The relationship between monetary and financial stability: Evidence from Central and Eastern European countries

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Abstract. The academic literature and recent experience of international crisis converge to the idea that monetary stability is a necessary prerequisite, but not sufficient for ensuring financial stability. The purpose of this paper is to investigate the nexus between monetary stability and financial stability, in the experience of several Central and Eastern European countries (Bulgaria, Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania), during 2004M01-2012M02. Using a Vector Autoregressive model, we analyze the impact of monetary policy interest rate (proxy variable for monetary stability) upon the short term interest rates, exchange rates, share prices and loan to deposit ratio (proxy variables for financial stability). We want to test if key policy rate instrument is conducive to financial stability. The main findings of the paper emphasize that monetary policy interest rate is conducive to financial stability only in the case of Czech Republic and Poland, countries with a high degree of monetary policy autonomy. In the case of Bulgaria and Lithuania, the changes in European Central Bank (ECB) refinancing interest rate are not in accordance with specifically countries conditions. In Latvia, there are similarities between the monetary condition and the currency board strategy and, in Hungary and Romania, the interest rate instrument, used for inflation targeting, is not conducive to financial stability.

Keywords: monetary stability, financial stability, key interest rate, emerging markets, vector autoregressive model.

JEL Classification: C58, D53, E43
AMS Classification: 62M10, 91B82

1 Introduction

The role of central banks in ensuring and maintaining financial stability was reconsidered, after the negative profound implications of the international economic and financial crisis on the real economy. The academic literature converges to the idea that monetary stability is a necessary prerequisite, but not sufficient for ensuring financial stability.

The purpose of our paper is to analyze the nexus between monetary stability and financial stability, in the experience of euro area candidate countries (Bulgaria, Czech Republic, Latvia, Lithuania, Hungary, Poland, Romania), before and during the financial crisis from 2008. Using a Vector Autoregressive model, we analyze the impact of monetary policy interest rate (proxy variable for monetary stability) upon the short term interest rates, exchange rates, share prices and loan to deposit ratio (proxy variables for financial stability).

Our empirical results show that the impact of monetary policy interest rate on financial variables depends on country specific conditions.

The paper is organized as follows. The next section briefly surveys the major contributions of the literature review. Section 3 lays out the data and the methodology used. Section 4 evaluates the empirical results. Section 5 concludes.

2 Literature review

The academic literature dedicates numerous studies to the nexus between monetary policy and financial stability, but there is still no clear consensus whether there are trade-offs or synergies between them. Assenmacher-Wesche and Gerlach [2] and Hunter et al. [8] argue that an explicit and proactive response of the monetary authorities to the financial imbalances is neither desirable nor feasible. On the other hand, Manolescu [13], Albulescu [1], Vinals [14] and Ingves [9] show that the potential costs of financial instability are large enough to justify a proactive approach of monetary policy.

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The major challenge comes from the fact that financial stability is a multidimensional concept and there is no widely accepted definition or a standard measurement framework. As opposed to monetary stability which is a clearly defined objective, Albulescu [1] states that financial stability may include, but it is not limited to a numerical objective.

In this paper, financial stability is defined in terms of changes in the structure of interest rates, exchange rate, share prices and bank loan-deposit ratio. Various authors have examined the impact of monetary policy via key interest rate on financial variables. From the empirical standpoint, the impact of monetary policy on key macroeconomic variables is analyzed within Vector Autoregressive (VAR) approach, using constraints and impulse response analysis. For example, Granville and Mallick [6] examine, in the experience of EMU between 1994 and 2008 the response of the term structure of interest rates, share prices, exchange rates, property price inflation and the deposit-loan ratio to changes in the consumer price level and ECB policy rate and they they found that there is a pro-cyclical relationship between monetary and financial stability in the long run. Honda and Kuroki [7] investigate the effects of changes in the policy target variable on stock prices and the term structure of interest rates in Japan and find that changes in the surprise component of the target variable significantly affect both intermediate-term and long-term interest rates. Moreover, they find an inverse relationship between the target rate and stock prices. Also, Ioannidis and Kontonikas [10], Bjorland and Leitemo [3], Li et al. [11] show that an unexpected increase in key interest rate drop share prices down, in developed countries. On the other hand, the impact of stock returns on monetary policy decisions has not received special attention from an empirical standpoint.

