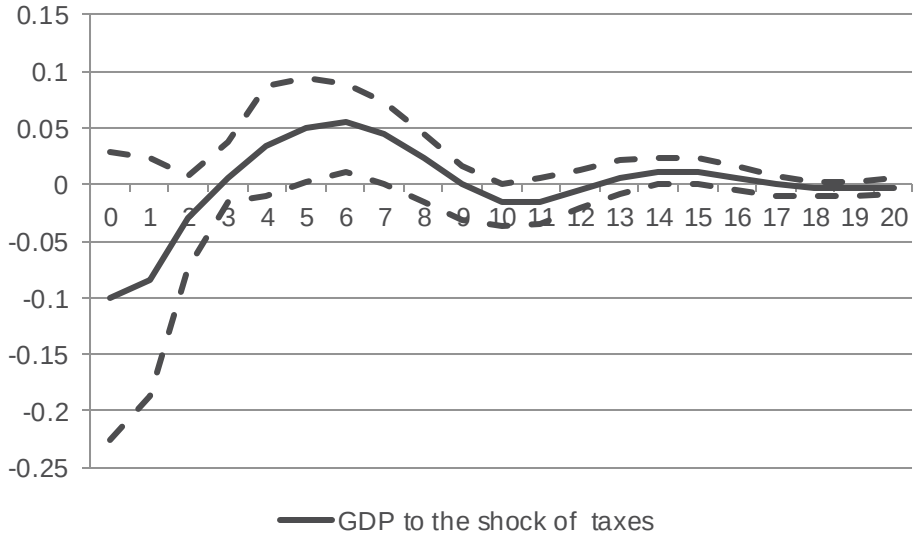


Results: revenues and expenditures multipliers

	Impact multiplier	Cumulative multiplier (8q)	Highest cumulative multiplier during the first 8q
G_t, T_t	G_t= 0,26 T_t= -0,43	G_t= 1,5* T_t= -0,004 *	G_t= 1,5* (8) T_t= -0,9 (2)

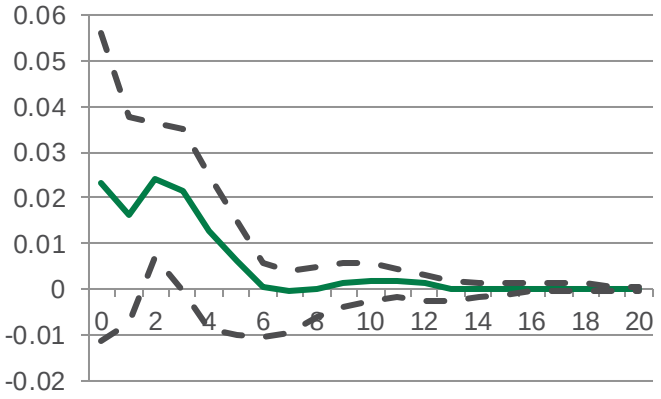
Statistical significance at 95% level, confidence intervals are estimated using the Efron & Hall algorithm and 1000 bootstrap replication.
() – quarters.



