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A Change in Volatility or Asymmetry? A Monetary Transmission Mechanism in Small Open European Economies during the Financial Crisis

Przemysław Włodarczyk https://orcid.org/0000-0003-1316-6328
Ph.D., Assistant Professor, University of Lodz, Department of Economic Policy, Faculty of Economics and Sociology, e-mail: przemyslaw.wlodarczyk@uni.lodz.pl

Abstract

The article analyses the influence of crisis-induced changes in economic activity on the monetary transmission mechanism in the small open economies of Czechia, Hungary, Poland, and Sweden from 2000: 1 to 2016: 5 using the Markov Switching Structural Bayesian Vector Autoregressive models.
The results confirm that in countries where the exchange rate transmission channel is relatively weak (Hungary and Sweden), changes in volatilities coincide with changes in the coefficients of the monetary transmission mechanism, reducing the efficiency of a monetary policy during a crisis. The changes of the coefficients occurred in neither Poland nor Czechia, where the exchange rate pass-through was not closed completely. The results imply that in small open economies, public authorities' efforts to sustain exchange rate pass-through may critically affect their ability to retain monetary control during a crisis.

Keywords: monetary transmission mechanism, economic crisis, small open economy, Markov Switching Bayesian Structural Vector Autoregression (MSBSVAR)

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Introduction

Despite the ongoing development of theoretical and empirical economics, the economics community is still polarised over many unresolved and widely debated issues. One fundamental problem faced by economic science is related to controversies concerning the nature of changes in economic activity that accompany economic crises. Although leading economists have made considerable efforts to explain these phenomena, especially in the aftermath of the global financial crisis (GFC) of 2008, it is still widely disputed whether a crisis should be viewed as a period of rapidly increasing volatility of economic processes, as proposed by Stock and Watson (2012) and Sims and Zha (2006b), or as a period of asymmetric reactions from economic entities, as proposed by Hubrich and Tetlow (2015), among authors. This ambiguity has serious consequences for the formulation of normative economic programs and methodological approaches, due to uncertainty over the proper use of standard econometric models in modelling crisis periods.

If a crisis results solely from a sudden change in the volatility of economic processes, traditional economic policy instruments retain their functionality, although their impact may need to be strengthened to manage more erratic economic processes. Accordingly, standard models can be successfully applied to model and forecast economic behaviour during crises. Conversely, if a crisis results in an asymmetric change in the nature of economic relationships, altering the parameters that describe these relationships, standard economic policy instruments may no longer effectively influence economic activity in that period. Similarly, models used to describe and forecast economic behaviour should account for these new circumstances.

These dilemmas also affect the theory of monetary policy, including the concept of the monetary transmission mechanism (MTM). As the MTM is potentially dependent on the expectations of economic agents, which may vary between periods of crisis and prosperity, our knowledge about how monetary policy should be implemented during economic downturns is seriously challenged. The problem of cyclical changes in the MTM is particularly pronounced in small open economies for at least two reasons. First, these economies are more vulnerable to economic downturns because they are more fragile and sensitive to variations in global economic conditions; the use of appropriate and efficient anticyclical policies is therefore more important for them. Second, using traditional methods to model these economies poses more technical problems; as many were or are in transition, the available data series are relatively short. When data series are short, the problem of crisis-induced changes in economic relationships cannot be solved by adjusting data samples, as is sometimes done in studies on developed economies.

Given these considerations, this study aims to provide new evidence on the nature of MTM changes observed during the GFC in the small open economies of the three non-eurozone Visegrad Group countries (i.e., Czechia, Hungary, and Poland), with Sweden serving as a benchmark. The analyses are performed within the Markov Switching Bayesian Structural Vector Autoregression (MSBSVAR) framework and are in line with earlier works by Sims, Wagonner, and Zha (2008) and Hubrich and Tetlow (2015). This approach is flexible enough to account for both the changes in variances and the changes in the coefficients of the estimated econometric model, which makes it suitable to address the research question. The results of the assessment are ambiguous. In Hungary and Sweden, changes in volatilities coincided with changes in the coefficients of the MTM, while in Czechia and Poland, the crisis resulted only in changes in the volatility of economic processes.

To explain the observed discrepancies in reactions, further investigation was performed. An analysis of Impulse Reaction Functions (IRFs) from the estimated models indicated that the changes in coefficients in the crisis phase occurred in countries where the exchange rate transmission channel was relatively weak. This is mostly due to high levels of indebtedness, which raised concerns about a possible procyclical reaction of liabilities in response to monetary expansion and exchange rate depreciation. In contrast, Poland and Czechia, where debt was kept at reasonable levels, maintained control over the exchange rate transmission channel and were able to use traditional policy instruments, including monetary expansion and exchange rate depreciation, to counteract any negative changes in economic activity throughout the crisis phase. As a result, it can be concluded that efforts by public authorities in small open economies to sustain exchange rate pass-through critically affect their ability to retain monetary control during crises. This explanation offers a new perspective on the fundamental role of fiscal and monetary policy coordination in preserving policy reaction capabilities during economic downturns, a conclusion that is very much overlooked in the existing economic literature.

The article is structured as follows. Part 2 analyses current theories on the evolution of economic variables during a crisis, with particular attention to the monetary policy transmission problem. It also briefly reviews the existing empirical evidence and highlights its main weaknesses. Part 3 describes the model selected for empirical analyses. Part 4 outlines the data used, discusses challenges in model identification, and details the estimation techniques used. Part 5 presents the research findings. The final section summarises the results and briefly discusses their policy implications.

Theoretical background and a review of the empirical evidence

The MTM is relatively well covered in the modern economic literature. MTM analyses gained momentum with the introduction of multivariate structural vector autoregressive (SVAR) models in the seminal works by Sims (1972; 1980; 1986). SVAR models effectively represent the relatively complex system of relationships within the MTM because their inherent overparametrisation allows each system variable to be studied with respect to its impact on all other variables.

The search for a robust specification of SVAR systems for MTM analysis resulted in the introduction of various schemes to identify monetary policy shocks. Sims (1986), Bernanke and Blinder (1992), Gordon and Leeper (1994), Bernanke and Mihov (1998), Christiano, Eichenbaum, and Evans (1999; 2005), Sims and Zha (2006a), Altig et al. (2011), Christiano, Trabandt, and Walentin (2011) used different versions of short-run restrictions. Blanchard and Quah (1989) pioneered the use of long-run identification restrictions, mainly in studies on the impact of technology shocks on labour (for a critical summary, see, e.g., Chari, Kehoe, and McGrattan 2005). Faust

(1998) and Uhlig (2005) proposed schemes based on sign restrictions, which proved especially useful in quadratic programming and Bayesian analysis.

Despite the rapidly growing number of complex identification schemes that utilise increasingly sophisticated assumptions, no consensus has been reached as to the shape of the MTM. As a result, there has recently been a renaissance of the standard Cholesky identification scheme based on a simple arrangement of the order of model variables. The main cause of the renaissance was researchers' growing awareness that complex identification schemes are often difficult to justify on theoretical grounds. They also conflict with the fundamental idea behind VAR modelling, which was intended to be relatively atheoretical and therefore distinct from traditional structural models proposed by the Cowles Commission and the computable and dynamic stochastic general equilibrium models that followed.

The Great Moderation period (1985–2007) was characterised by relatively low economic volatility in developed economies. This stability was attributed to institutional and structural changes and was considered a permanent feature of the Western economic system (Stock and Watson 2002). It encouraged economists to focus on the mechanisms governing monetary policy during "good times", which could be easily identified using traditional econometric methods. However, the Great Recession of 2007–2010 revived the need to better understand the nature of changes in economies affected by declining economic activity. Efforts to explain the changes were also evident in MTM analyses and prompted a new wave of research in this field.

Changes in the MTM of developed economies during a crisis have been recently discussed in many articles. Researchers focusing on eurozone countries – such as Ciccarelli, Maddaloni, and Peydro (2013), Aristei and Gallo (2014) or Leroy and Lucotte (2015) have shown that the effect of monetary policy on output is stronger during a crisis. Periods of greater financial stress increase competition in the banking sector because firms' and consumers' account balances are declining, and problems with finding suitable providers of capital emerge. The resulting narrowing of the spread between customer-paid rates and interbank interest rates forces banks to react more quickly to changes in monetary policy. Similar patterns have been confirmed for the United States by Debes et al. (2014), Hubrich and Tetlow (2015), Fry-Mckibbin and Zheng (2016), and Dahlhus (2017), and for a group of 20 developed OECD countries by Jansen, Potjagailo, and Wolters (2015).

Hubrich and Tetlow (2015) and Jansen, Potjagailo, and Wolters (2015) argue that expectations have a role in explaining changes in the monetary transmission process during a crisis. The idea that the expectations of economic entities influence decisions at different stages of the business cycle is not new. It was first proposed by Keynes (1936), who analysed the role of "animal spirits" in the context of investment decisions and business cycle dynamics. Modern economics increasingly includes expectations into economic modelling because individuals' confidence under systemic uncertainty significantly affects their behaviour. Silvia and Iqbal (2011) observed that when uncertainty is low and confidence is high, people work, invest, and consume more than when confidence is relatively low and uncertainty is high, i.e., during economic crises and military or political unrest. As uncertainty increases, individuals lose their confidence in economic growth, disappointed by distressed markets and companies prioritising balance sheet improvements through savings and employment rationalisation schemes. These circumstances tend to discourage consumers from consumption and investment plans, especially if they involve borrowing money (Bloom 2009; Jansen, Potjagailo, and Wolters 2015). The dependencies lend rationality to the prediction that the public reaction to an expansionary monetary policy will be weaker during an economic downturn than during prosperity until expectations change.

However, Boyarchenko, Haddad, and Plosser (2016) noted that in developed economies, communications from monetary authorities tend to boost economic entities' confidence, even if they are not followed by changes in monetary policy. Hence, in countries where the monetary authorities manage to stabilise expectations, expansionary monetary policy may be more efficient during a crisis than in times of prosperity (Hubrich and Tetlow 2015).

Studies investigating the relationship between confidence and MTM efficiency suggest this relationship should be treated normatively. Leduc (2010), Hubrich and Tetlow (2015), and Jansen, Potjagailo, and Wolters (2015) recommend that in the acute phase of a financial crisis, monetary authorities should attempt to mitigate a negative spiralling of expectations because convincing the public that the business cycle will soon improve can be a self-fulfilling prophecy, restoring monetary policy effectiveness. Nalban (2016) compares this mechanism to a financial accelerator whereby lower interest rates increase confidence and spending, thus inducing optimism that sustains itself through higher-order effects. This is crucial for an effective monetary policy when traditional transmission channels are absent.

Changes in the MTM of small open economies during a crisis have drawn relatively little attention so far, even though these economies seem to be different from developed economies in several important respects (Nalban 2016), such as lower credibility of monetary authorities, immature financial markets, the stabilising role of the exchange rate pass-through, the likelihood of currency mismatches, and the procyclicality of capital flows.

Developed economies are relatively stable and robust to exogenous economic shocks, allowing their monetary authorities to relatively easily earn a "credibility bonus" that underpins expectation management (Boyarchenko, Haddad, and Plosser 2016). This bonus tends to be absent in small open developing economies, where memories of hyperinflation remain relatively fresh and exogenous shocks that are hard to neutralise are frequently decisive for the overall condition of the economy. It is also disputable whether economic shocks can increase competition in the financial markets of emerging economies. As these economies' financial sectors mostly depend on foreign-controlled capital, declining economic activity and returns would trigger an outflow of capital to countries with more promising economic fundamentals and growth prospects rather than increasing competition between financial institutions (Corsetti, Pesenti, and Roubini 1999), making the monetary policies of developing economies less effective during crises.

