sciendo

South East European Journal of Economics and Business
Volume 17 (2) 2022, 67-82
DOI: 10.2478/jeb-2022-0015

EVALUATING MONETARY POLICY EFFECTIVENESS IN NORTH MACEDONIA: EVIDENCE FROM A BAYESIAN FAVAR FRAMEWORK

Magdalena Petrovska, Jasna Tonovska, Miso Nikolov, Artan Sulejmani

Abstract

This paper has adopted a Bayesian FAVAR approach to examine the monetary transmission mechanism in North Macedonia. The model is based on a broad data set that encompasses 140 monthly time series spanning between January 2010 and January 2019. In particular, the impact of policy on bank portfolio variables, and the impact of policy on economic activity variables have been evaluated. Our findings show that monetary tightening, causes a fall in output, inflation rate, employment, bank lending, the stock of government securities held by banks, and equity prices. On the other hand, it increases short-term money market rates, lending rates, deposits, and only in the immediate aftermath of the key policy rate rise, the share of non-performing loans in the loan portfolio. The study is expected to provide useful input to monetary policy implementation in North Macedonia. The study as well enriches the literature in this domain by discussing the challenges facing monetary authorities of small open economies with fixed exchange rate regimes in understanding how their policy instrument work through the economy.

JEL Classification: *E52, E47*

Keywords: *Monetary transmission mechanism, FAVAR, Bayesian estimation, Monetary policy*

Magdalena Petrovska (corresponding author)
Senior Advisor
Monetary Policy and Research Department
National Bank of the Republic of North Macedonia
Blvd Kuzman Josifovski Pitu 1; 1000 Skopje
Republic of North Macedonia
E-mail: petrovskam@nbrm.mk
ORCID ID: 0000-0001-5939-7987

Jasna Tonovska*
Teaching and research assistant
Department of Foreign Trade
Faculty of Economics – Skopje
Ss. Cyril and Methodius University in Skopje
Republic of North Macedonia
E-mail: jasna.tonovska@eccf.ukim.edu.mk
ORCID ID: 0000-0002-8150-7633

Miso Nikolov*
Internal Auditor
IUTE Credit Macedonia
Republic of North Macedonia
E-mail: misho.nikolov@iutecredit.mk

Artan Sulejmani
Analyst
Monetary Policy and Research Department
National Bank of the Republic of North Macedonia
Republic of North Macedonia
E-mail: sulejmania@nbrm.mk
ORCID ID: 0000-0001-6011-8834

1. Introduction

Understanding the monetary transmission mechanism in developing countries is rather challenging.

A fundamental consideration in the conduct of monetary policy is for central banks to develop robust estimates of the speed, direction, and relative strength of transmission of their policy actions. This is a notably complex task in developing countries where financial markets are shallow and underdeveloped, the economy is undergoing structural change and macroeconomic data limitations in terms of their completeness, timeliness, and accuracy are widespread. Moreover, the more extensive reliance on the remittance inflow in the less developed economies can also influence monetary transmission channels, thus eventually affecting the macroeconomic implications of monetary policy reactions (for more insight on the role of remittances on economic growth in SEE countries please refer to Bucevska (2022).

North Macedonia's monetary policy framework is centered on managing the exchange rate, with price stability as the primary objective. The monetary authority stands ready to sell/purchase foreign exchange in the FX market to maintain the exchange rate at its pre-announced level. By modulating the interest rate policy, and hence the amount of liquidity in the banking system, as operational targets, the National Bank strives to defend the fixed parity. The exchange rate serves as the nominal anchor or intermediate target of monetary policy.

Monetary policy implementation under an exchange rate peg as a commitment mechanism to achieve price stability is, nonetheless, more complex than a simple reaction in conformity with a certain monetary policy rule: the authorities need to not only manage the interest rate differential and close the inflation gap with the anchor country. They also must take into account the level of international reserves that are considered supportive of the credibility of the peg exchange rate arrangement (El Hamiani Khatat et al. 2020). The exchange rate targeting countries may face some operational and policy challenges, including the necessity for supportive fiscal policy, and a strengthened and coherent monetary policy framework (see, for instance, Mance et al. 2015) for an in-depth discussion on this particular aspect for the case of Croatia), the optimal choice of monetary policy reaction function, development, and implementation of sound strategies on managing interest rate and exchange rate and selection of liquidity management framework (El Hamiani Khatat et al. 2020).

This paper aims at observing the monetary transmission mechanism through the link between monetary policy instruments under the direct control of the central bank—i.e. the key policy interest rate—and the ultimate economic outcomes it is seeking to influence, typically economic activity and inflation.

The interest rate channel of monetary transmission suggests that central banks use their leverage over nominal, short-term interest rates, to affect the cost of capital, and consequently, purchases of durable goods and firm investments. Assumed short-run price stickiness implies that short-term interest rate changes influence the real interest rate. In turn, changes in the real interest rate strike firm investment and household spending decisions on durable goods. As a consequence, the level of aggregate demand and final output are both affected.

Central banks actively monitor a large set of macroeconomic time series. Therefore, monetary policy decisions are based on the information contained in not only a few key variables but many economic aggregates. In other words, the central banks set interest rates in a "data-rich environment" (Mönch 2005).

Against this background, Bernanke, Boivin, and Eliasz (2005) suggest coupling the benefits of factor analysis and structural VAR analysis by estimating a joint vector-autoregression of factors extracted from a large set of time series and perfectly observable economic variables such as the policy rate. They find their approach, which they label "factor-augmented VAR (FAVAR)" to be a practical choice for adequately identifying the monetary policy transmission mechanism.

Not only do FAVARs allow the proper identification of monetary policy shocks, but they also have other advantages over standard VARs which, intending to maintain the degrees of freedom, usually contain only a small bunch of variables. Namely, although a given notion can be approximated by many variables, it is generally not completely obvious which variable exactly should be employed as a measure of, for instance, output or inflation. Hence, by applying factor analysis to numerous proxies one can eliminate measurement error. Moreover, impulse response functions can be calculated for any variable in the informational data set.

This study is the first to research the monetary transmission mechanism in North Macedonia using fully-fledged FAVAR. The employed data set encompasses almost all relevant macroeconomic indicators (for more details, please refer to Table A.1. in the Appendix). Ultimately, the estimated factors are a proxy for the macroeconomic fundamentals. Therefore, this paper is assessing the impact of monetary policy on a subset of selected variables, while considering the broader macroeconomic environment.

Our findings show that monetary tightening

causes a fall in output, inflation rate, employment, bank lending, the stock of government securities held by banks, and equity prices. On the other hand, it increases short-term money market rates, lending rates, deposits, and only in the immediate aftermath of the key policy rate rise, the share of non-performing loans in the loan portfolio.

The remainder of the paper is structured as follows. The Literature Review section offers a comprehensive analysis of relevant literature on the subject. The Data and Methodology sections provide a perspective on the used data set, as well as a brief intro to Bernanke, Boivin and Eliasz (2005) approach used in this research. Results are presented and discussed with reference to the aim of the study in the subsequent section. The robustness check section provides some insight related to the alternative model specifications. The last section concludes the paper with final remarks and policy implications.

