Comparing Constraints to Economic Stabilization in Macedonia and Slovakia: Macro Estimates with Micro Narratives

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Abstract

This paper re-emphasizes the link from structural policies to enhanced macroeconomic stabilization using a small structural model estimated on quarterly data for Macedonia and Slovakia over 1995-2007. The success of macroeconomic stabilization, typically in hands of monetary policy, is not only determined by a suitable choice of the nominal anchor, which shapes the reaction function of monetary policy, but also the constraints within which the monetary policy strives to achieve its objectives. The key attributes of the constraints to macroeconomic stabilization are economic rigidities and structural shocks. By benchmarking the estimated economic rigidities and structural shocks faced by Macedonia to those faced by Slovakia, we find that Macedonia has relatively weaker transmission mechanisms of monetary policy, higher output rigidity, a lower exchange rate pass-through, and faces larger external shocks. For Macedonia, these relatively higher constraints on monetary policy together with the chosen exchange rate anchor result in higher output and inflation volatility relative to Slovakia. Hence, it appears that small open economies with stronger economic rigidities should apply monetary policy regimes that allow for more flexible adjustments in external relative prices to enhance their macroeconomic stability.

Key words: Transition economies, Macedonia, Slovak Republic, macroeconomic stabilization, economic rigidities, New Keynesian Policy model

JEL Classification: E30, E58, D11, D21, D53

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1. Introduction

The link from macroeconomic stability to economic growth has been studied for some time in both academic and policy circles, most recently e.g. by Loayza et al. (2005) and Iradian (2007). The reverse link from better structural, pro-growth policies to enhanced macroeconomic stabilization is emphasized less often but is equally obvious. Stabilization policy is focused on maintaining price stability and unemployment levels close to the natural unemployment rate. These goals are typically outsourced by government to, preferably, an independent agent, the central bank which chooses a (explicit or implicit) nominal anchor, as an intermediate goal and a way to anchor the public's expectations. The chosen nominal anchor then dominates in a reaction function of the central bank, i.e. the central bank adjusts its monetary policy instrument by putting the highest weight on sticking to the nominal anchor. The typical representations of the central banks reaction functions, which we also consider in this paper, are due to due to Taylor (1993) for (explicit or implicit) inflation targeting, and Benigno et al. (2007) for exchange rate targeting. Both representations of the reaction function happen to be interest rate rules with certain degree of discretion. Which of the two reaction functions will be more successful in stabilizing a given economy depends on the constraints that the economy puts to achieving the monetary policy objectives. These constraints, in turn, can be significantly alleviated by appropriate structural reforms which mainly promote the economy's flexibility and responsiveness to changes in the monetary policy stance.

In this paper we consider two transition economies of Macedonia and the Slovak Republic, which happen to apply exchange rate targeting and inflation targeting regimes, respectively. We assume that the economies' constraints to achieving the monetary policy objective of low inflation and output variability are represented by the consumption behavior of households, pricing behavior of firms, and the interactions of the domestic economy with the external sector. We describe the above constraints using a small open-economy model with rational expectations where the model parameters are estimated using quarterly data for Macedonia and the Slovak Republic over 1995-2007. In the assumed model, the key elements of the constraints on monetary policy are real and nominal rigidities, and domestic and external structural shocks. We benchmark the differences in the estimated model coefficients and provide some explanations for the

estimated differences using relevant microeconomic data. The gaps between Macedonian and Slovak structural indicators show that the economic rigidities in Macedonia could be significantly diminished by appropriate structural reforms. While structural shocks by their nature cannot be generally reduced through government policies, reducing fiscal shocks, i.e. the magnitude and frequency of changes in the fiscal policy stance, is in control of government policy. More specifically, we find that for Macedonia vis-à-vis the Slovak Republic, the consumption habit formation and cost of adjusting capital stock are higher, the credit channel of monetary policy is weaker, the net exports elasticity to exchange rate changes is weaker, the portion of non-Ricardian households is higher, the effect of increasing capacity utilization on inflation is higher, and the exchange rate pass-through is lower. On the other hand, we find that Macedonia does better in terms of containing fiscal policy shocks than the Slovak Republic. Overall, it appears that the Slovak Republic is enjoying a lower inflation/output volatility tradeoff compared with Macedonia, for which our gap analysis provides some directions for improvements on the structural reforms. In addition, to our knowledge this paper makes a first attempt to fit a structural model with rational expectations to the data on Macedonian and Slovak economies.

The remainder of the paper is organized as follows. Section two discusses the main features of the employed structural model. Section three describes the data and the estimation methodology. Section four discusses the estimation results. Section five offers microeconomic explanations of the estimated macroeconomic characteristics of the Macedonian and Slovak economies. Section six analyzes impulse responses of selected economic variables to identified structural shocks. And, section seven concludes.

2. Model Description

This section describes theoretical underpinnings of the New Keynesian policy model that we estimate to capture some fundamental characteristics of the Macedonian and Slovak economies. Let $E_t X_{t+1}$ denote the rational expectation forecast of X_{t+1} conditional on the

information set available to the forecasting agent at time *t*. The equation describing inflation dynamics is modeled by the following "hybrid" Phillips curve[1]

$$\pi_t = \rho_\pi E_t \pi_{t+1} + (1-\rho_\pi)\pi_{t-1} + \lambda_1 y_t + \lambda_2 \Delta s_t + \varepsilon_{AS,t} \qquad (1)$$

where π_t is CPI inflation, y_t is the output gap, Δs_t is the change in the nominal effective exchange rates (an increase implies depreciation of the Macedonian denar – MKD; or the Slovakian koruna – SKK), and $\varepsilon_{AS,t}$ is an autocorrelated aggregate supply (AS) shock. Although allowing for an inertial effect by giving a non-zero weight to π_{t-1} in equation (1) was initially empirically motivated, the effect can be derived from a staggered price-setting mechanism, where a proportion of firms use a naïve, backward-looking rule to forecast inflation. The inertial effect also arises as a consequence of a Calvo-type price setting mechanism, with partial indexation to last period's inflation. For explicit derivation of the hybrid Phillips curve, see e.g. Christiano et al. (2005). The empirical usefulness of the hybrid specification has been advocated in e.g. Fuhrer and Moore (1995). Further, CPI inflation increases in response to a positive output gap and thus increasing marginal cost of production. The effect of the exchange rate on CPI inflation is exercised directly through the domestic currency price of imported final goods, and the domestic currency price of the imported intermediate inputs. Eventually, the exchange rate will also affect nominal wages via the effect of CPI inflation on wage setting. In either case, the exchange rate will affect the cost of domestically produced goods and inflation in the prices of domestically produced goods (see e.g. Svensson, 2000). For empirical reasons we use the specification with the first difference in the real exchange rate as in Giordani (2004).

The output gap dynamics is described by the following aggregate demand (IS) equation:

$$y_t = \rho_y E_t y_{t+1} + (1-\rho_y) y_{t-1} + \delta_1 (i_{t-j} - E_{t-j}\pi_t) + \delta_2 \Delta q_{t-k} + \delta_3 E_t g_{t+l} + \varepsilon_{IS,t} \qquad (2)$$

[1] The term hybrid relates to the fact that the Phillips curve is backwards, as well as forward-looking in inflation.

where i_t is the nominal interest rate, Δq_t is the change in the real effective exchange rate, g_t is the change in government consumption per GDP, and $\varepsilon_{IS,t}$ an autocorrelated aggregate demand shock. $\varepsilon_{IS,t}$ is assumed to encompass both domestic and foreign demand shocks. One can see from equation (2) that the output gap depends on its expected value one period ahead and its lagged value, where the relative impact is determined by the size of ρ_y. The forward-looking term is due to households' inter-temporal optimizing behavior and the lagged term arises as a result of consumption-habit formation, or a costly adjustment of the capital stock under inter-temporal optimization, see e.g. Clarida et al. (2002) and Christiano et al. (2005) for further details. When the interest rate increases, consumption today in terms of consumption tomorrow becomes more costly, leading to a reduction in current domestic demand. Moreover, the interest rate affects the user cost of capital, influencing investment demand. Aggregate demand is thus influenced through intertemporal substitution effects (by the real interest rate), and through intratemporal price effects (by changes in the real exchange rate). The presence of the real exchange rate captures the resulting changes in export (and import) demand. More specifically, the net exports are assumed to increase with depreciating domestic currency (increase in Δq_t). Further, increased government consumption per GDP, g_t, can have either positive or no effect on the output gap depending on the proportion of the rule-of-thumb consumers in the economy. A higher portion of the rule-of-thumb consumers, i.e. non-Ricardian households will result in higher effect of changes in government consumption on the output gap, *ceteris paribus* (Gali et al., 2007).[2] The motivation for the open-economy IS equation can be found in Monacelli (2005), Clarida et al. (2001), and Svensson (2000). The lag length selection of variables, i.e. determination of j, k and l in the considered ranges of $j = 0...-2$, $k = +1...-1$ and $l = +1...-1$, respectively, is motivated empirically, and has been performed in an encompassing manner using the Bayesian Information Criterion (BIC). In the lag-length selection process, we have imposed the restriction that the impact of exchange rate changes on the output gap is faster than the impact of real interest rate changes. The latter

[2] If government investment was included instead, one could explore the possibility of either crowd in or crowd out effects on private domestic demand. We however choose to stick to the specification of fiscal policy analogous to Gali et al.

is a stylized fact which holds for most small open economies (see e.g. Buncic and Melecky) and we assume it for Macedonia and the Slovak Republic as well.

