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From Fiscal Consolidation to Fiscal Optimization

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Summary

The fiscal consolidation program in 2015 was a success. Despite this success, it is time to consider a switch away from the fiscal consolidation policy towards a fiscal optimization policy. By "fiscal optimization policy" we mean a proper design of fiscal instruments that might lead towards the maximum potential rate of GDP growth. Relying on a panel regression model for 76 countries, the IMF recommended some guidelines for such an optimal fiscal policy in its latest regional report on Central, Eastern, and Southeastern European (CESEE) countries.

In this paper we test the IMF's recommendations in a different analytical framework based on the QUEST_Serbia Dynamic Stochastic General Equilibrium (DSGE) model. We endogenize all fiscal revenue instruments, update macroeconomic data, and estimate the model's coefficients using Bayesian technique. We also develop a new analytical tool for the decomposition of Impulse Response Functions (IRF), which helps us to reduce complex dynamic non-linear general equilibrium relations to simpler linearized relations between endogenous variables and key state variables.

Our findings support a general IMF suggestion in the particular case of the Serbian economy for reducing fiscal duties on labor and capital inputs, as well as public consumption and transfer payments. We, however, do not support increasing VAT rates or expanding public investments unless some additional conditions are met.

Key words: Fiscal consolidation, DSGE models, optimal taxation, IRF decomposition

JEL CLASSIFICATION: C680, E620

Introduction

Fiscal and monetary policies have switched roles in 2015. Fiscal policy has been considered expansionary for years. Depending on the stage of the business cycle, it has been counter-cyclical or pro-cyclical, but always expansionary. During the period of high growth rates from 2003 until 2008, fiscal policy further stimulated GDP growth. Since the onset of the global recession, the Serbian economy has entered recession three times, and the fiscal policy has unsuccessfully attempted to improve growth prospects. The final outcome has been a persistent fiscal deficit and rising public debt. When the debt-to-GDP ratio reached the level of 70 percent in 2014, it was clear that such a policy was not sustainable any more. The program of fiscal consolidation was designed in 2015, and has been implemented so far with good results.

On the other hand, the monetary policy has never been counter-cyclical until last year. Arguing that a lower fiscal deficit would provide room for the reduction of the repo interest rate, the National Bank of Serbia (NBS) turned to monetary easing in 2015. The IMF supported such a switch in the monetary policy. Up to that point, the NBS has been only concerned with price stabilization, for which goal it advocated the policy of high interest rates at any cost in terms of lost output.

As for the fiscal consolidation program, expectations were standard. Fiscal consolidation generally squeezes aggregate demand by depressing public and private consumption, which were the main driving force for growth in the Serbian economy. The Serbian government and IMF officially announced that GDP would drop by 0.5 percent. Unofficially, the Serbian government was hoping to achieve any positive growth rate no matter how low it would be**;** in fact, this happened. The Serbian economy grew in 2015 with the GDP growth rate between 0.5 and 0.7 percent[1]. This outcome does not imply that the standard theoretical implications of a fiscal consolidation program were challenged. Quite the opposite**;** as expected, a reduction in private and public consumptions had a negative impact on aggregate demand and growth. However, a rise in exports and investment outperformed such negative shocks. As for the value-added side of GDP, the energy and mining sectors recovered from a drop caused by the flood in 2014, while manufacturing and construction resumed some growth. The overall effect on growth would have been even better if agriculture had not had a bad crop season. Public services and real estate also contributed to a slow-down in economic activity (which was not a surprise). Other productive sectors did not have much impact on growth.

This is all recent history. What can we expect in the near future? It is reasonable to assume that one-off factors of growth will not have permanent effects, and the program of fiscal consolidation will continue in one way or another. It is true that the severity of fiscal consolidation was somewhat eased in the fourth quarter of 2015, but the main components of the program are still in place. Public debt is stubbornly high, and might even increase since some hidden public debts have recently been discovered. It is hard to expect that public debt will bounce back in 2017. Equally true, high growth rates or growth rates over the average public borrowing cost will not spontaneously emerge. Therefore, another issue of high relevance is emerging**;** the long-lasting theoretical and empirical debate about the interdependence of fiscal policy instruments and long-term growth rates. More specifically the question is: is it possible to have higher growth in Serbia due to a better mix of fiscal instruments.

We have written this paper in order to provide an answer to this question. The paper is organized in the following way**:** the first part provides the empirical background for the analytical modeling of the link

[1] At the moment of writing, the fourth quarter of 2015 is not yet closed, so we need to forecast GDP performance. According to the forecast made for the value-added side of GDP, the growth rate in 2015 will be 0.7 percent. However, a similar forecast done for the final demand side of GDP is a little bit more pessimistic and expects 0.5 percent growth. The Ministry of Finance predicts growth of 0.8 percent. Nevertheless, it is a fact that the fiscal year 2015 ended with small but positive growth.

between fiscal instruments and growth in Serbia and CESEE. The second part explains how the QUEST_Serbia DSGE model is modified in order to endogenize fiscal revenue variables. In the third part our new analytical tool of decomposing IRFs is described, and used to analyze the complex role of transfer payments. In the fourth part this analysis is extended to other revenue and expenditure instruments. Finally, we conclude which IMF recommendations are equally valid for Serbia as for other CESEE countries, and in which cases we need to be more cautious.

Empirical fiscal evidence

We now address the empirical relationships between GDP growth rates (y-o-y) and fiscal revenue and expenditure categories that are expressed as a percentage of GDP. The period of analysis encompasses three sub-periods that are of particular interest. The first sub-period starts with the first quarter of 2003 and ends at the fourth quarter of 2008. The Serbian economy in this period experienced impressive growth, which was, however, based on domestic demand financed through foreign loans. The second sub-period began with the first quarter of 2009, when the negative impacts of the global recession spilled over to the Serbian economy. Serbia faced a typical sudden stop crisis with broken lines of international financing. From that moment up to the last quarter of 2015, the Serbian economy has been in a depression**,** desperately trying to restructure the economy and adopt a new growth model based on exports and private investment. The third sub-period was in fact a part of the second period. It refers to the four quarters of 2015, and is marked as the period of fiscal consolidation. Therefore, we separate in Table 1 the four landmarked points of observation: 2003Q1, 2009Q1, 2014Q4 and 2015Q4[2].