According to Frankel (2011), the exchange rate pass-through plays a larger role in small open economies, a finding empirically supported by studies on the Visegrad countries (Ca'Zorzi, Hahn, and Sanchez 2007; Bajo-Rubio and Maria-Dolores 2011; Mirdala 2014; Przystupa and Wróbel 2014). This larger role can additionally stabilise the MTM of developing economies. Based on the uncovered interest rate parity, an expansionary monetary policy understood as a reduction of the domestic interest rate makes the domestic currency depreciate as a result of capital outflow to countries with relatively high interest rates. This, in turn, increases the exchange rate, which raises the relative costs of imports. If exchange rate changes are relatively quickly transmitted into imports' prices, then, according to Burstein, Neves, and Rebelo (2003), and Burstein, Eichenbaum, and Rebelo (2005), consumers respond by replacing imported goods with cheaper local substitutes, thus increasing domestic demand. At the same time, relatively low prices of domestic goods increase external demand. Both effects together can compensate for lower demand from domestic consumers caused by consumption being suspended in the face of economic instability. This process narrows the channel through which changes in the MTM can occur during a crisis.

The impact of the exchange rate pass-through mechanism can be mitigated by balance sheet effects resulting from currency mismatches. Because banks and companies in transitioning economies often face the problem of inadequate domestic capital funding, they sometimes seek capital abroad. Due to the international financial market incompleteness known as the "original sin", investors are unwilling to finance loans in the borrower's domestic currency (as they risk depreciation of the lender's domestic currency and the erosion of liabilities). Furthermore, the lack of appropriate hedging for foreign-currency-denominated loans in domestic currency means these organisations end up borrowing in foreign currency (Eichengreen and Hausmann 1999; Eichengreen, Hausmann, and Panizza 2002). A currency mismatch occurs because their liabilities are denominated in foreign currency while most revenues are earned in domestic currency. Exchange rate changes associated with an expansionary monetary policy shift may thrust such organisations into debt servicing problems as the total value of their liabilities increases. This may contribute to negative business cycle effects – reducing domestic demand in the wake of employment cuts and bankruptcies – and offsetting the aforementioned positive pass-through effects (Krugman 1999; Frankel 2011; for a recent account of currency mismatch issues in the Visegrad countries, see, e.g. IMF 2015 and Chui, Kuruc, and Turner 2016; for analysis of the Polish economy, see, e.g. Kapuściński 2017).

Another major difference between emerging and developed economies, closely associated with the "original sin" hypothesis and currency mismatches, is the procyclicality of capital flows. Evidence from Hausmann and Panizza (2003) and Mehl and Reynaud (2005) suggests that highly indebted countries are more exposed to foreign currency lending due to their reduced credibility. Additionally, if a country that has substantial external debt adopts an expansionary monetary policy during an economic downturn (as discussed above), its domestic currency is likely to depreciate, which can increase the total debt denominated in foreign currency. In the wake of such changes, the current account deficit and the debt-to-GDP ratio can grow, prompting investors to claim the repayment of outstanding liabilities before new debt is issued. While satisfying investors is straightforward when both the economy and tax revenues are growing, it can be very costly when government expenditure cuts coincide with an economic downturn. Such a confluence of factors can dramatically decelerate economic activity, consequently reducing the current account and further hindering the exchange rate pass-through mechanism (Frankel 2011). As a result, an inherent conflict occurs between fiscal and monetary policy goals, potentially limiting their effectiveness (Adler 2008).

Summing up the available evidence on MTM responses during a crisis, it can be concluded that in developed economies, a monetary policy is more efficient during a crisis than when the economy is expanding. This is due to at least two reasons:

1) increasing competition between banks and financial institutions;
2) the availability of a "credibility bonus" related to consumers' expectations.

It remains debatable whether both effects occur in emerging economies, given their less developed financial markets and less respected monetary authorities. The monetary policy of small open economies is likely to be less effective during a downturn when the expectations of economic entities make them shelve their consumption and investment decisions than when the economy is expanding. However, whether the effect of negative expectations will prevail is largely determined by a mix of three factors: the impact of exchange rate pass-through, the occurrence of balance sheet effects associated with currency mismatches, and the procyclicality of capital flows.

The empirical evidence on MTM in small open European economies affected by a crisis is still relatively sparse and inconclusive. Results pointing to a monetary policy's weaker impact on economic variables during economic downturn were presented for the Visegrad countries by Darvas (2013), and for Poland by Łyziak et al. (2011). According to some studies, changes in the MTM are caused by fluctuations in the volatility of the analysed processes rather than by changes in the parameters of the analysed relationships. Similar results have been reported by Dobešová et al. (2015) for Czechia and Slovakia, and by Rosoiu (2015) for Romania. Conversely, Franta, Horvath, and Rusnak (2014) and Nalban (2016) presented evidence confirming the occurrence of structural changes in the MTM, which increased the efficiency of the Czech and Romanian monetary policies during the crisis. Lastly, Myšková, Hampel, and Dobešová (2013) presented inconclusive results for the Visegrad countries. The importance of the exchange rate pass-through for explaining the performance of small open developing economies during a crisis has been noted by, inter alia, Dąbrowski, Śmiech, and Papież (2015) and Dąbrowski and Wróblewska (2016).

This paper contributes to the literature on this subject in at least two ways. Firstly, it presents new empirical evidence about the nature of crisis-induced changes in the MTM of small open economies while testing the hypothesis that the MTM of small open economies is structurally stable during a crisis. Secondly, it investigates factors that distinguish small open emerging economies from developed economies and that may explain the higher stability of MTM in the former: specifically, the exchange rate pass-through combined with the absence of balance sheet effects associated with a currency mismatch and the procyclicality of capital flows.

The Empirical Model

Recent advancements in econometrics have broadened the range of methods for modelling MTM changes. As a result, researchers use a variety of competing specifications in their analyses. A review of studies on MTM changes shows that most authors used variants of the Threshold Structural Vector Autoregressions (TSVAR) model. For example, Fry-Mckibbin and Zheng (2016) and Nalban (2016) proposed the Threshold Bayesian SVAR (TBSVAR) models, while Ciccarelli, Maddaloni, and Peydro (2013) and Jansen, Potjagailo, and Wolters (2015) chose the Panel

Threshold SVAR models, and Myšková, Hampel, and Dobešová (2013) employed a standard VAR model estimated for two separate sub-periods.

Given the purpose of this analysis, the TSVAR models are not the best choice because their specification assumes simultaneous shifts in volatilities and parameters, thus precluding some intermediary specifications. Moreover, traditional TSVAR models are vulnerable to arbitrary threshold specifications. Nonetheless, this problem can be easily resolved using appropriate Bayesian techniques (see Fry-Mckibbin and Zheng 2016; Nalban 2016).

MTM changes have also been studied with Markov Switching (Bayesian) SVARs based on heteroscedasticity assumptions. This class of models, created by Lanne, Lütkepohl, and Maciejowska (2010), Netsunajev (2013), and Kulikov and Netsunajev (2016), allows researchers to develop agnostic specifications of the MTM because shocks can be identified by assuming heteroscedasticity of the analysed time series instead of making typical assumptions about the matrix of contemporaneous parameters. Woźniak and Dromaguet (2015) proposed an alternative version of the model that combines the standard short-run identifying assumptions and the heteroscedasticity assumptions. While MS(B)SVAR models with heteroscedasticity assumptions present an interesting alternative to the standard SVAR models which identify shocks based on arbitrarily selected contemporaneous matrix restrictions – they are unsuitable for investigating the nature of MTM changes during a crisis because of the heteroscedasticity assumptions, which preclude some potentially valid specifications.

Darvas (2013), Franta, Horvath, and Rusnak (2014), and Dobešová et al. (2015) used Time-Varying Parameters SVAR (TVP-SVAR) models to analyse MTM changes. This class of models allows both the stochastic evolution of parameters and their volatility to be considered. However, the parameter drift may fail to pick up some high-frequency phenomena affecting the MTM (Hubrich and Tetlow 2015). In spite of this criticism, which discourages the use of TVP models in studies such as this one, Hubrich and Tetlow (2015), following Sims, Wagonner, and Zha (2008), propose the Markov Switching Bayesian SVAR (MSBSVAR) as a more appropriate analytical tool. This model is flexible enough to account for: changes in the volatilities of the analysed processes, changes in the parameters of structural relationships, and changes in the parameters and volatilities together.

Furthermore, because both types of changes are governed by separate Markov chains, the model precisely accounts for the time structure of changes. Lastly, the ability of the Markov switching mechanism to detect even abrupt, discrete shifts in the MTM is useful when expectations must be considered. Hence, as Hubrich and Tetlow (2015) recommended, we selected the MSBSVAR class of models to investigate the impacts of a crisis on the MTM in small open economies.

Following Sims et al. (2008), let us consider an unrestricted VAR(l, m, n) model of the form:

$$y_t^{'}A_0\left(s_t^C\right)=\sum_{i=1}^{l}y_{t-i}^{'}A_i\left(s_t^C\right)+\sum_{j=0}^{m}z_{t-j}^{'}C_j\left(s_t^C\right)+\varepsilon_t^{'}\Xi^{-1}\left(s_t^V\right), \quad (1)$$

where: y is a vector of endogenous variables, z is a vector of exogenous variables that are assumed to be at least predetermined and weakly exogenous, A_0, A_i, C_j are the matrices of the appropriate state-dependent parameters, and s_t^n for $n = \{C, V\}$ is a latent variable that describes the current state of an economy separately for parameters s_t^C and variances s_t^V.

Let us assume that the state of an economy is determined by a set of political, economic, technological, and institutional factors which are sensitive to independent shocks that can suddenly change the character of the observed economic processes. Therefore, the latent state variables meet the Markov condition and can be modelled as if they were following an irreducible, aperiodic, time-homogeneous, and ergodic Markov chain. Consequently, and following Hubrich and Tetlow (2015), the variable s_t^n takes values from the set $\{1, 2, \ldots, h^n\}$ and is governed by the first-order Markov chain given by:

$$\Pr\left(s_t^n = 1 \mid s_{t-1}^n = k\right) = p_{ik}^n \quad i, k = 1, 2, \ldots, h^n, \tag{2}$$

where p_{ik}^n is the probability of an economy entering state i, provided that in the preceding period it was in state k, and the Markov transition probabilities are given by time-constant matrix P.

If we assume, for simplicity, that $x_t = \left[y_{t-1}^{'}, \ldots, y_{t-1}^{'}, z_t^{'}, \ldots, z_{t-m}^{'}\right]$ and $A_{-}^{'}\left(s_t^n\right) = \left[A_1^{'}\left(s_t^n\right), \ldots, A_1^{'}\left(s_t^n\right), C_0^{'}\left(s_t^n\right), \ldots, C_m^{'}\left(s_t^n\right)\right]$, we obtain the following equation:

$$y_t^{'} A_0\left(s_t^C\right) = x_t^{'} A_{-}\left(s_t^C\right) + \varepsilon_t^{'} \Xi^{-1}\left(s_t^V\right). \tag{3}$$

Further, by imposing a normality restriction on the state-dependent errors using the condition:

$$\Pr\left(\varepsilon_t \mid Y^{t-1}, Z^t, S^{n,t}, A_0, A_{-}, \Xi\right) \sim N\left(0_\eta, I_\eta\right), \tag{4}$$

where $Y^{t-1}, Z^t, S^{n,t}$ are the vectors of variables stacked in the time dimension and $N\left(0_\eta, I_\eta\right)$ is a multivariate normal distribution with a zero mean and a unit variance, we arrive at an unrestricted Markov-Switching VAR model estimable by the Bayesian procedure proposed by Sims, Wagonner, and Zha (2008). It is the same model that Hubrich and Tetlow (2015) used for inference in their original article.

The Data

The following analysis is based on monthly data from 2000: 1–2016: 5 for the three non-eurozone Visegrad countries (V3) – Czechia, Hungary, and Poland – which are small open economies with a similar historical background. In the early 1990s, all three started transitioning to a market economy. The first and most volatile phase of this process was completed in 1995, and the whole transformation came to an end with the countries' entry into the European Union on 1 May 2004.