When choosing the suitable monetary policy reaction function for Macedonia and the Slovak Republic we turn to the classification of monetary policy regimes by the IMF[3]. The IMF classifies the monetary policy regime of Macedonia as a fixed exchange rate one (with respect to the EUR). This regime has been applied by Macedonia since 1995 with a single devaluation in 1997. The chosen reaction function is thus of the following form

$$i_t = i_t^* + \beta \Delta s_t + \varepsilon_{MP,t} \tag{3}$$

advocated by Benigno et al. (2007). The monetary policy rule in equation (3) postulates that the National Bank of the Republic of Macedonia (NBRM) adjust its interest rate in response to changes in the foreign interest rate, i_t^*, and the nominal exchange rate while applying some degree of discretion to this rule, as represented by $\varepsilon_{MP,t}$. The latter is assumed to be a white-noise process.[4]

On the other hand, the monetary policy regime applied by the Slovak National Bank (SNB) has been classified as inflation targeting since December 2004, and recently applied within the context of ERMII which the Slovak Republic joined in 2007. Nevertheless, implicit inflation targeting was applied by the SNB since 1998 when the pegged exchange rate framework was abandoned and a combination of managed floating and implicit inflation targeting was adopted. Inflation targeting is traditionally represented by the Taylor rule in the kind of models used in this paper. The Taylor rule has been found empirically plausible and reasonably robust to different model structures (see Svensson, 2000). In some circumstances, the Taylor rule can also be used to describe optimizing behavior (see Benigno and Benigno, 2003). A forward-looking version of the Taylor rule is employed to emphasize a central bank's focus on future inflation when adjusting its monetary policy instrument. We also allow for explicit reaction to changes in the exchange rate in the view of possible exchange rate smoothing, and most recently

[3] http://www.imf.org/external/np/mfd/er/2006/eng/0706.htm#table.

[4] An i.i.d specification of the monetary policy shock is a common assumption in the literature, see Smets and Wouters (2003) and Del Negro et al. (2005).

the ERMII rules[5], and the existence of fixed exchange rate regime in the pre-1998 period. Since the output gap appeared to be empirically insignificant we ended up using the following modified Taylor rule

$$i_t = \rho_i i_{t-1} + (1-\rho_i)(\alpha E_t \pi_{t+1} + \beta \Delta s_t) + \varepsilon_{MP,t}. \quad (4)$$

The specification in equation (4) implies that the monetary authority responds to expected inflation one period ahead and the current changes in the nominal exchange rate, while at the same time adhering to a certain degree of inertia in i_t.

The dynamics of fiscal policy stance, in terms of changes in government consumption per GDP, is described simply by a first-order autoregressive process (AR(1))

$$g_t = \rho_g g_{t-1} + \varepsilon_{G,t} \quad (5)$$

where $\varepsilon_{G,t}$ is the idiosyncratic change in government consumption per GDP which is allowed to be autocorrelated.

Finally, the evolution of the real effective exchange rate is specified in order to close the model. The change in the real exchange rate, in logs, is defined as $\Delta q_t \equiv \Delta s_t - \pi_t + \pi_t^*$ where π_t^* is unobserved foreign inflation. We adopt an assumption common in the literature of the exchange rate evolving according to real UIP. The UIP condition is generally stated as an identity over the log of the exchange rate and interest rates, with the exchange rate expressed as the ratio of domestic to foreign currency units.

$$\Delta E_t q_t = (i_t - E_t \pi_{t+1}) - r_t^* \quad (6)$$

where r_t^* is the unobserved foreign real interest rate. r_t^* thus comprises wider range of external shocks including the forward exchange rate risk premium and the terms of shock, and is possibly serially correlated.[6]

[5] These include stabilization of the LC/EUR exchange rate around chosen exchange rate parity within 15% bands.

[6] For more details regarding the empirical properties of UIP, see the studies by Ferreira and Leon-Ledesma (2007), Chinn and Meredith (2004), and Mark and Moh (2001).

3. Data and the Estimation Method

In order to maximize the available data coverage while considering the data quality, we use quarterly data for Macedonia from 1997Q1 to 2007Q3, and for the Slovak Republic from 1995Q1 to 2007Q3. All data for the Slovak Republic were obtained from the IMF's International Financial Statistic except the nominal interest rate which was obtained from Datastream. For both countries, the output gap was constructed as a deviation of quarterly real GDP in logs from its potential levels estimated using the Hodrick-Prescott filter. The GDP series for Macedonia was obtained from the National Statistical Office. Inflation was calculated as an annualized percentage change in quarterly CPI, which for Macedonia was obtained from the National Statistical Office. The interest rate used for the Slovak Republic is the three-month interbank rate (middle rate) from Datastream. This rate tracks well the current monetary policy rate (the repo rate), on which data are available only since 2000. The interest rate used for Macedonia is the Central Bank Bill rate obtained from the National Bank of Macedonia. We have not used the interbank rate for Macedonia as the interbank money market was quite inactive over the analyzed period. The observable exchange rate employed is the real effective exchange rate that for Macedonia was obtained from the National Bank of Macedonia. The series of government consumption for Macedonia is readily available on the quarterly basis only from 1999 onwards, and we have extrapolated the series back to 1997Q1 using a constructed series of government spending on wages and salaries, and goods and services. The correlation coefficients between the levels and differences of the constructed series and the actual government consumption series over 1999Q1-2007Q4 is 0.95 and 0.98, respectively. Both government consumption series and the spending of government on wages and salaries, and goods and services were obtained from the Macedonian National Statistical Office. In addition, when calculating the ratio of government consumption to GDP we have used the CPI index to convert the real GDP series into current prices because nominal GDP is not available for Macedonia on a quarterly basis. All data are demeaned prior to the estimation. Giordani (2004) has recently pointed out that working with demeaned data avoids dealing with parameter instability and structural breaks which, he finds, largely affect the unconditional mean of the modeled series.

There are several estimation methods used in the literature to fit New Keynesian models to data. The recently most popular method has been the Bayesian estimation which overcomes some problems of the Full Information Maximum Likelihood method[7] by imposing priors on the structural coefficients' distributions (see e.g. An and Schorfheide, 2005; or Buncic and Melecky, 2008). Given the relatively higher model uncertainly for transition economies, and the fact that system estimators can be inconsistent if one of the equations in the system is misspecified (see Johansen, 2005) our preferred estimation method is the Generalized Method of Moments (GMM) (see e.g. Gali and Gertler, 1999; among others). We used two lags of the variables in the system as instruments. The long-run heteroscedasticity and autocorrelation consistent (HAC) covariance matrix weighting the moment conditions in the GMM estimator is estimated using the Quadratic kernel with the variable New-West bandwidth selection. In addition, pre-whitening of the moment conditions was applied.

4. Discussion of estimation results

The estimated model parameters, using GMM and the quarterly data for Macedonia from 1997Q1-2007Q3 and for the Slovak Republic from 1995Q1-2007Q3, are reported in Table 1.[8]

[7] One of the drawbacks of using ML is that parameters can take on corner solutions or theoretically implausible values. Additionally, it is often the case that the log-likelihood function is flat in certain directions of the parameter space and extremely hilly overall, so that without careful constraints on the parameters space, it is difficult to numerically maximize the log-likelihood function (see the discussion in An and Schorfheide, 2005, for more details).

[8] An explicit, microfounded derivation of the kind of model presented here could be found in e.g. Svensson (2000) or Monacelli (2005). Examples of the model's estimations using data for Australia, Japan, the U.S., or the euro area could be found in e.g. Melecky (2008) or Buncic and Melecky (2008).