2. Literature review

Monetary transmission materializes along multiple channels: directly through the effect of interest rates on private consumption and investment decisions; indirectly through the impact of exchange rates on import prices and external competitiveness; through the volume and price of credit from the financial system; through asset price adjustments and wealth effects; and inflation expectations of the private sector (Li et al. 2016).

The propagation of monetary policy signals via these channels depends upon various factors, including financial markets development, the coherence and credibility of the monetary policy regime, and the uncertainties in the domestic and external economic environment (Li et al. 2016)

In what follows, we briefly synthesize the findings of selected empirical studies, which employ VAR methodology and its variants, including FAVAR models, to assess the operation of the interest rate channel of monetary policy. The rationale behind this is to achieve broader insight into the macroeconomic implications of monetary policy tightening cycles.

The interest rate channel of monetary policy transmission in advanced, as well as in emerging and developing countries is a widely exploited topic. On a sample of Euro area member countries, Mandler et al. (2016) use Bayesian vector autoregression (BVAR) with endogenous prior selection to model the dynamics of output, prices, and financial variables to an exogenous increase in the Eurosystem's monetary policy interest rate. In particular, the authors examine the cross-country disparities in monetary transmission across the "big-four" Euro-area countries (France, Germany, Italy, and Spain). To this end, they show that real output responds less negatively in Spain to monetary policy tightening than in the other three countries, while the reduction in the price level is weaker in Germany. In parallel, the findings point out that the rise in bond yields is stronger and more persistent in France and Germany compared to Italy and Spain.

Based on the global vector autoregressive model (GVAR), Georgiadis (2015) reports the existence of asymmetries in euro-area monetary policy transmission across individual Euro-area countries, attributable to the structural features of the economies, such as labor market rigidities and different industrial structures. Specifically, Euro area economies with a bigger proportion of aggregate output linked to sectors with interest rate-sensitive demand display a stronger transmission of monetary policy to real activity. Analogously, euro-area countries with more real wages and/or fewer unemployment rigidities are as well associated with stronger transmission of monetary policy to real activity.

Focusing specifically on the monetary policy transmission during financial crises, Jannsen et al. (2019) use panel VAR for twenty advanced economies to find that monetary policy shocks through the interest rate channel have significantly larger effects on output and prices during financial crises than during normal times. Based on different samples of emerging and developing countries, the SVAR models developed by Cevik and Teksoz (2012), Jain-Chandra and Unsal (2014), and Anwar and Nguyen (2018) confirm the effectiveness of the interest rate channel in transmitting monetary policy shocks to the real economy.

By employing VAR and vector error correction mechanism (VECM) methodology, Besimi et al. (2007) evaluate the monetary transmission operating in North Macedonia. The authors offer evidence for the functioning of multiple channels of monetary policy transmission: the Denar-Euro exchange rate, interest rate, money supply channel as well as currency substitution channel. The results show a weaker impact of interest rate changes on domestic prices, compared to the effects of exchange rate and money supply changes. Moreover, the authors find that devaluation raises currency substitution, which in turn attenuates inflationary pressures, concluding that currency substitution should be factored into monetary policy design in small open economies with fixed exchange rate regimes.

FAVAR literature on monetary transmission for countries with a fixed exchange rate regime is rather scarce. For example, Ljubaj (2012) estimates a

factor-augmented vector error correction model (FAVEC) to determine the impact of monetary policy on household and corporate loans in Croatia, while taking into account the overall macroeconomic developments. The paper confirms the existence of a long-run relationship between household loans, the macroeconomic environment factor, and the monetary policy indicator. At the same time, no such relation was confirmed for corporate loans. Impulse response functions estimated based on the FAVEC model showed that a restrictive monetary policy shock leads to a decrease in household loans, while a positive shock in the macroeconomic environment factor, which generally represents an increase in overall economic activity, has a favorable impact on bank loans to households.

The study by Potjagailo (2016) implements FAVAR model to explore spillover effects from Euro area monetary policy over thirteen EU countries outside the Euro area. An expansionary Euro area monetary policy shock is found to raise production in most non-Euro area countries, whereas short-term interest rates and financial uncertainty decline. Spillovers on production are larger in non-Euro area economies with higher trade openness, whereas financial variables react to a higher extent in countries with higher financial integration. Regarding the exchange rate regime, countries with fixed exchange rates show stronger spillovers both in terms of production and interest rates.

Relatedly, our study contributes to thus far limited research on FAVAR analytical method that focuses on the interest rate channel of monetary policy in a small open economy with a fixed exchange rate regime like North Macedonia.

3. Data

Our data set consists of 140 monthly macroeconomic time series for North Macedonia. The data sources include the State Statistical Office, the National Bank of the Republic of North Macedonia, the Macedonian Stock Exchange, and the European Commission. The data spans from January 2010 to January 2019. The starting point of the data set reflects the time when a more pronounced structural transformation of the Macedonian economy began. Furthermore, the series that display seasonal variation were adequately adjusted. Also, when plausible, we performed a logarithmic transformation to the series to achieve linearity. Additionally, non-stationary series have been transformed by taking the first difference and thus making them stationary. Finally, all the series used to compute the factors were standardized to have mean zero and unit variance, since factor extraction might be impaired by the different units and scales.

Following Bernanke, Boivin and Eliasz (2005) procedure, the data set is divided into slow-moving and fast-moving variables. Slow-moving variables are those which respond with lags after a shock in monetary policy (like for instance, production, prices, etc.). On the other hand, fast-moving variables are contemporaneously responsive to monetary policy, (i.e. they are highly sensitive to policy shocks and news), and might be represented by interest rates, financial assets, and exchange rates. The classification of variables between each category is provided in Appendix A.

4. Methodology

The methodology discussed in this section is an adaptation from Bernanke, Boivin and Eliasz (2005). Our empirical application follows the so-called "one-step" (joint estimation) approach to the estimation of monetary FAVARs.

As was already discussed, in FAVAR models, the information contained in a large data set is summarized by a few variables called factors, which are incorporated into a VAR model. This enables us to enlarge the data set employed in standard VAR models, and generate the response of hundreds of variables to monetary policy innovations. Bernanke, Boivin, and Eliasz (2005) assume that the joint dynamics of (Ft, Yt) is given by the following equation:

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \phi(L) \begin{bmatrix} F_{t-1} \\ Y_{t-1} \end{bmatrix} + \mu_t \quad (1)$$

where $\phi(L)$ is a conformable lag polynomial of finite order d and the error term, μ_t, is mean zero with covariance matrix Σ. The vector Y_t contains M observable economic variables and the vector F_t represents K unobserved factors that are supposed to influence the economic variables. The factors can be thought of as unobservable concepts such as economic activity or investment climate, which cannot be represented by any observable macroeconomic series but instead several series of economic indicators. Subsequently, should the terms of $\phi(L)$ that relate Y_t to $F_{t\text{-}1}$ all be zero, then equation (1) would be reduced to a standard VAR in Y_t. If Y_t is related to the lagged factors then equation (1) will be referred to as a factor-augmented vector autoregression, or FAVAR.