Table 1: General government revenue and expenditure as a percent of GDP

	2003Q1	2009Q1	2014Q4	2015Q4
Fiscal revenue				
SSC	9.0%	13.3%	13.1%	12.0%
VAT	10.1%	10.7%	11.1%	9.9%
Excise	4.1%	3.8%	5.3%	6.0%
Non-Tax	2.7%	4.5%	6.1%	5.2%
Tariffs	2.2%	1.8%	0.8%	0.8%
Others	1.5%	1.1%	1.6%	1.4%
CIT	0.9%	2.0%	1.3%	1.2%
PIT	5.1%	4.8%	4.0%	3.6%
Total	35.6%	42.0%	43.3%	40.1%
Fiscal expenditure				
Capex	1.9%	1.8%	3.2%	4.7%
Guaranties	0.0%	0.0%	1.1%	1.4%
Goods & Services	6.1%	5.5%	8.3%	7.0%
Interest payments	1.2%	0.9%	2.3%	2.7%
Repayments	0.1%	0.1%	4.2%	0.1%
Others	1.1%	0.5%	1.7%	1.0%
Subsidies	3.9%	1.7%	4.4%	4.9%
Transfer payments	16.7%	20.5%	17.2%	18.6%
Public wages	9.8%	10.9%	11.0%	10.0%
Total	40.8%	41.9%	53.4%	50.4%

[2] Notice that these data are of quarterly frequency and include all seasonal effects. Corresponding annual data average out those seasonal effects, and are usually reported in other documents.

Data from the second and third columns in Table 1 indicate the reaction of the fiscal policy in Serbia to the spill-over effects of the global recession on the country's economy. In the period between 2009Q1 and 2014Q4, the share of social security contributions (SSC) in GDP slightly increased by 0.2 percent, while fiscal proceeds from personal income tax (PIT) dropped by 0.8 percent. The net effect of these changes was negative, with the consequence that the fiscal burden on labor input somewhat lessened during the crisis. The same was true for corporate income tax (CIT), which represents a fiscal duty levied on capital with a decrease of 0.7 percent of GDP. These types of fiscal revenue are typically considered as distortive taxes. Data suggest that policy-makers in Serbia tried to reduce the tax burden on production factors in order to provide a better fiscal environment for fighting recession with a less distortive tax effect. The lost fiscal revenue was compensated by increasing indirect taxes on consumption, which are considered as non-distortive taxes. Proceeds from Value-Added Tax (VAT) increased by 0.4 percent of GDP, and excise duties by 1.5 percent. Tariffs were already low, but they dropped further by 1 percent of GDP due to the implementation of the Stabilization and Association Agreement with the EU. All in all, fiscal revenue increased in this period by a moderate 1.3 percent of GDP.

In the very same sub-period fiscal expenditure increased by more than 10 percent of GDP. All acting Serbian governments of that time intended to support the economic recovery through increasing capital expenditure by 1.4 percent of GDP, public consumption (goods and services) by 2.8 percent, and subsidies by 2.7 percent, while public salaries and wages increased by only 0.1 percent of GDP. On the other hand, transfer payments were reduced by 3.3 percent. The rising share of fiscal expenditure in GDP was treated as a key measure of an expansionary fiscal policy. However, the modest increase in fiscal revenue was not sufficient to cover the huge increase in fiscal expenditure. The governments embarked on borrowing abroad, which pushed up public debt to an unsustainable level.

The last sub-period is rather short, and it is still not over. In this period of fiscal consolidation fiscal revenue due to SSC and PIT proceeds was further reduced because of the shrinking fiscal base comprising of pension payments and the public wage bill. Fiscal consolidation additionally caused a reduction in public purchases of goods and services. As private consumption suffered as well, VAT revenue also declined. On the other side, transfer payments and subsidies increased last year even if budgetary support for the public pension scheme lessened. The burden of interest payments went up alongside capital expenditure, if we include called public guaranties in this fiscal category. As we already mentioned, the fiscal stance was eased in the fourth quarter of the fiscal year 2015.

Table 2: Coefficients of correlation in Serbia and regression coefficients in CESEE

Shares in GDP	Serbia	CESEE	Shares in GDP	Serbia	CESEE
Expenditure side			Revenue side		
Capex	0.060991	0.106	SSC	-0.178785	-0.646**
	[0.6805]			[0.224]	
Guarantees	-0.541632*		VAT	0.594455***	0.018
	[0.0001]			[0.0001]	
Goods	-0.170347	-0.858*	Excises	-0.620138***	
	[0.247]			[0.0001]	
Interest payment	-0.570495*		Non-Tax	-0.039672	-0.110
	[0.0001]			[0.7889]	
Liquidity cost	-0.123891		Tariffs	0.814471***	
	[0.4015]			[0.0001]	
Others	-0.239033	-0.082	Others	-0.742183***	0.501
	[0.1018]			[0.0001]	
Subsidies	0.167321		CIT	-0.385884***	-0.824**

	[0.2557]			[0.0068]	
Transfer payments	-0.5307***	0.207	PIT	0.787941***	0.086
	[0.0001]			[0.0001]	
Public wages	0.215417	0.115			
	[0.1414]				

***(**,*) indicates significance at 1 (5,10) percent, values within bracket [] show probability that $|t=0|$.

In 2015 the IMF [2015] provided an analysis of the connections between fiscal revenue and expenditure instruments on the one hand, and longer term GDP growth rates on the other, in CESEE countries[3]. Fiscal revenue and expenditure were corrected for a cyclical component. The econometric model was augmented with six control variables. The panel regression model was estimated using data for 76 countries (CESEE, advanced countries and Less Developed Countries) in the period between 1990 and 2014. Serbia was included in the panel data, but the period of fiscal consolidation was not. Additionally, dummy variables for two separate regions (advanced countries and CESEE) were included. The method of panel estimation was Ordinary Least Squares (OLS), with country and time fixed affects. We have reproduced estimated values of regression parameters in Table 2 in the column under the heading **"**CESEE**"** for CESEE countries as a group. The sign of these parameters (positive or negative) indicates underlying correlation (positive or negative) between GDP growth rates and corresponding categories of fiscal revenue and expenditure. In order to compare Serbia's position with the group of CESEE countries, we have calculated ordinary coefficients of correlation between GDP growth rates and shares of corresponding fiscal variables in GDP in Serbia for the period between Y2003Q1 and Y2015Q4. The coefficients of correlation obtained are shown in the column under heading the "Serbia".

A comparative analysis of Serbia's and CESEE's fiscal correlation pattern points in the following directions**:** corporate income taxes and social security contributions correlate negatively with growth in CESEE, as suggested by the theory. That correlation has been significant in CESEE countries. The corresponding signs of correlation were also negative in Serbia, but not significant for SSC. Negative correlation between growth and CIT in Serbia was significant at 1 percent.

Consumption taxes did not correlate significantly with growth in CESEE countries. By contrast, the correlation between VAT proceeds and tariffs in Serbia, on the one hand, and growth on the other, was high, positive and highly significant. Interestingly, a similar correlation with respect to excise duties was also high and significant, but negative.

It is also interesting to note that personal income tax was not associated in a significant way with negative growth effects. In the CESEE countries the estimated coefficient was not significant, while in Serbia the coefficient of correlation was significant, but positive. Those empirical findings contradict theoretical expectations.