Table 1: Estimates of the model parameters using GMM

parameter	Estimate for Macedonia	Estimate for Slovakia
ρ_y	0.4764 (0.0354)***	0.6504 (0.0871)***
δ_1	0.0130 (0.0007)*** $j=-1$	0.0375 (0.0078)*** $j=-2$
δ_2	0.0623 (0.0226)***	0.1229 (0.0389)***
δ_3	0.2343 (0.0611)***	0.1408 (0.0340)***
ρ_π	0.5657 (0.0069)***	0.5660 (0.0254)***
λ_1	0.0394 (0.0015)***	0.0145 (0.0070)**
λ_2	0.0240 (0.0032)***	0.0374 (0.0159)**
ρ_i	na	0.6427 (0.0273)***
α	na	1.0152 (0.0698)***
β	3.7619 (1.2333)***	0.3962 (0.0503)***
ρ_g	-0.0943 (0.1573)	-0.3317 (0.1252)**
σ_{IS}	1.5334	1.8567
σ_{AS}	1.3129	1.2487
σ_{MP}	3.5540	1.0984
σ_G	1.5217	2.3922
σ_{r^*}	8.1636	4.4756

Note: the estimation method is GMM. Standard errors are in parentheses. *, **, *** - indicate significance at the 10%, 5% and 1% significance level, respectively. *k*=0 and *l*=+1 for both Macedonia and the Slovak Republic, j is indicated in the relevant row.

Starting with the estimated IS equations, we could see that the output gap process is more backward- than forward-looking in Macedonia as implied by the estimate of ρ_y: 0.48. The same cannot be said about the output gap process in the Slovak Republic where ρ_y was estimated at 0.65 implying more weight on the expected output gap in the process. Given the micro-foundations of the model, this would suggest that consumption habit formation is much stronger in Macedonia than the Slovak Republic. More broadly, it could also suggest that adjustments of the capital stock are more costly in Macedonia than in the Slovak Republic. Further, the strength of the interest rate (credit) transmission channel of monetary policy is almost three times higher in the Slovak Republic than Macedonia where the δ_1 estimates are 0.01 and 0.04, respectively. This suggests that the Slovakian economy reacts much stronger to a given change in monetary policy vis-à-vis Macedonia, so that the economy is easier to stabilize using interest rate adjustments,

ceteris paribus. Further, the estimated elasticity of output to changes in the real effective exchange rate, δ_2, is about two times higher in the Slovak Republic than Macedonia, where the estimates are 0.06 and 0.12, respectively. The relative magnitudes of δ_1 and δ_2 in both economies imply that stabilization of output could be more effective through the exchange rate transmission channel rather than the interest rate transmission channel of monetary policy. Under the exchange rate targeting regime, however, this channel is much less effective because most of the changes in the real effective exchange rate are bound to happen through the adjustment in relative prices (i.e. domestic relative to foreign). Since prices are usually less flexible than exchange rates, macroeconomic stabilization of output using the exchange rate channel would result in longer-lasting deviations of output from its potential, other things equal. The estimates of δ_3 for Macedonia and the Slovak Republic are 0.23 and 0.14, respectively, implying that a larger portion of consumers in Macedonia relative to the Slovak Republic are rule-of-thumb consumers, i.e. non-Ricardian households (see Gali et al., 2007). Overall, the IS equation fits somewhat better the data of the Slovak Republic than Macedonia where the adjusted R squares are 0.54 and 0.52, respectively. Nevertheless, the estimates of σ_{IS} for the Slovak Republic and Macedonia, of 1.85 and 1.53, imply that it is the Slovak Republic who faces marginally higher aggregate demand shocks.

Consider now the estimated AS equations. In order to achieve a reasonable fit to the CPI inflation data we had to use long-differencing, namely year-to-year changes in CPI as the dependent variable, and the annual cumulative output gap and year-to-year change in the nominal effective exchange rate as the explanatory variables.[9] The estimates of ρ_π for the two countries suggest that the inflation dynamics is driven more by inflation expectations rather than past inflation. It appears that the estimate of ρ_π = 0.57 applies to both Macedonia and the Slovak Republic. The elasticity of inflation to an increasing output gap, λ_1, is estimated to be almost three times higher in Macedonia, 0.039 versus 0.015 in Slovakia. The relative magnitudes of λ_1 thus imply about two times higher output rigidity in Macedonia. Hence, a given increase in capacity utilization

[9] Note that the year-to-year long differencing on quarterly data induces by definition third-order autocorrelation in the AS shocks that is handled according in estimation of the HAC covariance matrix.

(demand pressure) will be translated in to a three times higher increase in marginal costs in Macedonia relative to Slovakia. In other words, the flexibility of the potential output to adapt to the increased demand is much lower in Macedonia. The elasticity of CPI inflation to changes in the nominal effective exchange rate, λ_2, is estimated to be 0.024 and 0.037 for Macedonia and the Slovak Republic, respectively. The about 65 percent lower exchange rate pass-through in Macedonia could imply either higher monopolistic power of the importers, or a higher share of services in final sales of imports in Macedonia. Further, the second-round effect of CPI inflation on wages as a result of an exchange rate increase could be higher in the Slovak Republic, which would further enforce the exchange rate pass-through. Overall, the AS curve fits the data of the Slovak Republic better than those of Macedonia with the respective adjusted R-squares being 0.86 and 0.78. Based on the relative estimates of the standard deviation of AS shocks σ_{AS}, Macedonia appears to be subject to somewhat higher supply shocks.

When estimating the MP reaction function for NBRM we have included a dummy variable to account for the two spikes in the NBRM interest rate series in 2001Q2 and 2002Q4.[10] The estimate of the β coefficient is 3.76 for Macedonia which satisfies the stability conditions (the model has a stable solution), see also Benigno et al. (2007). The estimates of the MP rule for Slovakia imply that the SNB smoothes the interest rate – where ρ_i is estimated to be 0.64 – increases interest rate in response to increasing expected inflation, with $\alpha = 1.02$, and depreciation of the Slovak koruna, $\beta = 0.40$. Overall, the MP equation fits better the data of the Slovak Republic, and only with the use of a dummy variable for the two spikes in the NBRM interest rate series the adjusted R squares for Macedonia and the Slovak Republic turned out to be 0.70 and 0.46, respectively. Nevertheless, the MP discretionary shock within the context of the presented MP rules is significantly higher in Macedonia, with the standard deviation of 3.55, than in the Slovak Republic; estimated standard deviation of 1.10.

[10] The spike in 2001Q2 was due to the domestic conflict and the Central bank sterilization of the surge in government defense related expenditures. The situation stabilized by early 2002, but in 2002Q4 the Central Bank had to intervene again because the government went on a spending spree just before the September 2002 elections. Once the government changed, the new authorities immediately entered into a stand-by agreement with the IMF and tightened both fiscal and monetary policy considerably.

As discussed before, changes in the government expenditure relative to GDP are described by an AR(1) process for both countries. The AR coefficients in the two countries are estimated to be negative but differ in their magnitude and significance. Namely, the estimates of ρ_g for Macedonia and the Slovak Republic are -0.09 and -0.33, respectively. The estimate of negative autocorrelation of changes in government consumption in Macedonia is insignificant and thus not different from zero – implying that the changes in government consumption in Macedonia follow the white-noise process and that the fiscal stance in this respect is relatively stable in Macedonia. On the other hand, there seems to be significant negative autocorrelation in government consumption-per-GDP changes in Slovakia implying frequent changes in the fiscal stance in Slovakia. Furthermore, the magnitude of the estimated fiscal (government consumption) shock is higher for Slovakia than Macedonia, 2.17 and 1.52, respectively. This further reinforces the relatively higher uncertainty about future economic environment in Slovakia induced by a changing share of government consumption in GDP.

Finally, the shock to the real effective exchange rate, as implied by the UIP condition has an estimated standard deviation of 8.16 and 4.48 for Macedonia and the Slovak Republic, respectively. This implies that Macedonia's economy is exposed to about two times larger external shocks compared with the Slovak Republic. The exchange rate shocks could comprise e.g. changes in the terms of trade, the effective foreign real interest rate, or changes in capital flows.

5. Microeconomic Narrative of the Macroeconomic Estimates

In this section we focus on justifying the differences in selected estimates of the model structural coefficients for Macedonia and the Slovak Republic using microeconomic evidence. We focus on the coefficient estimates in the IS and AS curves because these equation are richest in the behavioral characteristics of the economies and represent the most important constraints for maximizing monetary and fiscal policy objectives. Namely, from the estimates of the *IS curve* we focus on illustrating why in Macedonia (i) the consumption habit formation or cost of capital stock adjustments could be higher in Macedonia, (ii) the credit channel of monetary policy could be weaker, (iii) the exchange

rate effect on net exports could be weaker, and (iv) the portion of the rule-of-thumb consumers (non-Ricardian households) could be higher, vis-à-vis the Slovak Republic. Similarly, we try to illustrate why in Macedonia, relative to the Slovak Republic, (v) the effect of increasing capacity utilization (demand pressure) on inflation could be higher, and (vi) the exchange rate pass-through could be lower.

