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Asymmetric Preferences for Monetary Policy Rules in the Visegrad Four and the Financial Crisis

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Abstract

This paper analyses asymmetric preferences for the monetary policies of the Visegrad Four (the Czech Republic, Hungary, Poland, and Slovakia). We extend Surico's (2007) asymmetric preference model to a small open economy in order to consider the exchange rate for a monetary policy framework as suggested by several earlier studies on the Visegrad Four. The results suggest that two asymmetries are evident in all the countries: an aversion to interest rates above the reference value and a preference for nominal exchange rate depreciation relative to the euro area. Moreover, the Czech policy does not exhibit any change in preferences during the recent financial crisis, while Poland responds aggressively.

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1. Introduction

The Visegrad Four (V-4), which consists of the Czech Republic, Hungary, Poland, and Slovakia, have experienced large economic fluctuations because of rapid economic reforms and repeated financial crises. The possibility that their monetary policies require revision to deal with these fluctuations cannot be ruled out. Table 1 shows the macroeconomic volatility ratios of these countries relative to the euro area. The ratios are significantly greater than 1, which reflect large volatilities in these countries.

This study adopts Surico's (2007a) asymmetric preference model to consider the high volatilities in these countries. Moreover, we extend the model for a small open economy to consider the exchange rate. As explained in the literature review section, many studies suggest the importance of considering the exchange rate to analyze the monetary policy in the central and eastern European countries (CEECs).

Surico's (2007a) approach enables us to consider not only the implicit volatility component of the policy rule but also the flexible objective function of the central banker. Although the conventional objective of monetary policy is specified as a quadratic form around the origin, the linear exponential (Linex) loss function assumed in Surico (2007a) is allowed to swing left or right around the origin. The swing is stipulated by central banker's preference parameter called the "asymmetric parameter" and implies that the central banker could put different weight for the deviations of economic variable from its target. For instance, the output expansion and contract could generate a different size of loss under the assumption. The remarkable advantage of this approach is that the hypothesis of symmetric preferences can be tested statistically through the estimation of asymmetric parameters.

While the asymmetric preference induces the nonlinearity in the policy rule, the symmetric preference corresponds to a simple-linear rule as identified by Taylor (1993). Several authors have challenged the conventional linear-quadratic framework by assuming the objective asymmetry and/or the nonlinearity in the supply schedule since the nonlinear rule is generated by the assumptions. Nobay and Peel (2000) derived the nonlinear policy response using the nonlinear Phillips curve; later, Nobay and Peel (2003) utilized objective asymmetry to this end. Further, Cukierman (2002) investigated the average inflation bias caused by the policy maker's asymmetry to the business cycle, and Cukierman and Muscatelli (2002) estimated the nonlinear policy rule in the United States, Japan, and the United Kingdom. Bec *et al*. (2002) indicated that the nonlinear policy reaction, which arises from the asymmetric preference specifying the Heaviside loss function, could be observed in the United States, Germany, and France.

Ruge-Murcia (2003) presented evidence for the nonlinear response of the central bank and the aversion to positive unemployment in the United States. In addition, Dolado *et al*. (2004) examined both the asymmetry objective and the nonlinear Phillips curve to investigate the nonlinear policy response in the United States, thereby detecting an aversion to inflation during Volcker-Greenspan period. Kim *et al*. (2005) implemented a series of statistical tests for the Fed's nonlinear policy, indicating that the convexity of the Phillips curve identified by Dolado *et al*. (2005) could be the source of the nonlinearity. Moreover, Surico (2007b) suggested that there was an asymmetry in output expansion in the pre-Volcker US policy. More recently, Hasanov and Omay (2008) estimated the nonlinear policy reaction function in Turkey and demonstrated a response asymmetry in which the bank reacts to output more aggressively during a recession than during a boom.[1]

In addition to the necessity of modifying the conventional framework based on their concepts, it is probable that the V-4's monetary policies are affected by the recent sub-prime financial crisis. In order to examine the effect of the crisis on V-4's policies, we perform a subsample estimation and infer the effects of the crisis on their preferences.

This paper obtains the following three results. First, Surico's (2007a) model is supported in the Czech Republic and Poland, but not in Hungary and Slovakia. The implicit variance components are significant in the former countries, but the model seems to be rather insufficient for the latter. Second, the extended model exhibits greater applicability to all four countries. In particular, the exchange rate terms become strongly significant. Moreover, as the common tendency of asymmetries in the V-4, an aversion to interest rates above the reference value and a preference for nominal exchange rate depreciation relative to the euro area are evident. Third, the Czech Republic exhibits no changes in its asymmetric preferences in the face of the crisis, while Poland responds to the crisis aggressively.

This paper is organized as follows. Section 2 reviews the previous literature on the estimations for CEECs' monetary policy rule. Section 3 explains Surico's (2007a) model first, and then extends the model to a small open economy. Section 4 shows the estimation results, and conclusions are presented in Section 5.

2. Literature review

An increasing number of studies have focused on the monetary policies of the

[1] Omay and Hasanov (2008) found the nonlinearity in the inflation mean in Turkey and reported the regime dependent reaction of policymaker toward the inflation shocks. The regime dependence in Turkish policy is also detected in Hasanov *et al*. (2010).

CEECs. We choose studies on monetary policy rules of CEECs since the asymmetric preferences are obtained through the estimation of monetary policy rules.

Maria-Dolores (2005) estimated the Taylor rule (Taylor, 1993) in the Visegrad countries for the period 1998 to 2003. The generalized methods of moment (GMM) estimations suggested that inflation-targeting countries such as Poland, Hungary, and the Czech Republic validated the rule but Slovakia did not: Slovakia exhibited the most expansionary monetary policy operations relative to the euro area.

Paez-Farrell (2007) estimated Taylor-type rules for the Visegrad countries during the period 2001 to 2006. His results suggested that a policy rule involving the exchange rate performed well in these countries except for the Czech Republic: the speed limit policy identified by Walsh (2003) was useful in describing the Czech policy.