On the expenditure side, capital expenditure and public wages were positively associated with growth, but estimates of these coefficients were not significant. Public purchases of goods and services were negatively and significantly correlated with growth in CESEE countries, while in Serbia their negative correlation was not significant. Finally, another point of discrepancy is that transfer payments positively, but not significantly, contributed to growth in CESEE countries, while there was a significant and negative correlation between transfer payments and growth in Serbia.

[3] Similar relations were empirically tested by Kneller *et al*. [1999] for a panel of 22 OECD countries during 1970-95. They provided considerable evidence that distortionary taxation reduces growth, whilst non-distortionary taxation does not, and that productive government expenditure enhances growth, whilst non-productive expenditure does not. However, some combinations of these specific fiscal revenue and expenditure categories had ambiguous effects on growth.

On the basis of the above empirical and analytical findings the IMF recommended what a growth-oriented reform of fiscal revenue and expenditure in CESEE countries should do in order to achieve the highest possible GDP growth rates. This shift away from one type of revenue or expenditure toward another was suggested in the following way:

- Growth-oriented revenue reform in CESEE economies would shift the revenue base away from CIT and SSC toward consumption taxes, property taxes and PIT,
- Growth-oriented spending reform in CESEE would shift spending away from public consumption and transfers toward investment.

Serbia is one of the CESEE countries, and shares their destiny. We will test these recommendations in the third and fourth parts of this paper to particularly mark which recommendations apply equally to the Serbian economy. Before that, in the second part of the paper, we will outline our analytical framework.

Modeling fiscal revenue

Fiscal policy models based on an endogenous growth hypothesis were initiated by Barro [1990] and extended by Barro and Sala-i-Martin [1992], [1995] and Mendoza *et al.* [1997]. They provided a realistic explanation of how fiscal policy can influence the steady-state growth rate, and traced transitional mechanisms toward this long-term growth path. Predictions from these models are derived by classifying elements of the fiscal policy into one of four categories: distortionary or non-distortionary fiscal revenue and productive or non-productive fiscal expenditure. Distortionary fiscal revenue is that which affects the investment decisions of economic agents, and hence deforms the steady-state rate of growth. Non-distortionary fiscal revenue does not affect saving-investment decisions and has no effects on the rate of growth. Government expenditure is differentiated according to whether it is included as a factor in the private production function or not. If it is, then it is classified as productive and hence has a direct positive effect upon the rate of growth. If it is not then it is classified as unproductive expenditure and does not affect the steady-state rate of growth, see Kneller *et al*. [1999] for a clear summary of this theoretical exposition.

Our analytical framework is based on DSGE models. In such models, however, a clear distinction between distortionary and non-distortionary taxation forms may not be made explicitly. For example, taxes on consumption are typically treated as non-distortionary. A consumption tax rate is considered as non-distortionary since it does not affect the investment decisions of firms. However, it does affect households' consumption choices over time. If the tax proceeds on consumption are expected to increase in the future, households will want to consume more now and less in the future, so consumption growth will be reduced as well as savings, and eventually saving-investment decisions will be affected. The opposite would be true if the tax proceeds on consumption were expected to decline in the future. Hence, claims that an increase in the VAT rate is non-distortionary with no negative effects on growth may not be correct. Such a claim has to be verified in each particular case before being recommended by policy-makers.

The basic structure of the QUEST_Serbia model follows Ratto *et al*. [2009]. The model has been modified to the Serbian circumstances by Labus [2014], and used for testing the fiscal consolidation package by Labus and Labus [2015]. We will further modify the model in this paper in order to endogenize fiscal revenue categories. The main idea is to link fiscal revenue to business cycle conditions. This was present in the original QUEST_Serbia model. The expenditure side indeed responded to an output gap, while the revenue side was modeled mostly in a way to reflect government fiscal policy stances. We now endogenize the revenue side as well, and make it correspond to the business cycle path.

Before we explain this modification of the model, let us rewrite the expenditure side. Government expenditure constitutes public purchases of consumer goods and services, government investments and transfer payments:

$$EXP_t^G = C_t^G \cdot P_t^C + I_t^G \cdot P_t^C + TRAN_t \quad (1)$$

Government consumption is directly exposed to changing business cycle conditions. This is modeled by its temporary deviations around the long-term growth rates[4]:

$$\Delta g_t^G = \tau_{lag}^G \Delta g_{t-1}^G + \tau_{adj}^G \cdot \Delta g_t^{G/Y} + \tau_{gap}^G \cdot \Delta g_t^{\tilde{y}} + \zeta_t^G \quad (2)$$

where ($\Delta g_t^G = g_t^G - g$) is the deviation of the government consumption growth rate around the steady-state GDP growth rate**,** $\Delta g_t^{G/Y}$ is the deviation of the government consumption share in GDP from its target level. Parameter (τ_{lag}^G) indicates the level of inertia in the reaction process, while parameter (τ_{gap}^G) captures the delay with which the fiscal response to an output gap takes place. The remaining parameter (τ_{adj}^G) measures the speed of adjustment of temporary deviations to the target share of government consumption in GDP. Finally, the whole process is subject to permanent stochastic shocks (ζ_t^G).

The response of government investments to changing business conditions is formulated in a symmetric way[5]:

$$\Delta g_t^{IG} = \Delta g_{t-1}^{IG} + \tau_{adj}^{IG} \cdot \Delta g_t^{IG/Y} + \tau_{gap}^{IG} \cdot \Delta g_t^{\tilde{y}} + \zeta_t^G \quad (3)$$

where ($\Delta g_t^{IG} = g_t^G - g - g^{TFP}$) is the deviation of the government investment growth rate around the steady-state GDP growth rate corrected for the embodied technological progress**,** $\Delta g_t^{IG/Y}$ stands for the deviation of the government investment share in GDP from its target level. No inertia is assumed in this process, while parameters (τ_{adj}^{IG}), and (τ_{gap}^{IG}) capture some delays in adjustment to the policy target and friction in responding to the output gap.

The transfer payment system acts as an automatic stabilizer in a business cycle by coupling the income of unemployed people and of pensioners with the actual realization of wage payments in the economy. We assume that the government regards the share of transfer payments to the wage bill (or alternatively to GDP) as a decision variable, and on top of that, it provides income for unemployed people:

$$\frac{TRAN_t}{W_t L_t} = \left(\frac{TRAN}{WL}\right)_{target} + b \cdot (L0 - L_t) + \zeta_t^{TRAN} \quad (4)$$

The target share of transfer payments to the wage bill is ($\left(\frac{TRAN}{WL}\right)_{target}$), the target labor participation rate is ($L0$), and parameter (b) measures the generosity of the social safety net. The whole process is subject to a stochastic shock (ζ_t^{TRAN}).