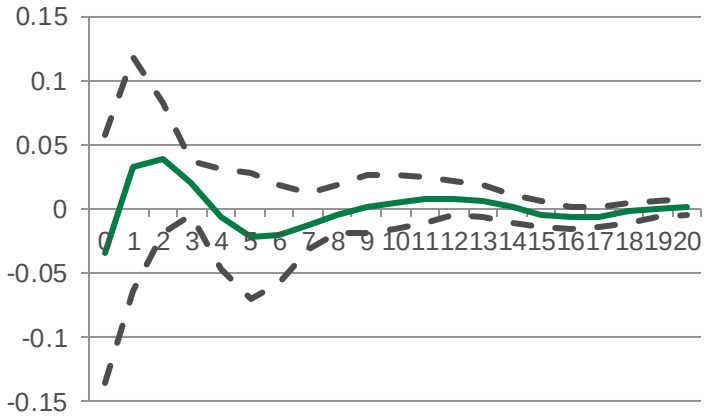


Results: impulse response functions of expenditure items

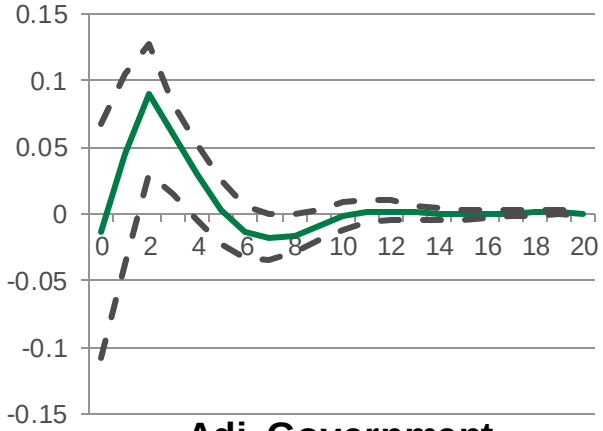
Response of real GDP to 1% shock of



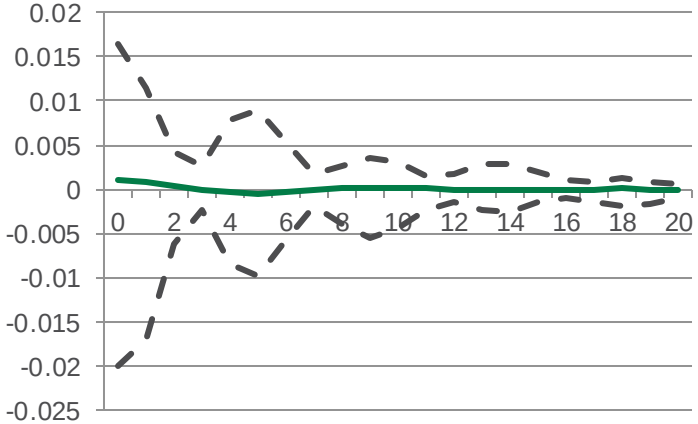
Capital expenditures



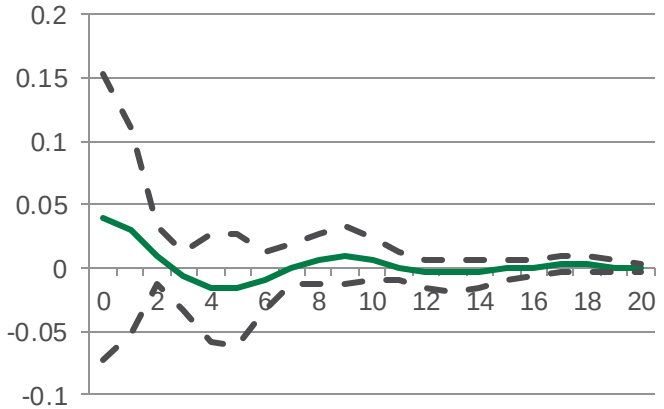
Government Consumption



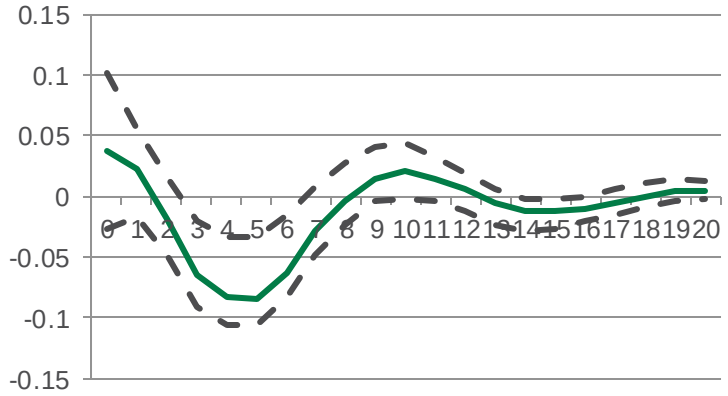
Adj. Government Consumption



Transfers to population



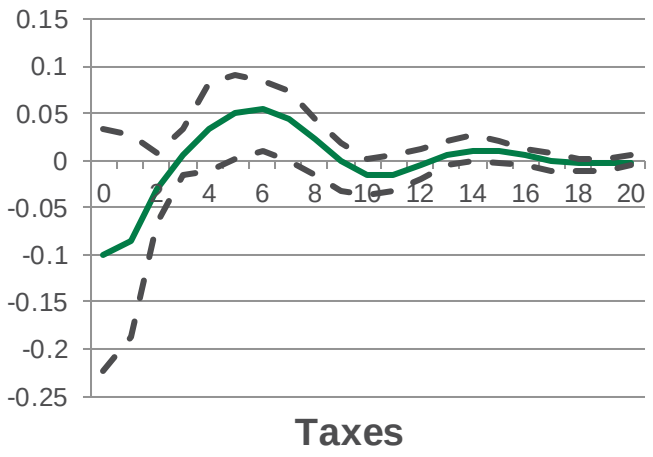
Government wages



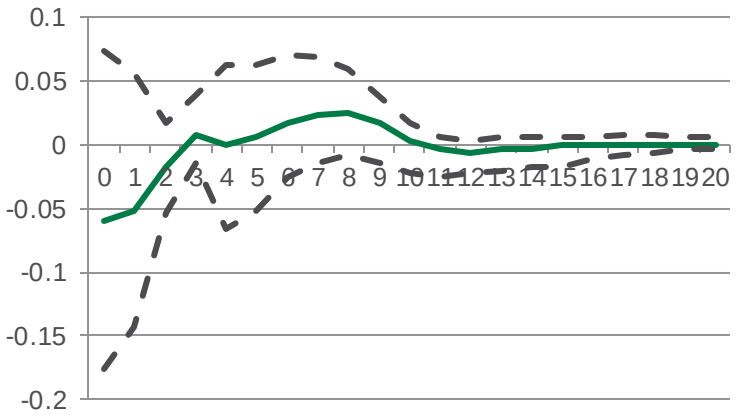
Pensions

Results: impulse response functions of revenue items