Ghatak and Moore (2008) examined not only the Taylor rule but also the MacCallum rule for CEECs' policies. It is often stressed that in the developing countries, monetary policy targets the monetary base, and as such they considered the MacCallum rule as a monetary base rule. According to their results, the MacCallum rule was appropriate for the inflation-targeting countries, while the Taylor rule was suitable for the fixed exchange rate regime countries. They suspected the adequacy of the Taylor rule in analyzing the monetary policies of developing countries.

Frömel *et al*. (2009) emphasized the importance of the exchange rate in the CEECs' policy rules. They implemented the dynamic ordinary least squares method and reported that the CEECs' policy depended on their exchange rate regime: countries following a rigid exchange rate regime targeted the exchange rate, while those with more flexible regime focused on inflation deviation on the basis of the Maastricht criteria.

Although these studies on CEECs' monetary policy often contradict each other, a consensus could be found on the importance of the exchange rate. In the context of these analyses, we should also include the exchange rate as a possible factor in analyzing the Visegrad countries.

3. Models

Analyzing with the optimization based rule, the observed path of the monetary policy reveals the policy maker's preferences. The parameters of the optimization-based rule involve the central banker's preferences and parameters of the underlying economic structures, so that the estimation of the rule enables us to recover the policy preference. Considering this advantage, we first introduce Surico's (2007a) model, and then extend it to a small open economy.

3.1 Surico's (2007a) asymmetric model

This section introduces Surico's (2007a) asymmetric preference model. He adopts the Linex loss function, which includes the symmetric (quadratic) preference as its special case. The Linex loss is allowed to lean left or right around the origin, while the quadratic preference is fixed in an origin-symmetric formulation.[2] A Linex loss takes the following form:

$$L_t = E_{t-1}\left\{\lambda_\pi\left[\frac{e^{\alpha(\pi_t-\bar{\pi})}-\alpha(\pi_t-\bar{\pi})-1}{\alpha^2}\right]+\left[\frac{e^{\gamma g_t}-\gamma g_t-1}{\gamma^2}\right]\right.$$
$$\left.+\lambda_i\left[\frac{e^{\omega(i_t-\bar{i})}-\omega(i_t-\bar{i})-1}{\omega^2}\right]+\frac{\lambda_{\Delta i}}{2}(i_t-i_{t-1})^2\right\}, \quad (1)$$

where π_t, g_t, and i_t denote inflation, the output gap, and the nominal interest rate, respectively. The parameters λ_π, λ_i, and $\lambda_{\Delta i}$ are the weights assigned to the central bank objectives, and α, γ, and ω represent the asymmetric parameters for inflation, the output gap, and the interest rate that discipline the degree of leaning of the loss function (see Figure 1). Figure 1 shows the asymmetric loss due to inflation corresponding to various values of α. If α is zero, the loss is reduced to a symmetric case.[3] If α takes a positive value as in the middle panel of the figure, the central banker disfavors a positive deviation of inflation from its target, while a negative α implies the opposite.

With the flexible objective, the central banker faces the following economic structures:

$$\pi_t = E_t\pi_{t+1}+\frac{\kappa g_t}{1-\kappa\tau g_t}+\varepsilon_t, \quad (2)$$

and

$$g_t = E_t g_{t+1}-\theta(i_t-E_t\pi_{t+1})+\xi_t. \quad (3)$$

Eq. (2) denotes a nonlinear Phillips curve that represents the actual supply schedule in the European countries, where the high-downward wage rigidity promotes a trade-off between price and output (see Dolado *et al*., 2005, for the nonlinear Phillips curve). Eq. (2) is the standard dynamic IS curve as used in the New Keynesian context.

Since there are no endogenous variables and a discretional central banker is assumed, the intertemporal optimization boils down to a static problem. The first-order condition takes the following form:

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[2] The Linex loss was first introduced in monetary policy analysis by Nobay and Peel (2003).

[3] In fact, we utilize Hôpital's rule for this reduction of the function.

$$-E_{t-1}\left[\left(\frac{e^{\alpha(\pi-\bar{\pi})}-1}{\alpha}\right)\left(\frac{\lambda_\pi\kappa\theta}{(1-\kappa\tau g_t)^2}\right)\right]-E_{t-1}\theta\left(\frac{e^{\gamma g_t}-1}{\gamma}\right)+\lambda_i\left(\frac{e^{\omega(i_t-\bar{i})}-1}{\omega}\right)+\lambda_{\Delta i}(i_t-i_{t-1})=0\,, \tag{4}$$

Taking second-order Taylor expansions for Eq. (4) around the point where variables are equivalent to their target, we obtain the following approximation:

$$\begin{aligned}&-\lambda_\pi\kappa\theta E_{t-1}(\pi-\bar{\pi})-\theta E_{t-1}(g_t)-\frac{\alpha\lambda_\pi\kappa\theta}{2}E_{t-1}[(\pi_t-\bar{\pi})^2]-\frac{\theta\gamma}{2}E_{t-1}(g_t^2)+\\&-2\lambda_\pi\kappa^2\tau\theta E_{t-1}[(\pi-\bar{\pi})g_t]+\lambda_i(i_t-\bar{i})+\frac{\lambda_i\omega}{2}(i_t-\bar{i})^2+\lambda_{\Delta i}(i_t-i_{t-1})+o_t=0,\end{aligned} \tag{5}$$

where o_t is the remainder on approximation. If all the asymmetric parameters tend to zero in Eq. (5),

$$-\lambda_\pi\kappa\theta E_{t-1}(\pi-\bar{\pi})-\theta E_{t-1}(g_t)+\lambda_i(i_t-\bar{i})+\lambda_{\Delta i}(i_t-i_{t-1})+o_t=0\,.$$

From the reduction, we recognize that no asymmetry case corresponds to the simple rule identified by Taylor (1993).