The institutional monetary policy framework and exchange rate regimes were adjusted in all three countries throughout the period of analysis. Inflation targeting was introduced by Czechia and Poland in January and October 1998, respectively, and by Hungary in the summer of 2001. Czechia and Poland relatively quickly established free float exchange rate regimes, introduced in June 1997 and March 2000, respectively. In Hungary, the exchange rate regime was substantially modified throughout the sample period by replacing a crawling peg with a crawling band in May 2001. Another change, which fixed the exchange rate within a ±15% band, was made in October 2001. Hungary ultimately introduced a free float currency regime in February 2008. Meanwhile, in November 2013, Czechia introduced a fixed exchange rate against the euro as an auxiliary monetary policy instrument in the environment of low interest rates.

These shifts in monetary policy frameworks and exchange rate regimes that occurred in the V3 countries during the sample period may impact both the strength and volatility of the MTM relationships and, thus, have a detrimental effect on the quality of the estimates obtained from traditional, single-regime models. The use of regime-switching models, which allow for changes in both the parameters and the variances of the underlying processes, enables us to address these concerns directly within the model specification. When the timing of these changes is taken into account, we observe that the monetary policy framework changes occurred mostly at the very beginning of the sample, which should have a marginal impact on the quality of the estimates related to the 2008–2010 GFC period. The possible impact of exchange rate regime changes on the estimates is additionally limited by the fact that the analyses are performed using the Real Effective Exchange Rate index (REER) instead of bilateral exchange rates. REER measures the strength of the domestic currency against the strength of the currencies of a country's main trading partners. As such, this relationship might still evolve and provide valuable insight into the development of exchange rate determinants even under fixed exchange rates.

The fourth country, Sweden, was selected to serve as a benchmark. Sweden is a small, open, developed economy renowned for its financial and economic stability. Its monetary policy throughout the period was based on a strategy of targeting the inflation rate, which was fully introduced in January 1995. Free-float exchange rates had been introduced two years earlier, in January 1993.

Despite its relative economic stability, in February 2015, Sweden hit the "zero lower-bound" (ZLB), followed by negative STIBOR (Stockholm Interbank Offered Rate) According to Górajski and Ulrichs (2016, p. 14) and similar studies, such a situation may cause additional non-linearities in the MTM due to the presence of a "liquidity trap", among other factors. Their likely impact on the results of this analysis can be neutralised by a logarithmic transformation that involves imposing non-negativity restrictions on the nominal interest rate. The outcome of this approach is a curtailed sample and the loss of 16 observations for Sweden from the period 2015: 2–2016: 5. This approach should not compromise the overall performance of the estimated models and the quality of the comparisons because, apart from Sweden, none of the analysed V3 countries faced the ZLB problem within the sample period. As a result, the problem falls outside the scope of the present paper.

Table 1. Correlations between the sentiment indicators and industrial production in the sampled countries

Czechia				Hungary			
Variables	ESI	BCI	IP	Variables	ESI	BCI	IP
ESI	1			ESI	1		
BCI	0.86	1		BCI	0.81	1	
IP	0.62	0.7	1	IP	0.33	0.58	1

Poland				Sweden			
Variables	ESI	BCI	IP	Variables	ESI	BCI	IP
ESI	1			ESI	1		
BCI	0.93	1		BCI	0.95	1	
IP	0.67	0.7	1	IP	0.52	0.55	1

ESI – Economic Sentiment Indicator, BCI – Business Confidence Indicator, IP – Industrial Production.

Source: author's elaboration.

Table 2. Standard deviations of sentiment indicators for the sampled countries

Variables	Czechia		Hungary		Poland		Sweden	
	$\sigma(x)$	$\frac{\sigma(x)}{\sigma(y)}$	$\sigma(x)$	$\frac{\sigma(x)}{\sigma(y)}$	$\sigma(x)$	$\frac{\sigma(x)}{\sigma(y)}$	$\sigma(x)$	$\frac{\sigma(x)}{\sigma(y)}$
ESI	0.097	0.604	0.113	0.663	0.086	0.329	0.083	1.299
BCI	0.016	0.101	0.015	0.09	0.011	0.041	0.017	0.261
IP	0.160	1	0.171	1	0.262	1	0.064	1

$\sigma(x)$ – standard deviation of a given variable, $\frac{\sigma(x)}{\sigma(y)}$ – standard deviation with respect to the standard deviation of industrial production.

Source: author's elaboration.

Our analysis includes the following variables:

- Industrial production index (IP_t): Serves as a proxy for GDP (sourced from OECD Data Explorer).
- Consumer price index (CPI_t) (sourced from OECD Data Explorer).
- Short-term interest rates (IR_t): Approximated by 1-month PRIBOR (Prague Interbank Offered Rate), BUBOR (Budapest Interbank Offered Rate), WIBOR (Warsaw Interbank Offered Rate) and STIBOR (Stockholm Interbank Offered Rate; all obtained from Eurostat).
- Real effective exchange rate index ($REER_t$): Derived from bilateral exchange rates for the 42 leading trading partners of the analysed countries (obtained from Eurostat).
- Real effective exchange rate of the eurozone ($REER_t^f$): Approximates the exchange rate of the main trading partners (obtained from Eurostat).
- World oil prices (P_t^{oil}): Represented by the Brent crude oil 1-month forward (in the EUR index) (made available by the ECB Statistical Data Warehouse).

In our model, these characteristics of the real economy are enhanced by data reflecting the expectations and sentiments of economic entities, which, according to the literature discussed in Part 2, can significantly influence the transmission of monetary impulses.

Two alternative measures of sentiment are widely used in the economic literature. The Eurostat Economic Sentiment Indicator (ESI_t) is constructed as a weighted average of five sectoral confidence indicators (industry, services, construction, retail trade, and private consumption). They are obtained from monthly surveys of approximately 125,000 companies and 40,000 consumers in the EU. The Business Confidence Indicator (BCI_t), which is calculated by the OECD, provides an insight into manufacturing companies' expectations. The index is smoothed using an appropriate Hodrick-Prescott filter to remove all cycles shorter than six months.

We briefly characterise the data on the sentiment indicators by comparing the correlations between the indicators, as well as correlations between the indicators and the data on industrial production (see Table 1). The information contained in both sentiment indicators is generally comparable, as shown by the correlations between the ESI and the BCI time series, which range from 0.81 to 0.95 depending on the country. The BCI tracks industrial production data relatively closely (correlations between 0.55 and 0.7), whereas the ESI shows a weaker correlation with the industrial production data (correlations between 0.35 and 0.67). Consequently, the ESI effectively compresses a wider information set regarding the expectations of economic entities.

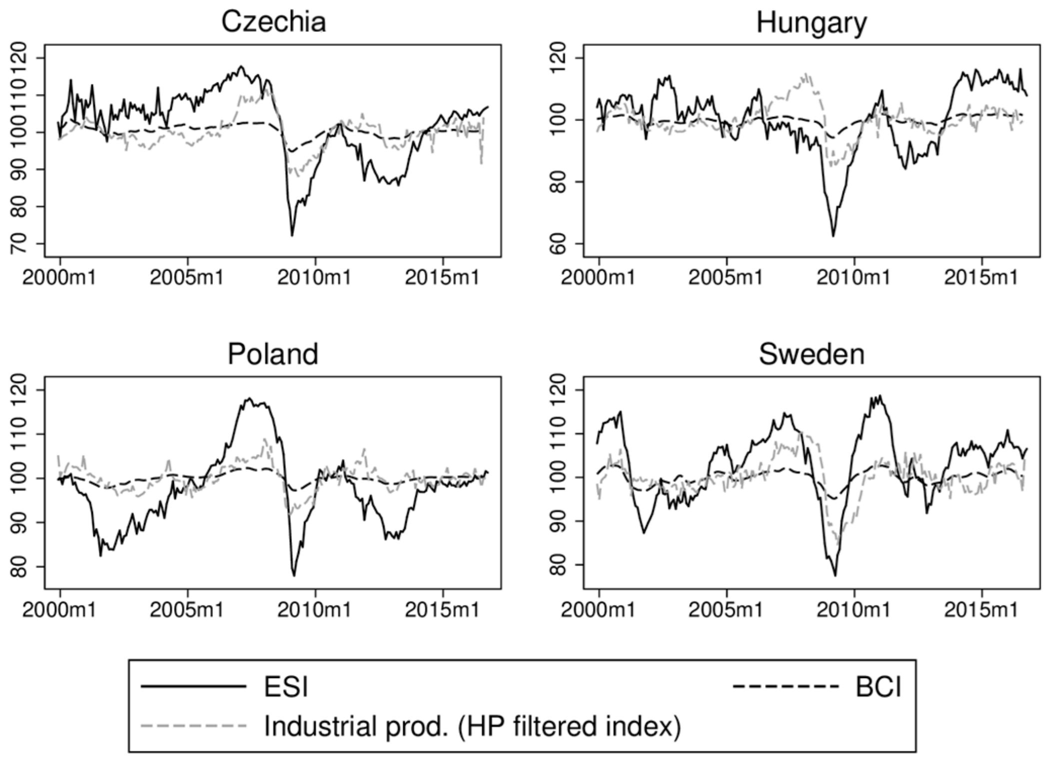

Figure 1. Economic Sentiment Indicator, Business Confidence Indicator, and the index of industrial production for the sampled countries

Source: author's elaboration based on data from Eurostat and OECD Data Explorer.

The business cycle-related characteristics of the analysed economic sentiment indicators can be summed up by their standard deviations and their standard deviations relative to the standard deviation of GDP, approximated by industrial production index (see Table 2). A brief look at the data in Table 2 shows that the ESI is up to six times more volatile than the BCI, although it is also relatively efficient in approximating output volatility. Thus, it outperforms the BCI as a source of information regarding the expectations of economic entities.

The last argument for using the ESI as an indicator of economic sentiments stems from its ability to show real economic phenomena slightly ahead of time, which the BCI lacks. This ability is particularly noticeable with the Hungarian and Swedish data presented in Figure 1. We can therefore conclude that the ESI contains information that can improve the model's fit with the data.

All time series used in the analyses below were seasonally adjusted. They are expressed as annual rates (12-month log-differences) and are denoted by lowercase letters. The key statistical characteristics of the data are presented in Appendix 1.

Model Identification and Estimation

The VAR model proposed for analysing the MTM has seven variables. The endogenous variables given by vector $y_t = [ip_t, cpi_t, ir_t, reer_t, esi_t]$ constitute a relatively standard set of explanatory variables commonly used to model monetary policy transmission in small open economies and large developed economies (e.g., the US and the eurozone) alike.

The literature proposes different variants of this core set of explanatory variables. Sims and Zha (2006a) and Hubrich and Tetlow (2015) modelled the US economy using a VAR model with a money supply measure instead of an exchange rate, whereas Peersman (2004) and Elbourne and de Haan (2006) employed both money supply data and exchange rates to study eurozone countries. Similar specifications of the VAR model were proposed for the small open economies by Kapuściński et al. (2014), Bogusz, Górajski, and Ulrichs (2015), Nalban (2016) and Przystupa and Wróbel (2016). Depending on the goals of their respective studies, the authors also used different supporting variables.

In line with our previous reasoning, our model not only incorporates the standard determinants of monetary transmission but also a measure of economic sentiment. This approach closely follows Nalban (2016) and is somewhat similar to the approach adopted by Hubrich and Tetlow (2015), who included financial stress indicators in their model. It is based on the premise that the expectations of economic entities can significantly influence their decisions and thereby predict regime switches.

Small open economies are vulnerable to changes in external economic conditions. Accordingly, our vector of exogenous variables z_t relates economic activity in the analysed countries to shocks at the global and/or European level. Kim and Roubini (2000) proposed a vector of exogenous variables composed of the oil price index and foreign interest rates. In this analysis, foreign real effective exchange rates are used instead of foreign interest rates, resulting in

$z_t = \left[oil_t,\ reer_t^f \right]$. There are two reasons for this. Firstly, using eurozone interest rates would require reducing the sample because of negative interest rates from February 2015. Secondly, the proposed vector of exogenous variables has a theoretical underpinning. Monetary authorities respond to the commodity prices' effect on the real economy by adjusting interest rates. These interest rate changes influence exchange rates, which then generate shocks that change terms of trade and output levels in the real economy. Thus, exchange rates can also be considered an important monetary policy determinant.

