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Assessing the impact of fiscal measures on the Czech economy

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ABSTRACT

We build a DSGE model to investigate the transmission of fiscal policy to the real economy in the Czech Republic. Departing from the elements of the Czech National Bank's current g3 forecasting model (Andrle, Hlédik, Kameník, and Vlček, 2009), we introduce a comprehensive fiscal sector incorporating a number of modeling features that are often neglected in the mainstream DSGE literature, e.g. allowing government consumption and government capital to be productive. Furthermore, we extend our fiscal model to include unemployment in a way proposed by Galí, López-Salido, and Vallés (2007). Crucial fiscal parameters, related mainly to the specified fiscal rule, are estimated using Bayesian techniques. The model is then used to calculate a set of fiscal multipliers for individual revenue and expenditure items of the government budget. We find that the largest real GDP fiscal multipliers in the first year are associated with government consumption (0.6), social security contributions paid by employers (0.6), and government investment (0.5).

1. Introduction

Fiscal policy has received considerable attention since the global economic and financial crisis began in 2008. This attention has also fallen on central banks, since fiscal measures often significantly affect economic activity (real GDP, inflation) and consequently monetary policy interest rates need to be set appropriately. Governments frequently introduce several fiscal measures at once, in so-called fiscal packages, which consist of various measures on both the expenditure and revenue sides of the government budget. Depending on the model used, fiscal measures might not be easily implemented into the model to produce macroeconomic forecasts fully consistent with the fiscal policy settings. This applies also to the practice in the Czech National Bank (CNB).

The CNB's core g3 model, developed and described in the study of Andrle et al. (2009), currently lacks sufficient detail with respect to the fiscal sector. Hence, the objective of this paper is to address this deficiency by building a satellite DSGE model with an extended fiscal sector. To concentrate mainly on fiscal policy variables, we proceed with some simplification of the g3 model; to be more specific, stochastic trends are omitted from the model, but on the other hand we enrich the model with several important fiscal channels. First, we introduce into our model so-called "rule-of-thumb" households, in the manner of Galí et al. (2007). These households do not accumulate any savings and consume all their disposable income. Second, we allow government consumption and government capital to be productive; in other words, government consumption brings some utility to households and government capital contributes to firms' production. These two productive features are often neglected in the mainstream DSGE literature, although the possibility of productive government consumption and government capital has been discussed in the past (Bailey, 1971; Barro, 1981; Baxter and King, 1993). Third, our model contains an extensive set of fiscal instruments, namely, four instruments on the expenditure side (government consumption, government investment, unemployment benefits, and other social benefits) and five instruments on the revenue side (a consumption tax, a wage tax, a capital tax, social security contributions paid by employers, and a lump-sum tax). Fourth, we extend our model to include unemployment, in a tractable way proposed by Galí (2011), which helps to partly endogenize unemployment benefits. Fifth, we specify the government's fiscal rule with feedback coefficients for domestic output and debt, as found, for example, in Leeper et al. (2010), and estimate its coefficients for Czech data using Bayesian techniques.

Given the absence of a consensus in the literature regarding the precise value of the fiscal multipliers, one of our objectives is to provide the CNB with the values of the fiscal multipliers for the Czech economy. Our DSGE model with its extended fiscal sector allows us to produce a rich set of multipliers, by several fiscal instrument categories, and also to assess the robustness of the multipliers to the underlying model assumptions. Recent estimates of fiscal multipliers for the Czech economy based on the structural VAR approach (Valenta, 2011) indicate an output fiscal multiplier of between 0.3 and 0.6 in the first year after a shock to government spending. The real GDP fiscal multipliers implied by our

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DSGE model attain their largest values in the first year in the case of government consumption (0.6), social security contributions paid by employers (0.6), and government investment (0.5). These are followed by the fiscal multipliers for the consumption tax, the wage tax, and unemployment benefits (all roughly 0.2), then by other social benefits, lump-sum taxes, and the capital tax (0.1). Our results suggest that the most costly, in terms of the real GDP loss in the first year, are fiscal consolidations based on cuts in government consumption and increases in social security contributions paid by employers, followed by cuts in government investment.

Comparing our estimates of fiscal multipliers with the results reported in a meta analysis by Gechert and Will (2012) based on the examination of 89 studies suggests that the rather low values of the fiscal multipliers for the Czech economy could be attributed to its high import intensity of GDP. Furthermore, in what follows our DSGE-based fiscal multipliers should be viewed as lower bound estimates compared to those produced by macroeconometric models, single equation approaches or VARs. Nevertheless, our sensitivity checks demonstrate that the higher the share of "rule-of-thumb" households, the higher the values of fiscal multipliers, which corresponds to the evidence from the meta analysis.

For practical purposes, using our proposed DSGE model we evaluate the partial impact of selected fiscal measures on the Czech economy (that is, not accounting for all supply-side effects and assuming that fiscal shocks are of a temporary nature and the economy starts from its equilibrium). We find that the selected fiscal consolidation measures, related to the ongoing process of fiscal consolidation in the Czech Republic, might slow real GDP growth down by 0.4, 0.8, and 1.1 percentage points in 2013, 2014, and 2015, respectively, as compared to the baseline with unchanged fiscal policy.

The paper is structured as follows. Section 2 reviews relevant literature, Section 3 outlines our satellite DSGE model with the extended fiscal sector, and Section 4 provides estimates of fiscal multipliers and several robustness checks, and quantifies the impact of the selected fiscal measures on the Czech economy. The last section summarizes our findings and outlines suggestions for future research.