Much less, hovewer, has been written about the optimal monetary instrument to maintain financial stability. Goodhart et al. [5] assess the choice between adopting a monetary base or an interest rate setting instrument for prudential purposes. The authors suggest that the interest rate instrument is preferable, since during times of a panic or financial crisis the central bank automatically satisfies the increased demand for money.

3 Data and Methodology

The impact of monetary policy on financial variables is analyzed within the VAR framework, in order to capture the dynamic interactions. We want to test if the key policy rate used for monetary stability is conducive to financial stability in the experience of several Central and Eastern European Countries: Bulgaria, Czech Republic, Hungary, Latvia, Lithuania, Poland and Romania.

3.1 Data

For each country, a five dimensional VAR model is defined with monetary policy interest rate, short term interest rate-3 months, log of exchange rate measured as local currency per EURO, log of share prices and loan to deposit ratio for the banking system. Particularly, for Bulgaria and Lithuania, we took the ECB refinancing interest rate, due to their currency board monetary policy strategy, which implies the lack of controlled monetary instruments. The monetary policy interest rate is the main rate established by the central bank for the primary instrument of monetary policy, around which fluctuates the overnight market interest rate.

We have selected a proxy variable for the main markets which incur risks that may affect the stability of the domestic financial system in selected countries, as follows:

- short-term interest rate for the money market. A prudent monetary policy stance try to bring money market rates to normal levels in order to consolidate the favorable conditions for the sustainable resumption of lending to the private sector and economic rebound. If the short term interest rate appears to be disconnected from the key interest rate, this is a useful insight of a potential imbalance in the financial system.
- exchange rate measured as local currency per EURO for foreign exchange market. The exchange rate stability plays an important role in developing foreign investments and minimizes the currency risk of debtors. The negative comovement between key interest rate and exchange rate is desirable under a monetary policy shock. An exogenous interest rate increase by the central bank which does not lead to an appreciation of the local currency denotes an imbalance in the financial system.
- share prices for capital market. The speculative bubbles of asset prices may degenerate into a financial crisis. From the perspective of a central bank, an unexpected increase in key interest rate should drives share prices down.
- loan to deposit ratio for banking market. A credit boom which it is not accompanied by an increase in the level of deposits (which reflects the confidence in national currency) indicates a potential imbalance in the financial system and the fact that households and companies face the problem of informational asymmetry.

Therefore, a positive monetary policy shock should leads to a decrease in loan to deposit ratio for the banking system.

Monthly time series data ranging from 2004M01 to 2012M02 have been used. We divide the period analyzed in two subperiods as follows: 2004M01- 2008M07 and 2008M08- 2012M02 in order to investigate the impact of monetary policy interest rate on financial variables mentioned above during the financial crisis.

All series are provided by the IMF-IFS statistics (via Datastream) and the precise Datastream mnemonics are available on request.

3.2 Methodology

Let Y_t be a VAR model of order p with the following form:

$$\mathbf{Y_t = \upsilon + A_1 Y_{t-1} + ... + A_p Y_{t-p} + u_t}, \tag{1}$$

where Y_t is a (K*1) vector of endogenous variables, ν is a K*1 vectors of intercepts, A_i are the (K*K) fixed VAR coefficient matrices and $u_t=(u_{1t},...,u_{kt})'$ is an unobservable error term. It is assumed to be a zero-mean independent white noise process with time-invariant, positive definite covariance matrix $E(utut')=\sum u$. K is the number of time series variables and it is equal to 5: monetary policy interest rate, money market interest rate- 3 month, log of exchange rate, log of share prices and loan to deposit ratio for the banking system, computed as follows:

$$\mathbf{Loan\_to\_deposit\_ratio_j = Total\_loans_j \Big/ Total\_deposits_j * 100} \tag{2}$$

where j= Bulgaria, Czech Republic, Hungary, Latvia, Lithuania, Poland and Romania.