5.1. Microeconomic Narrative for the IS curve estimates

(i) Why the consumption habit formation or cost of capital stock adjustments could be higher in Macedonia?

Data on CPI's weights, which are typically based on households' consumption patterns, seem to confirm stronger habit formation in Macedonia. The CPI basket changed in both countries between 1999 and 2007, however, the overall change in the structure of the CPI (approximated by the standard deviation of the changes in the weights of the various COICOP categories) was greater in the Slovak Republic. Faster rising incomes in Slovakia compared to Macedonia meant that Slovaks increased spending on non-necessities more than Macedonians. In addition, developments in prices differed considerably; for example, price-adjustment in energy and utilities to cost recovery levels in the Slovak Republic occurred much faster compared to Macedonia, meaning that Slovaks' consumption habits had to adjust much earlier.

Table 2: Changes CPI weights in the Slovak Republic and Macedonia

	Slovak Republic			Macedonia		
	1999	2007	change	1999	2007	change
Food and non-alcoholic beverages	293.4	168.3	-125.1	488.2	373.0	-115.2
Alcoholic beverages, tobacco and narcotics	46.3	55.7	9.4	43.0	40.0	-3.0
Clothing and footwear	120.6	42.0	-78.6	79.0	76.0	-3.0
Housing, water, electricity, gas and other fuels	138.8	227.1	88.3	118.1	121.0	2.9
Furnishings, household equipment and routine maintenance of the house	61.3	58.2	-3.1	38.2	50.0	11.8
Health	14.5	36.7	22.3	22.6	34.0	11.4
Transport	98.9	102.7	3.9	90.9	91.0	0.1
Communications	15.9	44.0	28.1	30.5	64.0	33.5
Recreation and culture	95.1	85.1	-10.0	33.0	43.0	10.0
Education	11.6	17.5	5.9	1.1	8.0	6.9
Restaurants and hotels	52.1	87.5	35.4	9.8	49.0	39.2
Miscellaneous goods and services	51.7	75.2	23.5	45.6	51.0	5.4
Standard deviation			54.7			38.6

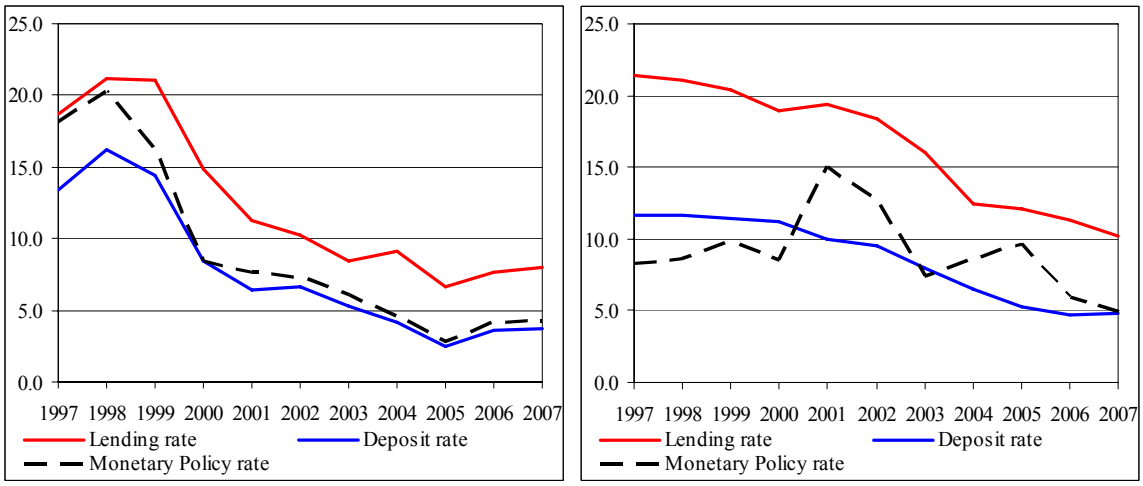
Note: Components sum to 1,000, according to COICOP methodology.
Source: for Slovakia Eurostat; for Macedonia State Statistics Office (the Macedonia numbers are the 2002 published numbers. Given that weights were not changed between 1999 and 2005, the 2002 weights are assumed to be valid for 1999.

More broadly, higher output gap persistence (see the estimated IS curve in Table 1) also suggests that adjustments of the capital stock are more costly in Macedonia than in the Slovak Republic. The difficulties of Macedonian businesses to take advantage of changing business conditions are discussed under "output rigidity" in Section (v) below.

(ii) Why the credit channel of monetary policy could be weaker in Macedonia?

The IS curve estimates suggest that Macedonia's output gap is less responsive to interest rate changes than Slovakia's output gap.[11] The direct interest rate channel works largely through its impact on domestic credit and hence aggregate demand. Its efficiency is thus crucially dependent on the transmission of changes in the monetary policy rate to deposit and lending rates. This transmission, see Figure 1, can be less effective for several reasons.

Figure 1: Lending, Deposit and Monetary Policy Rates in Slovakia and Macedonia



Source: IFS and NBRM; the monetary policy rate is approximated by the CB bill rate for Macedonia and the 3-month interbank rate for Slovakia, see the data description section for details.

[11] A recent NBRM report on the effect of the interest rate transmission mechanism largely supports the view that this channel is weak. Available in Macedonian at: http://www.nbrm.gov.mk/default-MK.asp?ItemID=98BEA8015487194DB5825340B5C5ECCF

First, there is relatively lower competition in the financial sector of Macedonia compared to that of Slovakia. Though Macedonia has a higher number of banks per capita, the Macedonian banking sector is dominated by few large banks preventing competitive pressures to force increased lending and deposits, and to reduce interest rate margins. As a result, the lending rate and the interest rate margins in Macedonia have been higher compared to those in Slovakia (see Figure 1). Slovak banks, facing higher competition borrowed extensively funds from abroad. On the other hand, Macedonian banks, facing limited competition still remain net international creditors despite higher domestic interest rates and profit margins relative to Slovakia (see Table 3).

Table 3: Net External Position and Competitiveness of the Banking Sector

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Macedonia										
Net external position[1]	2.4	3.9	5.5	13.0	9.3	10.2	10.8	7.7	7.7	4.7
Banking sector reforms[2]	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Banking Efficiency[3]	…	…	3.3	3.6	3.5	3.5	3.6	4.8	…	…
Slovakia										
Net external position[1]	5.2	4.7	8.3	7.3	2.3	-2.5	-6.9	-14.6	-5.7	-9.9
Banking sector reforms [2]	2.3	2.3	2.3	2.3	2.3	2.7	2.7	2.7	3.0	3.0
Banking Efficiency[3]	…	…	4.8	4.4	4.9	4.8	4.8	4.9	…	…

Note: 1/ Net of banking sectors' external claims and liabilities; 2/ EBRD Banking reforms and interest rate liberalization index; 3/ World Bank Financial development indicator; *Source:* IMF International Financial Statistics, EBRD, World Bank.

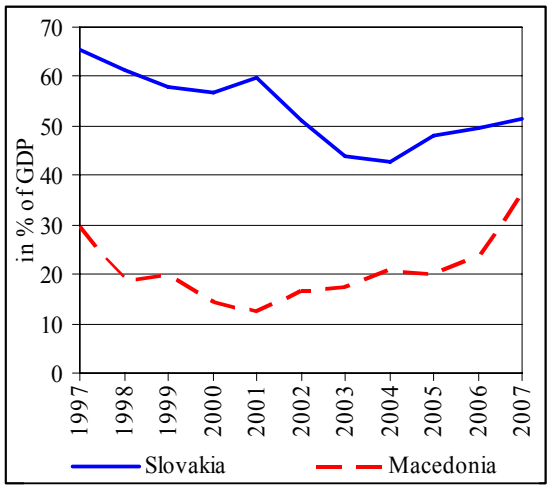
Second, the mix of macroeconomic policies, namely the de-facto fixed exchange rate and frequent fiscal surprises, have allowed Macedonian banks to enjoy higher risk-free returns (through FX arbitrage) relative to Slovak banks, thus further crowding out lending to the private sector and limiting banks' competition (see Table 3 and Figure 2). Since their introduction in 2004, the average interest rate on the 3-month T-bills issued by the Macedonian Ministry of Finance was 7.5%, compared to 4.1% in the Slovak Republic during the same period. The real (CPI-adjusted) risk-free return was thus, on average, significantly positive (6.2) for Macedonian banks since 2004, while it was negative (-0.3) for Slovakian banks. This could also reduce the relative incentives of Macedonian banks to lend to the private sector.

Third, the extent of the involvement of the private sector in financial operations, especially borrowing is important. Credit to the private sector barely reached 40% of

GDP in Macedonia by 2008, compared to more than 50% of GDP in Slovakia (see Figure 2 panel 1). Especially in the earlier years covered in this paper, a large part of the Macedonian economy had relatively limited access to financing due to less competitive banking sector, while those with access to financing were financed at unreasonably high costs.