Determining how exogenous variables should be entered into the model is more complicated, and the economic literature has not reached a consensus on this issue. In their original paper, Kim and Roubini (2000) proposed treating these variables as weakly exogenous:

$$\Pr\left(z_t \mid Y^{t-1}, Z^{t-1},\ S^{n,t}, A_0, A_-, \Xi\right) = \Pr\left(z_t \mid Y^{t-1}, Z^{t-1}\right), \tag{5}$$

whereby the weakly exogenous variables are determined not only by their lagged values but also by the lagged values of endogenous variables. As a result, they are influenced, although asynchronously, by developments in the analysed economy. This assumption may be valid for large economies, such as those that comprise the core of the EU, but it may prove incorrect when analysing transition economies. Some researchers (e.g., Hubrich and Tetlow 2015; Górajski and Ulrichs 2016; Nalban 2016) proposed treating exogenous variables as strictly exogenous:

$$\Pr\left(z_t \mid Y^{t-1}, Z^{t-1},\ S^{n,t}, A_0, A_-, \Xi\right) = \Pr\left(z_t \mid Z^{t-1}\right). \tag{6}$$

As the strictly exogenous variables are only determined by their lagged values, changes taking place in the analysed economies have no effect on them. Because this assumption is relevant for the small open economies of the Visegrad countries, it will be considered in our model.

To compute and analyse impulse responses of the VAR model, we must properly interpret the vector of exogenous shocks $\varepsilon_t^{'}$. The most popular method for identifying these shocks imposes exclusion restrictions on the matrix of contemporaneous parameters A_0. This is usually achieved via the Cholesky decomposition, which yields a set of just-identifying restrictions by proper ordering of variables and by introducing a lower-triangular A_0 matrix.

The vector of endogenous variables y_t is split into three blocks: $y_t = \left[y_{1t}, ir_t, y_{2t}\right]$, where y_{1t} is a vector of variables that concurrently enter the monetary authorities' information set, ir_t is an instrument of monetary policy, and comprises all other endogenous variables that are simultaneously influenced by monetary authorities' decisions. This identification scheme is relatively simple to use and reveals patterns hidden in the data without requiring too many a priori assumptions.

Based on the above, we propose the following ordering of endogenous variables for our model: $y_t = [ip_t, cpi_t, ir_t, reer_t, esi_t]$. This specification accounts for the fact that, because of nominal rigidities, real economic variables do not react to monetary policy changes at the same time. For instance, unlike exchange rates and economic entities' expectations that immediately respond to the monetary authorities' decisions, output and inflation take time to react. It is also notable that the real economic variables are the only ones to concurrently affect the monetary policy. Exchange rate and economic sentiment changes are considered by monetary authorities with a lag.

To account for the openness of the analysed economies, a vector of exogenous variables is introduced, and the assumption is made that they simultaneously influence all other variables in the model. This is achieved by placing them at the front of the vector of endogenous variables. The full ordering of the model's variables is therefore give $y_t = \left[ip_t, cpi_t, ir_t, reer_t, esi_t\right]$ by vector $x_t = \left[oil_t,\ reer_t^f, ip_t, cpi_t, ir_t, reer_t, esi_t\right]$. This specific identification prompts the question of whether monetary authorities target a domestic exchange rate or a foreign exchange rate when designing their policy. In fact, the above ordering of variables implies that the foreign real exchange rate continuously influences monetary policy and its adjustments are instantaneously transmitted to the domestic real exchange rate. For this assumption to be valid, the exchange rate would have to be viewed in terms of domestic vs. foreign currency price rather than as a real exchange rate. In the latter case, monetary authorities targeting the foreign real exchange rate (the euro real exchange rate in this study) would, in fact, be targeting the exchange rate of its main trading partner's currency, which is quite close to targeting the exchange rate between the domestic currency and the euro.

The model proposed in this paper was estimated in Dynare according to the procedure proposed by Sims, Wagonner, and Zha (2008), with the priors selected as Hubrich and Tetlow (2015) proposed. Specifically, standard Minnesota priors for monthly data were employed for the VAR model elements. Consequently, its hyperparameters were given by the vector [0.57; 0.13; 0.1; 1.2; 10; 10]. For the state transition matrix, we used the Dirichlet priors of 5.6 for the two-state chains and 11.9 for the three-state chains, meaning that the expected duration of stay in a given regime was equal to 20.3 months. To obtain the posterior modes, we used six million replications as a burn-in. Every 5th of the next 2.5 million replications was kept, resulting in a total of 500,000 posterior draws for further analysis.

The goodness-of-fit of the estimated models was determined by comparing the logarithms of Marginal Data Densities (log MDDs), calculated using the method proposed by Sims, Wagonner, and Zha (2008). Following common practice, we assumed that of the two model specifications, one was statistically significantly superior to the other if their log MDDs differed by more than ten orders of magnitude (Kass and Rafterty 1995). As this strategy may sometimes lead to inconclusive results, the competing models were also assessed in terms of the probability of switches occurring in their regimes and the possibility of using historical data to explain them. This empirical strategy is based on a fact indicated by Hubrich and Tetlow (2015) that the MSBSVAR models are characterised by a trade-off between changes in volatility and changes in parameters. According to this trade-off, bigger changes in shock variances are accompanied by smaller changes in the parameters of equations, and vice versa. It is therefore possible that a model that explains both volatility and parameter switches exhibits better goodness-of-fit than one that accounts for changes in only one of these categories. The situation is purely statistical and would be possible if the parameters were moving recursively and hectically between two relatively closely parametrised regimes, with no clear historical events to explain their behaviour.

Empirical Results

This part of the paper presents the results of an empirical analysis performed on the 2000: 1–2016: 5 data for the non-eurozone Visegrad countries and Sweden. The analysis was undertaken to answer two questions:

1. Do the MTMs of small open economies remain relatively stable during a crisis? Specifically, do the models show shifts in the volatilities of economic processes rather than in the parameters?
2. How does the exchange rate pass-through, combined with the absence of balance sheet effects related to a currency mismatch and the procyclicality of capital flows, contribute to the higher stability of the MTMs in these countries?

The first question was answered by estimating models that account for different characteristics of the switches that had taken place in the Czech, Hungarian, Polish and Swedish MTMs. The baseline model (*1v1c*) is a standard Bayesian Structural VAR that disregards switches in both the volatilities of the analysed relationships and the structural parameters. The other models accounted for changes in data variance only (*2v1c* and *3v1c* had two and three variance regimes, respectively) and in parameters only (*1v2c* and *1v3c* had two and three coefficient regimes, respectively). The models were also estimated for changes affecting both the variances and parameters (*2v2c* had two variance regimes and two parameter regimes, while *3v2c* had three variance regimes and two coefficient regimes).

For models that accounted for shifts in both volatilities and coefficients, it was additionally assumed that switches were governed by separate Markov chains to determine whether or not the switches coincided during a business cycle. The proposed model specification and identification yielded estimates capable of recovering a set of impulse response functions whose results proved relatively stable and consistent with economic theory. The log MDDs of the estimated models are presented in Table 3.

To test the robustness of the results, additional variables were used (e.g., employment and unemployment rates), and the ESI was replaced with the BCI index. The results of tests using alternative variables proved fairly stable regarding the strength of economic relationships and the timing of regime and volatility changes. When ESI was substituted with BCI, the models lost some volatility that could have been attributed to easily identifiable economic phenomena such as EU accession or the GFC. This outcome reaffirms the decision to use the ESI index in the baseline model.

Another test was related to the sample choice. The sample for Czechia was shortened to November 2013 (when the exchange rate was fixed against the euro), while the sample for Sweden was extended to the full length (May 2016). The curtailment of the sample in Czechia did not change the identification of states, whereas its extension for Sweden provoked increased and hard-to-interpret changeability of both the volatility and the coefficient states.

Appendix 2 presents the results of robustness tests in which ESI was substituted with BCI and the sample length was adjusted. Due to space limitations, the other robustness tests are available upon request. These results confirmed that the initial decisions regarding the choice of sample were correct and did not interfere with the results.

Table 3. Log MDDs of the estimated MSBSVAR models

Country	Model type						
	1v1c	*2v1c*	*3v1c*	*1v2c*	*1v3c*	*2v2c*	*3v2c*
Czechia	2960.7	3018.2	3042.5	3001.3	3009.2	3046.5	**3063.6**
diff.	– 102.9	– 45.4	– 21.1	– 62.3	– 54.4	– 17.1	–
Hungary	2606	2723.6	2738.8	2713.7	2723.3	2743.8	**2765.8**
diff.	– 159.8	– 42.2	– 27	– 52.1	– 42.5	– 22	–
Poland	3022.6	3054.1	**3070**	3036.7	3040.1	3061.5	3053.2
diff.	– 47.4	– 15.9	–	– 33.3	– 29.9	– 8.5	– 16.8
Sweden	2602.9	2645.3	2661.2	2644.1	2646.5	2665.9	**2675.9**
diff.	– 73	– 30.6	– 14.7	– 31.8	– 29.4	– 10	–

Source: author's elaboration.

The estimates in Table 3 show that the model accounting only for volatility changes performs statistically significantly better than the other models only for Poland. Conversely, the empirical results for Hungary, Czechia, and Sweden favour models with switches in both volatilities and coefficients, which produced the highest log MDDs. The best-performing of these models were those with three variance regimes and two coefficient regimes.

As previously mentioned, a model with shifts in both volatility and coefficients may outperform models that account for only one type of switch, simply because it has more capacity to adjust to the rapid rate of changes in economic conditions. Nonetheless, following Hubrich and Tetlow (2015), we decided to enhance our comparison of the models' goodness-of-fit by analysing the estimated state probabilities. Figure 2 juxtaposes the probabilities of volatility states obtained with the *3v1c* models (the left-hand panel) with the probabilities of volatility (the solid lines) and coefficient states (the dashed line) produced by the *3v2c* model (the right-hand panel). Volatility states are presented such that the black line represents the high-volatility state (identified by its probability dominating during the GFC of 2008–2010), while the grey line represents the medium-volatility state, which typically either directly precedes or follows the high-volatility state.[1]

The frequent switches between states in both models in Figure 2 show that the Czech MTM was rather unstable in the years of analysis. Looking solely at the volatility regime changes, a period of increased instability in economic processes is noticeable, likely related to the Czech pursuit of EU membership, which was finally granted in May 2004. Czechia differed from the other V3 countries in that increased economic volatility continued beyond that date – its economy would

1 Due to the high level of complicatedness of Markov Switching Structural VAR model it is hard to identify these states directly, as the changes might only affect some of the variables and relationships described in the model.

intermittently enter and leave a high-variance state until July 2007. The models show that between January 2008 and January 2013, the Czech economy struggled with the GFC, with its acute phases taking place between July 2008 and July 2010 and again between July 2012 and January 2013, with a respite phase between July 2010 and July 2012. With the beginning of 2014, the volatility of economic processes increased again, likely due to the new geopolitical situation in the region related to the Russia–Ukraine war and the ensuing economic sanctions.

Introducing the coefficient switches in the model did not help explain the analysed processes: the model continued to show state instability, suggesting no valid information was gained. However, the coefficient switches appeared to stabilise changes in variance, thus enabling a clear economic interpretation along the lines mentioned above. We can therefore presume that the main cause of changes in the Czech MTM was the changing volatility of economic processes rather than the swinging nature of economic relationships.

As for Hungary, three periods of elevated economic uncertainty were identified. In the first period, which coincided with Hungary's accession to the EU, uncertainty was especially noticeable towards the end of negotiations. It was at least partially due to the exchange rate regime switches that necessitated intervention in the currency market. The second period occurred during the GFC between October 2008 and June 2010. In the third period, geopolitical factors sustained the crisis-related increased volatility of economic processes until 2015. The results of the *3v2c* model, which show a coincidence between changes in volatility, changes in the model's parameters, and declines in economic sentiment, imply that a structural change may have taken place in the Hungarian economy during those periods.