Rearranging Eq. (5) for i_t, we obtain the following estimation form:

$$i_t=(1-\rho_i)\begin{Bmatrix}\delta_0+\delta_1 g_t+\delta_2 g_t^2+\delta_3(\pi_t-\bar{\pi})+\\+\delta_4(\pi_t-\bar{\pi})^2+\delta_5(\pi_t-\bar{\pi})g_t+\delta_6(i_t-\bar{i})^2\end{Bmatrix}+\rho_i i_{t-1}+v_t\,, \tag{7}$$

$$\delta_0\equiv\bar{i},\ \delta_1\equiv\frac{\theta}{\lambda_i},\ \delta_2\equiv\frac{\theta\gamma}{2\lambda_i},\ \delta_3\equiv\frac{\lambda_\pi\kappa\theta}{\lambda_i},\ \delta_4\equiv\frac{\alpha\lambda_\pi\kappa\theta}{2\lambda_i},$$

$$\delta_5\equiv\frac{2\lambda_\pi\kappa^2\tau\theta}{\lambda_i},\ \delta_6\equiv\frac{-\omega}{2},\ \text{and}\ \ \rho_i\equiv\frac{\lambda_{\Delta i}}{\lambda_i+\lambda_{\Delta i}}\,.$$

$$\frac{v_t}{(1-\rho_i)}\equiv-\begin{Bmatrix}\delta_1(g_t-E_{t-1}g_t)+\delta_2(g_t^2-E_{t-1}g_t^2)+\delta_3(\pi_t-E_{t-1}\pi_t)+\\+\delta_4[(\pi_t-\bar{\pi})^2-E_{t-1}(\pi_t-\bar{\pi})^2]+\delta_5[(\pi_t-\bar{\pi})g_t-E_{t-1}((\pi_t-\bar{\pi})g_t)]\end{Bmatrix}+\frac{o_t}{\lambda_i},$$

where v_t denotes the prediction error of the central bank, so that the regressors have a correlation with the error term. The endogeneity should be cut out with the orthogonal information set to the error. In addition, the asymmetric parameters are reproduced as follows:

$$\gamma=\frac{2\delta_2}{\delta_1},\ \ \alpha=\frac{2\delta_4}{\delta_3},\ \ \text{and}\ \ \omega=-2\delta_6\,.$$

Although it is not our focus, the nonlinearity of the Phillips curve is also tested by the coefficient δ_5 since this parameter is directly related to the nonlinearity (Surico, 2007). Since the variance component, omitted in the simple rule, is implicitly included as squared terms of the variables, specification (7) would be a better representation of the monetary policy rule for Visegrad countries.

3.2 Extension to a small open economy

The previous section introduced the pure model of Surico (2007a). This section extends the model to a small open economy in order to consider the exchange rate component in the monetary policy rule for the Visegrad countries.

Although a Linex loss is assumed as before, we add an exchange rate asymmetry to the objective. Calvo and Reinhard (2002) and Reinhart and Rogoff (2004) investigated the intervention of the central bank in the foreign exchange rate market. The Linex loss function is reshaped as follows:

$$L_t = E_{t-1}\left\{\lambda_\pi\left[\frac{e^{\alpha(\pi_t-\bar{\pi})}-\alpha(\pi_t-\bar{\pi})-1}{\alpha^2}\right]+\left[\frac{e^{\gamma g_t}-\gamma g_t-1}{\gamma^2}\right]+\lambda_i\left[\frac{e^{\omega(i_t-\bar{i})}-\omega(i_t-\bar{i})-1}{\omega^2}\right]+\right.$$
$$\left.+\lambda_{\Delta s}\left[\frac{e^{\chi\Delta s_t}-\chi\Delta s_t-1}{\chi^2}\right]+\frac{\lambda_{\Delta i}}{2}(i_t-i_{t-1})^2\right\}, \tag{8}$$

where Δs_t denotes the exchange rate difference and χ corresponds to the asymmetry in the exchange rate.

The economic structure is the same as before—a nonlinear Phillips curve and a dynamic IS curve:

$$\pi_t = E_t\pi_{t+1}+\frac{\kappa g_t}{1-\kappa\tau g_t}+\varepsilon_t\,,$$
$$g_t = E_t g_{t+1}-\theta(i_t-E_t\pi_{t+1})+\xi_t\,.$$

In addition to these, we also assume a uncovered interest rate parity (UIP) as follows:

$$\Delta s_t = i_t - i_t^f\,.$$

The central banker manipulates its operational interest rate, while taking these economic structures as given. For the same reason as in the previous section, this optimization is reduced to a static problem, and we obtain the following first-order condition:

$$-E_{t-1}\left[\left(\frac{e^{\alpha(\pi_t-\bar{\pi})}-1}{\alpha}\right)\left(\frac{\lambda_\pi\kappa\theta}{(1-\kappa\tau g_t)^2}\right)\right]-E_{t-1}\theta\left(\frac{e^{\gamma g_t}-1}{\gamma}\right)+\lambda_i\left(\frac{e^{\omega(i_t-\bar{i})}-1}{\omega}\right)$$
$$+\lambda_{\Delta s}\left(\frac{e^{\chi\Delta s_t}-1}{\chi}\right)+\lambda_{\Delta i}(i_t-i_{t-1})=0.$$

Taking a second-order Taylor expansion around the point of the variables corresponding to their targets,

$$-\lambda_\pi \kappa\theta E_{t-1}(\pi_t-\bar{\pi})-\theta E_{t-1}(g_t)-\frac{\alpha\lambda_\pi\kappa\theta}{2}E_{t-1}[(\pi_t-\bar{\pi})^2]-\frac{\gamma\theta}{2}E_{t-1}(g_t^2)+$$
$$-2\lambda_\pi\kappa^2\tau\theta E_{t-1}[(\pi_t-\bar{\pi})g_t]+\lambda_i(i_t-\bar{i})+\frac{\lambda_i\omega}{2}(i_t-\bar{i})^2+\lambda_{\Delta s}\Delta s_t+ \quad (9)$$
$$\frac{\lambda_{\Delta s}\chi}{2}\Delta s_t^2+\lambda_{\Delta i}(i_t-i_{t-1})+o_t=0.$$