Equation (1) cannot be estimated directly because the factors F_t are unobservable. However, if we interpret the factors as representing forces that potentially

affect many economic variables, we may hope to infer something about the factors from observations on a variety of economic time series. For concreteness, suppose that we have available a number of background, or "informational" time series, collectively denoted by the N × 1 vector Xt.

The number of time series N in Xt is thus supposed to be big, and may well be bigger than T, the number of periods. Bernanke, Boivin and Eliasz (2005) assume that the time series in Xt is linked to the unobservable factors Ft and the observable economic variables Yt by an equation in the following form:

$$X_t = \Lambda f F_t + \Lambda y Y_t + e_t \quad (2)$$

where Λf is a $N \times K$ matrix of factor loadings, Λy is $N \times M$ and e_t is a $N \times 1$ vector of error terms that are assumed to be mean zero but may display some small degree of cross-correlation depending on the estimation method (i.e. depending on whether estimation is by principal components or likelihood methods). Equation (2) express the idea that both Yt and Ft, which can be correlated, summarize the common forces that drive the dynamics of the noisy measures of Xt.

Furthermore, to estimate equations (1) and (2) jointly via likelihood methods, a transformation of the model into a state-space form is needed. Also, in this method, the factors are effectively identified by both the observation equation and the transition equation of the state-space model. The instrumental to identification here is to make an assumption that limits the channels by which the Y's contemporaneously affect the X's. To this end, the joint likelihood estimation only necessitates that the first K variables in the data set are chosen from the set of "slow-moving" variables and that the recursive structure is imposed in the transition equation. The employed identification scheme is elaborated by Bernanke, Boivin and Eliasz (2005) in a detailed manner.

Additionally, following Bernanke, Boivin and Eliasz (2005) we assume that the policy rate is the only observable factor, i.e. the only variable included in Y_t. In doing so, we treat the policy rate as a factor and interpret it as the monetary policy instrument. This is based on the presumption that monetary policy has a pervasive effect on the economy.

The likelihood-based method used by Bernanke, Boivin and Eliasz (2005) is fully parametric and computationally more demanding. Although in principle the estimation of equations (1) and (2) jointly by ML is possible, assuming independent normal errors, Bernanke, Boivin and Eliasz (2005) argue that it is infeasible in practice due to the irregular nature of the likelihood function and the very large dimensions of this model.

The method they instead propose was developed by Geman and Geman (1984), Gelman and Rubin (1992), and Carter and Kohn (1994), and its application to large dynamic factor models is discussed in Eliasz (2002). Bernanke, Boivin and Eliasz (2005) implement a multi-move version of the Gibbs sampler in which factors are sampled conditional on the most recent draws of the factors. This Bayesian approach is undertaken to circumvent the high-dimensionality problem of the model by approximating marginal likelihoods by empirical densities. More details about the estimation procedure can be found in the appendix of the working paper version of Bernanke, Boivin and Eliasz (2005).

5. Results and discussion

Our FAVAR model aims at examining how far-reaching the effects of monetary policy are. Figure 1 shows the responses of a selection of macroeconomic variables to an increase of 0.25 p.p. in the key policy rate and the corresponding 90% confidence intervals.

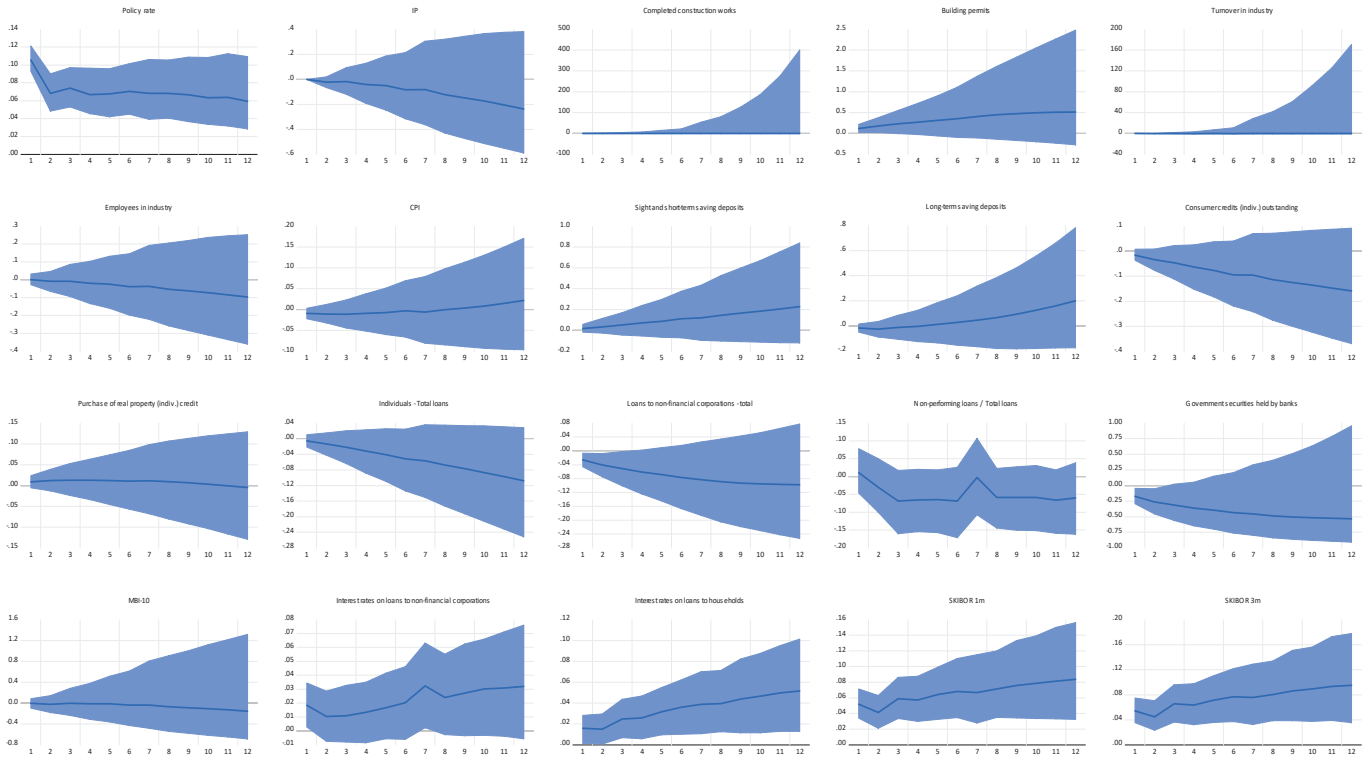
Briefly summarized, our results suggest that a tightening of monetary policy causes a fall in economic activity, employment, inflation rate, lending, the stock of government securities held by banks, and equity prices. On the other hand, the following increase: short-term money market rates (1M and 3M SKIBOR), lending rates, deposits, and only in the immediate aftermath of a monetary tightening, the share of non-performing loans in the loan portfolio.

To this end, apart from building permits, which follow a counter-intuitive pattern[1], impulse responses related to all other variables indicative of economic activity (i.e. industrial production; completed construction works; employment, and turnover in the industry) are not statistically significant, although they have signs in line with economic theory. Statistically, insignificant impulse responses could be a particular sample issue, especially having in mind the structural changes in the period under review and the underlying instability of factor loadings, which makes it difficult to come to more sound conclusions.