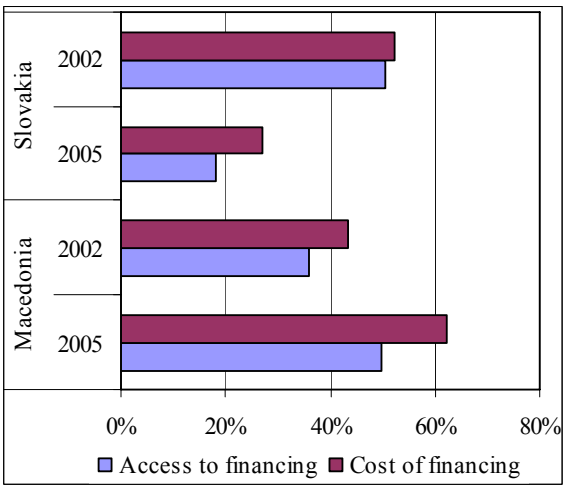
Figure 2: Financial Deepening and Access to and Cost of financing as a constraint of doing business

Panel A: Domestic Credit as % of GDP



Source: IMF IFS

Panel B: Access and Cost of financing as a constraint of doing business



Source: BEEPS 2002 and 2005.

Fourth, the extent of the euroization (formerly dollarization) is much larger in Macedonia than Slovakia making the actual lending/deposit base affected by the changes in the monetary policy rate on local currency denominated instruments much narrower, and the changes in the monetary policy rate thus less effective in managing aggregate demand. At the end of 2006, only 1.5% of loans to households and 33% of loans to the corporate sector were extended in foreign currency in Slovakia, compared to 45% of loans to the household sector in Macedonia and 58% of loans to the corporate sector.

(iii) Why the exchange rate effect on net exports could be weaker in Macedonia?

Several factors could explain the weaker output response to changes in the real exchange rate in Macedonia compared to the Slovak Republic that we have estimated.

First, the structure of Slovak imports contains a larger share of goods expected to have higher import elasticities. Generally, import demand elasticities for manufactured goods tend to be higher compared to those of raw materials and food,[12] which can explain the lower responsiveness of imports to REER development in Macedonia. Machinery and equipments account for the largest share of Slovak imports (see Table 4). On the other hand, Macedonian imports are dominated by goods imported for processing and re-exported (textiles and iron and steel; the bulk of imports classified as other manufactured products) as well as a sizable share of basic consumption goods (food and oil). Imports for processing are more sensitive to wage pressures (rather than REER developments) which have been modest due to the high unemployment in Macedonia.

Table 4: Imports and exports structures, SITC classification, 1999-2006, in % of total

	Imports Structure			Exports Structure		
Slovakia	1999	2003	2006	1999	2003	2006
Food, drinks and tobacco	6.2	4.3	4.8	3.5	2.8	3.8
Raw materials	4.0	3.4	3.3	4.0	2.5	2.4
Fuels, lubricants and related materials	13.0	12.1	14.1	4.7	5.1	6.4
Chemicals and related products	11.3	9.8	8.8	7.8	5.0	5.5
Other manufactured products	27.8	29.1	29.9	40.4	36.4	32.8
Machinery and transport equipment	37.7	40.7	38.8	39.4	47.4	48.5
Macedonia						
Food, drinks and tobacco	13.8	12.8	10.7	19.0	16.8	16.0
Raw materials	3.2	2.6	3.6	4.3	2.9	4.7
Fuels, lubricants and related materials	9.1	14.0	20.2	1.9	5.4	9.4
Chemicals and related products	10.4	11.1	9.7	4.6	5.2	4.2
Other manufactured products	20.8	20.0	36.7	61.0	63.6	60.7
Machinery and transport equipment	20.0	18.8	18.3	7.0	5.9	4.9

Source: EUROSTAT for Slovakia and State Statistics Office for Macedonia

Second, Macedonian exports are concentrated in only few sectors (firms) with low excess capacity and growing competition. Almost 50% of Macedonian exports are re-exports of iron and steel, and textiles, or, in recent years, fuel where the corresponding firms operate close to full capacity utilization. As a result, Macedonian reliance on few export companies has grown over time resulting in growing export concentration. On the other hand, there are relatively more exporting Slovak firms, and Slovakia's exports cover a

[12] Among the first who made this observation was Kreinin (1973).

greater variety of products and more markets. Hence, Slovakia's exports are less reliant on few key industries, which enables firms to take advantages of changes in their external price competitiveness. Table 5 below presents developments in export concentration in Macedonia and the Slovak Republic. Although Slovakia increased concentration of its exports by products, it has diversified exports across more destinations. On the other hand, Macedonia exports become less diversified in both product and destinations.

Table 5: Developments in export concentration, in percent of total exports

Slovakia	1996	2006	**Macedonia**	1996	2006
top 5 countries	70.2	56.0	top 5 countries	62.4	69.2
top 10 countries	85.3	77.5	top 10 countries	80.7	85.1
top 5 products	19.6	37.6	top 5 products	36.9	45.3
top 10 products	30.6	46.2	top 10 products	54.7	61.0

Source: COMTRADE

Third, Macedonian exports had a more restricted market access due to lower trade integration into the European region, low levels of FDI, and inability to meet quality standards. Compared to Slovakia, which gained duty free access to the EU market under the Europe Agreement in 1995, Macedonia's access to the EU market occurred much later with the signing of the Stabilization and Association Agreement in 2001, and more intensive integration with the immediate neighborhood started only with the 2006 CEFTA agreement. The FDI inflow, typically associated with increased market access and transfer of know-how,[13] has been much lower for Macedonia compared to Slovakia. Over the 1997-2007 decade, FDI averaged 4.6% of GDP in Macedonia, compared to 6.4% of GDP in the Slovak Republic; as a result, cumulative inflows of FDI over this period in Macedonia reached USD2.3 billion, or only 10% of the Slovak USD23.7 billion inflow. Also, greater compatibility with quality standards can explain the greater responsiveness of Slovak exports to changing price competitiveness. According to the International Organization for Standardization, only 217 Macedonian firms were ISO 9001-certified at the end of 2006 compared to 2195 of Slovak firms. Similar

[13] This link has been well-demonstrated especially by the Volkswagen FDI in the Slovak Republic.

discrepancies emerge when comparing certification on other quality standards (see Table 6).[14]

Table 6: Number of ISO certified firms

	Dec.01	Dec.02	Dec.03	Dec.04	Dec.05	Dec.06
ISO 9001:2000						
Slovakia	144	768	1,148	2,008	2,050	2,195
Macedonia	1	7	47	133	154	217
ISO 14001						
Slovakia	73	70	165	184	222	305
Macedonia	1	1		5	6	8

Source: International Standards Organization 2006 Survey

Finally, the sensitivity of net exports to changes in REER may be qualitatively different due to the different exchange rate regime applied in the two countries. Under a flexible exchange rate regime (the Slovakia's case) the exchange rate adjusts to the domestic economic activity and external environment, while under an exchange rate peg (the Macedonia's case), the domestic economic activity and prices have to adjust to the external developments – especially in the case of small open economies. Therefore, under the peg, changes are bound to happen mostly through adjustments in prices. This will obviously change relative prices in the economy and hence the production structure, because price adjustments will vary across different sectors due to varying price rigidities and export orientation. Hence, also the pegged exchange rate contributes to the explanation of the relatively lower output gap elasticity to exchange rate changes.

(iv) Why the portion of the rule-of-thumb consumers (non-Ricardian households) could be relatively higher in Macedonia?

Ricardian households will increase their savings in face of increased government consumption (spending) to retain funds for accommodating future increases in taxes. They thus buy government bonds in response to fiscal impulse so that there is no actual effect on aggregate demand. The presence of significant portion of non-Ricardian

[14] The inability to meet quality standards has translated into growing reliance on low-value added exports in Macedonia reflected in deteriorating (at best not-improving) terms-of-trade (2% decline over 2000-2005). On the other hand, Slovakia has witnessed a considerable improvement in its terms-of-trade, 23.3% over 2000-2005.

households in transition economies should not be a surprise, given the relatively stringent conditions needed for Ricardian equivalence to hold: perfect capital markets, consumption smoothing behavior, intergenerational concerns, and no distorting effects of taxes, among others (also see Barro 1974; Briotti, 2005). We look into selected aspects of the non-Ricardian behavior in Macedonia in comparison with Slovakia.