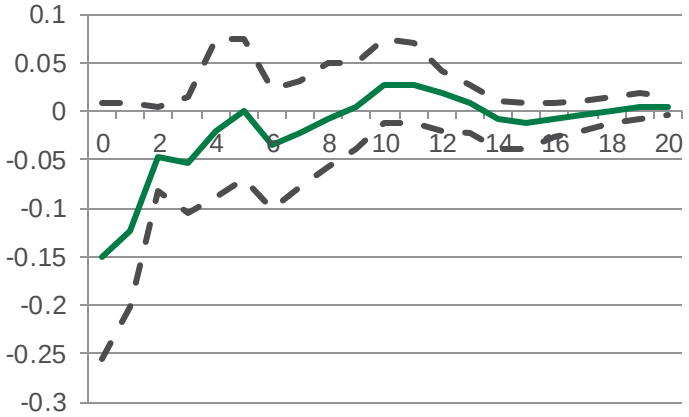
Response of real GDP to 1% shock of



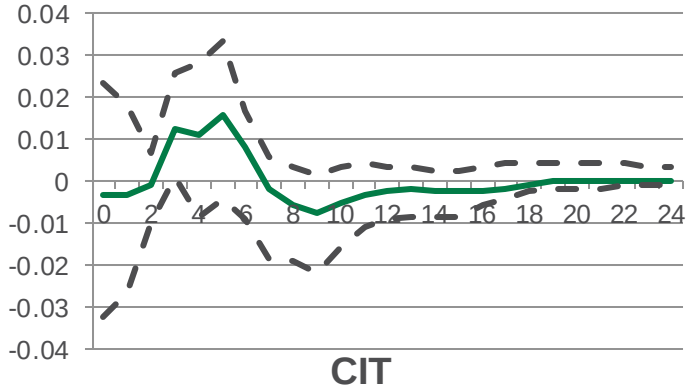
Taxes



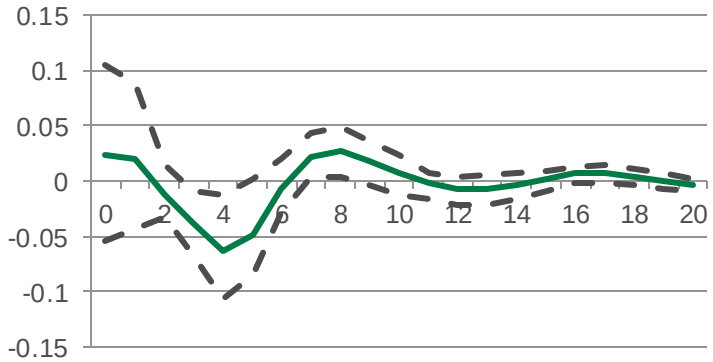
PIT



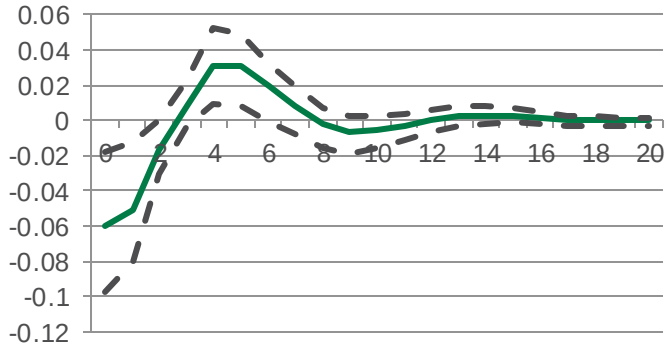
Social contributions



CIT



Customs



VAT

Results: multipliers for budget components

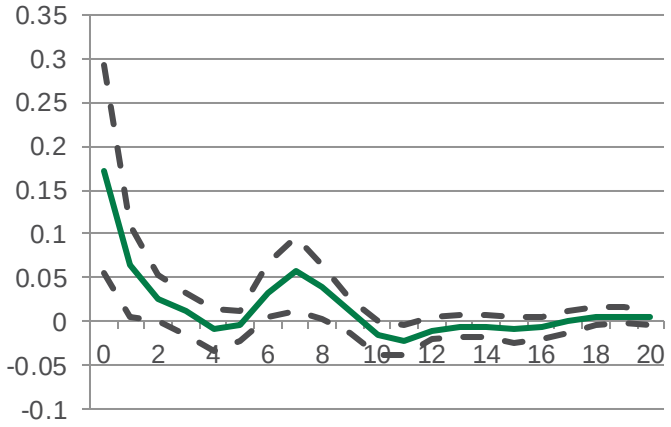
Fiscal variable	Impact multiplier	Cumulative multiplier after 8 quarters	Highest absolute multiplier during first 8 quarters	Highest cumulative multiplier during first 8 quarters
Government Wages	0,5	0,5	0,5 (1)	1 (2)
Government Consumption	-0,5	-0,12	0,6 (2)	0,85 (3)