Next, the price puzzle is not present in our FAVAR model (meaning, it tends to produce results consistent with conventional wisdom). However, the impulse response function for the CPI inflation is not statistically significant, as well.

Proceeding further, Figure 1 provides the following explanations. For instance, the NPL ratio - its increase in the immediate aftermath of monetary tightening,

Figure 1. Impulse response functions of a bunch of economic activity and bank portfolio variables to a contractionary monetary policy shock (measured by a 0.25 p.p. increase in the 28-day CB bills interest rate), generated from the FAVAR model. The shaded area represents a 90% confidence band around the impulse response functions



in fact, a mathematical factuality, as the ratio itself is measured by non-performing loans (numerator) to total loans (denominator). As the latter decreases due to the subdued credit growth, the ratio levels up. But soon afterward, this ratio plunges into negative territory (i.e. after the initial worsening, it starts improving to some extent), suggesting the agent's ability to adjust their balance sheets.

Our findings show that promptly after the initial worsening of the NPL ratio, monetary tightening starts to work as a countercyclical tool to prevent the build-up of NPLs. This implies that across monetary tightening episodes, banks more credibly assess the quality of their assets. In other words, if anything, monetary tightening may be associated with reductions in NPLs as banks eventually become more inclined to consider a variety of options for refinancing and restructuring existing exposures. In parallel, the observed improvement of the NPL ratio, soon after its initial deterioration, might also be an indication that households and firms start rebalancing their balance sheets as well. In particular, higher borrowing costs might induce households and firms to gradually reduce leverage through the conventional intertemporal substitution effect. However, we must point out that the NPL ratio's reaction to monetary tightening is statistically insignificant.

Further, we find evidence that a tightening of monetary policy reduces the supply of bank credit (suggesting that the tightening of credit conditions—through higher rejection of loan applications, reduces the volume of new loans). However, statistically significant is solely the reaction of the total credits to non-financial corporations. In parallel, our results reveal an interesting dichotomy, firstly between, sight and short-term saving deposits on one hand and long-term saving deposits, on the other hand, and secondly between consumer loans on one hand and real estate loans for individuals, on the other hand. Hence, sight and short-term saving deposits increase immediately following monetary contraction, unlike long-term saving deposits that initially decrease as a reaction to a policy rate hike. Additionally, consumer loans decrease in response to monetary tightening, unlike the real estate loans for individuals that increase at first and then decline. However, none of these impulse-response functions are statistically significant.

Such seemingly counter-intuitive reactions observed in financial vehicles with longer maturities (i.e. long-term saving deposits and real estate loans

for individuals), is most probably an indication for separate dynamics of interest rates across the maturity spectrum. Namely, the dynamics of interest rates across different contract lengths depend on various other underlying factors such as prospects of economic growth, expectations regarding inflation and monetary policy, as well as risk preferences.

Another possible reason behind this could be the following. In the period under review, a massive shift towards both, longer-term saving and lending with fixed-interest rate arrangements are observed in banks' business practices in North Macedonia. Namely, in order to split the risk of monetary policy change with their customers, credit institutions offer implicit interest rate insurance to risk-averse borrowers. Hence, banks provide borrowers with fixed below-market rates during times of high market rates and get compensated when market rates fall below the initially provided fixed-rate (Gambacorta, 2004). Fixed below-market interest rates in the analyzed period are getting increasingly popular notably among the real estate loans to individuals in North Macedonia. Moreover, fixed interest rate deposits are also perceived by risk-averse individuals as an attractive investment avenue. To this end, the fixed interest rates guaranteed with certain long-term saving deposits, tend to be smaller compared with the variable returns of other financial vehicles. All these underlying factors (i.e. banks increasing orientation towards long-term businesses with households and firms) most probably make banks change these instruments' prices less frequently thus making the interest rate channel of the monetary policy less operational at the longer end of the maturity spectrum.

Furthermore, equities underperform during tight monetary policy periods. Namely, a monetary tightening lowers stock market valuation (Jarociński and Karadi 2018). The reasons are twofold: first, the present value of future cash flows declines due to the higher discount rate, which increases with both the higher real interest rates and the rising risk premia, and, second, a decline in the expected cash flows caused by the deteriorating outlook as a result of monetary tightening (Jarociński and Karadi 2018). Moreover, the unfaltering downward-sloping impulse response function of the MBI-10[2] might be an indication that investors have no confidence that the corporate earnings can absorb the impact of higher interest rates for a prolonged period around the policy announcement. However, this impulse response as well is not statistically significant.

Analogously, a drop in banks' holdings of government securities as a response to unexpected monetary tightening might to a large extent be perceived as a valuation/accounting effect, consistent with the finance theory. Namely, debt securities are inversely related to interest rates. Bond prices fall when the cost of borrowing money rises, and vice-versa. In North Macedonia, government securities pay a fixed interest rate. If interest rates rise, investors will no longer favor the lower fixed interest rate paid by a government bond, producing a decline in its price on a secondary market as a result. When interest rates rise, investors can obtain a better rate of return in other places, so the price of original bonds adjusts downward to yield at the current rate (i.e. investors would be prepared to buy on a secondary market a previously issued fixed coupon bond only if compensated by a higher yield/lower bond price). Therefore, monetary tightening reduces the market value of government securities, consequently reducing the nominal stock value of government securities held by banks. However, we must also point out that in general, the government securities holdings of commercial banks are subject to many other factors. Primarily it is banks' loan-government securities interest spread that largely accounts for the entire portfolio shift. Furthermore, the steepness in the term structure of the government securities could also have played some role. Also, the risk-weighted capital requirements may have influenced some banks' decisions to increase their holding of government securities. This impulse response function is statistically significant, but it should be taken with a reserve given that this particular channel of transmission is not that straightforward, i.e. a mix of possible factors is at play.

Finally, the employed interest rate variables (short-term money market rates as well as lending rates for both, non-financial institutions and households) display, with no exception, statistically significant, logical, and theory-implied impulse response paths.

6. Robustness check and limitations

A prominent practical issue to consider when using the FAVAR methodology is how many factors are needed to capture the information necessary to adequately model the effects of monetary policy (Bernanke, Boivin and Eliasz 2005). Therefore, we explored the sensitivity of the impulse response functions to an alternative number of factors. Hence, we estimated the corresponding FAVAR model with different number of factors to demonstrate how the inclusion of factors (i.e. information) can improve the results. To this end, we found that results are not robust to the use of more than three factors. Moreover, the FAVAR with one or two factors provides insensible

results too. We were experimenting with the number of lags included in the model, as well. With this regard, FAVAR with 7 lags produces economically and statistically the most reasonable impulse responses.

Regarding the number of lags, we employed lag orders of four to eight. We observed smaller overall scope of changes when the number of lags shifts from seven to eight as well as from seven to six as few impulse responses lose their significance. Next, we proceeded by increasing the number of factors up to five. Changing the number of factors to 4 or 5 does appear to change our results or interpretation qualitatively. This also applies to choosing 1 or 2 factors. So, the most crucial step of our analysis is to determine the number of factors to be included in our model. In general, the empirical literature does not (yet) generate a final solution to the determination of the number of factors. Therefore, as documented in Belke and Osowski. (2017), the ad hoc approach is most widely adopted by authors in choosing the number of factors (see, for example, Bernanke, Boivin and Eliasz (2005); Shibamoto, (2007), McCallum and Smets, (2007).