And rearranging Eq. (9) with the nominal interest rate, we obtain the following estimation equation:

$$i_t=(1-\rho_s-\rho_i)\left\{\begin{matrix}\delta_0+\delta_1 g_t+\delta_2 g_t^2+\delta_3(\pi_t-\bar{\pi})+\delta_4(\pi_t-\bar{\pi})^2+\\ +\delta_5(\pi_t-\bar{\pi})g_t+\delta_6(i_t-\bar{i})^2+\delta_7(i_t-i_t^f)^2\end{matrix}\right\}+\rho_s i_t^f+\rho_i i_{t-1}+v_t^i, \quad (10)$$

where

$$\delta_0\equiv\bar{i},\ \delta_1\equiv\frac{\theta}{\lambda_i},\ \delta_2\equiv\frac{\theta\gamma}{2\lambda_i},\ \delta_3\equiv\frac{\lambda_\pi\kappa\theta}{\lambda_i},\ \delta_4\equiv\frac{\alpha\lambda_\pi\kappa\theta}{2\lambda_i},\ \delta_5\equiv\frac{2\lambda_\pi\kappa^2\tau\theta}{\lambda_i},$$
$$\delta_6\equiv\frac{-\omega}{2},\ \delta_7\equiv\frac{-\chi}{2},\ \rho_s\equiv\frac{\lambda_{\Delta s}}{\lambda_i+\lambda_{\Delta i}+\lambda_{\Delta s}}\ \text{and}\ \rho_i\equiv\frac{\lambda_{\Delta i}}{\lambda_i+\lambda_{\Delta i}+\lambda_{\Delta s}},$$

and

$$\frac{v_t^i}{(1-\rho_s-\rho_i)}\equiv-\left\{\begin{matrix}\delta_1(g_t-E_{t-1}g_t)+\delta_2(g_t^2-E_{t-1}g_t^2)+\delta_3(\pi_t-E_{t-1}\pi_t)+\\ +\delta_4[(\pi_t-\bar{\pi})^2-E_{t-1}(\pi_t-\bar{\pi})^2]+\delta_5[(\pi_t-\bar{\pi})g_t-E_{t-1}((\pi_t-\bar{\pi})g_t)]+\\ +\delta_7[(i_t-i_t^f)^2-E_{t-1}(i_t-i_t^f)^2]\end{matrix}\right\}+\frac{o_t}{\lambda_i},$$

where v_t^i denotes the prediction error of the central bank so that regressor endogeneity occurs as before. The asymmetric parameters are identified as follows:

$$\gamma=\frac{2\delta_2}{\delta_1},\ \alpha=\frac{2\delta_4}{\delta_3},\ \omega=-2\delta_6\ \text{and}\ \chi=-2\delta_7.$$

In this model, the exchange rate difference is represented by the difference between the domestic and the euro area's interest rates, and the coefficient of the term represents the asymmetric preference of the exchange rate toward the euro area.

4. Estimation

This section shows the estimation results. The starting period for all countries is January 1999, which marked the launching of euro as the currency for Europe and the commencement of the ECB's monetary policy. This period seems to be appropriate in considering the exchange rate relative to the euro area. In addition, considering the availability of data, the ending periods are October 2009 for the Czech Republic, Hungary, and Poland and December 2008 for Slovakia. These monthly datasets were obtained from Eurostat. Inflation is measured as the annual percentage change of the harmonized index of consumer prices, and the output gap is estimated as the "quasi-real-time output gap," as suggested by Orphanides and van Norden (2002). The quasi-real-time output gap reflects the actual data revision of the central bank, with information up to t - 1 used to forecast the potential output gap in period t. The Hodrick-Prescott filter is used on the log of industrial production in this recursive detrending. Moreover, a three-month market interest rate is used as an operational instrument of the central bank for the Czech Republic, Poland, and Slovakia and the two-week MNB rate for Hungary. For the euro area's interest rate, a three-month market rate is also used.

In estimating the monetary policy rule, the GMM is implemented because both the Surico (2007a) and extended models are subject to endogeneity of regressors. Also, in order to obtain consistent parameters for a possible serial correlation, the Newey-West heteroskedasticity and autocorrelation consistent variance covariance matrix is used. Moreover, we also show the results with one- and six-month-ahead inflation for the robustness of the model estimation.[4]

4.1 Results of Surico's (2007a) model

Table 2a-d reports the results of Surico's (2007a) model. These results indicate the model's adequacy and robustness over the inflation horizon of the Czech Republic and Poland, while the results of Hungary and Slovakia are far inferior to those of the former two countries. These insufficient results suggest the possibility of omitted variables, especially in the monetary policy of Hungary and Slovakia. A reconsideration of previous studies suggests that the exchange rate seems to be the first candidate.

Although it is difficult to find a pattern in the asymmetric preferences of all Visegrad countries, the Czech Republic and Poland show a common tendency of asymmetries: the interest rate asymmetry takes positive and significant values in almost all estimations. This suggests that the central banks of both countries disfavor interest rates above the reference value, and prefer an expansionary monetary policy.

Unfortunately, the closed economy model does not sufficiently outline a monetary policy for the V-4. In the next section, we estimate the extended model of Surico (2007a) in order to examine the importance of the exchange rate in designing a monetary policy for the Visegrad countries.

[4] The instruments used for all estimations in this paper are between two and four lags of endogenous regressors. Most first-stage F values far exceed 10 so that the weak instrument problem seems to be avoided.

4.2 Extended model

Previous estimations showed an insufficiency of the asymmetric preference model in Hungary and Slovakia. This section examines the extended model, which incorporates the exchange rate relative to the euro area to improve the result.

Tables 3a-d show the results of the extended model. These results exhibit an improvement in the fitness of the model for all the V-4 countries, including Hungary and Slovakia: the added exchange rate component is strongly significant and robust for all the countries. Therefore, we could also confirm the consensus in the literature on the importance of the exchange rate for a monetary policy rule of the CEECs.