Adjusted Government Consumption	-0,32	4,1*	2.2* (2)	5,3* (5)
Capital expenditures	0,69*	3,1*	0,7* (2)	3,12* (6)
Transfers to population	0,01	0,02	0,01 (1)	0,02 (2)
Pensions	0,3	-2.4	-0,72 (5)	-2,43 (8)
VAT	-0,7*	-0,4	-0,7* (1)	-1,5 (2)
CIT	-0,08	0.8	0,38 (5)	0.98 (6)
PIT	-1,25	-1	-1,25 (1)	-2,7 (2)
Customs	2,15	-7	-5,8* (4)	-11,5 (6)
Social contributions	-1,6	-4,8	-1,6* (0)	-4,8 (8)

*Statistical significance at 95% level, confidence intervals are estimated using the Efron & Hall algorithm and 1000 bootstrap replication.

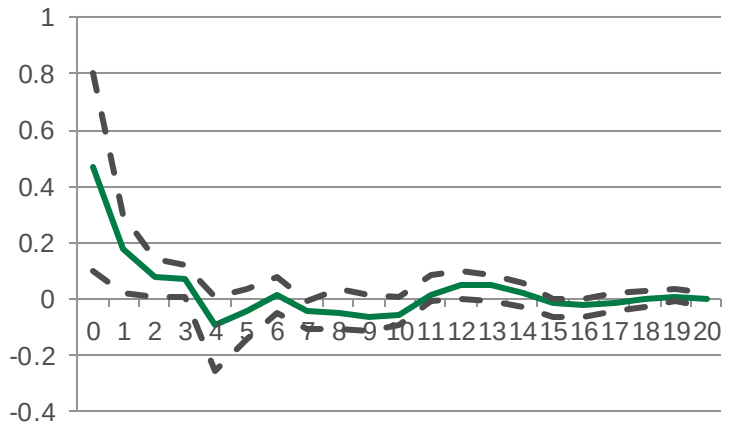
() – quarters.