The process is stable if

$$\mathbf{det(I_k - A_1 z - ... - A_p z^p) \neq 0, \ for\ |z| \leq 1} \tag{3}$$

which means that the polynomial defined by the determinant of the autoregressive operator has no roots in and on the complex unit circle.

A situation of special interest arises if some of the variables taken into consideration are driven by a common stochastic trend. We have tested the number of cointegrating relationships by using the maximum likelihood methodology of Johansen and we have performed the cointegration test based on all pairs of series, before turning to the five dimensional system, because the cointegration rank test tend to have relatively low power when it is applied to higher dimensional system.

If cointegrating relations are present, the VAR form is not the most convenient model setup and, therefore, we consider specific parameterizations that support the analysis of the cointegration structure. In this case, Vector Error Correction model (VECM) with the following standard representation:

$$\mathbf{\Delta Y_t = \Pi Y_{t-1} + \Gamma_1 \Delta Y_{t-1} + ... + \Gamma_{p-1} \Delta Y_{t-p+1} + u_t} \tag{4}$$

is more convenient, where

$$\mathbf{\Pi = -(I_k - A_1 - ... - A_p)} \tag{5}$$

$$\mathbf{\Gamma_i = -(A_{i+1} + ... + A_p), \quad for\ i=1,...,p-1}. \tag{6}$$

The VECM is obtained from the levels VAR form by subtracting Y_{t-1} from both sides and rearranging terms. $\prod Y_{t-1}$ is the only one that includes I(1) variables and must also be I(0). Thus, it contains the cointegrating relation. The $\Gamma_1,..., \Gamma_{p-1}$ are often referred to as short run parameters and $\prod Y_{t-1}$ is sometimes called the long term part.

Against the background that the variables may be cointegrated, we follow the standard practice in this line of the literature and specify VAR models for the levels of the variables. Brüggemann and Balabanova [4] state that this fact avoids the false cancelation of long-run relationship between the variables.

For checking if the selected VAR model or VECM provides the best representation of the time series set, we have tested against the residual autocorrelation, nonnormality, ARCH effects and parameter instability.

4 Empirical results

The unit root analysis, according to Augmented Dickey-Fuller (ADF) and Philips-Perron tests, indicates that the unit root hypothesis cannot be rejected for the all the considered time series and that most of them can be characterized as integrated of order 1, I(1).

Results in our estimation (table 1) confirm a direct relationship between monetary policy interest rate and short term market interest rates in all countries, before and after the financial crisis, except Bulgaria where, during 2004-2008M07, there is an inverse relationship between these two variables. This means that, before the financial crisis, domestic interest rate was disconnected from the ECB interest rate in the short run. Contrary to the results for Bulgaria, in Lithuania, domestic short term interest rate track closely the ECB interest rate, which offer some insights that the velocity of the convergence process, taking into consideration the anchor interest rate value, is greater in Lithuania compare to Bulgaria.

The empirical results show a significant relationship between key interest rate and exchange rate in Czech Republic, Poland, Romania during 2004M01 and 2008M07, meaning that an increase in key policy rate leads to the appreciation of local currencies (CZK, PLN, RON) against the single european currency. Taking into consideration the second subperiod, we find an inverse significant nexus between these two variables only in the case of Poland and Czech Republic, according to traditional macroeconomic theory. Also, in the second subperiod, there we found no significant relationship between monetary policy interest rate and exchange rate in Hungary and Romania. Note that the currency board strategy implies that the exchange rate of BGN and LTL against EURO is constant, therefore, from an empirical standpoint, the analysis has no coherent interpretation. Bulgaria opted for a tight peg against the single currency and Lithuania, by joining Exchange Rate Mechanism II (ERM II), in 2004, retains a stable exchange rate of the litas against the anchor (EUR). Moreover, Latvia adopted a fixed peg on the SDR, and, in terms of exchange rate regime, Minea and Rault [12] show that there are similarities with currency board. As litas, the Latvian lats was included in ERM II. For these countries, the exchange rate enters in the model as exogenous variable.