The comparison of the log MDDs shows that only for Poland is the *3v1c* model superior to the *3v2c* model. The state probabilities confirm this finding. The likely causes of regime changes can be easily identified by analysing estimates produced by the model that accounts for volatility switches alone. The estimates show that accession to the EU contributed to increased economic uncertainty from the beginning of the sample period to May 2004. Between the spring of 2008 and the autumn of 2010, the effects of the GFC are noticeable. Two less distinct spikes in volatility occurred between January 2006 and July 2007 and from mid-2013 to the end of the sample period. The first is very likely to have been caused by political factors, specifically by the first government of the Law and Justice Party. The second spike is a compound of geopolitical and political factors, namely the military unrest in Eastern Europe and the run-up to political elections that culminated in the presidential elections of July 2015 and the subsequent parliamentary elections that saw the Law and Justice Party form its second government.

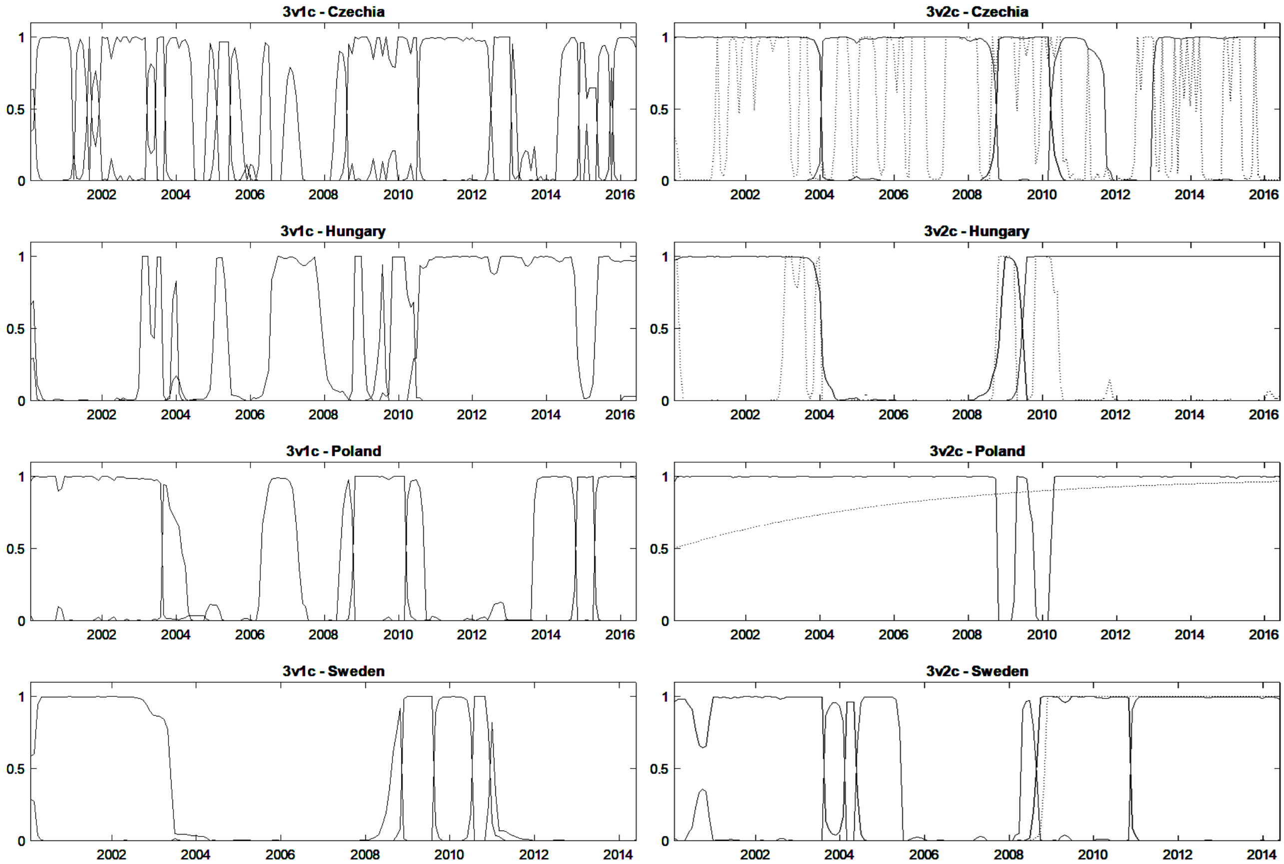

Figure 2. Probabilities of states estimated with the *3v1c* model and the *3v2c* model (the left and right panels, respectively)

Probabilities of states in variances are represented by solid lines (grey and black), probabilities of states in coefficients are represented by the dashed line.

Source: author's elaboration.

A closer look at the *3v2c* model results shows that, despite many attempts, degenerate probabilities for the coefficient changes prevented it from producing proper estimates. This inevitably leads to the conclusion that changes in the Polish MTM in the sample period were caused by switches in variances rather than in parameters.

The results for Sweden (see Figure 2), the last of the analysed countries, show that its economy was relatively stable. The main factor that affected the Swedish MTM was the GFC of 2008: 7–2011: 5. In those years, changes in the volatility of economic processes coinciding with a deep correction of economic entities' expectations brought about a structural change in the Swedish MTM. Some volatility spikes in economic processes are also noticeable in the early years of the sample period.

The above findings can be summed up as follows. In the crisis period, the Polish and partly Czech MTMs were affected by volatility swings, whereas in the Swedish and Hungarian MTMs, structural changes occurred. It would be interesting to determine why the MTMs of the analysed economies responded differently to the crisis. To this end, we shall assess the role of exchange rate pass-through, balance sheet effects caused by currency mismatches, and the procyclicality of capital flows, as proposed in Part 2 of this article. This assessment will involve evaluating IRFs yielded by the respective models, enhanced by comparisons of additional statistical data.

This part of the analysis is based on the results obtained from models *3v2c* (Hungary and Sweden) and *3v1c* (Poland and Czechia), which were found to better fit the statistical data than the alternative specifications (Table 3). The IRFs come from regimes that prevailed during the financial crisis of 2008–2010. In Figure 2, the regimes are represented by a combination of solid and dotted black lines (for Poland and Czechia, they are marked by solid black lines). Due to the applied convention, all of the graphs present reactions to 1 p.p. positive shocks in each of the analysed variables.

According to the literature review in Part 2, the negative impact of changing expectations and economic sentiment during a crisis can be mitigated by the exchange rate pass-through, which causes a depreciation of exchange rates to induce favourable fluctuations in demand. To investigate this possibility, we will analyse the IRFs showing the exchange rates' response to a monetary policy shock and the industrial production's response to an exchange rate shock, as presented in Figure 3.

The graphs show that an expansionary (negative) monetary policy shock is followed by a depreciation of the real effective exchange rate in all four economies. This depreciation is strongest in Poland and much less pronounced in Sweden and Czechia. In Hungary, its impact is delayed, weak, and statistically insignificant. The other IRFs in Figure 3 show the reactions of industrial production to changes in the real effective exchange rates. As can be seen, the reactions are country-specific and consistent with predicted changes in MTMs during the crisis. Where the crisis caused structural changes in the MTM (Sweden and Hungary), the depreciation of exchange rates was followed by an insignificant decline in industrial production. In Poland and Czechia, whose MTMs changed in response to switches in the volatility of economic processes, the falling exchange rate was met with a positive reaction from industrial production. Given that the strength of the exchange rate pass-through depends on the reaction to both shocks, we can infer that the exchange rate pass-through was stronger in Poland than in Czechia.

As already mentioned, the benefits of the exchange rate pass-through in the sampled small open economies can be diminished by the balance sheet effects (due to a currency mismatch) and the effects of procyclical capital flows. Because both types of effects increase the demand for refinancing by private companies and government caused by the depreciation of domestic currency these effects are likely to contribute to a rise in interest rates.

The IRFs in Figure 4 show the reaction of interest rates to the real (effective) exchange rate shock in regimes that prevailed in crisis years. In Czechia, Poland and Sweden, the reaction of interest rates to the depreciation of the real effective exchange rates was not statistically significant. This implies that neither Poland nor Czechia, where the crisis only caused volatility changes, was affected by balance sheet effects related to a currency mismatch or procyclical capital flows.

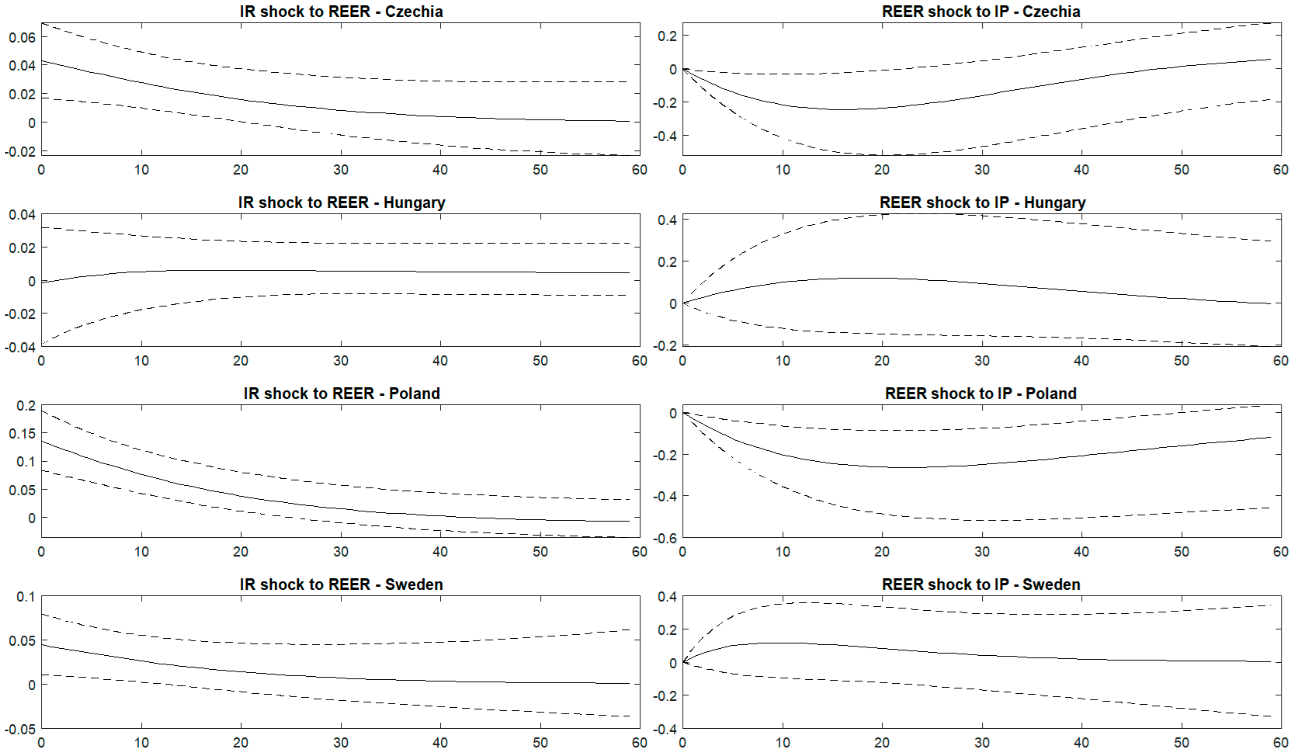

Figure 3. Exchange rate pass-through in the analysed economies (reactions to 1 p.p. positive shocks; the prevalent regime during the Great Recession)

Source: author's elaboration.