First, less efficient and complete financial markets in Macedonia relative to Slovakia reduce the availability of financial instruments to offset the anticipated future changes in fiscal policy (see Table 7). Poor competition in the banking sector, underdeveloped government debt markets, limited financial deepening and sophistication, and external capital restrictions might have reduced incentives to save rather than consume the extra household income as a result of increased government spending, and increased liquidity constraints which prevent effective consumption smoothing.

Table 7: Capital market development indicators

	2003	2004	2005	2006	2003	2004	2005	2006
	Slovakia				Macedonia			
as % of GDP								
Stock market capitalization	8.4	10.5	9.3	10.1	7.8	7.7	11.1	17.7
Government securities, outstanding	32.5	32.1	28.0	26.3	14.4	13.6	16.1	15.7
S&P Rating	A-	A-	A	A	BB	BB	BB+	BB+
Non-bank financial institutions reforms, EBRD index	2.7	2.7	2.7	3.0	1.7	2.0	2.0	2.3

Source: Stock market capitalization from WDI, Government securities outstanding – author calculations based on the Ministry of Finance and Central bank data, S&P rating from Standard&Poor's sovereign ratings; Index of reform of non-bank financial institutions from EBRD Transition Indicators.

Second, poverty is more prevalent in Macedonia making the affected people consume more or all of their disposable incomes while leaving less of it for savings. Around a fifth of Macedonia population is absolutely poor (World Bank, 2005). Since comparable poverty data for Slovakia are not readily available, an indirect illustration can be drawn from relative per capita incomes and income inequality. Namely, in 2006, Macedonia's per capita GNI at PPP was USD7850, significantly below Slovak's GNI per capita at PPP of USD17060, also the GINI indexes were 39.0 in 2003 for Macedonia, and 25.8 in 1996 for Slovakia.[15]

[15] World Bank estimates "Distribution of Income or consumption 2.7". More recent data are not available.

Third, a history of more prudent fiscal policies and smaller government could explain the larger portion of non-Ricardian households in Macedonia, as many households have not felt yet significant adverse effects due to excessive government consumption. With the exception of the 2001-2002 period, the Macedonian budget was largely balanced over the last decade (compared to an average deficit of around 5% of GDP in Slovakia), i.e. changes in government consumption were compensated by changes in current tax revenues, and the government size in Macedonia has been significantly smaller compared to Slovakia – government expenditures averaged around 37% and 44% of GDP over 1997-2007 in Macedonia and the Slovak Republic, respectively.

5.2. Microeconomic Narrative for the AS curve estimates

(v) Why the effect of increasing capacity utilization (demand pressure) on inflation could be higher in Macedonia?

The Phillips curve estimates imply relatively higher output rigidity in Macedonia compared with Slovakia. This means that Macedonian producers are unable to respond to higher demand without considerably increasing costs and thus hurting their competitiveness.

There are several competing explanations for the capacity constraints of Macedonian businesses. Macedonian producers may be operating at higher levels of capacity utilization. Given the depreciated and largely obsolete inherited capital stock and low investments over the last 15 years (averaging 20% of GDP compared to Slovakia's 29% of GDP) it is reasonable to expect that Macedonian producers have lower opportunities to expand output within existing facilities at relatively low marginal costs. However, data on capacity utilization in manufacturing from the Eurostat and the Macedonian statistical office are not supportive of this argument. Capacity utilization in manufacturing fluctuated between 65-70%[16] during 2005-2008 in Macedonia compared

[16] Business Tendencies in the Manufacturing Sector, Macedonia State Statistics Office, available at: http://www.stat.gov.mk/statistiki.asp?ss=11.03&rbs=1

to 70-80%[17] in the Slovak Republic. However, it should be taken into account that these surveys are most likely not fully comparable and that access capacity may be located largely in sectors for which there is limited demand.

This brings us to a more likely explanation of higher output rigidity in Macedonia, the gap between domestic demand and production, in other words, narrow production base. Around 60% of Macedonian industrial production is accounted for by sectors with rigid capacity constraints (electricity, oil) or export-oriented sectors which operate at almost full capacity (iron and steel, and textiles).

Further, the size and structure of both economies differ considerably. While Macedonian economy is dominated by small (even micro) entities, most of the value added in the Slovak Republic is generated by large enterprises (see Table 8) which probably have sufficient excess capacity or greater ability to expand production with limited cost implications (see also Figure 2 panel 2), and better exploit the economies of scale.

Table 8: Structure of economies by size of entities (as % of total)

	Number of entities			Number of employees			Value added		
	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
Slovakia	93.1	5.5	1.4	28.7	22.5	48.8	25.1	17.3	57.6
Macedonia	99.0	0.6	0.4	63.8	13.6	22.6	47.5	13.0	39.5

Source: For Slovakia: European Business, Facts and Figures, 2007 Edition - Eurostat Statistical book (p.30), data refers to 2004, for Macedonia: author calculations based on National Accounts data from the State Statistics Office.
Note: Data refers to non-financial business economy

A considerably more favorable business environment enables Slovak businesses to react faster and cheaper to increased demand. The Slovak Republic ranks 32nd on the 2008 Doing Business indicator compared to Macedonia's 75th ranking (despite a considerable improvement from 2007, and from before when the country ranked around 100th). Overall, the better business environment provides Slovak businesses with more and cheaper financing, less corrupt and faster public administration, and more efficient

[17] Current level of Capacity utilization in manufacturing industry, EUROSTAT, available at: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&plugin=1&language=en&pcode=bs070

protection of creditor and property rights compared to their Macedonian counterparts (see Table 9).

Table 9: Ranking on 2008 Doing Business indicators

	SR	MK		SR	MK
Doing Business	32	75	Getting Credit	7	48
			Protecting Investors	98	83
Starting a Business	72	21	Paying Taxes	122	99
Dealing with Licenses	50	76	Trading Across Borders	90	72
Employing Workers	75	128	Enforcing Contracts	50	84
Registering Property	5	91	Closing a Business	36	127

In addition, a better skills structure of the Slovak labor force could explain the ability of Slovak firms to expand output faster and cheaper. Even though Macedonia has a much higher unemployment rate (standing at around 34% in 2007, compared to around 13%[18] in Slovakia), an unemployed Macedonian is much less skilled and educated compared to his counterpart in Slovakia. Around 55% of the unemployed in Macedonia were first-time job seekers (considerable number aged 35 and above) compared to only 25% in the Slovak Republic. Above 40% of unemployed in Macedonia have less than secondary education compared to around 28% in the Slovak Republic. This suggests that for Macedonian businesses it is more difficult and expensive to find and hire skills that are in demand compared to Slovak businesses. This is also reflected in the relatively lower score in the Doing Business survey concerning the legal framework governing employment of workers (see Table 9, Employing Workers).

(vi) Why the exchange rate pass-through could be lower in Macedonia?

The estimate that Slovak CPI reflects exchange rate changes more than Slovak CPI can be explained by differences in functioning of product markets as well as trade integration of the two countries.

Functioning competitive product markets imply that changing prices reflect developments in costs. Administered prices can break this link. Most of the prices are set liberally in both economies; however, the small set of administered prices in Macedonia

[18] Data is for 2006

(utilities, electricity) has shown greater resistance to economic developments (largely reflecting the authorities' policies to protect the living standard of the population). End-prices of electricity increased five-fold between 1997 and 2007 in the Slovak Republic compared to only doubling in Macedonia over the same period. Even though prices of smaller number of goods are being regulated in Macedonia compared to the Slovak Republic; the share of administered prices in the CPI in 2006 was 1.2% and 23.4% in Macedonia and Slovakia (EBRD, 2007), the problem appears to lie in the commercial orientation of the provision of major CPI basket articles.

Additionally, constraints to market entry, based on either the market size or institutional arrangement, can reduce the exchange rate pass-through by allowing monopolistic importers to charge excessive profit margins on their products and adjust prices in an asymmetric way. Equally low competition in the domestic market then supports the survival of such monopolistic structures in the import industry. The lower degree of market competition in Macedonia compared to Slovakia can explain the lower sensitivity of CPI to exchange rate changes. Namely, the Slovak Republic scored 3.3 on EBRD's index of competition policy[19] in 2007 and 0.39 on OECD's Index of pro-competitive reforms[20] (data is for 2005), compared to Macedonia's score of 2.3 on the EBRD index and 0.59 on the OECD index.

Finally, the differing exchange rate pass-through may reflect differences in the living standards of the population in both countries (i.e. the construction of the CPI) as well as differences in the extent of trade integration. Macedonian CPI gives a considerably larger weight to food and beverages (around 40% compared to Slovakia's around 20%) which are mostly domestically produced and as a result shielded from exchange rate developments (see Table 10). Also, imports of goods account for above 80% of Slovak GDP compared to only around 60% of Macedonian GDP. Further more, imports of goods which are closely reflected in the CPI (foods and beverage, fuels and lubricants, transport equipment and consumption goods) account for 35.7% of GDP in the

[19] The index ranges from 1 to 4+ with 1 referring to "No competition legislation and institutions" and 4+ referring to "Standards and performance typical of advanced industrial economies; effective enforcement of competition policy; unrestricted entry to most markets" (EBRD, 2007, p.211). Most of the advanced transition economies have an Index of competition policy of 3.3, with only Estonia performing better (Index of competition policy of 3.7)

[20] The index range is between 0 and 1 with smaller value implying better performance on the index. Index data from Miroudut et al. (2007).