Let us now turn to the revenue side**,** where we made most of the adjustments. Government revenue (REV_t^G) is collected from taxes on labor income, including SSC, consumption, and profit, as well as from lump-sum taxes:

$$REV_t^G = (tax_t^W + tax_t^{SSC}) \cdot W_t L_t + tax_t^{VAT} P_t^C C_t + tax_t^{PF} i_t^K P_t^K K_t + tax_t^{LS} \quad (5)$$

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[4] The initial equation is: $g_t^G - g = \tau_{lag}^G (g_{t-1}^G - g) + \tau_{adj}^G \cdot \left[\ln\left(\frac{C_{t-1}^G \cdot P_{t-1}^C}{Y_{t-1} \cdot P_{t-1}}\right) - \ln\left(\frac{C^G}{Y}\right)_{target}\right] + \tau_{gap}^G \cdot \left[\ln\left(\widetilde{y}_t\right) - \ln\left(\widetilde{y}_{t-1}\right)\right] + \zeta_t^G$, where $\left(\frac{C^G}{Y}_{target}\right)$ is the target share of government consumption in GDP.

[5] $g_t^{IG} - g - g^{TFP} = (g_{t-1}^{IG} - g - g^{TFP}) + \tau_{adj}^{IG} \cdot \left[\ln\left(\frac{I_{t-1}^G \cdot P_{t-1}^C}{Y_{t-1} \cdot P_{t-1}}\right) - \ln\left(\frac{I^G}{Y}\right)_{target}\right] + \tau_{gap}^{IG} \cdot \left[\ln\left(\widetilde{y}_t\right) - \ln\left(\widetilde{y}_{t-1}\right)\right] + \zeta_t^{IG}$ where $\left(\frac{I^G}{Y}_{target}\right)$ is the target share of government investment in GDP.

PIT, SSC, VAT and tax on profit are linear and fixed by two components, proportional and progressive levies on the corresponding tax bases. The first component refers to the average rates set independently of business cycle conditions (τ_0^W, τ_0^{SSC}, $\tau_0^{VAT}$and τ_0^{PF} respectively). The second component is the progressive tax rate that captures cycle fluctuations (τ_1^W, τ_1^{SSC}, τ_1^{VAT}, and τ_1^{PF} respectively). It serves as an automatic stabilizer during business fluctuations.

All taxes are derived in a similar way**,** as a first-order Taylor expansion around zero output gap. Hence, labor income tax is:

$$tax_t^W = \tau_0^W \cdot (1 + \tau_1^W \cdot \tilde{y}_t) + \zeta_t^W \quad (6)$$

In a similar way we model SSC, VAT and tax on profit:

$$tax_t^{SSC} = \tau_0^{SSC} \cdot (1 + \tau_1^{SSC} \cdot \tilde{y}_t) + \zeta_t^{SSC} \quad (7)$$

$$tax_t^{VAT} = \tau_0^{VAT} \cdot (1 + \tau_1^{VAT} \cdot \tilde{y}_t) + \zeta_t^{VAT} \quad (8)$$

$$tax_t^{PF} = \tau_0^{PF} \cdot (1 + \tau_1^{PF} \cdot \tilde{y}_t) + \zeta_t^{PF} \quad (9)$$

Tax revenue is uncertain since it depends on cyclical fluctuations and the efficiency of tax collection. Therefore, it is subject to stochastic shocks (ζ_t^W, ζ_t^{SSC}, $\zeta_t^{VAT}\zeta_t^{PF}$ respectively). Shocks are modeled as first-order autoregressive processes with zero mean and standard deviations set by the modeler. Their coefficients are estimated by using Bayesian technique. The empirical part of the model is based on time series of PIT, SSC, VAT and tax on profit for the period Y2003Q1 –Y2015Q4[6].

Finally, a lump-sum tax is included in order to facilitate the government in controlling public debt. It approximates in an ordinary way the government's trial-and-error praxes to enforce the collection of one-off fiscal revenue from state-owned enterprises (SOEs) even if they run losses or are insolvent. In the model, the government sets the target share of public debt in GDP (B_{target}). If the realized share of public debt in GDP in the previous period is higher than the target debt-to-GDP ratio, the government will apply an additional tax rate (τ^B). Also, the government monitors the trend of debt-to-GDP ratio. If this ratio is increasing, meaning that the rate of its change is positive ($\Delta\left(\frac{B_t}{P_t Y_t}\right)$), the government will charge additional taxes at the rate (τ^{DEF}):

$$\Delta t_t^{LS} = \tau^B \left(\frac{B_{t-1}}{P_{t-1}Y_{t-1}} - B_{target}\right) + \tau^{DEF}\Delta\left(\frac{B_t}{P_t Y_t}\right) \quad (10)$$

As we already mentioned, this happens in theory. In reality, the government compares a desired level of public debt with the one actually realized, and accordingly enforces various temporary means of collecting non-tax revenue. Therefore, the burden of the lump-sum tax falls more on taxpayers than on consumers and their disposable income.

The share of fiscal deficit in GDP is defined as follows:

$$def_t^G = \frac{EXP_t^G - REV_t^G}{Y_t \cdot P_t} \quad (11)$$

The fiscal deficit adds up to the existing level of public debt. Right now we are not so much interested in fiscal deficit *per se* or public debt, but in analyzing how different fiscal instruments can support GDP growth. The reason is simple**;** public debt not only encompasses the contemporaneous fiscal deficit, but also includes interest payments for servicing the debt accumulated so far. If the rate of growth is higher than the cost of debt servicing, then the debt-to-GDP ratio will go down under the assumption of a balanced budget. Consequently, the risk of default will be lower.

We assume that the tax rates are constant over time, and are estimated through the process of Bayesian estimation. However, proceeds and expenditure are time-varying. The presence of the time-varying

[6] Ministry of Finance, Republic of Serbia database http://www.mfin.gov.rs/pages/article.php?id=11901.

taxes and transfers modifies the representative household's budget constraints as well as firms' after-tax profit constraints. We need to augment the original equations of the model labels for fiscal revenue variables with a time subscript (t). The form of equations however remains the same, and therefore there is no need to rewrite them at this point.

Policy simulation

We will simulate the impact of fiscal policy instruments on growth by using the IRFs of GDP growth rate to various permanent fiscal shocks. The period for simulation is extended to 20 quarters, which marks a mid-term growth span of five years. The size of shocks was the same in all simulation exercises, and is set to 0.01 (one percentage point). The resulting impulse responses can be separated into two groups. The first group comprises the IRFs of GDP growth rate to stochastic shocks of transfer payments and the government consumption growth rate. Those responses generate temporary oscillations in the growth rate around its steady state. After four to six periods these deviations die out and the GDP growth rate returns to the steady state.

On the opposite spectrum of reactions, there are permanent negative IRFs of GDP growth rate to stochastic shocks of increasing PIT, SSC, VAT (including excise duties) and CIT. A distinct case is reserved for the growth rate of government investments.