The empirical results show that the degree of capital market development influences the impact of key interest rate on stock prices. Therefore, we find an inverse significant relationship between monetary policy interest rate and stock market indices, during the whole sample, only in the case of Poland and Czech Republic. Taking into consideration the first period, there we found a direct relationship between the above mentioned variables in Lithuania, which means that ECB interest rate was not an efficient instrument of intervention for mitigating the excessive accumulation of financial imbalances before the financial crisis. In the aftermath of the financial crisis, we remark an improvement of interest rate as instrument of intervention on Latvian and Lithuanian stock market indices. An increase with one unit of key interest rate leads to a decrease of stock prices with 3.013155 and 5.849623 in Latvia and, respectively Lithuania, at a significance level of 5%. For Bulgaria, Romania and Hungary, there we found no significant nexus between these two variables at any degree of freedom, neither before, nor after the financial crisis.

Country	Financial variables	Log of Index 2004M01-2008M07		Log of Index 2008M08-2012M02	
		Coefficient	t-Statistic	Coefficient	t-Statistic
Czech Republic	Interbank rate 3 Month	0.514442	[3.35492]*	0.431099	[-3.18026]*
	Exchange rate CZK/EUR	-1.239145	[-2.37053]*	-1.738963	[3.10867]*
	Prague Stock Exchange Index	-4.885486	[-1.68979]*	-12.70421	[-1.39338]**
	Loan to Deposit Ratio	-80.13602	[-2.69697]*	-27.47611	[-1.47720]**
Bulgaria	Interbank Rate 3 Month	-0.729257	[-1.66371]**	0.773021	[2.90507]*
	Exchange rate BGN/EUR	N/A	N/A	N/A	N/A
	Sofia Stock Exchange index	-9.212778	[-0.22531]	5.289994	[0.64772]
	Loan to Deposit Ratio	-3768.237	[-1.77916]*	584.6438	[2.28306]*
Latvia	Interbank rate 3Month	0.020782	[2.03463]*	0.690576	[1.30260]**
	Exchange rate LVL/EUR	N/A	N/A	N/A	N/A
	Riga Stock Exchange Index	4.415330	[0.99734]	-3.013155	[-2.70268]*
	Loan to Deposit Ratio	-4.913834	[-1.85268]*	2.769160	[1.96383]*
Lithuania	Interbank rate 3 Month	0.424281	[1.98675]*	0.560453	[2.75884]*
	Exchange rate LTL/EUR	N/A	N/A	N/A	N/A

	Vilnius Stock Exchange Index	12.55470	[3.88781]*	-5.849623	[-3.35270]*
	Loan to Deposit Ratio	2.748612	[1.21394]	2.377241	[2.90705]*
	Interbank rate 3 Month	0.382162	[1.57901]**	0.567629	[-2.41943]*
Hungary	Exchange rate HUF/EUR	-4.074477	[-1.24701]	1.984404	[0.56159]
	Budapest Stock index	2.755473	[0.55919]	-2.177802	[-0.47794]
	Loan to Deposit Ratio	9.616931	[0.45135]	-1.701803	[-0.53746]
	Interbank rate 3 Month	0.729278	[4.57557]*	0.480941	[3.47035]*
Poland	Exchange rate PLN/EUR	-0.203040	[-2.96227]*	-0.500823	[-2.82832]*
	Warsaw Stock Exchange Index	-1.842568	[1.31971]**	-7.24402	[2.62834]*
	Loan to Deposit Ratio	-0.156886	[-2.32585]*	-0.241989	[-1.74534]*
	Interbank rate 3 Month	0.243017	[1.56980]**	1.629858	[-2.09022]*
	Exchange rate RON/EUR	-0.004965	[-1.51555]**	-0.000817	[-0.01943]
Romania	Bucharest Exchange Trading Index	0.088034	[0.04350]	-3.695464	[-0.67651]
	Loan to Deposit Ratio	0.408619	[0.75130]	2.954762	[1.80694]*