Overall, our benchmark specification (i.e. FAVAR with 3 factors and 7 lags) seems to provide a consistent and sensible measure of the effect of monetary policy. However, the sensitivity analysis introduced as a tool in the model validation process, suggests that the qualitative conclusions on the effect of monetary policy are altered by the use of both, the different number of factors, and the different number of lags.

In addition, in the period under review, the Macedonian economy has undergone a structural change. To this end, there is good reason to believe that particular methodological extensions to the employed approach that would allow for time variation in the coefficients and the variances of the shocks could be more suitable. However, even some more flexible specification for the transition equation (see. Mumtaz 2010) that accounts for the possibility of structural breaks in the dynamics that characterize the economy, may still not directly capture instability in the factor loadings. With these limitations in mind, the results should be taken as indicative, rather than precisely predictive.

Moreover, in this paper, we do not conduct the two-step estimation process, which could serve as an additional measure of robustness. It is important to note, that Bernanke, Boivin and Eliasz (2005) argue that although the two-step and one-step estimation methods yield slightly different responses for money aggregates and consumer price indexes, the overall point estimates of the responses are quite similar.

Lastly, although most studies argue that the FAVAR approach leads to better empirical estimates (Bernanke, Boivin and Eliasz 2005; Lombardi, Osbat and Schnatz 2010; Fernald, Spiegel and Swanson 2014) we still cannot exclude the possibility of a potential mismeasurement due to exclusion of certain series. In today's highly globalized World, central banks rely both on the country's economic state and on what is happening abroad. Variables such as the commodity price indices as well as the foreign interest rates may have a potential effect on monetary policy transmission. It may be particularly interesting to introduce foreign interest rates as exogenous policy shocks. This may constitute the object of future studies.

Against this backdrop, the current version of the FAVAR framework might be extended by the ECB key interest rate and the overall size of FX flows—related to current and capital account transactions, since the latter is the driver for arbitrage between the money and FX markets, in turn shaping the nature of monetary transmission (El Hamiani Khatat et al. 2020). By adding the FX flow to the framework, but also by adding certain global variables, such as the prices of food and energy commodities, the framework would become economically more consistent and flexible. Such an upgrade would enable the framework to cover a number of sources of shocks. Moreover, this type of extension will allow us to test the effect of the potential shocks on the FX flows, for example. FX flow is certainly part of the monetary policy reaction function in countries with a fixed exchange rate. The ability of the central bank to calibrate the interest rate to domestic conditions may be challenging, especially when FX reserves are low, and the economy is exposed to sizeable terms-of-trade shocks (El Hamiani Khatat et al. 2020).

Analogously, including especially the FX flow would be a great asset of this framework. With this regard, the current version of our research work corroborates with Potjagailo (2016), who analyzed the spillover effects from Euro area monetary policy across the EU, including the countries with fixed exchange rate regimes. Both studies lack the FX flow as a variable in the respective data set, so to this end, they share the same limitation.

In addition, when it comes to the prices of primary commodities, they are not explicitly included in the current version of the framework, but still, their impact is implicitly embedded through the movement of both, consumer and producer prices.

7. Conclusion

This study investigates the effectiveness of the transmission mechanism of interest rate policy in North Macedonia using the Bayesian Factor-Augmented Vector Autoregressive (FAVAR) approach launched by Bernanke, Boivin and Eliasz (2005). Moreover, this study fills the gap in the literature for North Macedonia as it assesses the effects of monetary policy conditioned on a richer information set. In parallel, the paper discusses the challenges facing monetary authorities of small open economies with fixed exchange rate regimes in understanding how their policy instruments work through the economy, thus contributing to the general knowledge base in this area.

The employed FAVAR generates responses of an extensive set of variables to monetary policy innovations, thus allowing for a more broad-based examination of the empirical plausibility of the model specification.

Our empirical application of the FAVAR methodology shows that a monetary tightening induces a fall in economic activity, inflation rate, employment, lending, the stock of government securities held by banks, and equity prices. On the other hand, the following increase: short-term money market rates, lending rates, deposits, and only in the immediate aftermath of a monetary tightening, the share of non-performing loans in the loan portfolio.

However, sensitivity analysis suggests that the qualitative conclusions on the effect of monetary policy are altered by the use of a different number of factors and lags. Moreover, some of the impulse responses are statistically insignificant. This might be a particular sample issue, notably having in mind the structural changes that occurred in the analyzed period and the underlying instability of factor loadings, which makes it unfeasible to come to more sound conclusions. Therefore, these results should be taken as indicative, rather than absolute and comprehensive.

In addition, we still cannot eliminate the possibility of a potential mismeasurement due to exclusion of certain series.

The findings corroborate with the empirical literature and economic logic, thus offering a more comprehensive view of the transmission mechanism and the effect of monetary policy on the economy of North Macedonia. Hence, the results could be of particular use and interest to the monetary policy authorities, during the creation and conduct of monetary policy.

Endnotes

1 The non-intuitive and statistically insignificant response of the number of building permits can be associated with the dominance of some discretionary factors. Namely, several big city councils introduced a temporary moratorium on the approval of new construction works. The purpose of the moratorium (which in some cases exceeds 2 years period) is to allow the cities time to further study the issues surrounding the soundness of the urban design.

2 Macedonian market capitalization-weighted stock market index that includes the 10 most actively traded shares.

Notes

* The views expressed in this paper are those of the authors and do not necessarily represent the views of the National Bank of the Republic of North Macedonia

* Jasna Tonovska is former National Bank of the Republic of North Macedonia employee

* Miso Nikolov is former National Bank of the Republic of North Macedonia employee

References

Anwar, S. and Nguyen, L. P. 2018. Channels of monetary policy transmission in Vietnam. Journal of Policy Modeling 40 (4): 709-729.

Barigozzi, M., Conti, A. M. and Luciani, M. 2014. Do Euro Area Countries Respond Asymmetrically to the Common Monetary Policy? Oxford bulletin of economics and statistics 76 (5): 693–714.

Belke, A. and Rees, A. 2014. Globalisation and monetary policy—A FAVAR analysis for the G7 and the Eurozone. The North American Journal of Economics and Finance 29: 306-321.

Belke, A. and Osowski, T. 2018. International effects of euro area versus US policy uncertainty: A FAVAR approach. Economic Inquiry 57 (1): 453–481.

Belviso, F. and Milani, F. 2006. Structural factor-augmented VARs (SFAVARs) and the effects of monetary policy. Topics in Macroeconomics 6 (3).

Benkovskis, K., Bessonovs, A., Feldkircher, M. and Wörz, J. 2011. The transmission of euro area monetary shocks to the Czech Republic, Poland and Hungary: evidence from a FAVAR model. Focus on European Economic Integration, 3: 8-36.

Berggren, E. 2017. The estimation of factors in FAVAR models. Lund University

Bernanke, B. S., Boivin, J. and Eliasz, P. 2005. Measuring the Effects of Monetary Policy: A Factor-Augmented Vector Autoregressive (FAVAR) Approach. The Quarterly journal of economics 120 (1): 387–422.