Slovak Republic in 2006, compared to 28.4% of GDP in Macedonia, suggesting the imports have also a larger share in Slovak consumption.

Table 10: Import structure for Macedonia and the Slovak Republic

	Macedonia		Slovak Republic	
	2005	2006	2005	2006
Food and beverages	6.3	6.3	3.6	3.6
Industrial supplies nes	22.7	24.6	22.1	23.6
Fuels and lubricants	10.3	11.8	10.0	10.8
Capital goods	6.5	6.9	17.5	20.9
Transport equipment	3.4	4.1	11.5	13.3
Consumption goods nes	6.1	6.1	7.5	7.9
Goods nes	0.0	0.1	0.5	0.0
TOTAL	55.4	59.9	72.6	80.2
Included closely in CPI	26.2	28.4	32.5	35.7

Source: COMTRADE, Imports according to BEC methodology

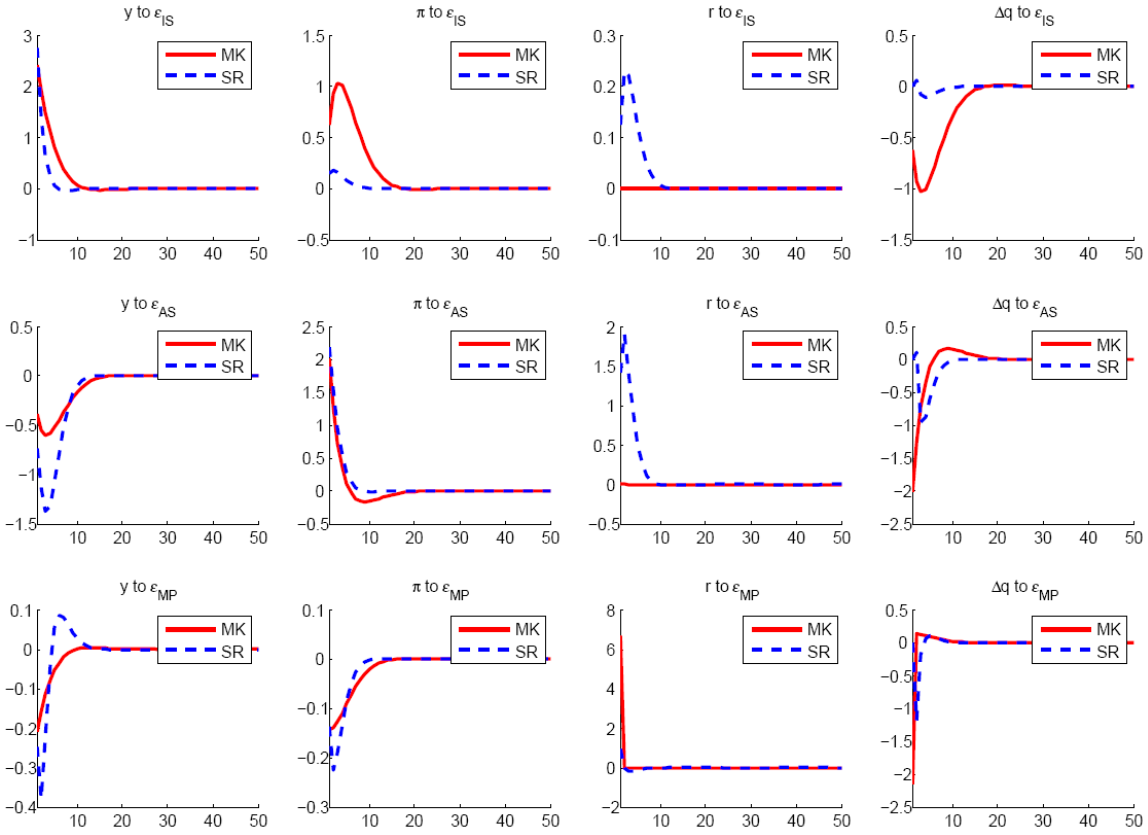
6. Impulse Response Analysis

The impact of various shocks on the main variables of interest is commonly analyzed using impulse response functions (IRFs). An IRF gives an answer to a question of what will happen to an endogenous variable of a given economic system when the system is shocked by a certain event, such as aggregate demand shock[21], while keeping other things constant. The endogenous system is then rolled forward so that in the long run the impulse response is expected to converge back to the equilibrium (the steady state) in response to transitory shocks. We carry out the impulse response analysis using the estimated model for Macedonia and the Slovak Republic and compare the IRFs of the two countries for selected variables. In order to recover IRFs, the linearized rational expectation model is put into state-space form and solved using the QZ solution algorithm of Sims (2002). The solved model has then a VAR structure readily allowing the computation of the IRFs. We focus on the responses of the output gap, inflation, interest rate and the real exchange rate to the aggregate demand, aggregate supply, monetary policy, fiscal and external (exchange rate and foreign) shocks. The estimated IRFs are presented in Figure 3 and

[21] The aggregate demand shock could be result of e.g. the change in consumers' preferences.

Figure **4**. All impulse responses are to one standard deviation of a shock.[22]

Figure 3: Responses of the output gap, inflation, interest rate and exchange rate to demand (IS), supply (AS) and monetary policy (MP) shocks in Macedonia (MK) and the Slovak Republic (SR).



The first row of Figure 3 shows the impulse responses of the output gap, inflation, interest rate, and real exchange rate to a positive demand (IS) shock. We can observe that at impact the domestic IS shock has slightly higher impact on the output gap in Slovakia – partly because its size is bigger (see Table 1). However, the adjustment back to the steady state is faster in Slovakia perhaps due to more forward-looking nature of the process driving output gap formation (viz. Table 1). As the output gaps in both countries

[22] This means that the relative size of the shocks hitting Macedonia and Slovakia may differ for each type of shock. Alternatively, one could hit both systems with shocks of the same size for both countries and for each type of shock. This will however disregard the fact that the two countries face shocks of different sizes and that even a bigger shock can have a smaller immediate impact on variables as the structural form is solved into the reduced form, used for the IRFs, where the reduced-from coefficients are a non-linear function of the structural coefficients including the estimated standard deviations. We thus prefer using one standard deviation shocks in the IRF analysis.

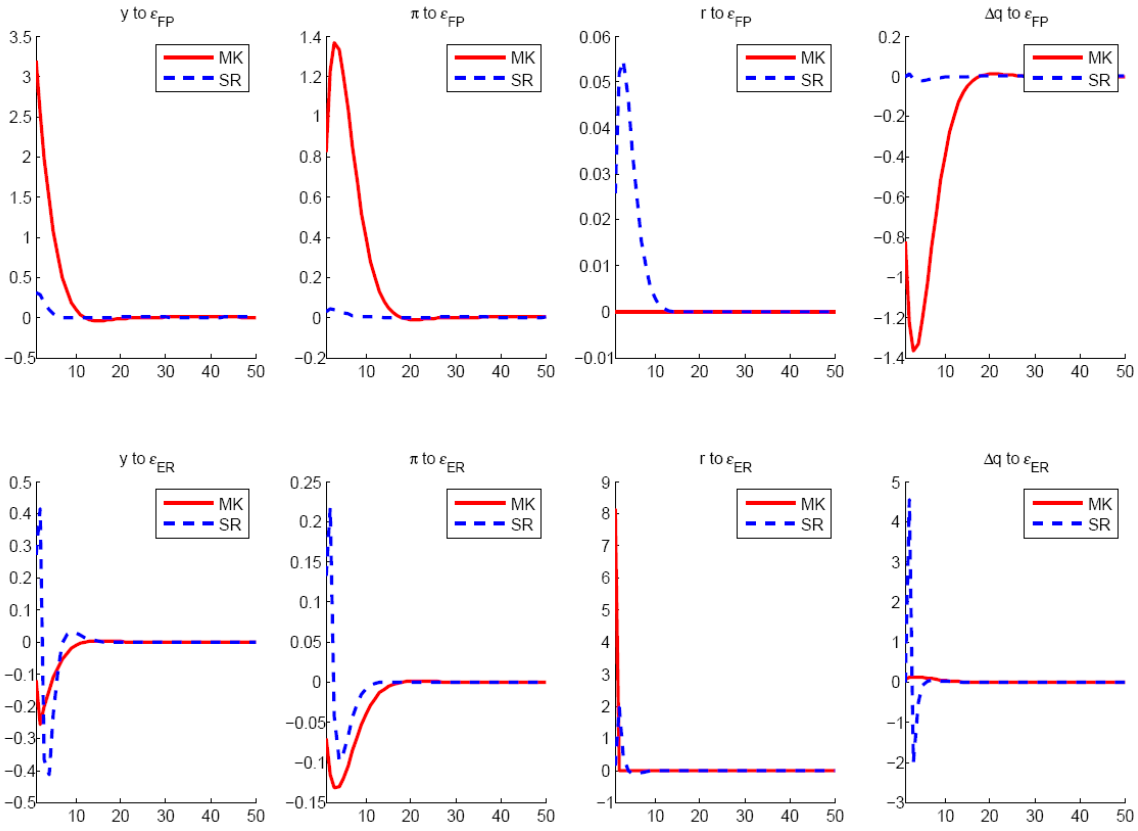
open, the higher sensitivity of inflation to excess demand in Macedonia (see Table 1) results in about three times a higher impact of the IS shock on inflation in Macedonia compared to Slovakia, where in addition the adjustment back to the equilibrium is much longer in Macedonia. This is partly due to the fact that the reaction of Macedonia's interest rate to the IS shock is negligible compared to Slovakia, where the monetary authority react to increasing inflation by raising interest rates. The Macedonian denar appreciates sharply in effective terms as inflation rises, while the response of the real exchange rate (appreciation of the Slovakian koruna in effective terms) is proportionally smaller in Slovakia due to a more subdued inflation response. Overall, Slovakia's economy appears to be much efficient in absorbing the IS shock.