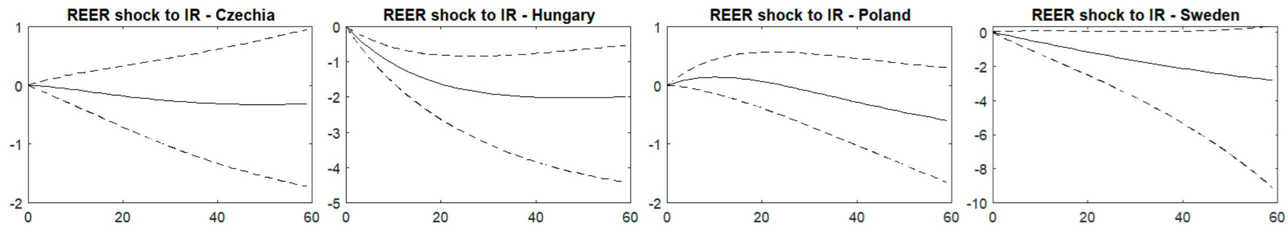

Figure 4. Reaction of interest rates to the appreciation of the real effective exchange rate (reactions to 1 p.p. positive shocks; regime dominating during the Great Recession)

Source: author's elaboration.

Conversely, the IRF in Figure 4 confirms that in Hungary, the REER depreciation was followed by a statistically significant and relatively large increase in the interest rate. Therefore, either the balance sheet effects were active or capital flows became procyclical. Both situations may have been due to Hungary being the only country among the four analysed that experienced major fiscal sustainability problems during the sample period. Its debt-to-GDP ratio significantly exceeded the limit of 60% set in the Stability and Growth Pact of 2003, peaking at approximately 80% in 2010 (for a full fiscal sustainability analysis for the Visegrad countries see, e.g., Włodarczyk 2016). In a transition country, this combination of high public debt and limited financial resources may lead to relatively high absorption of foreign loans and debt service problems during a crisis.

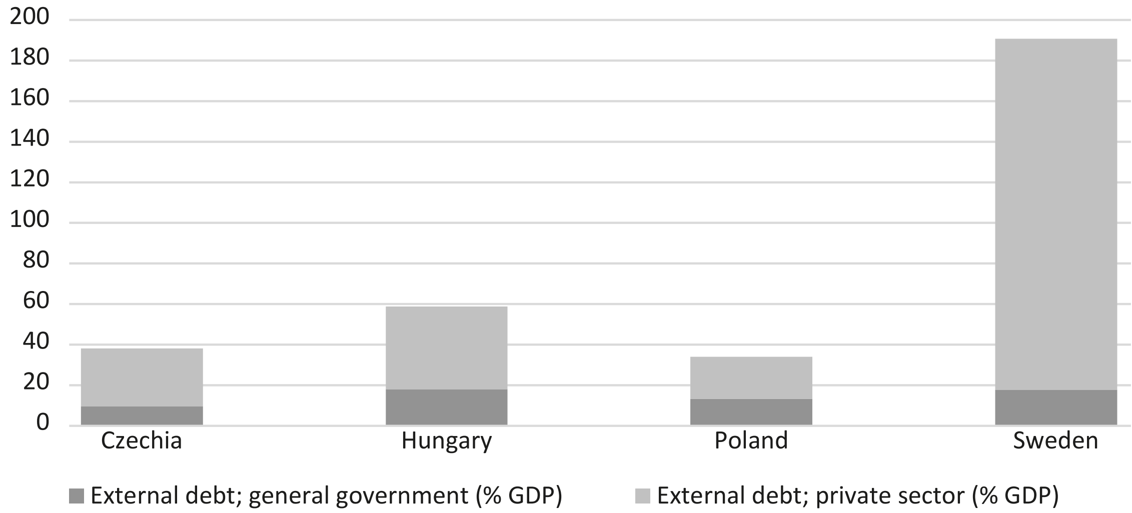

Figure 5. The structure of gross external debt in the analysed countries, 2016: Q3

Source: author's elaboration based on QEDS and OECD Data Explorer.

The data on the debt structure and the yields on 10-year government bonds provide the rationale for the proposed hypothesis. Figure 5 shows gross external debt in the analysed countries by source (in relation to GDP). The necessary data were derived from the World Bank's Quarterly External Debt Statistics (QEDS) and OECD Data Explorer. Due to the lack of earlier data, data from the third quarter of 2016 (the last sub-period in the sample) were used.

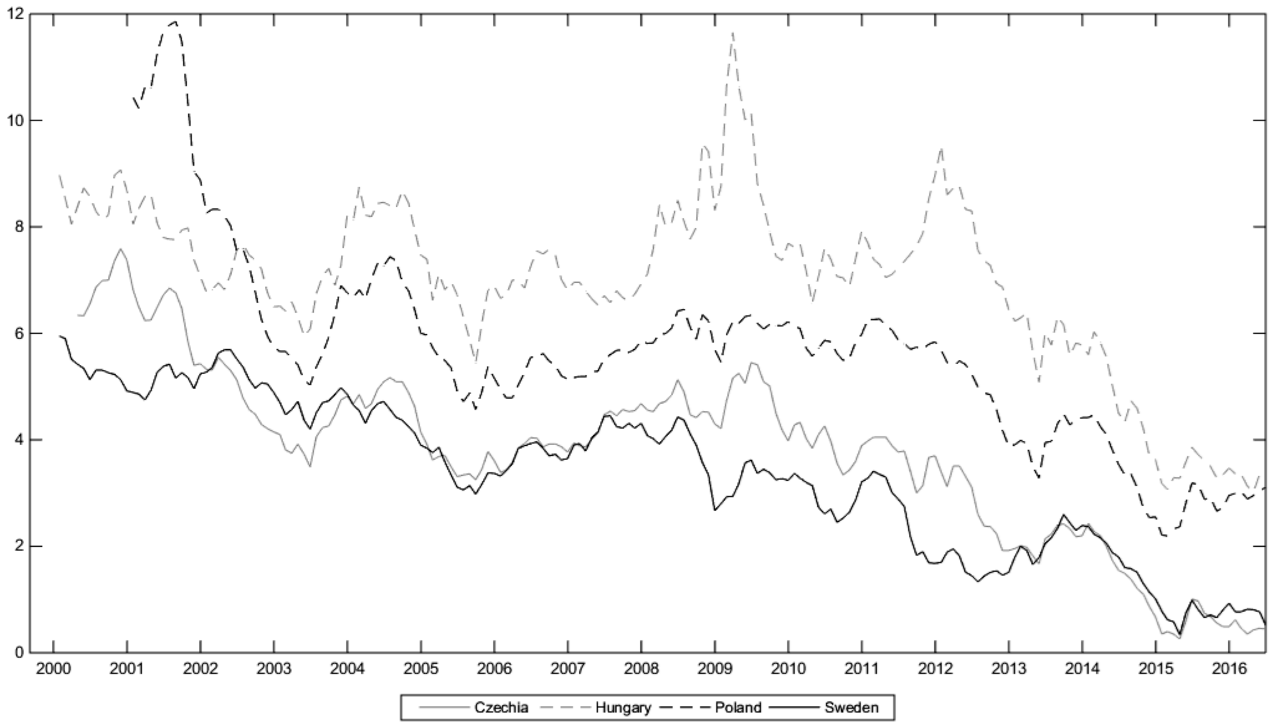

Figure 6. Yields on 10-year government bonds in the selected countries (%)

Source: author's elaboration based on OECD Data Explorer.

The graph shows that Hungary had the highest general government external debt-to-GDP ratio (18%) and relatively high private sector external debt (40.8% of the country's GDP). These numbers, as well as the relatively sharp rise in the long-term interest rates on Hungarian bonds (see Figure 6) between October 2007 and March 2009, seem to substantiate the hypothesis that Hungary was affected by an incident of balance sheet effects or procyclical capital flows that impaired the efficiency of monetary policy transmission during the crisis years.

In Sweden, the incident of balance sheet effects/procyclical capital flows was much less serious, despite changes in both volatility and parameters that occurred in the aftermath of the GFC. The increase in interest rates triggered by the depreciating exchange rate only bordered on statistical significance (see Figure 4), and the long-run interest rates did not go up during the crisis period (see Figure 6). However, it is possible that the extremely high external debt-to-GDP ratio, which amounted to 190% of Swedish GDP (mainly due to the debt of the private sector), created a situation where the depreciating exchange rate increased the principal nominal debt owed to non-residents. In such a scenario, the deterioration of economic entities' balance sheets is likely, making them postpone borrowing decisions until the situation improves or to file for bankruptcy. Whichever scenario prevailed, it made the monetary transmission in Sweden less effective.

Conclusion

The article analyses the impact of crisis-induced changes in general economic activity on the monetary transmission mechanism of the small open economies of Czechia, Hungary, Poland, and Sweden. The analysis spans the period from 2000: 1 through 2016: 5. To determine the nature of the changes, the goodness-of-fit of the Markov Switching Structural Bayesian Vector Autoregressive models was compared, specifically accounting for: 1) changes in the variances of economic processes, 2) changes in the coefficients of the estimated relationships, and 3) both types of changes simultaneously.

The study confirmed that, during the crisis years, changes took place in the volatility of economic processes in Poland and Czechia, whereas in Sweden and Hungary, structural changes in the MTM coincided with volatility changes. A closer examination of the four countries' MTMs shows that the main reason for their different responses was the role of the exchange rate pass-through mechanism. Where the mechanism was not fully blocked (Poland and Czechia), demand effects resulting from exchange rate fluctuations compensated for the lower responsiveness of internal demand, helping the monetary policy retain its effectiveness throughout the crisis. In countries where this effect did not occur (Hungary and Sweden), the period of economic downturn involved structural changes in the MTM and diminishing effectiveness of monetary policies. This leads to the conclusion that, in small open economies, the public authorities' ability to sustain the exchange rate pass-through may critically affect their ability to exercise monetary control during a crisis.

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References

Adler, G. (2008), *Original Sin and Procylical Fiscal Policy: Two Sides of the Same Coin?*, "IMF Working Paper", 209, https://doi.org/10.5089/9781451870671.001

Altig, D., Christiano, L.J., Eichenbaum, M., Lindé, J. (2011), *Firm-specific capital, nominal rigidities and the business cycle*, "Review of Economic Dynamics", 14 (2), pp. 224–247, https://doi.org/10.1016/j.red.2010.01.001

Aristei, D., Gallo, M. (2014), *Interest rate pass-through in the Euro area during the financial crisis: A multivariate regime-switching approach*, "Journal of Policy Modeling", 36 (2), pp. 273–295, https://doi.org/10.1016/j.jpolmod.2013.12.002

Bajo-Rubio, O., Maria-Dolores, R. (2011), *Exchange rate pass-through in the new member states of the European Union. Some explanatory factors*, "Ekonomia Economics", 2 (14), pp. 88–94.

Bernanke, B.S., Blinder, A.S. (1992), *The Federal Funds Rate and the Channels of Monetary Transmission*, "The American Economic Review", 82 (4), pp. 901–921, https://www.jstor.org/stable/2117350 (accessed: 5.02.2018).

Bernanke, B.S., Mihov, I. (1998), *Measuring Monetary Policy*, "The Quarterly Journal of Economics", 113 (3), pp. 869–902, https://doi.org/10.1162/003355398555775

Blanchard, O.J., Quah, D. (1989), *The Dynamic Effects of Aggregate Demand and Supply Disturbances*, "The American Economic Review", 79 (4), pp. 655–673, https://www.jstor.org/stable/1827924 (accessed: 5.02.2018).

Bloom, N. (2009), *The Impact of Uncertainty Shocks*, "Econometrica", 77 (3), pp. 623–685, https://doi.org/10.3982/ECTA6248

Bogusz, D., Górajski, M., Ulrichs, M. (2015), *Sztywna vs. elastyczna strategia bezpośredniego celu inflacyjnego w modelu optymalnej polityki pieniężnej dla Polski*, "Przegląd Statystyczny", 62 (4), pp. 379–396.

Boyarchenko, N., Haddad, V., Plosser, M.C. (2016), *The Federal Reserve and Market Confidence*, "Federal Reserve Bank of New York Staff Reports", 773.