Let us first explain how transfer payments can impact GDP growth. For that purpose we have prepared Figure 1. The IMF has suggested a shift of fiscal spending away from transfer payments and toward investment. In this case we ignore investment, and check only what will happen if transfer payments are hit by a negative stochastic shock. Figure 1 comprises two types of the consequence. The solid line represents the IRF of growth to a transfer payments shock. Hatched bars, however, show how this line is obtained or what the driving forces behind the IRF path are. A reduction in transfer payments immediately depresses the GDP growth rate, which is the theoretically expected result because such a policy reduces households' disposable income and their private consumption. However, growth resumes rather quickly and returns to its steady-state level. How to explain this movement? For this we need to use a new analytical tool that we call the decomposition of IRFs, see Labus & Labus [2016]. Hatched bars show how the decomposition works.

Namely, a DSGE model of rational expectations can be represented in general form by a set of first-order and equilibrium conditions:

$$\begin{gathered} \mathbb{E}_t\{f(\boldsymbol{y}_{t+1}, \boldsymbol{y}_t, \boldsymbol{y}_{t-1}, \boldsymbol{u}_t)\} = 0 \\ \mathbb{E}(\boldsymbol{u}_t) = 0 \\ \mathbb{E}(\boldsymbol{u}_t \cdot \boldsymbol{u}_t') = \Sigma_u \end{gathered} \tag{12}$$

$\mathbb{E}_t$ is the expectation operator, *f* are structural equations, **y** is a vector of endogenous variables, and **u** is a vector of stochastic shocks. The system of equations (12) comprises linear and non-linear first-order difference equations, with leads and lags, which have no explicit algebraic solution. The solution has to be numerically computed in the form of policy functions that relate all endogenous variables in the current period to the endogenous variables of the previous period, and current shocks. To be more precise, endogenous variables in the current period are to be expressed only as a function of state variables in the previous period and current shocks:

$$\boldsymbol{y}_t = g(\boldsymbol{y}_{t-1}, \boldsymbol{u}_t) \tag{13}$$

The policy functions *g* are computed by linearizing the system (12) around the steady state ($\overline{\boldsymbol{y}}$) using the first-order Taylor expansion and the certainty equivalence principle:

(14) $$\boldsymbol{y}_t = \bar{\boldsymbol{y}} + \boldsymbol{g}_y \cdot (\boldsymbol{y}_{t-1} - \bar{\boldsymbol{y}}) + \boldsymbol{g}_u \cdot \boldsymbol{u}_t$$

IRFs are directly calculated from the policy functions (14). One has to start from the initial value of variables given by the steady state and the initial shock to the variable of interest, and iterate as many times as the number of future periods chosen. The results are IRFs. During the iteration process, the policy functions (14) sum up the individual contributions of state variables and report the aggregate outcome, which is the IRF value for a given period. If one keeps track of this process, and extracts the individual contributions of state variables to the IRF value for each period of iteration, the results are their individual contributions to IRFs. The sum of individual contributions must be equal to the value of IRFs for each period of iteration[7].

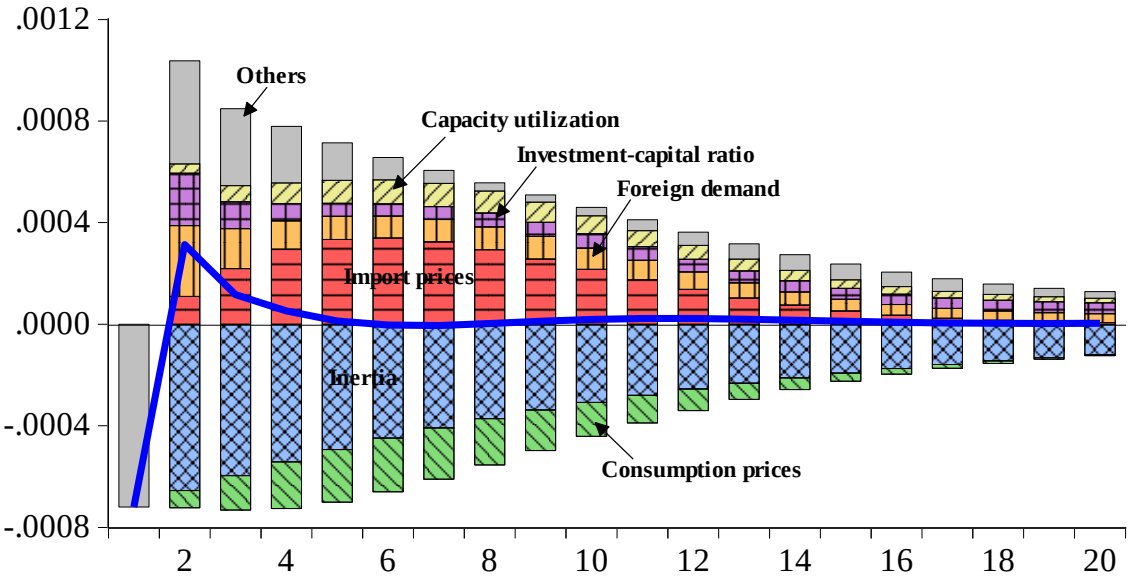

Figure 1: Impulse response functions of GDP growth rate to a fall in transfer payments

The columns of the matrix $\boldsymbol{g}_y$ contain the coefficients of the policy function for each endogenous variable with respect to its state variables at the point of the steady state solution. They reveal how much an endogenous variable reacts to, and swings around, the steady state for a unit change in the corresponding state variables. For that reason they can be considered as weights with which each state variable's IRF has to be multiplied to comprise the path of IRF for the related endogenous variable.

We present in Table 3 in column (2) the weights comprising the IRF of the GDP growth rate to a shock of transfer payments with respect to its key state variables[8]. We see that the first four state variables have positive impacts on the said IRF, while the remaining two key state variables have negative impacts. Next to that, we indicate in column (3) whether the paths of state variables are bellow or above the steady state. The path bellow the steady state is marked with a negative sign (-), while on the opposite side, the path above the steady state is marked with a positive sign (+). Finally, the product of the two signs from columns (2) and (3) is shown in column (4) under the heading "Sign of contribution". This indicates whether the corresponding state variable contributes positively or negatively to the IRF of the GDP growth rate to a shock of transfer payments. Information from these three columns in Table 3 helps us to understand the specific path of IRF in Figure 1. The solid line in this figure shows the cumulative

[7] The whole process of computation is explained in our paper [2015b].

[8] It is the researcher's choice how many key state variables to choose for the analysis. We opted for six key state variables in this paper. We wrote code for the MATLAB irf_decomposition function, which facilitates easy manipulation of the number of key state variables.

IRF, which is not very informative *per se*, while the stacked bars with hatches portray the individual contributions of key state variables to this cumulative IRF. This explains visually how the IRF is compiled from various opposing factors in a general equilibrium framework. More precisely, it shows the general equilibrium effects of a fiscal policy instrument.

