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Macroeconomic dynamics in Macedonia and Slovakia: Structural estimation and comparison ☆

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ABSTRACT

This paper estimates a structural macroeconomic model using data for Macedonia and Slovakia to characterize possible challenges Macedonia can face concerning macroeconomic stabilization during its transition process. A comparison of the estimated model parameters suggests that, in Slovakia, the output gap is less sensitive to real interest rate movements and prices experience greater inertia. The estimated monetary policy reaction functions show Macedonia and Slovakia as inflation targeters, with Macedonia as the more conservative one, despite its officially applied exchange rate targeting regime. The differences in the estimated parameters imply differing transmission mechanisms for Macedonia and Slovakia. Consequently, the variance of domestic variables in Slovakia is most influenced by monetary policy shocks, while there is no single dominating shock explaining the volatility of Macedonia's macroeconomic variables. The exchange rate shock, the monetary policy shock and the demand shock are jointly important in determining the volatility of Macedonia's variables. The model simulations indicate that Macedonia experiences lower output gap and inflation volatility than Slovakia. This comes, nevertheless, at the cost of higher interest rate and real exchange rate volatility in Macedonia, which could be an indication of more volatile financial markets with possible negative implications for financial stability.

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1. Introduction

The relation between macroeconomic stability and economic growth has been studied and emphasized for some time in both academic and policy circles, most recently by Hnatkovska and Loayza (2004) and Iradian (2007), among others. There also appears to be an important link between better structural, pro-growth policies and enhanced macroeconomic stabilization. This link is equally important, since macroeconomic stabilization is conducted under the structural constraints that characterize each national economy. Understanding the structural constraints to economic stabilization is therefore important for monetary policy to be implemented effectively, especially with regard to an appropriate choice of monetary policy regimes.

This paper estimates and compares structural characteristics of Macedonia and Slovakia to look into possible challenges in macroeconomic stabilization Macedonia could be facing during its transition. Macedonia and Slovakia are small, landlocked Eastern European countries that emerged from the shadow of central planning in 1993. Macedonia lags behind Slovakia in terms of income convergence to developed countries and the transition to a modern market economy. Nevertheless, Slovakia, as a potential role model for Macedonia in terms of economic development (see World Bank, 2009), provides an interesting counterfactual to the de-facto applied monetary policy regime (following the IMF classification). While Macedonia has been a de-facto exchange rate targeter for the period studied in this paper, Slovakia has been an inflation targeter, most recently in the context of the Exchange Rate Mechanism II (ERMII), and in 2009 adopted the euro. Comparing the structural estimates for the two economies could thus help determine whether the de-facto monetary policy regime is effective or whether it is potentially creating problems for economic stabilization and economic growth in Macedonia. This paper is one of the first in the literature to estimate a fully microfounded open economy model with a wide range of rigidities for Macedonia and Slovakia, which could potentially be used as an analytical tool by policy makers in the two countries.

The estimated structural, open-economy models for Macedonia and Slovakia suggest the following findings. Slovakia has a significantly higher elasticity of intertemporal substitution as well as export share in domestic production than Macedonia, and a significantly lower share of imports in consumption and the elasticity of substitution across the domestically produced and imported goods. These results suggest that a weaker credit channel of monetary policy exists in Slovakia. The estimated model also suggests that Slovakia has been experiencing significantly higher price rigidity than Macedonia due to differences concerning the production technology and a relatively

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lower share of firms that optimally reset their prices. The estimated monetary policy reaction functions to inflation, the output gap, the euro area interest rate and the exchange rate show that Macedonia and Slovakia are inflation targeters. This is an expected result for Slovakia, which officially applies an inflation targeting regime before adopting the euro in 2009, but contradicts the official pegged exchange rate regime applied by Macedonia. The results of this study show further that Macedonia has a lower output gap and inflation volatility than Slovakia, which comes at the cost of higher volatility in the interest rate and real exchange rate, and thus possibly higher volatility in financial markets with possible negative implications for financial stability going forward.

There have been recently several attempts in the literature to evaluate New Keynesian-type models for Slovakia (Ciganova and Vasicek, 2009; Senaj and Zeman, 2008, 2009) including the estimation of a New Keynesian Philips curve for Slovakia (Vasicek, 2009). Nevertheless these evaluations work mostly with calibrated models with limited consideration for the dynamics in the world economy (typically the euro area) and policy reaction functions that do not encompass the possibility for both inflation and exchange rate targeting. For Macedonia, there have been even less attempts to fit New Keynesian-type models to the data with the exception of Melecky and Najdov (2010) who compare the constraints to economic stabilization in Macedonia and Slovakia using an estimated semi-structural New Keynesian model. They sacrifice the identification of deep structural coefficients to relax cross-equation restrictions imposed by typical New Keynesian models and estimate the composite coefficients instead. In this paper, deep structural coefficients are estimated using a Bayesian approach, while allowing in the model for various types of nominal rigidities and a policy reaction function that nests both inflation targeting and exchange rate targeting regimes.

The remainder of the paper is organized as follows. Section 2 discusses the model estimated for Macedonia and Slovakia. Section 3 describes the data and estimation method. Section 4 discusses the estimation results and the differences between Macedonia and Slovakia. Section 5 presents the impulse response analysis. Section 6 looks into the variance decomposition of the simulated variables from the estimated model. Section 7 summarizes and concludes.