Notes: *significance level 5%, **significance level 10%

Table 1 Summary of VAR/VECM outcomes

Our empirical analysis regarding the impact of monetary policy on loan to deposit ratio shows a significant inverse relationship between these two variables in Czech Republic, Bulgaria, Latvia and Poland during 2004-2008M07, which means that key interest rate was an efficient instrument of intervention in mitigating the excessive credit growth. Although, the banking system is the core of the financial system, like in the mentioned above countries, for Romania, Hungary and Lithuania, there we found no significant nexus between the variables. These may due to the fact that the presence of foreign capital banks limits the efficiency of monetary policy. Taking into consideration the second subperiod, we find, also, an inverse relationship between key interest rate and loan to deposit ratio in the case of Czech Republic and Poland. Our results suggest that restrictive monetary conditions promote risk-taking among banks in Bulgaria, Latvia, Lithuania and Romania, where an increase in interest rate leads to a raise of loan to deposit ratio. This fact offers some insights that, when interest rate is not controlled by the national central bank, households and companies face the problem of informational asymmetry.

From historical perspective, interest rates were very low during the last years and liquidity trap limited the monetary policy efficiency in selected countries.

The only potential models defect is nonnormality for the residuals of the interest rate equation. The fact that residuals are not normally distributed is not surprising and is not necessarily a signal of inadequate modeling. The main caveat of our analysis is the fact that VAR/VECM models contain many parameters and with short samples, but the start of the estimation sample is governed by data availability.

5 Conclusions

Our paper investigates the nexus between monetary stability and financial stability, in the experience of several Central and Eastern European countries (Bulgaria, Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania), before and after the financial crisis. Using a Vector Autoregressive model, we analyzed the impact of monetary policy interest rate (proxy variable for monetary stability) upon the short term interest rates, exchange rates, share prices, and loan to deposit ratio (proxy variables for financial stability).

Our empirical results suggest the following:

- in Czech Republic and Poland, countries with a high degree of monetary policy autonomy, the key interest rate instrument used for inflation targeting is conducive to financial stability;
- in Bulgaria and Lithuania, countries which lost their monetary policy autonomy, the changes in ECB refinancing interest rate are not in accordance with specifically domestic conditions. We found evidences that before the financial crisis, domestic interest rate in Bulgaria was disconnected from the ECB interest rate in the short run. Our results offers some insights that, when interest rate is not controlled by the national central bank, households and companies face the problem of informational asymmetry. Also, the ECB interest rate is not used accordingly to stock market conditions. Nevertheless, we find some insights that the velocity of the convergence process, taking into consideration the anchor interest rate value, is greater in Lithuania compare

to Bulgaria. Moreover, we remark an improvement of interest rate as instrument of intervention on Lithuanian stock prices, in the aftermath of the financial crisis;

- in Latvia, there are similarities between the monetary condition and the currency board strategy;
- in Hungary and Romania, the interest rate instrument used for inflation targeting is not conducive to financial stability. For Hungary, except the short term interest rate, there we found no significant nexus between key interest rate and the other financial variables, at any degree of freedom, nor before, neither after the financial crisis. In the case of Romania, we found no significant relationship nor between key interest rate and stock prices during the whole period neither between key interest rate and exchange rate after September 2008. Moreover, the restrictive monetary conditions promote risk-taking among Romanian banks. Achieving simultaneous monetary and financial stability calls for refinements of the current monetary and prudential policy frameworks in Hungary and Romania.

Future research is needed to complete our results. A first development is impulse response analysis, under the assumptions that structural shocks are orthogonal. A second development should give interest to the external economic developments in the analysis of the efficiency of monetary policy in selected CEE countries.

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