Moreover, a positive asymmetry in the interest rate and a negative asymmetry in the exchange rate are apparent in all the V-4 countries. Monetary policies of the Visegrad Four are characterized by an aversion to interest rates above the reference value and a preference for nominal exchange rate depreciation relative to the euro area. These two asymmetries are considered to be conflicting preferences. In other words, the asymmetry in interest rates suggests an expansionary stance of the central bank, while the asymmetry in exchange rates shows a tight monetary policy, since the aversion to higher interest rates implies a tendency to maintain the interest below its reference value, and the preference for currency depreciation indicates that it will be maintained above the euro area's interest rate. The Visegrad countries have determined their policy rule in a trade-off between the interest rate and the exchange rate.[5]

The V-4's preferred policy rule supports the extended model. In the next section, we examine if the recent financial crisis affected the results and the asymmetric preferences of the V-4.

4.3 The financial crisis and asymmetric preferences in the Visegrad Four

This section discusses subsample estimations in order to identify the financial crisis effects on the monetary policy of the Visegrad countries. To this end, a subsample excluding the period beginning from January 2007 to the end is used.[6] Comparing the results from the full sample and the subsample, we could observe the financial effect on our extended model.

Tables 4a-d show the results of the subsample estimations. Although the results for the Czech Republic seem to be slightly inferior to those of the full sample,[7] all

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[5] Although this is not our focus, the parameter δ_5, which disciplines the nonlinearity of the Phillips curve, is also significant in most countries implying a nonlinearity of the supply schedule in the V-4.

[6] Cecchetti (2008, p. 12) suggests that sub-prime mortgage loans started to record losses from February 2007.

[7] Even though the baseline in the Czech Republic is slightly sensitive, the results on inflation forecasts are the same as in the full sample.

tendencies do not change. Therefore, the robustness of the extended V-4 model is unchallenged.

Regarding the crisis effects on asymmetries, Table 5 shows the distance between full-sample and subsample asymmetries and the sign of their products. Given the significance of the distance, if the sign becomes positive, then the policy stance is strengthened by the crisis, while the negative sign denotes that the stance is turned around. The table shows that while Czech preferences do not show any change during the financial crisis, almost all the preferences change significantly in Poland, where the inflation asymmetry is positive before the crisis but takes on negative values in the full sample. In other words, a disinflationary preference is reversed to an inflationary preference as a result of the crisis. In addition, both aversion to higher interest rates and preference for nominal exchange depreciation are strengthened by the crisis. Slovakia is not affected where interest and exchange rate asymmetries are concerned. However, these two preferences are reinforced in Hungary, as in the case of Poland.

5. Conclusion

This paper adopts Surico's (2007a) asymmetric preference model for the Visegrad countries in order to consider the volatility component of their monetary policies. We extend the model to a small open economy in order to consider the exchange rate for the Visegrad policies as suggested by many earlier studies on the CEECs. We first adopt Surico's (2007a) model, and then the extended model.

GMM estimations support the modification: the added component of the exchange rate is strong-significant for all the V-4 countries. In addition, the estimations of the extended model provide two assured preferences: an aversion to interest rates above the reference value and a preference for domestic currency depreciation relative to the euro area. These preferences conflict with each other, since the former requires an expansionary policy stance, while the latter implies a tight policy. Moreover, the subsample estimations suggest a large swing in the asymmetric preferences of the Polish policy during the recent financial crisis, while the Czech Republic exhibits no change in its asymmetric preferences.

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TABLES

Table I: Volatility Ratio Toward the Euro Area

Relative variance	Czech Republic		Hungary		Poland		Slovakia	
$Var(i) / Var(i_{EA})$	2.44	***	12.89	***	26.01	***	12.89	***
$Var(\pi) / Var(\pi_{EA})$	8.58	***	34.21	***	19.13	***	34.21	***
$Var(y) / Var(y_{EA})$	8.31	***	6.95	***	2.77	***	6.95	***

Note: *** denotes the 1% significance, ** the 5% significance, and * the 10% significance.

Table IIa: Surico's (2007a) Model for Czech Republic

Parameters	Baseline		l = 1		l = 6	
δ_0	4.90	***	4.89	***	4.79	***
	(0.20)		(0.21)		(0.20)	
δ_1	0.04	***	0.03	***	0.02	**
	(0.01)		(0.01)		(0.01)	
δ_2	0.00	***	0.00	***	0.00	*
	(0.00)		(0.00)		(0.00)	
δ_3	0.16	**	0.14	**	0.20	***
	(0.07)		(0.06)		(0.07)	
δ_4	-0.01		-0.03		-0.03	**
	(0.02)		(0.02)		(0.01)	
δ_5	0.00		0.00		0.02	***
	(0.01)		(0.01)		(0.01)	
δ_6	-0.34	***	-0.35	***	-0.36	***
	(0.03)		(0.03)		(0.04)	
ρ_i	0.84	***	0.84	***	0.85	***
	(0.02)		(0.02)		(0.02)	
γ	-0.16	**	-0.13	**	-0.22	
	(0.06)		(0.06)		(0.15)	
α	-0.17		-0.38		-0.29	*
	(0.30)		(0.34)		(0.15)	
ω	0.68	***	0.69	***	0.72	***
	(0.05)		(0.06)		(0.09)	
J-stat	10.47		9.82		11.29	

Notes: (i) *** denotes the 1% significance, ** the 5% significance, and * the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions.

Table IIb: Surico's (2007a) Model for Hungary

Parameters	Baseline	l = 1	l = 6
δ_0	7.52 ***	7.98 ***	10.08 ***
	(0.81)	(0.51)	(0.94)
δ_1	-0.58	-0.59 **	0.51 *
	(0.41)	(0.29)	(0.29)
δ_2	-0.06	-0.04	0.00
	(0.05)	(0.03)	(0.02)
δ_3	0.57 ***	0.41 **	0.98 **
	(0.17)	(0.19)	(0.40)
δ_4	0.17	0.06	-0.06
	(0.13)	(0.08)	(0.14)
δ_5	0.12	0.04	0.38 **
	(0.07)	(0.04)	(0.15)
δ_6	0.06 *	0.10 ***	-0.16 **
	(0.03)	(0.02)	(0.07)
ρ_i	0.88 ***	0.84 ***	0.93 ***
	(0.06)	(0.05)	(0.02)
γ	0.21 ***	0.15 ***	-0.01
	(0.05)	(0.04)	(0.07)
α	0.60	0.28	-0.12
	(0.56)	(0.47)	(0.29)
ω	-0.11 *	-0.19 ***	0.32 **
	(0.06)	(0.04)	(0.14)
J-stat	10.88	9.12	8.78

Notes: (i) *** denotes the 1% significance, **the 5% significance, and * the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions.