Table 3: Policy functions

	Transfer payments			VAT		
Logarithms of state variables	Weights	IRF path	Sign of contribution	Weights	IRF path	Sign of contribution
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Relative import price (-1)	0.721288	+	+	0.720633	-	-
Relative foreign output (-1)	0.387055	+	+	0.386647	+	+
Investment-capital ratio (-1)	0.172318	+	+			
Exchange rate (-1)				0.132876	-	-
Transfer payments shock (-1)	0.065484	-	-			
Capasity utilization (-1)	-0.167694	-	+	-0.16718	-	+
VAT shock (-1)				-0.04347	+	-
Relative consumption price (-1)	-0.970028	+	-	-0.96934	-	+
All others						

The individual impact of a fall of transfer payments on the GDP growth rate was negative and persistent throughout the entire period of adjustments. We have marked it with the label "Inertia" in Figure 2. This reveals diminishing contributions to the IRF, which are consistently negative. One state variable is the exchange rate. Its individual impact is not explicitly presented in Figure 2 since it is lower than the benchmark size, which separates the six most influential state variables from all the others[9]. However, after a reduction in transfer payments and private consumption, the nominal exchange rate increases (the real exchange rate depreciates) with the consequence of inflating import prices and shifting away from imports towards domestic production. That has an expenditure-switching effect that supports GDP growth. Other key state variables generated a similar effect. Capacity utilization, foreign demand (foreign output over domestic output) and investment-to-capital ratio supported growth[10]. On the opposite side, the relative consumption prices (consumer prices relative to the GDP deflator) depressed GDP growth. Increasing import prices created a feedback effect on domestic consumption prices and pushed them up. Domestic inflation did not support growth. Rather quickly, after four quarters, individual positive and negative impacts on the IRF canceled each other out, which paved the way for the GDP growth rate to return to its steady-state level. We emphasize the point that the negative effects of a transfer payment reduction on growth might be neutralized within a year through adjustments to the key state variables.

What is the lesson from this analysis for policy-makers? If they want to push up growth by increasing transfer payments, and consequently the private consumption of pensioners and unemployed people, that policy might have a short-lived positive effect. In a fiscal year's time its positive effects will evaporate, and end up with a higher fiscal deficit. Stimulating private consumption by expanding transfer payments might be politically opportune behavior, but not with sustainable positive effects on growth. General equilibrium analysis warns us that it might easily trigger adjustments in the exchange rate**,** with

[9] The criterion for separation was the absolute size of the weights.

[10] In order to explain the IRF paths of the said state variables in more detail, we would need to compile explanatory tables similar to Table 3 for each of them, and trace the impact of the other state variables on them. However, that sort of analysis is beyond the scope of this paper. We simply note the fact that some state variables have a positive impact on IRFs, while the others have a negative impact.

only negative consequences for growth. If the monetary authority intervenes to stabilize the exchange rate, that will further create distortions in the economy. On the other hand, a proposal for a reduction in transfer payments is highly unpopular. That is exactly what the IMF has suggested to CESEE counties, including Serbia. Our analysis supports this policy stance in a way**;** lower transfer payments, *ceteris paribus*, mean lower fiscal deficit and weaker pressure on already very high public debt. There is no question that lower transfer payments will initially have a negative effect on growth, but this effect is temporary and can be quickly absorbed by other adjustments.

The IMF's recommendations reconsidered

We provided in the previous chapter the basic analytical tool, within the framework of the QUEST_Serbia DSGE model, for testing the effects of various fiscal instruments on growth. Using the tool of decomposing IRFs we explained what one would expect to happen in the Serbian economy if transfer payments were reduced in order to improve the fiscal balance. That was one of the IMF's recommendations for CESEE countries facing fiscal constraints to growth. Now we turn to the remaining IMF recommendations on how to improve fiscal policy in order to achieve higher growth rates.

There is not only an IMF, but also a generally accepted, theoretical recommendation that expensive labor input is detrimental to sustained GDP growth. On the contrary, a flexible labor market plus low PIT is a standard reference in the literature on how fiscal policy can improve growth prospects. We have tested that proposal in our DSGE model. The results are presented in Figure 2.

Recalling data from Table 1, we notice that the tax burden of SSC in Serbia has an inverse "U" shape. Their share in GDP was 9.0 percent in 2003Q1. Since then, it increased to 13.3 percent at the onset of the global recession. Afterwards, the fiscal base has been shrinking remarkably. Consequently, tax proceeds have been going down even if the tax rate has increased. At the end of last year, their share fell to 12.0 percent. On the other hand, PIT has been steadily shrinking from 5.1 percent of GDP to 3.6 percent at the end of last year. This clearly shows a cyclical pattern, and may be considered as an automatic stabilizer in the business cycle. However, that role is not providing the dominant effect. Putting both fiscal charges together, one may conclude that fiscal duties on labor input are relatively high in Serbia.

A reduction of fiscal charges on labor input is a desirable policy, but one that is hard to implement. One reason is high public debt. The other reason is institutional, and is related to the rule that governs the distribution of fiscal proceeds on labor input between the central government and local governments. Nevertheless, lower SSC and PIT have a positive effect on GDP growth rates. As Figure 2 depicts, the key state variables and the most important driving forces behind the IRFs are the same in both case. Their relative importance and the size of the impact is different, but the direction of their impacts is similar. Import prices and exchange rate push up the IRFs, while consumption prices, capacity utilization and foreign demand depress growth rates. The net effect is positive and lasts for three years. After the three-year period, the GDP growth rate loses the benefits of cheaper labor input, and returns to its steady-state value.