2. The estimated model

The open economy model that is estimated is a modified version of the aggregate demand–aggregate supply (AD–AS) model of Linde et al. (2008). This model allows for gradual exchange rate pass-through (following Adolfson, 2001 and Monacelli, 2005) and imperfect financial integration (as in Benigno, 2001, among others). Further, the model allows for sticky prices by making firms face quadratic adjustment costs in pricing (following Rotemberg, 1982) and inertia in domestic and imported inflation by assuming that a fraction of firms follow a backward-looking rule of thumb when resetting their prices. Moreover, the model introduces inertia in output originating from habit formation in consumer preferences (following e.g. Smets and Wouters, 2003). The main equations of the model in log-linearized form are presented and discussed below, and the model's derivation and microfoundations can be found in Linde et al. (2008 Appendix A).

$$y_t = \left(1-a_y\right)y_{t-1} + a_y E_t y_{t+1} + a_r\left[i_t - E_t\pi^d_{t+1}\right] + a_{\tau 1}\tau_{t-1} + a_{\tau 2}\tau_t + a_{\tau 3}E_t\tau_{t+1} + a_{\tau f1}\tau^f_{t-1} + a_{\tau f2}\tau^f_t + a_{\tau f3}E_t\tau^f_{t+1} + a_{yf1}y^f_{t-1} + a_{yf2}y^f_t + a_{yf3}E_t y^f_{t+1} + u^y_t \quad (1)$$

$$i_t - i^f_t = E_t\Delta s_{t+1} - \phi a_t \quad (2)$$

$$a_t = d_a a_{t-1} + d_y y_t + d_\tau \tau_t + d_{\tau f}\tau^f_t + d_{yf}y^f_t + d_x x_t + u^a_t \quad (3)$$

$$x_t = e_y y_t + e_\tau \tau_t + e_{\tau f}\tau^f_t + e_{yf}y^f_t \quad (4)$$

$$q_t \equiv s_t + p^f_t - p^c_t = -\tau^f_t - \omega_m\tau_t \quad (5)$$

$$\pi^c_t = \omega_m\pi^m_t + (1-\omega_m)\pi^d_t = \pi^d_t + \omega_m\Delta\tau_t \quad (6)$$

$$\pi^d_t = b_{\pi 1}E_t\pi^d_{t+1} + b_{\pi 2}\pi^d_{t-1} + b_{\pi 3}\pi^d_{t-2} + b_y y_t + b_\tau\tau_t + u^d_t \quad (7)$$

$$\pi^m_t = c_{\pi 1}E_t\pi^m_{t+1} + c_{\pi 2}\pi^m_{t-1} + c_{\pi 3}\pi^m_{t-2} + c_\tau\left[\tau_t + \tau^f_t\right] \quad (8)$$

Eq. (1) is an aggregate demand equation in log-linearized form. In its derivation, it is postulated that households attain their utility from consuming bundles of domestic and imported goods and are assumed to value consumption relative to past aggregate consumption. Namely, household preferences are assumed to show external habit formation of the 'Catching up with the Joneses' type (see Abel, 1990; Smets and Wouters, 2003). The optimization problem of households is outlined in Appendix A. In Eq. (1), the current output gap thus responds positively to the one-period lagged output gap and expected future output gap, and is expected to respond negatively to increases in the real interest rate. Further, it responds to past, current and future domestic terms of trade and foreign terms of trade. In the model of Linde et al. (2008), the imperfect exchange rate pass-through means that import prices do not necessarily coincide with world market prices converted into domestic currency units, so the law of one price (LOOP) is not enforced to hold. Allowing for the possibility of an LOOP wedge means that one can identify two different types of terms of trade in the model. The first is the domestic terms of trade, i.e. the relative price between domestic and imported goods as perceived by the domestic resident, $\tau_t \equiv p^m_t - p^d_t$. The second is the foreign terms of trade, i.e. the relative price between the domestically produced good and the imported good on the world market, $\tau^f_t \equiv p^d_t - s_t - p^f_t$, where s_t stands for the exchange rate with complete exchange rate pass-through, $p^m_t = p^f_t + s_t$. However, under imperfect pass-through when $p^m_t \neq p^f_t + s_t$, there is a deviation from the law of one price given as $\delta_t = \tau^f_t + \tau_t$. Additionally, the current output gap responds to fluctuations in foreign demand and is affected by a household preference shock (see Appendix A for a detailed definition of the shock). Finally, the *a*s with subscripts are composite coefficients. Their definition in terms of the deep structural coefficients, which we estimate from historical data, is shown in Appendix B. In contrast to Linde et al. (2008) we allow the structural demand (preference) shock u^y_t to be serially correlated so that: $u^y_t = \rho_{uy}u^y_{t-1} + \varepsilon^y_t$.

Eq. (2) is the uncovered interest parity equation which postulates that an expected change in the exchange rate equals the interest rate differential plus the currency risk premium. This equation results from the solution of households' optimal allocation of bond holdings described in Appendix A. In periods when the economy is a net borrower, the domestic interest rate is higher than the foreign interest rate. Correspondingly, when there is no expected exchange rate depreciation, and when the economy is a net lender, the domestic interest rate is lower than the foreign interest rate. Movements in the net foreign asset position thus affect the interest rate differential between the domestic and foreign economies.

The risk premium described in Eq. (3) is a function of its past value, the domestic and foreign output gaps, domestic and foreign terms of trade and real profits. In addition, we allow for a normally distributed, autocorrelated shock to the currency risk premium: $u^a_t = \rho_a u^a_{t-1} + \varepsilon^a_t$. The definition of the composite parameters, *d*s, in terms of the structural parameters is provided in Appendix B.

Eq. (4) describes the dynamics of real profits, where real profits depend on the domestic output gap, domestic terms of trade, foreign terms of trade and the foreign output gap. The definition of the composite parameters, *e*s, in terms of the structural parameters is also provided in Appendix B.