Besimi, F., Pugh, G. T., and Adnett, N. J. 2006. The monetary transmission mechanism in Macedonia: implications for monetary policy. Centre for Research on Emerging Economies Working Paper No. 02-2006.

Blaes, B. 2009. Money and monetary policy transmission in the euro area: evidence from FAVAR- and VAR approaches. Discussion paper / Deutsche Bundesbank Series 1.

Boivin, J. and Giannoni, M. 2008. Global forces and monetary policy effectiveness. National Bureau of Economic Research No. w13736.

Bucevska, V. 2022. Impact of remittances on economic growth: Empirical evidence from South-East European countries. South East European Journal of Economics and Business Volume 17 (1): 79-94.

Cevik, S., and Teksoz, K. (2013). Lost in transmission? The effectiveness of monetary policy transmission channels in the GCC countries. Middle East Development Journal 5(3): 1350018-1.

Charnavoki, V. and Dolado, J. J. 2014. The Effects of Global Shocks on Small Commodity-Exporting Economies: Lessons from Canada. American economic journal: Macroeconomics 6 (2): 207–237.

Carter, C. K. and Kohn, R. 1994. On Gibbs sampling for state space models. Biometrika 81 (3): 541–553.

Cerulli, G., D'Apice, V., Fiordelisi, F. and Masala, F. 2017. Non-Performing Loans in Europe: The Role of Systematic and Idiosyncratic Factors. Banking Review Policy Journal 3 (5): 34-59.

Eickmeier, S. and Breitung, J. 2006. How synchronized are new EU member states with the euro area? Evidence from a structural factor model. Journal of Comparative Economics 34 (3): 538–563.

El Hamiani Khatat, M., Buessings-Loercks, M. and Fleuriet, V. 2020. Monetary Policy Under an Exchange Rate Anchor. IMF Working Paper No. 20/180.

Eliasz, P. 2002. Likelihood-Based Inference in Large Dynamic Factor Models Using Gibbs Sampling. Princeton University

Gambacorta, L. 2008. How do banks set interest rates? European Economic Review 52 (5): 792–819.

Geman, S. and Geman, D. 2010. Stochastic relaxation, Gibbs distributions and the Bayesian restoration of images. Journal of applied statistics 20 (5-6): 25–62.

Gelman, A. and Rubin, D. B. 1992. A Single Sequence from the Gibbs Sampler Gives a False Sense of Security. Bayesian statistics 4 (1): 625-631.

Georgiadis, G. 2015. Examining asymmetries in the transmission of monetary policy in the euro area: Evidence from a mixed cross-section global VAR model. European Economic Review 75 (C): 195-215.

Geweke, J. 1977. The Dynamic Factor Analysis of Economic Time Series. Latent Variables in Socio-Economic Models.

Mumtaz, H. and Surico, P. 2009. The Transmission of International Shocks: A Factor-Augmented VAR Approach. Journal of Money, Credit and Banking 41 (1): 71–100.

Iddrisu, A. A. and Alagidede, I. P. 2020. Revisiting interest rate and lending channels of monetary policy transmission in the light of theoretical prescriptions. Central Bank Review 20 (4): 183-192.

Jain-Chandra, S. and Unsal, D. F. 2014. The effectiveness of monetary policy transmission under capital inflows: evidence from Asia. Borsa Istanbul Review 14: 96-103.

Jannsen, N., Potjagailo, G. and Wolters, M. H. 2019. Monetary Policy during Financial Crises: Is the Transmission Mechanism Impaired?. International Journal of Central Banking 15 (4): 81-126.

Jarociński, M. and Karadi, P. 2020. Deconstructing Monetary Policy Surprises— The Role of Information Shocks. American Economic Journal: Macroeconomics 12 (2): 1–43.

Ji, J. 2017. Monetary Policy Transmission in Canada: A FAVAR Analysis. Department of Economics of the University of Ottawa.

Kapuściński, M. 2018. How far does monetary policy reach? Evidence from factor-augmented vector autoregressions for Poland. Bank i Kredyt 49 (3): 191-216.

Li, B. G., Adam, C. S. and Berg, A. 2016. Q&A: Seven Questions on Estimating the Monetary Transmission Mechanism in Low-Income Countries. IMF Research Bulletin 2016 (001).

Ljubaj, I. 2012. Estimating the Impact of Monetary Policy on Household and Corporate Loans: a FAVEC Approach. The Croatian National Bank Working Papers 34.

Lombardi, M. J., Osbat, C. and Schnatz, B. 2012. Global commodity cycles and linkages: a FAVAR approach. Empirical Economics 43 (2): 651-670.

Mance, D., Žiković, S. and Mance, D. 2015. Econometric Analysis of Croatia's Proclaimed Foreign Exchange Rate. The South East European Journal of Economics and Business 10 (1).

Mandler, M., Scharnagl, M. and Volz, U. 2016. Heterogeneity in Euro-Area Monetary Policy Transmission: Results from a Large Multi-Country BVAR Model. Deutsche Bundesbank Discussion Paper No. 03/2016.

McCallum, A. H. and Smets, F. 2007. Real Wages and Monetary Policy Transmission in the Euro Area. Kiel Working Paper No. 1360

Moench, E. 2008. Forecasting the yield curve in a data-rich environment: A no-arbitrage factor-augmented VAR approach. Journal of Econometrics 146 (1): 26-43.

Mumtaz, H. 2010. Evolving UK macroeconomic dynamics: a time-varying factor augmented VAR. Bank of England Working Paper No. 386

Potjagailo, G. 2016. Spillover effects from euro area monetary policy across the EU: A factor-augmented VAR approach. Kiel Institute for the World Economy Working Paper 2033

Sargent, T. J. and Sims, C. A. 1977. Business cycle modeling without pretending to have too much a priori economic theory. New methods in business cycle research 1: 145-168.

Senbet, D. 2016. Measuring the Channels of Monetary Policy Transmission: A Factor-Augmented Vector Autoregressive (FAVAR) Approach. Journal of Central Banking Theory and Practice 5 (2): 5–40.

Shibamoto, M. 2007. An Analysis of Monetary Policy Shocks in Japan: A Factor Augmented Vector Autoregressive Approach. Japanese Economic Review 58 (4): 484-503.

Sims, C. A. 1980. Macroeconomics and Reality. Econometrica 48: 1–48.

Sims, C.A. 1992. Interpreting the macroeconomic time series facts: The effects of monetary policy. European economic review 36 (5): 975–1000.

Stock, J. H. and Watson, M. W. 1999. Forecasting inflation. Journal of monetary economics 44 (2): 293–335.

Tran, N. 2018. The long-run analysis of monetary policy transmission channels on inflation: a VECM approach. Journal of the Asia Pacific Economy 23 (1): 17-30.

APPENDIX

The Appendix provides a brief description of the data, whether it is assumed to be a slow (S) or a fast (F) moving variable and the transformations taken to induce stationarity. The transformation codes are 1 – no transformation; 2 – first difference; 4 – logarithm; 5 – first difference of logarithm.