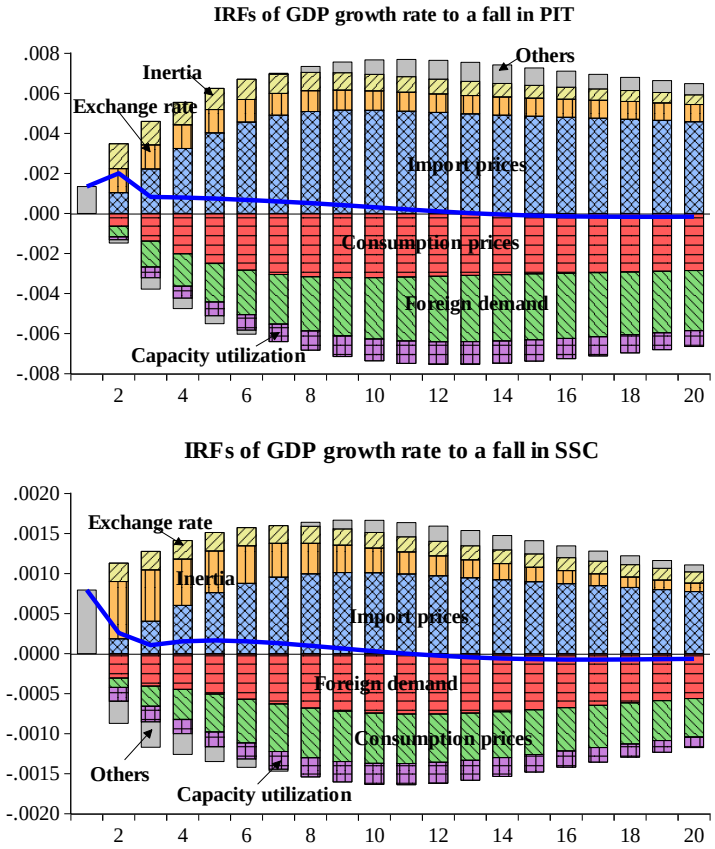

Figure 2: Decomposition of impulse response functions in the labor market

As far as the IMF's general recommendation for lowering fiscal duties on labor is concerned, our analysis supports it. We need additionally to notice that there are two related causes of this outcome. One is the relative price paths. Under the consumption and import price labels in Figure 2, we refer to the relative prices of consumer goods and imported goods to the GDP deflator. A change in the tax burden on labor automatically changes relative prices and reshapes the ratio between the domestic and foreign components of aggregate demand. The other factor is foreign demand. In our DSGE model this is represented as the ratio between foreign and domestic output. Changing the price of labor changes the competitiveness of the domestic economy, and the relative growth paths of the foreign and domestic economies**,** in favor of the domestic economy. A faster-growing domestic economy drives down the relative output ratio compared to the steady-state path, and surprisingly depresses the GDP growth rate[11]. Let us now turn to government spending. The IMF recommends shifting away from government consumption toward government investment. We have simulated that recommendation with two separate scenarios. We allow in the first one for a negative shock to (stochastic fall in) government consumption, while in the second one for a positive shock to (stochastic rise in) government investment. The results are presented in Figure 3. After a negative shock to government consumption, the GDP growth rate started to swing around the steady state. For the initial six periods, the growth rate was below the steady state, while in the next six periods it outperformed the steady state. Finally, in the remaining time the growth rate was practically identical to its steady-state benchmark. One might conclude that a reduction in government consumption has a temporary negative effect on the growth rate of the

[11] The weight in the policy function is 0.3866**,** meaning that in the steady state higher the foreign-to-domestic output ratio positively contributes to GDP growth rate after a rise in PIT. A fall in PIT, conversely, generates a reduction in the GDP growth rate due to the impact of the relatively low foreign-to-domestic output ratio.

economy. The inertia in reduced government purchases was persistently driving down the GDP growth rate. On the other hand, relative import prices were consistently compensating for the fall in public demand. Other state variables had a much more limited impact on the IRF cumulative effect.

As far as government investments are concerned, we have to take a step back, and explain their role in the production process before we proceed. In order to avoid the problem of non-stationarity, production factors are defined in terms of their growth rates. Hence, the aggregate Cobb-Douglas production function has the following form:

$$g_t = (1-\alpha)\cdot(g_t^K + g_t^{UCAP}) + \alpha\cdot(g_t^{LFP} + g_t^L) + (1-\alpha_G)\cdot g_t^{GK} \quad (15)$$

where (g_t), (g_t^K), (g_t^L) and (g_t^{GK}) stand for the growth rates of GDP, private capital, labor and government capital, (g_t^{UCAP}) and (g_t^{LFP}) represent the rates of capacity utilization and labor-augmented technological progress. The coefficient alpha (α) is the elasticity of output with respect to labor, while the coefficient alpha (α_G) is the elasticity of output with respect to public capital. Government investments add up to accumulate the public capital stock. The growth rate of public capital is, therefore, equal to the growth rate of public investments. The role of public capital as a factor in the production function of the economy justifies the treatment of public investments as being "productive".

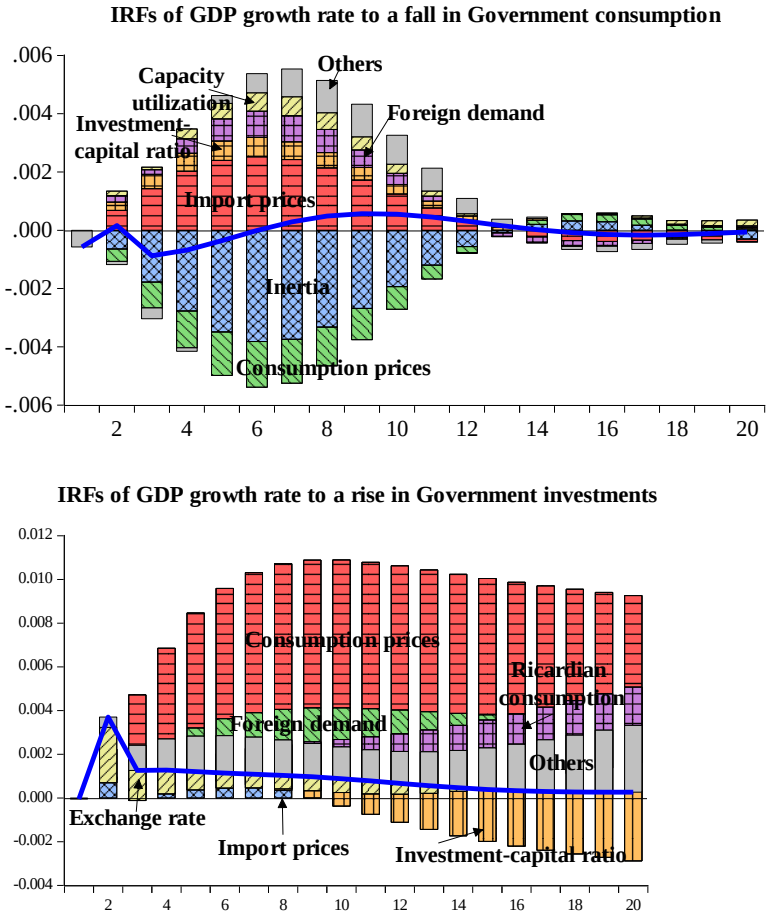

Figure 3: Decomposition of impulse response functions in the government spending area

coefficient alpha (α_G). It has to be lower than 1. Under the present settings of all other calibrated and estimated coefficients in the model, there is a threshold value of 0.97. For $0.97 < \alpha_G < 1$ IRF of GDP growth rate to a positive shock of government investments are above the steady-state growth rate. That means that an increase in government investments generates a speed-up of the GDP growth rate. For $0.97 < \alpha_G$ the corresponding IRF is below the steady-state growth rate. The GDP growth rate realized,

under the same stimulus of public investments, increases at a slower pace compared to the steady-state growth rate. It seems that the more increasing returns to scale in the production function the less productive the reaction of the growth rate to public capital. Our point is that an increasing share of public investment in GDP does not generate higher GDP growth rates under any circumstances. Much of it depends on the productivity of the public capital. A policy call for more public investment is justified only if that investment is really used in a "productive" way. Otherwise, it might be misused as a hidden subsidy for inefficient SOEs.