Table IIc: Surico's (2007a) Model for Poland

Parameters	Baseline	l = 1	l = 6
δ_0	8.99 ***	9.26 ***	11.95 ***
	(0.51)	(0.89)	(1.50)
δ_1	0.21 **	0.18	0.20
	(0.09)	(0.18)	(0.18)
δ_2	-0.04 ***	-0.16 ***	-0.09 ***
	(0.01)	(0.03)	(0.02)
δ_3	2.21 ***	2.48 ***	2.47 ***
	(0.14)	(0.23)	(0.63)
δ_4	0.18 ***	0.21 ***	0.30 **
	(0.05)	(0.06)	(0.13)
δ_5	-0.10 *	-0.34 ***	0.08
	(0.05)	(0.08)	(0.08)
δ_6	-0.05 **	-0.04	-0.08 ***
	(0.02)	(0.02)	(0.01)
ρ_i	0.89 ***	0.89 ***	0.90 ***
	(0.01)	(0.01)	(0.03)
γ	-0.35	-1.74	-0.87
	(0.22)	(1.72)	(0.85)
α	0.16 ***	0.17 ***	0.25 ***
	(0.05)	(0.05)	(0.06)
ω	0.11 **	0.08	0.16 ***
	(0.04)	(0.05)	(0.03)
J-stat	11.55	11.59	6.69

Notes: (i) *** denotes 1% significance, ** the 5% significance, and * the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions.

Table IId: Surico's (2007a) Model for Slovakia

Parameters	Baseline		l = 1		l = 6	
δ_0	3.66	***	6.96	***	9.76	
	(1.18)		(1.84)		(6.23)	
δ_1	0.51	*	0.63		0.03	
	(0.31)		(0.51)		(1.22)	
δ_2	0.03		-0.09	***	-0.14	
	(0.04)		(0.03)		(0.23)	
δ_3	-0.06		-1.07		-1.89	
	(0.34)		(0.65)		(3.35)	
δ_4	0.01		-0.04		-0.99	
	(0.03)		(0.07)		(1.53)	
δ_5	0.11		0.30	*	-0.08	
	(0.11)		(0.18)		(0.45)	
δ_6	0.00		-0.19	**	0.00	
	(0.05)		(0.09)		(0.13)	
ρ_i	0.95	***	0.97	***	0.99	***
	(0.04)		(0.01)		(0.02)	
γ	0.12		-0.27		-7.87	
	(0.15)		(0.23)		(273.58)	
α	-0.31		0.07		1.05	
	(1.28)		(0.14)		(1.02)	
ω	0.00		0.39	**	-0.01	
	(0.11)		(0.17)		(0.27)	
J-stat	11.34		9.90		8.71	

Notes: (i) *** denotes the 1% significance, ** the 5% significance, and * the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions.

Table IIIa: Extended Model for Czech Republic

Parameters	Baseline	l = 1	l = 6
δ_0	4.69 ***	4.63 ***	5.15 ***
	(0.19)	(0.28)	(0.16)
δ_1	0.04 ***	0.09 ***	0.06 ***
	(0.01)	(0.02)	(0.01)
δ_2	0.00 **	0.00 ***	0.00 **
	(0.00)	(0.00)	(0.00)
δ_3	0.10	0.26 ***	0.12 ***
	(0.06)	(0.09)	(0.03)
δ_4	-0.03 **	-0.05 *	-0.08 ***
	(0.01)	(0.03)	(0.01)
δ_5	-0.01 ***	-0.03 **	0.00
	(0.01)	(0.01)	(0.01)
δ_6	-0.41 ***	-0.44 ***	-0.36 ***
	(0.04)	(0.07)	(0.03)
δ_7	0.12 ***	0.16 **	0.20 ***
	(0.04)	(0.06)	(0.03)
ρ_s	-0.21 **	-0.03	0.10 ***
	(0.09)	(0.04)	(0.03)
ρ_i	0.63 ***	0.78 ***	0.64 ***
	(0.11)	(0.04)	(0.04)
γ	-0.12 *	-0.09 **	-0.07 **
	(0.06)	(0.04)	(0.03)
α	-0.61 *	-0.39 *	-1.39 ***
	(0.35)	(0.21)	(0.39)
ω	0.81 ***	0.88 ***	0.71 ***
	(0.09)	(0.15)	(0.06)
χ	-0.23 ***	-0.32 **	-0.40 ***
	(0.08)	(0.13)	(0.05)
J-stat	6.59	8.53	13.00

Notes: (i) *** denotes the 1% significance, ** the 5% significance, and *the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions.

Table IIIb: Extended Model for Hungary

Parameters	Baseline	l = 1	l = 6
δ_0	14.15 ***	15.13 ***	18.96 ***
	(0.57)	(0.80)	(0.92)
δ_1	0.01	0.00	0.00
	(0.02)	(0.02)	(0.02)
δ_2	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
δ_3	0.03	-0.04	-0.01
	(0.04)	(0.05)	(0.02)
δ_4	0.05 ***	0.06 ***	0.01
	(0.01)	(0.01)	(0.01)
δ_5	-0.01 ***	-0.01 **	0.00
	(0.00)	(0.01)	(0.01)
δ_6	-0.10 ***	-0.09 ***	-0.06 ***
	(0.01)	(0.01)	(0.00)
δ_7	0.08 ***	0.07 ***	0.07 ***
	(0.00)	(0.01)	(0.00)
ρ_s	0.38 ***	0.34 ***	0.49 ***
	(0.02)	(0.02)	(0.02)
ρ_i	0.21 ***	0.31 ***	0.07 *
	(0.05)	(0.05)	(0.03)
γ	0.16	-52.82	-0.84
	(0.20)	(25389)	(8.65)
α	3.59	-2.99	-0.80
	(4.80)	(3.93)	(1.30)
ω	0.19 ***	0.18 ***	0.12 ***
	(0.02)	(0.02)	(0.01)
χ	-0.15 ***	-0.15 ***	-0.14 ***
	(0.01)	(0.01)	(0.00)
J-stat	9.27	8.12	7.56