Table A.1. Data Description

	Economic Activity	Fast or Slow	Transformation	Data Source
1.	The industrial production index, 2015=100 – Total	S	5	SSO
2.	The industrial production index, 2015=100 – Energy	S	5	SSO
3.	The industrial production index, 2015=100 – Intermediate goods, except energy	S	5	SSO
4.	The industrial production index, 2015=100 – Capital goods	S	5	SSO
5.	The industrial production index, 2015=100 – Durable consumer goods	S	5	SSO
6.	The industrial production index, 2015=100 – Non–durable consumer goods	S	5	SSO
7.	The industrial production index, 2015=100 – Mining and quarrying	S	5	SSO
8.	The industrial production index, 2015=100 – Manufacturing	S	5	SSO
9.	The industrial production index, 2015=100 – Electricity, gas, steam, and air conditioning supply	S	5	SSO
10.	The real index of completed construction works –Total	S	5	SSO
11.	The real index of completed construction works –Buildings	S	5	SSO
12.	The real index of completed construction works –Civil Engineerings	S	5	SSO
13.	Number of dwellings for which building permits are issued – North Macedonia	S	5	SSO
14.	Number of dwellings for which building permits are issued – Vardar	S	5	SSO
15.	Number of dwellings for which building permits are issued – East	S	5	SSO
16.	Number of dwellings for which building permits are issued – South-West	S	5	SSO
17.	Number of dwellings for which building permits are issued – South-East	S	5	SSO
18.	Number of dwellings for which building permits are issued – Pelagonija	S	5	SSO
19.	Number of dwellings for which building permits are issued – Polog	S	5	SSO
20.	Number of dwellings for which building permits are issued – North-East	S	5	SSO
21.	Number of dwellings for which building permits are issued – Skopje	S	5	SSO
22.	Turnover indices in the industry – Total	S	5	SSO
23.	Turnover indices in the industry – Intermediate goods, except energy	S	5	SSO
24.	Turnover indices in the industry – Capital goods	S	5	SSO
25.	Turnover indices in the industry – Durable consumer goods	S	5	SSO
26.	Turnover indices in the industry – Non-durable consumer goods	S	5	SSO
27.	Turnover indices in the industry – Mining and quarrying	S	5	SSO
28.	Turnover indices in the industry – Manufacturing	S	5	SSO
29.	Turnover indices in the industry on the non-domestic market – Total	S	5	SSO
30.	Turnover indices in the industry on the non-domestic market – Intermediate goods industries, except energy	S	5	SSO
31.	Turnover indices in the industry on the non-domestic market – Capital goods	S	5	SSO
32.	Turnover indices in the industry on the non-domestic market – Durable consumer goods	S	5	SSO

33.	Turnover indices in the industry on the non-domestic market – Non-durable consumer goods	S	5	SSO
34.	Turnover indices in the industry on the non-domestic market – Mining and quarrying	S	5	SSO
35.	Turnover indices in the industry on the non-domestic market – Manufacturing	S	5	SSO
36.	Indices of employees in industry, 2015=100 – Total	S	5	SSO
37.	Indices of employees in the industry, 2015=100 – Energy	S	5	SSO
38.	Indices of employees in the industry, 2015=100 – Intermediate goods, except energy	S	5	SSO
39.	Indices of employees in industry, 2015=100 – Capital goods	S	5	SSO
40.	Indices of employees in the industry, 2015=100 – Durable consumer goods	S	5	SSO
41.	Indices of employees in the industry, 2015=100 – Non-durable consumer goods	S	5	SSO
42.	Indices of employees in industry, 2015=100 – Mining and quarrying	S	5	SSO
43.	Indices of employees in the industry, 2015=100 – Manufacturing	S	5	SSO
44.	Indices of employees in the industry, 2015=100 – Electricity, gas, steam, and air conditioning supply	S	5	SSO
45.	Tourist arrivals – Total	S	5	SSO
46.	Tourist nights – Total	S	5	SSO
47.	Average monthly gross wage – Total	S	5	SSO
48.	Average monthly gross wage – Agriculture, forestry, and fishing	S	5	SSO
49.	Average monthly gross wage – Mining and quarrying	S	5	SSO
50.	Average monthly gross wage – Manufacturing	S	5	SSO
51.	Average monthly gross wage – Electricity, gas, steam, and air conditioning supply	S	5	SSO
52.	Average monthly gross wage – Water supply; sewerage, waste management, and remediation activities	S	5	SSO
53.	Average monthly gross wage – Construction	S	5	SSO
54.	Average monthly gross wage – Wholesale and retail trade; repair of motor vehicles and motorcycles	S	5	SSO
55.	Average monthly gross wage – Transportation and storage	S	5	SSO
56.	Average monthly gross wage – Accommodation and food service activities	S	5	SSO
57.	Average monthly gross wage – Information and communication	S	5	SSO
58.	Average monthly gross wage – Financial and insurance activities	S	5	SSO
59.	Average monthly gross wage – Real estate activities	S	5	SSO
60.	Average monthly gross wage – Professional, scientific and technical activities	S	5	SSO
61.	Average monthly gross wage – Administrative and support service activities	S	5	SSO
62.	Average monthly gross wage – Public administration and defense; compulsory social security	S	5	SSO
63.	Average monthly gross wage – Education	S	5	SSO
64.	Average monthly gross wage – Human health and social work activities	S	5	SSO
65.	Average monthly gross wage – Arts, entertainment, and recreation	S	5	SSO
66.	Average monthly gross wage – Other service activities	S	5	SSO
	Price			
67.	Consumer Price Index, 2010=100 – Total	S	5	SSO
68.	Consumer Price Index, 2010=100 – Food and non-alcoholic beverages	S	5	SSO
69.	Consumer Price Index, 2010=100 – Alcoholic beverages and tobacco	S	5	SSO