Results: IRFs of expenditure items

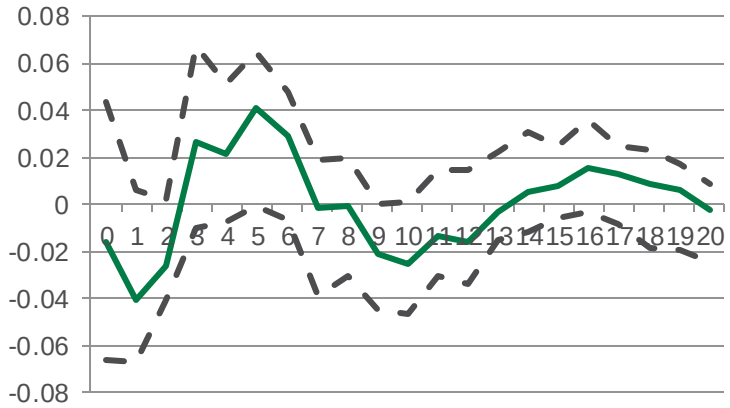
Response of CPI growth rate to 1% shock of



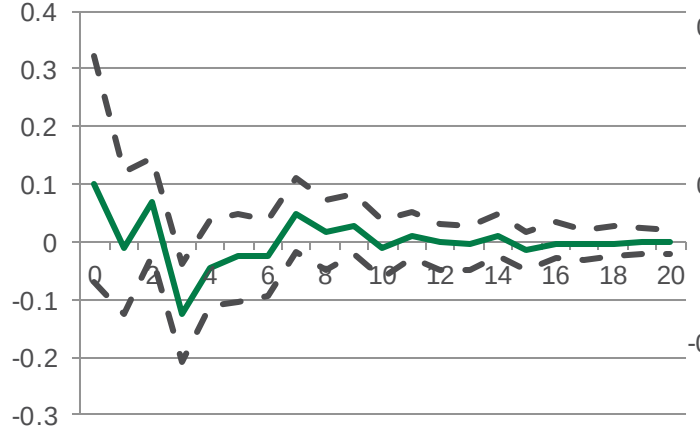
Budget expenditures



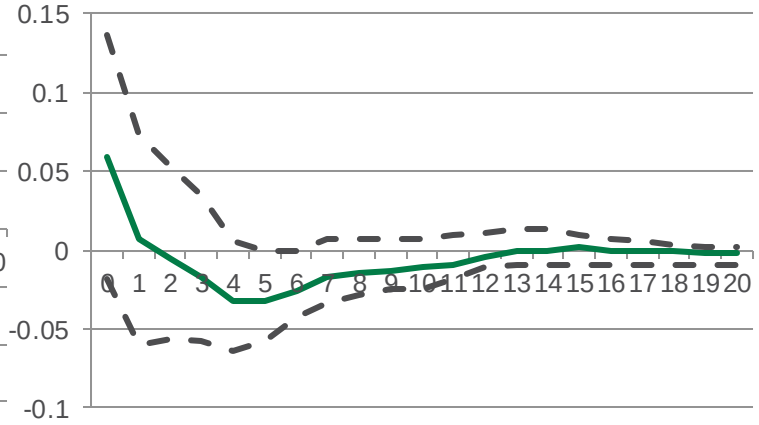
Government Wages



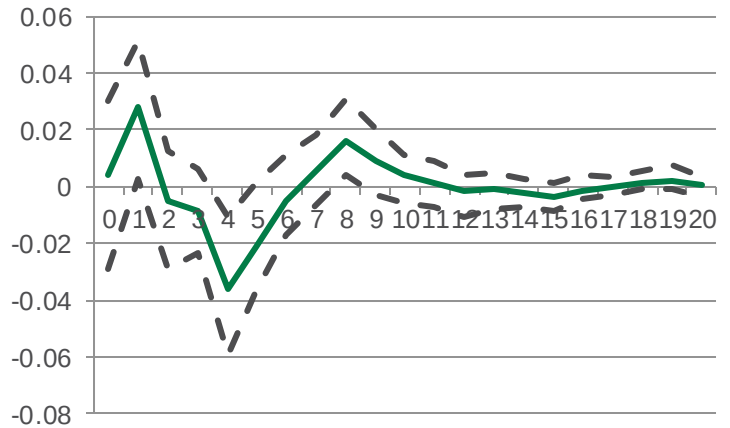