Burstein, A., Eichenbaum, M., Rebelo, S. (2005), *Large Devaluations and the Real Exchange Rate*, "Journal of Political Economy", 113 (4), pp. 742–784, https://doi.org/10.1086/431254

Burstein, A., Neves, J.C., Rebelo, S. (2003), *Distribution costs and real exchange rate dynamics during exchange-rate-based stabilizations*, "Journal of Monetary Economics", 50 (6), pp. 1189–1214, https://doi.org/10.1016/S0304-3932(03)00075-8

Ca'Zorzi, M., Hahn, E., Sanchez, M. (2007), *Exchange Rate Pass-Through in Emerging Markets*, "ECB Working Paper", 739, https://doi.org/10.2139/ssrn.970654

Chari, V.V., Kehoe, P.J., McGrattan, E.R. (2005), *Are structural VARs with long-run restrictions useful in developing business cycle theory?*, "Journal of Monetary Economics", 55 (8), pp. 1337–1352, https://doi.org/10.1016/j.jmoneco.2008.09.010

Christiano, L.J., Eichenbaum, M., Evans, C.L. (1999), *Monetary policy shocks: What have we learned and to what end?*, [in:] J.B. Taylor, M. Woodford (eds.), *Handbook of Macroeconomics*, Vol. 1A, North-Holland, Amsterdam, pp. 65–148, https://doi.org/10.1016/S1574-0048(99)01005-8

Christiano, L.J., Eichenbaum, M., Evans, C.L. (2005), *Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy*, "Journal of Political Economy", 113 (1), pp. 1–45, https://doi.org/10.1086/426038

Christiano, L.J., Trabandt, M., Walentin, K. (2011), *DSGE Models for Monetary Policy Analysis*, [in:] B.M. Friedman, M. Woodford (eds.), *Handbook of Monetary Economics*, Vol. 3, North-Holland, Amsterdam–San Diego, pp. 285–367, https://doi.org/10.1016/B978-0-444-53238-1.00007-7

Chui, M.K.F., Kuruc, E., Turner, P. (2016), *A new dimension to currency mismatches in the emerging markets – non-financial companies*, "Bank of International Settlements Working Paper", 550.

Ciccarelli, M., Maddaloni, A., Peydro, J.-L. (2013), *Heterogeneous transmission mechanism: monetary policy and financial fragility in the eurozone*, "Economic Policy", 28 (75), pp. 459–512, https://doi.org/10.1111/1468-0327.12015

Corsetti, G., Pesenti, P., Roubini, N. (1999), *What caused the Asian currency and financial crisis?*, "Japan and the World Economy", 11 (3), pp. 305–373, https://doi.org/10.1016/S0922-1425(99)00019-5

Dahlhus, T. (2017), *Conventional Monetary Policy Transmission During Financial Crises: An Empirical Analysis*, "Journal of Applied Econometrics", 32 (2), pp. 401–421, https://doi.org/10.1002/jae.2524

Darvas, Z. (2013), *Monetary transmission in three central European economies: evidence from time-varying coefficient vector autoregressions*, "Empirica", 40, pp. 363–390, https://doi.org/10.1007/s10663-012-9197-4

Dąbrowski, M.A., Śmiech, S., Papież, M. (2015), *Monetary policy options for mitigating the impact of the global financial crisis on emerging market economies*, "International Review of Economics and Finance", 51, pp. 409–431, https://doi.org/10.1016/j.jimonfin.2014.12.006

Dąbrowski, M.A., Wróblewska, J. (2016), *Exchange rate as a shock absorber in Poland and Slovakia: Evidence from Bayesian SVAR models with common serial correlation*, "Economic Modelling", 58, pp. 249–262, https://doi.org/10.1016/j.econmod.2016.05.013

Debes, S., Gareis, J., Mayer, E., Rüth, S. (2014), *Towards a Consumer Sentiment Channel of Monetary Policy*, "Würzburg Economic Papers", 91.

Dobešová, A., Klepáč, V., Kolman, P., Bednářová, P. (2015), *Modelling of volatility in monetary transmission mechanism*, "AIP Conference Proceedings", 1648, https://doi.org/10.1063/1.4912941.

Eichengreen, B., Hausmann, R. (1999), *Exchange rates and financial fragility*, "NBER Working Papier", 7418, National Bureau of Economic Research, Cambridge, https://doi.org/10.3386/w7418

Eichengreen, B., Hausmann, R., Panizza, U. (2002), *Original Sin: The Pain, the Mystery, and the Road to Redemption*, https://repository.graduateinstitute.ch/record/286974?v=pdf (accessed: 8.10.2025).

Elbourne, A., Haan, J. de (2006), *Financial structure and monetary policy transmission in transition countries*, "Journal of Comparative Economics", 34 (1), pp. 1–23, https://doi.org/10.1016/j.jce.2005.11.004

Faust, J. (1998), *The robustness of identified VAR conclusions about money*, "Carnegie-Rochester Series on Public Policy", 49, pp. 207–244, https://doi.org/10.1016/S0167-2231(99)00009-3

Frankel, J. (2011), *Monetary Policy in Emerging Markets*, [in:] B.M. Friedman, M. Woodford (eds.), *Handbook of Monetary Economics*, Vol. 3, North-Holland, Amsterdam–San Diego, pp. 1439–1520, https://doi.org/10.1016/B978-0-444-53454-5.00013-X

Franta, M., Horvath, R., Rusnak, M. (2014), *Evaluating changes in the monetary transmission mechanism in the Czech Republic*, "Empirical Economics", 46, pp. 827–842, https://doi.org/10.1007/s00181-013-0699-0

Fry-Mckibbin, R., Zheng, J. (2016), *Effects of the US monetary policy shocks during financial crises – a threshold vector autoregression approach*, "Applied Economics", 48 (59), pp. 5802–5823, https://doi.org/10.1080/00036846.2016.1186792

Gordon, D.B., Leeper, E.M. (1994), *The Dynamic Impacts of Monetary Policy: An Exercise in Tentative Identification*, "Journal of Political Economy", 102 (6), pp. 1228–1247, https://doi.org/10.1086/261969

Górajski, M., Ulrichs, M. (2016), *Optymalne wrażliwe na ryzyko strategie polityki pieniężnej dla Polski*, „Bank i Kredyt", 47, pp. 1–32.

Hausmann, R., Panizza, U. (2003), *On the determinants of Original Sin: an empirical investigation*, "Journal of International Money and Finance", 22 (7), pp. 957–990, https://doi.org/10.1016/j.jimonfin.2003.09.006

Hubrich, K., Tetlow, R.J. (2015), *Financial stress and economic dynamics: The transmission of crises*, "Journal of Monetary Economics", 70, pp. 100–115, https://doi.org/10.1016/j.jmoneco.2014.09.005

IMF (2015), *Central and Eastern Europe: New Member States (NMS) Policy Forum 2014. Selected Issues Paper*, "International Monetary Fund Country Report", 098, https://doi.org/10.5089/9781484321393.002

Jansen, N., Potjagailo, G., Wolters, M.H. (2015), *The Monetary Policy during Financial Crises: Is the Transmission Mechanism Impaired?*, "Kiel Working Paper", 2005.

Kapuściński, M. (2017), *The Role of Bank Balance Sheets in Monetary Policy Transmission: Evidence from Poland*, "Eastern European Economics", 55 (1), pp. 50–69, https://doi.org/10.1080/00128775.2016.1255559

Kapuściński, M., Łyziak, T., Przystupa, J., Stanisławska, E., Sznajderska, A., Wróbel, E. (2014), *Monetary policy transmission mechanism in Poland. What do we know in 2013?*, "Narodowy Bank Polski Working Paper", 180.

Kass, R.E., Rafterty, A.E. (1995), *Bayes Factor*, "Journal of the American Statistical Association", 90 (430), pp. 773–795, https://doi.org/10.1080/01621459.1995.10476572

Keynes, J.M. (1936), *The General Theory of Employment, Interest and Money*, McMillan and Co. Ltd., London.

Kim, S., Roubini, N. (2000), *Exchange rate anomalies in the industrial countries: A solution with a structural VAR approach*, "Journal of Monetary Economics", 45 (3), pp. 561–586, https://doi.org/10.1016/S0304-3932(00)00010-6

Krugman, P. (1999), *Balance Sheets, the Transfer Problem, and Financial Crises*, "International Tax and Public Finance", 6, pp. 459–472, https://doi.org/10.1023/A:1008741113074

Kulikov, D., Netsunajev, A. (2016), *Identifying Shocks in Structural VAR models via heteroskedasticity: a Bayesian approach*, "Bank of Estonia Working Paper", 8.

Lanne, M., Lütkepohl, H., Maciejowska, K. (2010), *Structural vector autoregressions with Markov switching*, "Journal of Economic Dynamics and Control", 34 (2), pp. 121–131, https://doi.org/10.1016/j.jedc.2009.08.002.

Leduc, S. (2010), *Confidence and the Business Cycle*, "Federal Reserve Bank of San Francisco Economic Letter", 35.

Leroy, A., Lucote, Y. (2015), *Heterogeneous monetary transmission process in the Eurozone: Does banking competition matter?*, "International Economics", 141, pp. 115–134, https://doi.org/10.1016/j.inteco.2015.01.006

Łyziak, T., Przystupa, J., Stanisławska, E., Wróbel, E. (2011), *Monetary Policy Transmission Disturbances During the Financial Crisis. A Case of an Emerging Market Economy*, "Eastern European Economics", 49 (5), pp. 75–96, https://doi.org/10.2753/EEE0012-8775490504

Mehl, A., Reynaud, J. (2005), *The Determinants of 'Domestic' Original Sin in Emerging Market Economies*, "European Central Bank Working Paper", 560, https://doi.org/10.2139/ssrn.863946

Mirdala, R. (2014), *Exchange Rate Pass-through to Consumer Prices in the European Transition Economies*, "Procedia Economics and Finance", 12, pp. 428–436, https://doi.org/10.1016/S2212-5671(14)00364-5

Myšková, K., Hampel, D., Dobešová, A. (2013), *Impulse-response analysis of monetary policy – Visegád group countries case*, "Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis", 61 (7), pp. 2561–2567, https://doi.org/10.11118/actaun201361072561

Nalban, V. (2016), *Sentiment-Driven Asymmetries in Romanian Monetary Policy Transmission*, "Eastern European Economics", 54 (3), pp. 251–270, https://doi.org/10.1080/00128775.2016.1149036

Netsunajev, A. (2013), *Reaction to technology shocks in Markov-switching structural VARs: Identification via heteroscedasticity*, "Journal of Macroeconomics", 36, pp. 51–62, https://doi.org/10.1016/j.jmacro.2012.12.005

Peersman, G. (2004), *The Transmission of Monetary Policy in the Euro Area: Are the Effects Different Across Countries?*, "Oxford Bulletin of Economics & Statistics", 66 (3), pp. 285–305, https://doi.org/10.1111/j.1468-0084.2004.00080.x

Przystupa, J., Wróbel, E. (2014), *Asymmetry of the Exchange Rate Pass-Through. An Exercise on Polish Data*, "Eastern European Economics", 49 (1), pp. 39–51, https://doi.org/10.2753/EEE0012-8775490103

Przystupa, J., Wróbel, E. (2016), *Modelling monetary transmission in less developed emerging markets: the case of Tunisia*, "Bank i Kredyt", 47, pp. 395–434.

Rosoiu, A. (2015), *Monetary Policy and Time Varying Parameter Vector Autoregression Model*, "Procedia Economics and Finance", 32, pp. 496–502, https://doi.org/10.1016/S2212-5671(15)01423-9

Silvia, J., Iqbal, A. (2011), *Monetary Policy, Fiscal Policy, and Confidence*, "International Journal of Economics and Finance", 3 (4), pp. 22–35, https://doi.org/10.5539/ijef.v3n4p22

Sims, C.A. (1972), *Money, Income and Causality*, "American Economic Review", 62, pp. 540–552.

Sims, C.A. (1980), *Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered*, "American Economic Review", 70 (2), pp. 250–257.