70.	Consumer Price Index, 2010=100 – Clothing and footwear	S	5	SSO
71.	Consumer Price Index, 2010=100 – Housing, water, electricity, gas, and other fuels	S	5	SSO
72.	Consumer Price Index, 2010=100 – Furnishings, household equipment, and routine maintenance of the house	S	5	SSO
73.	Consumer Price Index, 2010=100 – Health	S	5	SSO
74.	Consumer Price Index, 2010=100 – Transport	S	5	SSO
75.	Consumer Price Index, 2010=100 – Communication	S	5	SSO
76.	Consumer Price Index, 2010=100 – Recreation and culture	S	5	SSO
77.	Consumer Price Index, 2010=100 – Education	S	5	SSO
78.	Consumer Price Index, 2010=100 – Restaurants and hotels	S	5	SSO
79.	Consumer Price Index, 2010=100 – Miscellaneous goods and services	S	5	SSO
80.	Consumer Price Index, 2010=100 – Overall index excluding energy, liquid fuels and lubricants, and food	S	5	SSO
81.	Consumer Price Index, 2010=100 – Overall index excluding energy, liquid fuels and lubricants, and unprocessed food	S	5	SSO
82.	Consumer Price Index, 2010=100 – Overall index excluding energy, liquid fuels and lubricants, unprocessed food, tobacco, and alcoholic beverages	S	5	SSO
83.	Industrial producer price indices on the domestic market, 2015=100 – Total	F	5	SSO
84.	Industrial producer price indices on the domestic market, 2015=100 – Energy	F	5	SSO
85.	Industrial producer price indices on the domestic market, 2015=100 – Intermediate goods, except energy	F	5	SSO
86.	Industrial producer price indices on the domestic market, 2015=100 – Capital goods	F	5	SSO
87.	Industrial producer price indices on the domestic market, 2015=100 – Consumer goods	F	5	SSO
88.	Industrial producer price indices on the domestic market, 2015=100 – Durable goods	F	5	SSO
89.	Industrial producer price indices on the domestic market, 2015=100 – Non-Durable goods	F	5	SSO
90.	Industrial producer price indices on the foreign market, 2015=100, Total	F	5	SSO
91.	Industrial producer price indices on the foreign market, 2015=100, Intermediate goods, except energy	F	5	SSO
92.	Industrial producer price indices on the foreign market, 2015=100, Capital goods	F	5	SSO
93.	Industrial producer price indices on the foreign market, 2015=100, Consumer goods	F	5	SSO
94.	Industrial producer price indices on the foreign market, 2015=100, Durable goods	F	5	SSO
95.	Industrial producer price indices on the foreign market, 2015=100, Non-Durable goods	F	5	SSO
	Money			
96.	Monetary aggregate: M1	F	5	NBRNM
97.	Monetary aggregate: M2	F	5	NBRNM
98.	Monetary aggregate: M4	F	5	NBRNM
99.	Sight and short-term saving deposits (M2-M1)	F	5	NBRNM
100.	Long-term saving deposits (M4-M2)	F	5	NBRNM
	Credit			
101.	Individuals – Total loans – domestic currency	F	5	NBRNM
102.	Individuals – Consumer loans – domestic currency	F	5	NBRNM

103.	Individuals – Purchase of real property – domestic currency	F	5	NBRNM
104.	Individuals – Purchase of cars – domestic currency	F	5	NBRNM
105.	Individuals – credit cards; overdrafts; other loans – domestic currency	F	5	NBRNM
106.	Individuals – Total loans – foreign currency	F	5	NBRNM
107.	Individuals – Consumer loans – foreign currency	F	5	NBRNM
108.	Individuals – Purchase of real property – foreign currency	F	5	NBRNM
109.	Individuals – Purchase of cars – foreign currency	F	5	NBRNM
110.	Individuals – credit cards; overdrafts; other loans – foreign currency	F	5	NBRNM
111.	Consumer credit (individuals) Outstanding	F	5	NBRNM
112.	Individuals – Purchase of real property – Total	F	5	NBRNM
113.	Individuals – Total loans	F	5	NBRNM
114.	Loans to non-financial corporations – short-term, outstanding	F	5	NBRNM
115.	Loans to non-financial corporations – long-term, outstanding	F	5	NBRNM
116.	Loans to non-financial corporations –Total	F	5	NBRNM
117.	Total loans	F	5	NBRNM
118.	Non-performing loans/Total loans	F	1	NBRNM
119.	Government securities held by banks	F	5	NBRNM
	Financial Market			
120.	Macedonian stock exchange index – MBI-10	F	5	MSE
	Interest Rates			
121.	Interest rates on loans to non-financial corporations	F	2	NBRNM
122.	Interest rates on loans to households	F	2	NBRNM
123.	SKIBOR ON	F	2	NBRNM
124.	SKIBOR 1M	F	2	NBRNM
125.	SKIBOR 3M	F	2	NBRNM
	Exchange Rate			
126.	Foreign Exchange Rate: Switzerland (Denars per 1 Swiss Franc)	F	5	NBRNM
127.	Foreign Exchange Rate: USA (Denars per 1 US$)	F	5	NBRNM
128.	Foreign Exchange Rate: UK (Denars per 1 GB pound)	F	5	NBRNM
129.	NEER	F	5	NBRNM
130.	REER	F	5	NBRNM
	Expectations			
131.	SKIBOR 1M-SKIBOR ON	F	1	NBRNM
132.	SKIBOR 3M-SKIBOR ON	F	1	NBRNM
133.	Assessment of order-book levels – ind.	F	1	EC
134.	Assessment of export order-book levels – ind.	F	1	EC
135.	Assessment of stocks of finished products – ind.	F	1	EC
136.	Production expectations for the months ahead – ind.	F	1	EC
137.	Selling price expectations for the months ahead – ind.	F	1	EC
138.	Employment expectations for the months ahead – ind.	F	1	EC
139.	The Economic sentiment indicator (average = 100)	F	1	EC
	Key Policy Rate			
140.	28-Day CB Bills rate	F	1	NBRNM

The data sources include the State Statistical Office (SSO), the National Bank of the Republic of North Macedonia (NBRNM), the Macedonian Stock Exchange (MSE), and European Commission (EC).

Table A.2. Descriptive statistics

	Selected Variables	Mean	Median	Max	Min	JB	Prob.
1.	The industrial production index, 2015=100 - Total	96.2	96.8	120.9	68.8	1.2	0.5
2.	The real index of completed construction works - Total	70.6	66.2	184.1	14.7	12.3	0.0
3.	Number of dwellings for which building permits are issued – North Macedonia	544.9	501.0	1,591.0	165.0	68.6	0.0
4.	Turnover indices in the industry - Total	93.4	91.4	146.1	45.9	3.8	0.1
5.	Indices of employees in industry, 2015=100 - Total	97.7	98.7	110.0	88.1	4.2	0.1
6.	Consumer Price Index by COICOP, 2010=100 - Total	108.3	109.6	113.2	99.1	22.0	0.0
7.	Sight and short-term saving deposits	150,186.2	150,012.0	165,543.1	135,063.6	1.6	0.5
8.	Long-term saving deposits	64,216.6	69,370.2	103,614.4	22,028.8	8.0	0.0
9.	Credit to individuals - Purchase of real property - domestic currency	1,223.6	1,317.5	2,104.1	651.4	2.3	0.3
10.	Consumer credit (indiv.) outstanding	47,898.0	46,109.3	80,632.5	22,197.4	8.4	0.0
11.	Individuals - total loans	104,040.4	100,137.6	154,658.1	67,740.3	8.5	0.0
12.	Loans to non.fin.corp. - Total	140,699.9	144,712,4	167,764.6	109,701.5	7.7	0.0
13.	Non-performing loans/Loans	9.2	9.8	12.1	4.9	12.6	0.0
14.	Government securities held by banks	30,063.2	34,226.5	42,471.1	12,777.9	16.0	0.0
15.	MBI-10	2,175.2	1,981,5	5,617.8	1,583.7	22.3	0.0
16.	Interest rates on loans to non-financial corporations	6.8	6.9	8.8	4.6	5.6	0.1
17.	Interest rates on loans to households	7.7	7.5	10.9	6.0	7.0	0.0
18.	SKIBOR 1M	2.9	2.6	8.5	1.2	31.2	0.0
19.	SKIBOR 3M	3.4	3.1	9.3	1.5	20.6	0.0
20.	28-Day CB Bills rate	3.7	3.3	8.0	2.5	498.5	0.0

Note: The remaining variables are not reported for space reasons but are available from the authors upon any request.