Transfers to population



Government Consumption



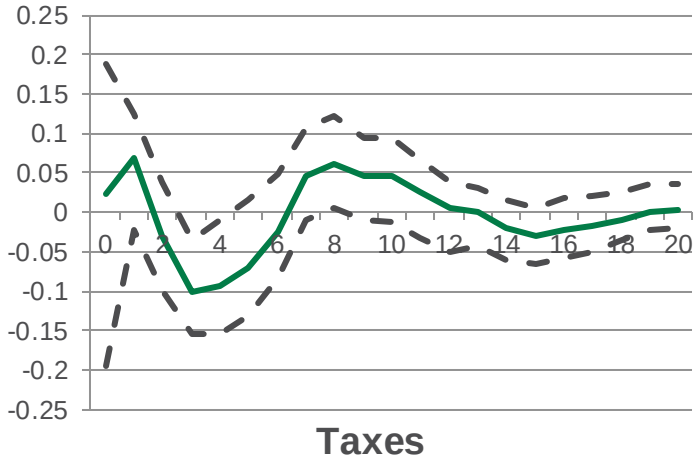
Pensions



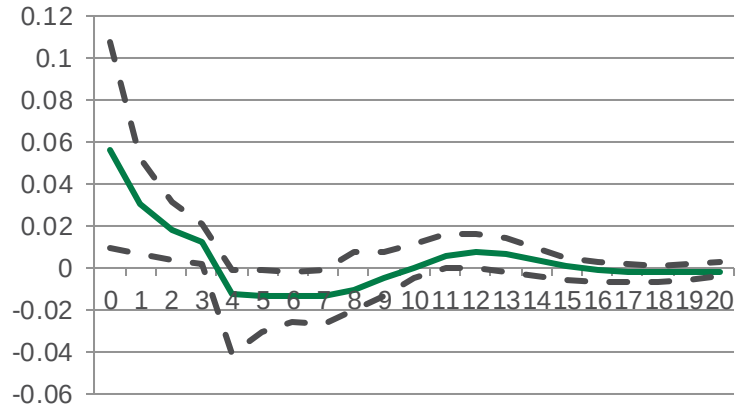
Capital expenditures

Results: impulse response functions of revenue items

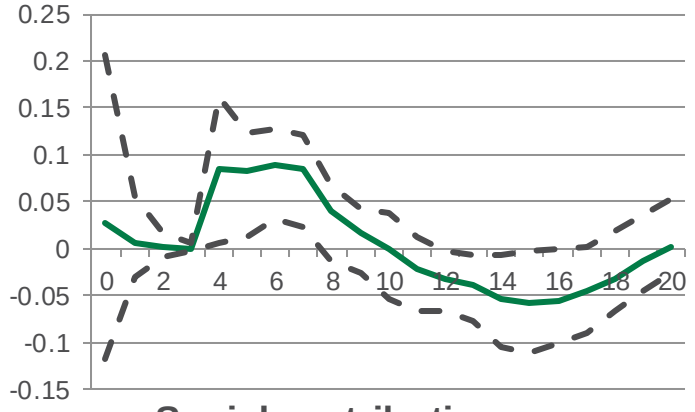
Response of CPI growth rate to 1% shock of