Notes: (i) *** denotes the 1% significance, ** the 5% significance, and *the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions

Table IIIc: Extended Model for Poland

Parameters	Baseline	l = 1	l = 6
δ_0	10.34 ***	8.80 ***	8.19 ***
	(0.95)	(0.69)	(0.49)
δ_1	0.02	-0.01	-0.01
	(0.05)	(0.05)	(0.02)
δ_2	-0.01 **	-0.02 ***	0.00
	(0.01)	(0.01)	(0.00)
δ_3	0.71 ***	0.46 ***	-0.16 **
	(0.15)	(0.16)	(0.08)
δ_4	0.12 ***	-0.01	-0.14 ***
	(0.03)	(0.03)	(0.02)
δ_5	-0.09 ***	-0.14 ***	-0.03 *
	(0.03)	(0.03)	(0.01)
δ_6	-0.13 ***	-0.15 ***	-0.18 ***
	(0.02)	(0.02)	(0.02)
δ_7	0.13 ***	0.19 ***	0.25 ***
	(0.03)	(0.03)	(0.03)
ρ_s	0.20 ***	0.25 ***	0.33 ***
	(0.03)	(0.04)	(0.04)
ρ_i	0.60 ***	0.51 ***	0.40 ***
	(0.05)	(0.05)	(0.06)
γ	-1.02	9.32	0.86
	(2.18)	(88.28)	(2.53)
α	0.33 ***	-0.05	1.79 **
	(0.10)	(0.12)	(0.87)
ω	0.25 ***	0.31 ***	0.36 ***
	(0.04)	(0.03)	(0.04)
χ	-0.25 ***	-0.38 ***	-0.51 ***
	(0.05)	(0.06)	(0.05)
J-stat	6.43	8.31	8.51

Notes: (i) *** denotes the 1% significance, ** the 5% significance, and * the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions.

Table IIId: Extended Model for Slovakia

Parameters	Baseline	l = 1	l = 6
δ_0	11.03 ***	11.07 ***	12.51 ***
	(0.84)	(0.88)	(1.46)
δ_1	-0.07 ***	-0.04 **	-0.09 ***
	(0.02)	(0.02)	(0.02)
δ_2	-0.01 **	-0.01 ***	0.00
	(0.00)	(0.00)	(0.00)
δ_3	0.15 **	0.10	0.03
	(0.07)	(0.07)	(0.04)
δ_4	-0.01 **	-0.01 *	-0.02 **
	(0.01)	(0.01)	(0.01)
δ_5	0.00	0.02 **	0.00
	(0.01)	(0.01)	(0.01)
δ_6	-0.11 ***	-0.11 ***	-0.10 ***
	(0.01)	(0.01)	(0.02)
δ_7	0.12 ***	0.13 ***	0.11 ***
	(0.01)	(0.01)	(0.01)
ρ_s	0.54 ***	0.49 ***	0.49 ***
	(0.03)	(0.03)	(0.02)
ρ_i	-0.06	0.05	0.00
	(0.06)	(0.04)	(0.05)
γ	0.28 **	0.32	0.08
	(0.11)	(0.21)	(0.08)
α	-0.14 ***	-0.22 ***	-1.31
	(0.03)	(0.08)	(1.59)
ω	0.22 ***	0.22 ***	0.19 ***
	(0.03)	(0.03)	(0.03)
χ	-0.25 ***	-0.25 ***	-0.21 ***
	(0.02)	(0.02)	(0.03)
J-stat	7.67	11.31	6.70

Notes: (i) *** denotes the 1% significance,** the 5% significance, and * the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions.

Table IVa: Excluding the Crisis for Czech Republic

Parameters	Baseline	l = 1	l = 6
δ_0	5.05 ***	5.23 ***	5.27 ***
	(0.43)	(0.94)	(0.29)
δ_1	0.02	0.31 ***	-0.04
	(0.06)	(0.11)	(0.03)
δ_2	0.00	-0.01 *	0.00 **
	(0.00)	(0.01)	(0.00)
δ_3	0.26 **	0.95 *	0.35 ***
	(0.12)	(0.54)	(0.10)
δ_4	-0.03	-0.05	-0.03
	(0.04)	(0.08)	(0.04)
δ_5	-0.03 *	-0.16 ***	-0.02 *
	(0.02)	(0.05)	(0.01)
δ_6	-0.36 ***	-0.49 **	-0.32 ***
	(0.05)	(0.23)	(0.03)
δ_7	0.18 ***	0.41 **	0.27 ***
	(0.06)	(0.21)	(0.03)
ρ_s	0.05	0.29 ***	0.20 ***
	(0.06)	(0.07)	(0.04)
ρ_i	0.67 ***	0.49 ***	0.49 ***
	(0.07)	(0.11)	(0.05)
γ	-0.09	-0.07 ***	-0.19 ***
	(0.12)	(0.02)	(0.07)
α	-0.20	-0.10	-0.19
	(0.34)	(0.21)	(0.26)
ω	0.72 ***	0.98 **	0.65 ***
	(0.11)	(0.45)	(0.05)
χ	-0.36 ***	-0.82 **	-0.54 ***
	(0.12)	(0.42)	(0.06)
J-stat	8.17	5.53	9.06

Notes: (i) *** denotes the 1% significance, ** the 5% significance, and * the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions.