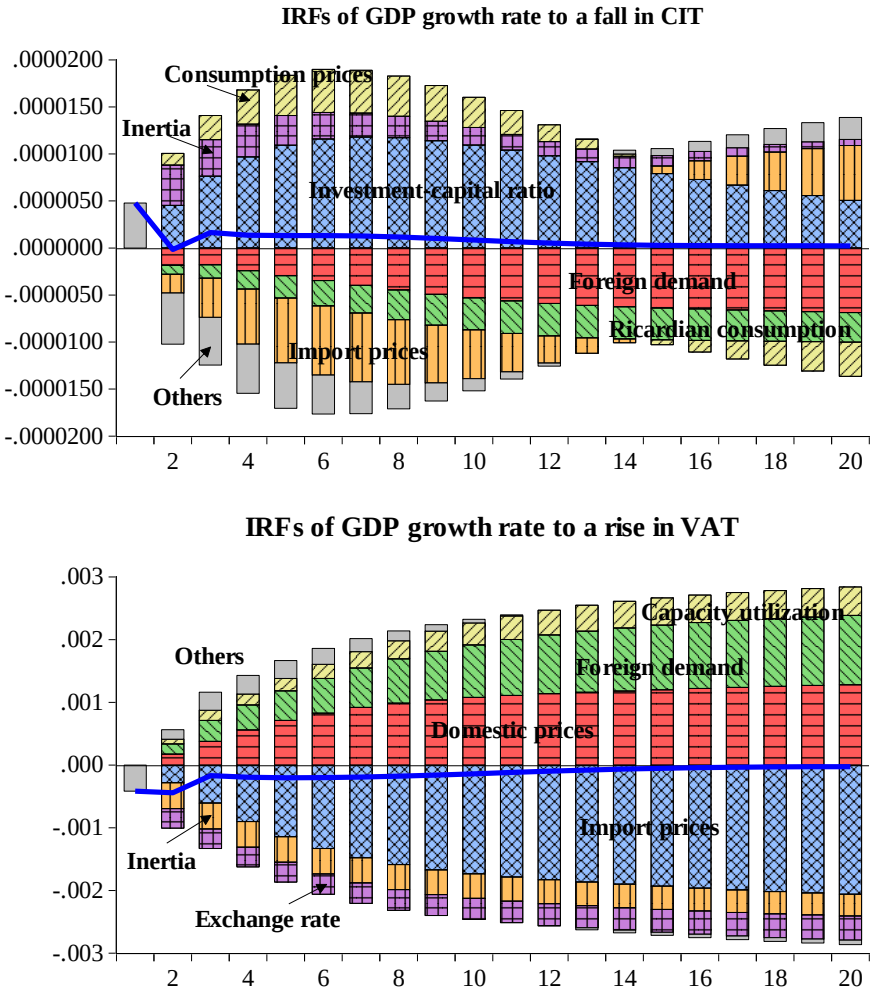

Figure 4: Decomposition of impulse response functions in capital and goods markets

The remaining IMF recommendations refer to the private capital and goods markets. In Figure 4 we present simulations performed under the assumption that CIT is reduced, while VAT rate (including excise duties) is increased, both for a unit of corresponding stochastic shocks. The IMF strongly argues for lowering CIT and considers such a tax as being highly distortive. On the other hand, the IMF suggests a shift away from direct taxation on production factors towards indirect taxes on consumption. In such a context, the IMF is not *a priori* against raising VAT rates if a country needs to finance a fiscal deficit[12].

[12] The IMF [2015, p.24] noted that "CESEE governments tend to raise a higher share of revenue from consumption taxes—i.e. value added tax (VAT) and excises—than their western European counterparts. By contrast, they raise less from direct taxes on personal (PIT) and corporate income (CIT)".

We do not argue whether VAT is distortive or not. The empirical studies reported in Table 2 are inconclusive regarding whether a higher VAT rater supports or reduces the GDP growth rate. However, our DSGE model shows that an increase in VAT rate will permanently penalize growth in Serbia. In order to explain this finding, let us return to information in Table 3. This time we refer to columns (5) – (7).

The main driving factors behind this negative impact are relative consumer and import prices coupled with the exchange rate effects. An increase in VAT rate inflates the nominal exchange rate, and consequently pushes up relative import prices. On the same time, relative domestic consumer prices go down. This is the QUEST_Serbia general equilibrium effect of a VAT increase on domestic consumption prices that may not be expected from other models. A higher price margin due to a higher tax rate on consumption was outperformed by the price drop due to decreasing consumption demand. Therefore in column (6) there is a negative sign at the cross point with the "relative consumption price" row. The similar negative sign is at the cross point with column (5), which reveals the steady-state weight of relative consumption prices. Hence, their product must be positive. All this simple means that a consumer price increase hurts GDP growth, while its drop supports higher growth. The situation with relative import prices is completely the opposite. They support growth in the steady state, but go down after a VAT shock, and therefore reduce the GDP rate. In the steady state**,** higher capacity utilization depresses growth, while improved foreign demand supports growth. After a VAT shock, both individual IRFs go up, which however generates the opposite effect on the GDP growth rate.

The impact of a lower CIT rate on growth is less controversial, and is fully in line with empirical findings and the IMF's recommendations. That means a lower tax on corporate income permanently increases GDP growth rate. As Figure 4 shows, the main factor behind this effect is the improved investment-to-capital ratio.

Conclusion

This paper is about the general guidelines that a reform-oriented government in Serbia should follow in order to refine the fiscal stabilization policy, with the aim to achieve the highest possible growth under fiscal constraints. It seems that compared to last year the prospects for growth are better for the next few years, but the expected growth rates are still below the ones this economy needs in order to make public debt sustainable in the future.

Guidelines have been proposed by the IMF for all CESEE countries, and were derived from theory and econometric studies. We have tested these recommendations in our QUEST_Serbia DSGE model. For that purpose we revised the model and made all fiscal revenue instruments endogenous and responsive to business cycle fluctuations. Additionally, we have proposed a new analytical tool decomposing IRFs**,** in order to better follow the propagation of shocks in a DSGE model.

We support the proposal that a further reduction of direct taxation on production factors would improve growth prospects in Serbia. Direct taxes include taxes on personal income, corporate income and SSC. On the other hand, a reduction in transfer payments and government consumption may have temporary negative effects on growth, but not a permanent effect. The economy will adjust to this reduction after a year. The much-advocated increase in government investment is welcome under some conditions. That investment has to be productive and not represent hidden subsidies for SOEs. Finally, our findings do not support an increase in the VAT rate (including excise duties). We have demonstrated why this policy may have a counterproductive effect on growth in a permanent way.

We do not suggest in this paper any size of adjustments to the present tax rates. That clearly depends on the targeted path of the future fiscal deficit, which is a choice for the government. We also do not address the political economy consequences of reshaping fiscal policy. Some of the recommendations are

beyond any theoretical doubt, but their implementation requires changes in the present institutional rules, which is never an easy political task.

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