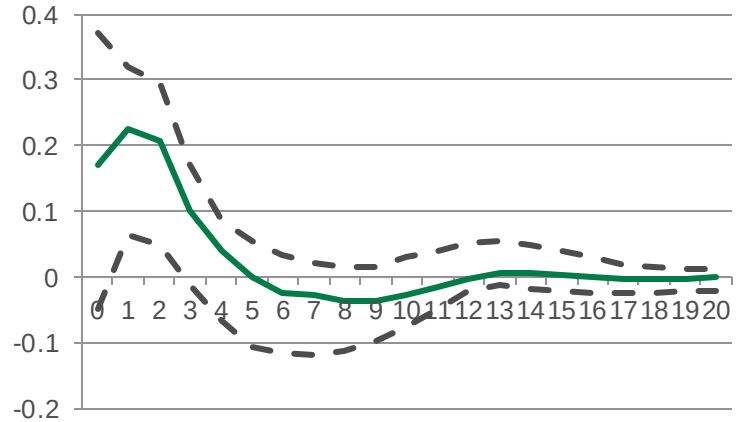
Taxes



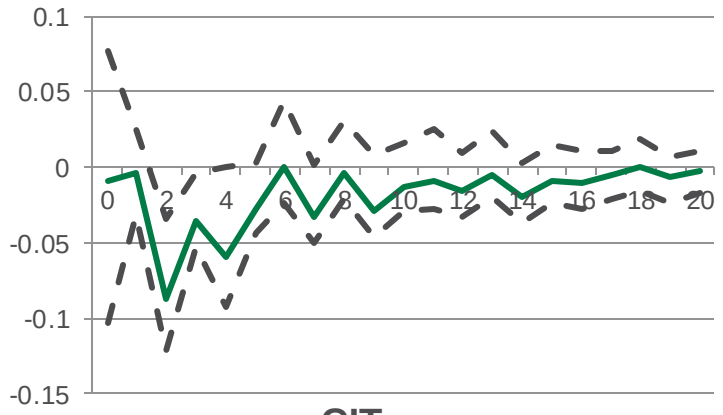
VAT



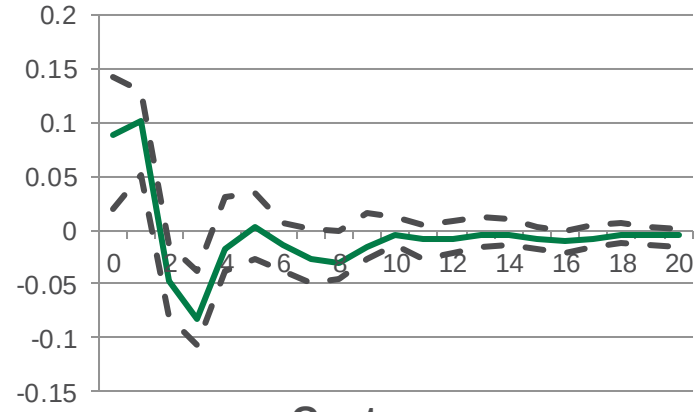
Social contributions



PIT



CIT



Customs

Results: impact on inflation for budget components

Fiscal variable	Impact coefficient	Cumulative coefficient after 8 quarters	Highest absolute coefficient during first 8 quarters	Highest cumulative coefficient during first 8 quarters
Expenditures	0,17*	0,39*	0,17* (0)	0,39* (8)
Taxes	0,02	-0,12	-0,09* (4)	-0,22 (6)
Government Wages	0,47*	0,6*	0,47 *(0)	0,8* (1)
Government Consumption	0,1	0,006	0,1(0)	0,16 (2)
Capital expenditures	0,0042	-0,02	0,02* (1)	-0,04 (6)
Transfers to population	-0,01	0,03	0,04 (5)	-0,08 (2)
Pensions	0,06	-0,07	0,06 (0)	-0,07 (8)
VAT	0,05*	0,05*	0,05* (1)	0,11* (3)
CIT	-0,009	-0,25	-0,08* (2)	-0,25 (8)
PIT	0,17	0,64*	0,22* (1)	0,74* (4)
Customs	0,08*	-0,02	0,1* (1)	0,18* (1)
Social contributions	0,02	0.41*	0,08* (6)	0,41* (8)

Statistical significance at 95% level, confidence intervals are estimated using the Efron & Hall algorithm and 1000 bootstrap replication.

() – quarters.