Table IVb: Excluding the Crisis for Hungary

Parameters	Baseline	l = 1	l = 6
δ_0	17.71 ***	18.13 ***	21.15 ***
	(0.87)	(0.62)	(0.63)
δ_1	0.03 **	0.03 ***	0.03 ***
	(0.01)	(0.01)	(0.01)
δ_2	0.00	0.00 **	0.00 ***
	(0.00)	(0.00)	(0.00)
δ_3	-0.02	-0.02	-0.07 ***
	(0.03)	(0.03)	(0.01)
δ_4	0.02 **	0.01	0.01 *
	(0.01)	(0.01)	(0.00)
δ_5	-0.01	-0.01 **	-0.01 ***
	(0.01)	(0.00)	(0.00)
δ_6	-0.07 ***	-0.07 ***	-0.05 ***
	(0.00)	(0.00)	(0.00)
δ_7	0.07 ***	0.06 ***	0.06 ***
	(0.00)	(0.00)	(0.00)
ρ_s	0.42 ***	0.43 ***	0.53 ***
	(0.01)	(0.02)	(0.02)
ρ_i	0.16 ***	0.13 ***	-0.01
	(0.03)	(0.04)	(0.03)
γ	0.11 **	0.15 ***	0.26 ***
	(0.05)	(0.04)	(0.05)
α	-2.36	-1.09	-0.19 **
	(5.13)	(1.48)	(0.10)
ω	0.14 ***	0.13 ***	0.11 ***
	(0.01)	(0.01)	(0.00)
χ	-0.13 ***	-0.13 ***	-0.13 ***
	(0.01)	(0.01)	(0.00)
J-stat	8.76	7.65	8.64

Notes: (i) *** denotes the 1% significance, ** the 5% significance, and *the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions.

Table IVc: Excluding the Crisis for Poland

Parameters	Baseline		l = 1		l = 6	
δ_0	31.35	***	32.39	***	34.30	***
	(2.90)		(2.63)		(6.66)	
δ_1	0.00		0.00		-0.02	
	(0.02)		(0.01)		(0.01)	
δ_2	0.00		0.00		0.00	
	(0.00)		(0.00)		(0.00)	
δ_3	0.14	***	0.16	***	0.12	***
	(0.03)		(0.03)		(0.03)	
δ_4	-0.01	**	-0.01		-0.01	***
	(0.01)		(0.01)		(0.00)	
δ_5	-0.01	**	-0.01	**	0.00	
	(0.00)		(0.00)		(0.00)	
δ_6	-0.03	***	-0.03	***	-0.03	***
	(0.00)		(0.00)		(0.01)	
δ_7	0.05	***	0.04	***	0.04	***
	(0.00)		(0.01)		(0.01)	
ρ_s	0.54	***	0.51	***	0.54	***
	(0.03)		(0.02)		(0.01)	
ρ_i	0.02		0.05		0.01	
	(0.04)		(0.03)		(0.02)	
γ	3.33		-0.48		-0.09	
	(54.71)		(2.06)		(0.18)	
α	-0.20		-0.10		-0.21	
	(0.11)		(0.08)		(0.11)	
ω	0.07		0.06		0.06	
	(0.01)		(0.01)		(0.01)	
χ	-0.09		-0.08		-0.08	
	(0.01)		(0.01)		(0.02)	
J-stat	9.22		7.70		7.09	

Notes: (i) *** denotes the 1% significance, ** the 5% significance, and * the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions.

Table IVd: Excluding the Crisis for Slovakia

Parameters	Baseline	l = 1	l = 6
δ_0	10.89 ***	11.13 ***	11.10 ***
	(0.20)	(0.18)	(0.23)
δ_1	-0.04 ***	-0.03 ***	-0.03 *
	(0.01)	(0.01)	(0.02)
δ_2	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
δ_3	-0.04 ***	-0.02	-0.05 **
	(0.01)	(0.01)	(0.02)
δ_4	0.01 ***	0.01 ***	-0.02 ***
	(0.00)	(0.00)	(0.01)
δ_5	0.01 **	0.00	0.01
	(0.00)	(0.00)	(0.01)
δ_6	-0.12 ***	-0.12 ***	-0.11 ***
	(0.00)	(0.00)	(0.00)
δ_7	0.12 ***	0.12 ***	0.13 ***
	(0.00)	(0.00)	(0.00)
ρ_s	0.50 ***	0.47 ***	0.43 ***
	(0.01)	(0.01)	(0.02)
ρ_i	-0.01	0.06 ***	0.13 ***
	(0.03)	(0.02)	(0.04)
γ	-0.24 *	0.04	0.09
	(0.13)	(0.10)	(0.22)
α	-0.34 ***	-1.01	0.65 *
	(0.09)	(0.67)	(0.34)
ω	0.25 ***	0.23 ***	0.23 ***
	(0.01)	(0.01)	(0.01)
χ	-0.24 ***	-0.25 ***	-0.25 ***
	(0.00)	(0.00)	(0.01)
J-stat	7.24	5.86	7.69

Notes: (i) *** denotes the 1% significance, ** the 5% significance, and *the 10% significance.

(ii) J-stat denotes the j statistic for the overidentifying restrictions

Table V: Asymmetric Preferences and the Financial Crisis

Country	Czech republic		Hungary		Poland		Slovak republic	
	Distance	Sign	Distance	Sign	Distance	Sign	Distance	Sign
γ_{full} , γ_{sub}	0.03	+	0.05	+	4.34	–	0.52 ***	–
	(0.13)		(0.21)		(54.76)		(0.17)	
α_{full} , α_{sub}	0.41	+	5.95	–	0.52 ***	–	0.20 **	+
	(0.49)		(7.02)		(0.15)		(0.10)	
ω_{full} , ω_{sub}	0.09	+	0.05 ***	+	0.19 ***	+	0.03	+
	(0.14)		(0.02)		(0.04)		(0.03)	
χ_{full} , χ_{sub}	0.12	+	0.02 **	+	0.16 ***	+	0.01	+
	(0.15)		(0.01)		(0.05)		(0.02)	

Notes: (i) *** denotes the 1% significance, ** the 5% significance, and * the 10% significance.

(ii) The column Sign gives the sign of the variable ($\gamma_{full} * \gamma_{sub}$).

FIGURES

Figure 1: Asymmetric loss functions corresponds to asymmetric parameters