Sims, C.A. (1986), *Are Forecasting Models Usable for Policy Analysis?*, "Federal Reserve Bank of Minneapolis Quarterly Review", 10 (1), pp. 2–16, https://doi.org/10.21034/qr.1011

Sims, C.A., Zha, T. (2006a), *Does Monetary Policy Generate Recessions?*, "Macroeconomic Dynamics", 10 (2), pp. 231–272, https://doi.org/10.1017/S136510050605019X

Sims, C.A., Zha, T. (2006b), *Were There Regimes Shifts in U.S. Monetary Policy?*, "American Economic Review", 96 (1), pp. 54–81, https://doi.org/10.1257/000282806776157678

Sims, C.A., Wagonner, D.F., Zha, T. (2008), *Methods for inference in large multiple-equation Markov-switching models*, "Journal of Econometrics", 146 (2), pp. 255–274, https://doi.org/10.1016/j.jeconom.2008.08.023

Stock, J.H., Watson, M.W. (2002), *Has the Business Cycle Changed and Why?*, [in:] M. Gertler, K. Rogoff (eds.), *NBER Macroeconomics Annual 2002*, Vol. 17, MIT Press, Cambridge, pp. 159–230, https://doi.org/10.1086/ma.17.3585284

Stock, J.H., Watson, M.W. (2012), *Disentangling the Channels of the 2007–2009 Recession*, "Brookings Papers on Economic Activity", 1, pp. 81–130, https://doi.org/10.1353/eca.2012.0005

Uhlig, H. (2005), *What are the effects of monetary policy on output? Results from an agnostic identification procedure*, "Journal of Monetary Economics", 52 (2), pp. 381–419, https://doi.org/10.1016/j.jmoneco.2004.05.007

Włodarczyk, P. (2016), *Fiscal sustainability of the Visegrad Group countries in the aftermath of global economic crisis*, "Lodz Economics Working Papers", 2/2017.

Woźniak, T., Dromaguet, M. (2015), *Assessing Monetary Policy Models: Bayesian Inference for Heteroskedastic Structural VARs*, "University of Melbourne Working Papers Series".

Appendix 1. Data descriptive statistics

Table A1. Data descriptive statistics

Czechia							Hungary						
Variables	IP	CPI	IR	REER	ESI	BCI	Variables	IP	CPI	IR	REER	ESI	BCI
Obs.	197	197	197	197	197	197	Obs.	197	197	197	197	197	197
Mean	3.48	2.21	2.14	1.94	1.24	0.13	Mean	4.35	4.56	7.18	1.30	0.91	0.14
Median	4.57	1.92	2.04	1.85	1.82	0.26	Median	5.85	4.63	7.48	0.58	–0.43	0.22
St. Dev	6.69	1.72	1.61	5.51	11.81	2.40	St. Dev	8.54	2.82	3.13	6.30	13.07	2.04
Min	–21.64	–0.42	0.20	–9.17	–45.36	–7.77	Min	–29.68	–1.49	0.91	–12.02	–41.66	–5.63
Max	14.90	7.28	5.40	21.86	35.37	6.54	Max	19.65	10.26	13.30	16.95	41.24	5.61
Poland							**Sweden**						
Variables	IP	CPI	IR	REER	ESI	BCI	Variables	IP	CPI	IR	REER	ESI	BCI
Obs.	197	197	197	197	197	197	Obs.	181	181	181	181	181	181
Mean	5.06	2.69	6.14	0.63	0.47	0.10	Mean	0.08	1.28	2.49	–0.49	0.30	0.06
Median	5.01	2.40	4.69	0.81	2.43	0.21	Median	0.74	1.15	2.18	0.16	2.03	0.47
St. Dev	5.47	2.50	4.65	8.78	10.30	1.39	St. Dev	7.18	1.25	1.38	5.66	12.56	2.61
Min	–14.39	–1.30	1.56	–23.72	–39.86	–4.85	Min	–26.16	–1.89	0.12	–15.94	–30.75	–5.72
Max	19.57	10.79	19.84	21.78	27.24	2.92	Max	13.22	4.28	5.13	11.12	33.74	5.82

Exogeneous variables		
Vari-ables	Oil	$REER_{EU}$
Obs.	197	197
Mean	5.59	–0.28
Median	4.19	0.58
St. Dev	32.75	6.02
Min	–67.12	–14.85
Max	106.96	14.69

The data expressed in 12-month log-differences. IP – Industrial Production, CPI – Consumer Price Index, IR – Interest Rate, REER – Real Effective Exchange Rate, ESI – Economic Sentiment Indicator, BCI – Business Confidence Indicator.

Source: author's elaboration.

Appendix 2. Robustness checks

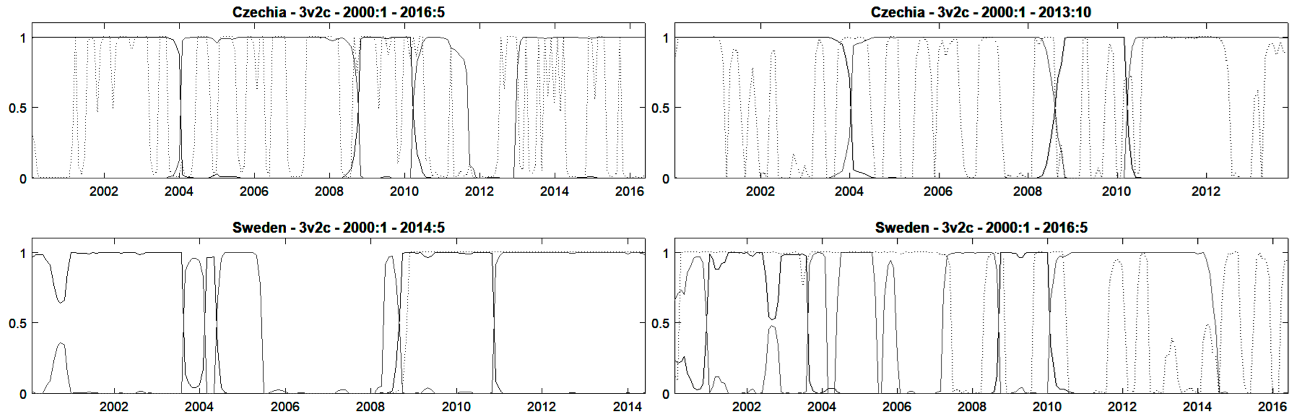

Figure A1. Probabilities of states estimated for varying sample lengths

Probabilities of states in variances presented by solid lines (grey and black), probabilities of states in coefficients presented by dashed line.

Source: author's elaboration.

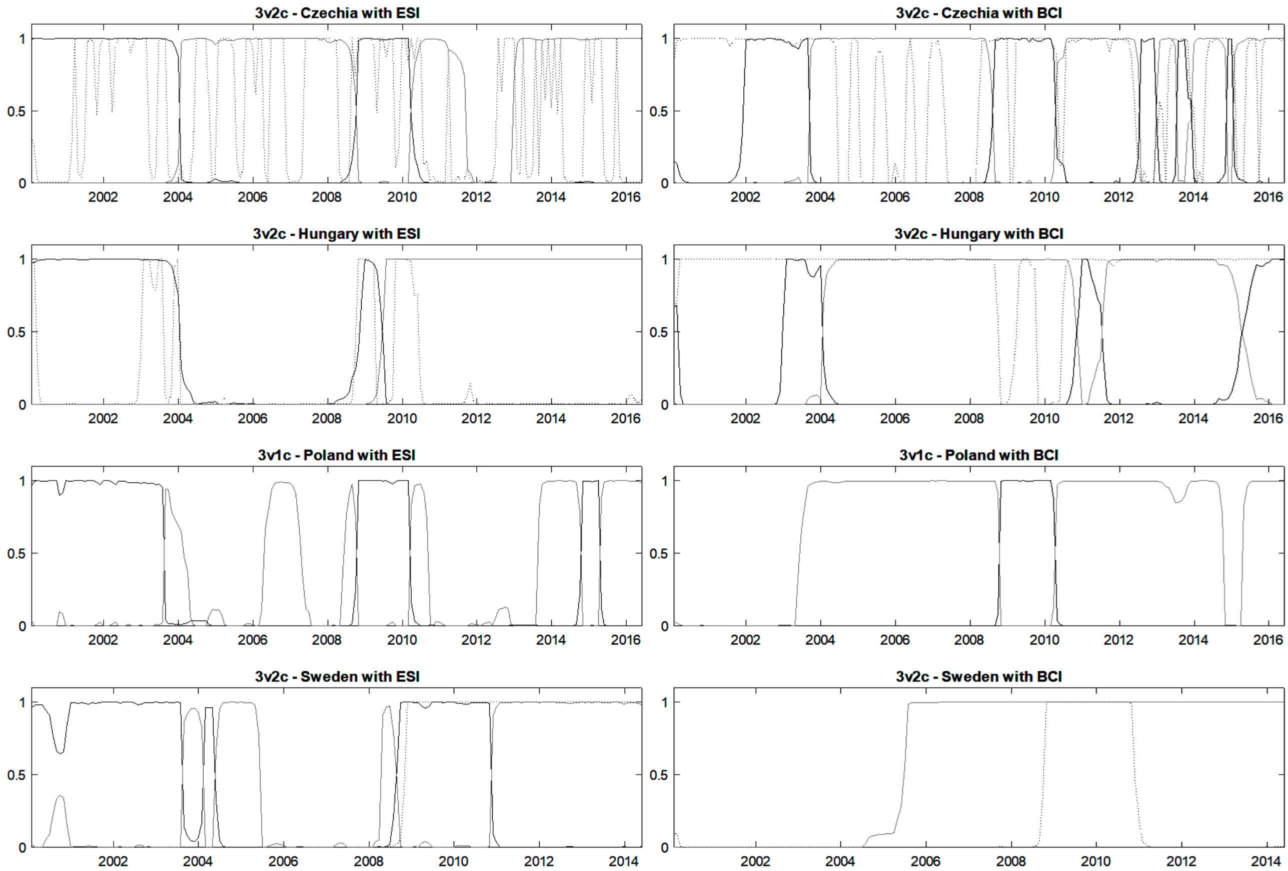

Figure A2. Probabilities of states estimated for the models specified with ESI and BCI

Probabilities of states in variances presented by solid lines (grey and black), probabilities of states in coefficients presented by dashed line.

Source: author's elaboration.

Zmiana wariancji czy asymetria? Mechanizm transmisji monetarnej w małych, otwartych gospodarkach europejskich w czasie kryzysu finansowego

W artykule przeprowadzono analizę wpływu wywołanych kryzysem zmian w aktywności gospodarczej na mechanizm transmisji monetarnej w małych gospodarkach otwartych Czech, Węgier, Polski i Szwecji w okresie od stycznia 2000 do maja 2016 roku. W badaniu wykorzystano strukturalne bayesowskie modele wektorowej autoregresji z przełączaniem Markowa (MSBSVAR).
Wyniki wskazują, że w krajach, w których kanał transmisji kursu walutowego jest stosunkowo słaby (Węgry i Szwecja), zmianom wariancji procesów gospodarczych w okresie kryzysu towarzyszyła zmiana wartości współczynników mechanizmu transmisji monetarnej, co w sposób negatywny wpływało na skuteczność polityki pieniężnej. Zmiany tego typu nie były obserwowane w Polsce i w Czechach, gdzie kanał transmisji kursu walutowego nie został całkowicie zneutralizowany. Wyniki sugerują, że wysiłki władz publicznych w małych gospodarkach otwartych, mające na celu utrzymanie kanału transmisji kursu walutowego, mogą mieć decydujący wpływ na ich zdolność do utrzymania skuteczności polityki pieniężnej w okresie kryzysu.

Słowa kluczowe: mechanizm transmisji monetarnej, kryzys gospodarczy, mała gospodarka otwarta, strukturalne bayesowskie modele wektorowej autoregresji z przełączaniem Markowa (MSBSVAR)