The second row of Figure 3 presents the variables' responses to a positive supply (AS) shock. Once the AS shock hits the economy, inflation increases at impact. The adjustment of inflation back to the steady state appears to be faster in Slovakia, while Macedonia experiences a short and minor deflation period before inflation stabilizes at its equilibrium value. The Slovakian central bank reacts to rising inflation by increasing its interest rate. On the other hand, the Macedonian central bank does not respond to the domestic AS shock. Nevertheless, both the denar and the koruna appreciate in effective terms, where a much larger appreciation is needed in Macedonia to stabilize the economy, given the virtually zero response of the Macedonian interest rate to the domestic AS shock. As a result of an increasing interest rate and appreciation of the koruna, Slovakia's output gap declines more than the Macedonia's output gap in response to the domestic AS shock. Given the lower output gap response, one may argue that the AS shock is somewhat better absorbed by the Macedonian economy.

The third row of Figure 3 displays the variables' responses to a positive monetary policy (MP) shock – a discretionary increase in the interest rate. As seen in the third panel, the MP discretionary shock is much higher in Macedonia than Slovakia (see also Table 1). Nevertheless, in both countries the domestic MP shock has only very short-lived effect on the interest rate. As the interest rate increases, the exchange rate responds proportionally, so that the Macedonian denar appreciates significantly more in effective terms than the Slovakian koruna. The raising interest rate and appreciating domestic currency decrease the output gap in both countries, where the initial output gap response

is more pronounced in Slovakia. However, the output gap in Slovakia swings into positive territory before stabilizing around its steady state. Inflation too declines in response to domestic currency appreciation and an increased domestic interest rate in both countries, with a higher decline in Slovakia. Despite the higher size of the MP shock in Macedonia, the economy appears to adjust faster to its equilibrium (steady state) than the Slovakian economy does to a corresponding domestic MP shock.

Figure 4: Responses of the output gap, inflation, interest rate and exchange rate to government consumption (FP), and external (ER) shocks in Macedonia (MK) and the Slovak Republic (SR).



The first row of Figure 2 shows the responses of the variables to a positive fiscal shock -- here an idiosyncratic increase in the government consumption-to-GDP ratio. One can see in the first panel that as the positive fiscal shock hits the economy the output gap response in a positive way in both countries, where in Macedonia the response is about six times larger, despite the standard deviation of the Slovakian fiscal shock being almost two time higher than that of the Macedonian fiscal shock (see Table 1). As the output gap

opens, also inflation increases in both countries in response to a positive fiscal shock, where again the increase in Macedonia's inflation is much higher, about eight times, than the response of inflation in Slovakia. The response of the domestic interest rate in Macedonia to the fiscal shock is negligible and essentially zero, as the monetary policy in Macedonia does not react to this impulse. In contrast, the Slovakian interest rate increases proportionally to the rising output gap and inflation, which, once deviating from its steady state, makes the Slovak National Bank react. The responses of the domestic variables are then reflected in the real exchange rate's response in the two countries. While the exchange rate's response in Slovakia is relatively subdued proportionally to the responses of the domestic variables, the exchange rate's response in Macedonia shows significant appreciation of the denar in effective terms, especially due to the relatively high increase in CPI inflation. Overall, the Slovakian economy seems to be coping with the fiscal shocks better than the Macedonian economy.

The second row of Figure 2 displays the variables' responses to an external shock, equivalent to an idiosyncratic depreciation of the domestic currency in effective terms, i.e. an increase in the real effective exchange rate. As the negative external shock hits the economy the Macedonian denar and Slovakian koruna depreciate in real effective terms, where the initial depreciation is much more pronounced in Slovakia. This is partly due to the exchange rate targeting nature of the monetary policy in Macedonia, where the National Bank of the Republic of Macedonia reacts immediately and increases its interest rate to stabilize the nominal exchange rate. This also helps in containing the real effective exchange rate's response. On the other hand, the Slovak National Bank reacts to the depreciation of the koruna in real effective terms only to the extent this depreciation is affecting output and inflation. The output gap and inflation shoot up at the impact of the koruna's depreciation, so that the Slovak National Bank increases the domestic interest rate. After the interest rate increase takes effect it makes the real exchange rate to swing back to the negative territory before it approaches its steady-state value. The same pattern could be observed in the response of the output gap and inflation over time, i.e. after the initial positive response, the pattern changes and the response becomes negative as the interest rate increases and the koruna appreciates, after its initial depreciation. In Macedonia, on the contrary, the initial responses of the output gap and inflation are

negative due to the high increase in the domestic interest rate in an effort to stabilize the nominal exchange rate. The responses then faze out and converge to the steady-state values for output and inflation. In general, Macedonia is able to contain the effect of the external shock better than Slovakia, but at the cost of a large spike in the domestic interest rate and significantly negative responses of the output gap and inflation.

While allowing for larger volatility in the exchange rate and focusing on inflation targeting Slovakia is able to secure lower volatility of output and inflation in the long-run (see Table 11). This is because if the external relative price is not allowed to adjust to absorb negative external and domestic shocks the adjustment has to happen in the domestic economy through prices and production volumes. The latter two are much less flexible than the exchange rate, and should exchange rate targeting be the long-term choice for monetary policy the Macedonian economy has to become more flexible to ensure that macroeconomic stabilization is not in the way of long-run growth. This can be achieved through improved labor markets functioning, financial intermediation, capital stock adjustments, and more competitive production.

Table 11: Asymptotic standard deviation of economic variables for Macedonia and Slovakia based on the estimated models' simulations

Volatility of	Output gap	Inflation	Interest rate	Real exchange rate
Macedonia	5.9931	4.6698	8.2882	5.0862
Slovakia	4.3198	3.0333	3.7332	5.2433

7. Conclusion

In this paper, an attempt was made to fit a New Keynesian Policy model to the data on Macedonia and Slovakia, while providing some justification for the differences in estimated model parameters and structural shocks using a gap analysis of relevant microeconomic data. Under the current monetary policy regime of exchange rate targeting, Macedonia needs to improve the transmission mechanism of the monetary policy by increasing competition in and efficiency of financial intermediation, promoting financial deepening, increasing access to finance, improving the response of domestic

producers to changes in external price competitiveness, eliminating the effect of regulated (subsidized) prices on export concentration while promoting export diversification, and making sure that regulated prices do not significantly distort consumption preferences. In addition, Macedonia has to address especially real rigidities related to costs of production expansion, promoting development of specialized clusters, horizontal and vertical integration of production, fast and adequately priced finance, and ensure overall improvements in investment climate. Based on the differences in the estimated functioning of the Macedonian and Slovak economies and the applied monetary policy regimes in the two countries, we come to a conclusion that small open economies with stronger economic rigidities should apply monetary policy regimes that allow for more flexible adjustments in external relative prices to enhance their macroeconomic stability. In other words, if a small open economy chooses to adopt exchange rate targeting as its monetary policy regime and to give up a portion of its adjustment flexibility to domestic and external shocks, it needs to work extra hard to generate additional flexibility within its production factors' and product markets to avoid higher inflation and output volatility outcomes in their stabilization efforts.

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