Robustness: GDP response

		basic	b_1=(-0.5)	b_1=(-2.5)	VAR(4)	exch	t_first
Budget expenditures	cum. 4q	0.36	0.36	0.36	0.29	0.40	0.37
	cum. 8q	0.40	0.40	0.40	0.35	0.52	0.40
Capital expenditures	cum. 4q	0.10	0.10	0.10	0.14	0.15	0.10
	cum. 8q	0.10	0.10	0.10	0.10	0.16	0.11
Government Consumption	cum. 4q	0.05	0.05	0.19	0.21	-0.11	0.10
	cum. 8q	-0.01	-0.01	0.05	0.23	-0.05	0.01
Adj. Government Consumption	cum. 4q	0.21	0.21	0.21	0.36	0.14	0.20
	cum. 8q	0.17	0.17	0.17	0.40	0.10	0.17
Taxes	cum. 4q	-0.17	0.04	-0.36	0.08	-0.12	-0.15
	cum. 8q	0.00	0.16	-0.19	0.28	0.07	0.02
Import customs	cum. 4q	-0.07	0.00	-0.13	0.02	0.04	-0.02
	cum. 8q	-0.08	-0.03	-0.11	-0.04	0.06	-0.02
CIT	cum. 4q	0.02	0.06	-0.01	0.01	0.04	0.05
	cum. 8q	0.03	0.07	0.01	0.02	0.25	0.07
PIT	cum. 4q	-0.12	-0.02	-0.38	-0.12	-0.07	-0.07
	cum. 8q	-0.05	0.01	-0.23	0.08	-0.02	-0.01
Social security contributions	cum. 4q	-0.40	-0.23	-0.51	0.04	-0.52	-0.37
	cum. 8q	-0.46	-0.37	-0.43	-0.70	-0.64	-0.44
VAT	cum. 4q	-0.09	-0.05	-0.11	-0.01	-0.08	-0.14
	cum. 8q	-0.03	-0.01	-0.04	0.04	-0.05	-0.10

Cumulative multipliers are statistically significant at 95%

Robustness: CPI response

		basic	a_g=(0.1)	a_g=(0.9)	VAR(4)	exch	t_first
Budget expenditures	cum. 4q	0.26	0.08	0.28	0.14	0.24	0.25
	cum. 8q	0.39	0.19	0.41	0.14	0.10	0.37
Budget expenditures on wages	cum. 4q	0.71	-0.59	0.83	0.77	0.53	0.75
	cum. 8q	0.59	-0.55	0.71	0.63	0.46	0.59
Taxes	cum. 4q	-0.13	-0.19	-0.10	-0.16	-0.10	-0.20
	cum. 8q	-0.12	-0.25	-0.15	-0.14	0.05	-0.30
Import customs	cum. 4q	0.04	0.04	0.10	0.30	-0.19	0.16
	cum. 8q	-0.02	0.02	0.10	0.38	-0.27	0.17
CIT	cum. 4q	-0.20	-0.14	-0.09	-0.21	0.06	-0.14
	cum. 8q	-0.26	-0.20	-0.14	-0.27	0.06	-0.24
PIT	cum. 4q	0.74	0.00	0.91	0.97	0.16	0.73
	cum. 8q	0.65	-0.09	0.82	0.81	0.03	0.64
Social security contributions	cum. 4q	0.12	-0.08	0.19	-0.31	0.26	0.12
	cum. 8q	0.42	0.28	0.45	-0.04	0.26	0.42
VAT	cum. 4q	0.11	0.07	0.13	0.12	-0.03	0.08
	cum. 8q	0.05	0.03	0.07	0.14	0.00	0.03

Cumulative multipliers are statistically significant at 95%

Key conclusions

- Fiscal multipliers are higher and more persistent for budget expenditures
- On the expenditure side capital outlays and government consumption have the highest multiplier
- Personal income tax, social contributions, customs are most harmful for GDP growth among taxes, while only customs are statistically significant
- Budget expenditures have positive impact on CPI, the impact of taxes is mixed
- The most inflationary budget items are wages, on expenditures side, and PIT, on taxes side
- The budget expenditures of social nature have minimum impact on real GDP