2. Related literature review

Generally, the empirical literature provides a variety of estimates of fiscal multipliers. These are often based on (S)VAR techniques, but DSGE model estimates have gained in prominence recently. A number of comprehensive models have been built, for instance the IMF's Global Integrated and Fiscal Model (see Kumhof et al., 2010), the European Commission's QUEST III model (Ratto et al., 2009), and the European Central Bank's the New Area-Wide Model (Christoffel et al., 2008). The last-mentioned was recently extended by Coenen et al. (2012b) to include a richer specification of the fiscal sector, and identified a significant role of discretionary fiscal policies for real GDP growth during the Great Recession. An interesting comparison of structural models, in terms of fiscal policy effectiveness, was performed by Coenen et al. (2012a). These authors found considerable agreement across models on both the absolute and relative sizes of different types of fiscal multipliers. A recent meta regression analysis of around 90 studies by Gechert and Will (2012) shows that the values of fiscal multipliers are rather dependent on the chosen modeling approach and its settings; nonetheless, the underlying studies suggest that the average fiscal multiplier is less than one.

Regarding the Czech Republic, there are several studies dealing with fiscal policy. Barrell et al. (2004) examine the impacts of economic policies in several EU countries, including the Czech Republic, for which they estimate a fiscal multiplier of 0.4. A somewhat higher fiscal multiplier of 0.6 is obtained by Hřebíček et al. (2005) using both regression analysis and structural simulation. Recently, Prušvic (2010) determines the government expenditure multiplier at 0.5, in line with previous estimates. An extensive set of various fiscal multipliers for the Czech Republic is provided by Klyuev and Snudden (2011), where the authors calibrate the IMF's GIMF model for the Czech data. The latest empirical evidence on the effects of fiscal policy on the Czech economy is provided by Valenta (2011) and Franta (2012). These studies explore VAR-based identification approaches and apply classical (Valenta, 2011) and Bayesian (Franta, 2012) estimation techniques. According to Valenta (2011), the output fiscal multiplier is estimated to be in the range of 0.3–0.6 in the first year following a shock to government spending.

3. Structural DSGE model

Our structural model is built along the lines of the models by Andrle et al. (2009), Coenen et al. (2012b), Galí (2011), and Galí et al. (2007). The small open economy is populated by two types of representative households, the first type called optimizers or Ricardian households, who can save, and the second type called "rule-of-thumb" consumers or non-Ricardian households, who cannot save and consume all their disposable income. The households consume a final consumption good, which is made from private consumption and government consumption goods. The members of households monopolistically supply a differentiated unit of labor to an employment agency, and wage setting follows Calvo contracts. Besides private capital, there is government capital, which freely enters intermediate domestic goods production. Government expenditures are divided into government consumption, government investment, unemployment benefits, and other social benefits. Government revenues come from consumption, labor, capital, dividend and lump-sum taxes, and social security contributions paid by employers. The government balances its budget by issuing bonds or by adjusting taxes. In the fiscal rules, fiscal instruments (taxes or expenditures) react to the deviations of government debt and output from their respective targets. The features of the model are shown in Fig. 1, where black parts overlap with the g3 model, red parts represent the fiscal sector, and green parts depict tax revenues. For a more detailed exposition of the model see Ambriško et al. (2012); in the following text we focus on the key equations.

The economy is populated by a continuum of households indexed by $h \in [0, 1]$, of which rule-of-thumb households have a share γ and Ricardian households $1 - \gamma$. Each household has a continuum of members[1] indexed by a pair $(i, j) \in [0, 1] \times [0, 1]$, where index i stands for the labor type and index j determines the disutility of work, specified as j^{ϕ_n} when the member is employed and zero otherwise, where $\phi_n \geq 0$ is the elasticity of the marginal disutility of work. Both types of households maximize their lifetime utility function given by:

$$\begin{aligned} & E_o \sum_{t=o}^{\infty} \beta^t U_{h,t}^k = \\ & = E_o \sum_{t=o}^{\infty} \beta^t \left[log\left(C_{h,t}^k - \chi_t^k C_{t-1}\right) - \theta \int_0^1 \int_0^{L_t^k(i)} j^{\phi_n} dj di \right] = \\ & = E_o \sum_{t=o}^{\infty} \beta^t \left[log\left(C_{h,t}^k - \chi_t^k C_{t-1}\right) - \frac{\theta}{1+\phi_n} \int_0^1 L_t^k(i)^{1+\phi_n} di \right] \end{aligned} \quad (1)$$

where β is the discount factor, superscript $k \in \{r, o\}$ distinguishes rule-of-thumb and optimizer households, $C_{h,t}^k$ is the household-specific consumption aggregate, C_{t-1} is the lagged economy-wide level of consumption, $L_t^k(i) \in [0, 1]$ is the fraction of members of type i who are employed in households of type k, θ is a parameter associated with the disutility of labor supply, and χ_t^k is an exogenous process which determines the degree of internal habit formation. Households' consumption is made up of private and government consumption goods as follows:

$$C_t^k = \left[(\alpha_C)^{\frac{1}{\nu_C}} \left(C_t^{pk}\right)^{\frac{\nu_C - 1}{\nu_C}} + (1-\alpha_C)^{\frac{1}{\nu_C}} \left(G_t^k\right)^{\frac{\nu_C - 1}{\nu_C}} \right]^{\frac{\nu_C}{\nu_C - 1}}, \quad (2)$$

[1] This extension is needed to introduce unemployment into the model; for elaboration see Galí (2011) or Ambriško et al. (2012).

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