УДК 336.774;338.1;338.2

C. Математические и количественные методы
C. Mathematical and Quantitative Methods

СВОЙСТВА И ХАРАКТЕРИСТИКИ SVAR-ИНДИКАТОРА ИНФЛЯЦИОННЫХ ОЖИДАНИЙ ДЛЯ БЕЛАРУСИ: ПОСЛЕДСТВИЯ ДЛЯ МОНЕТАРНОЙ ПОЛИТИКИ

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Статья посвящена анализу эмпирического индикатора инфляционных ожиданий для Беларуси, сгенерированного на основе идентификации структурной векторной авторегрессии. Показано, что инфляционные ожидания в Беларуси являются высоко волатильными и «незаякоренными». Перепады в уровнях инфляционных ожиданий обусловливают феномен функционирования монетарной среды в Беларуси в режимах, которые существенно отличаются по своим характеристикам. Это накладывает существенные ограничения на возможности монетарной политики государства. Поэтому важной предпосылкой повышения ее эффективности является стабилизация и «заякоривание» инфляционных ожиданий.

Ключевые слова: инфляционные ожидания; эмпирические меры инфляционных ожиданий; монетарная политика; Беларусь.

EXPLORING SVAR-BASED EMPIRICAL MEASURE OF INFLATION EXPECTATIONS FOR BELARUS: IMPLICATIONS FOR MONETARY POLICY

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This article explores empirical SVAR-based measure of inflation expectations for Belarus. Properties of this measure result in a diagnosis that inflation expectations in Belarus are highly volatile and unanchored. Level shifts in inflation expectations give a rise to a specific phenomenon of Belarusian monetary environment which is multiple regimes of

Образец цитирования:
Крук ДЭ. Свойства и характеристики SVAR-индикатора инфляционных ожиданий для Беларуси: последствия для монетарной политики. *Журнал Белорусского государственного университета. Экономика*. 2020;1:4–16 (на англ.).

For citation:
Kruk DE. Exploring SVAR-based empirical measure of inflation expectations for Belarus: implications for monetary policy. *Journal of the Belarusian State University. Economics.* 2020; 1:4–16.

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functionality with severely different properties. This sensitively restricts the effectiveness of monetary policy in the country. Hence, stabilizing inflation expectations at a reasonably low level and anchoring them is argued to be an important precondition for effective monetary policy in Belarus.

Keywords: inflation expectations; empirical measures of inflation expectations; monetary policy; Belarus.

Introduction

The cases of unstable monetary environment with unanchored inflation expectations (IE) are frequently considered as an informationally reach choice for studying causalities in monetary environment. As shown in numerous studies [1–3], whether IE are anchored or unanchored is critically important for the characteristics of monetary environment. Hence, using an IE measure for such cases might be a key for understanding them. For instance, one may expect that in case of unanchored IE, a measure of IE (in comparison to the case of anchored expectations) is to display relatively higher sampling range, relatively higher variance, structural breaks in mean value. Correspondingly, the indicators of monetary environment (interest rates, actual inflation rate) are to possess similar properties. Thus, from the view of the richness of informational content of the data and corresponding statistical inferences, the case of IE being unanchored is a promising approach for extracting new evidence about causalities in a monetary environment through a lens of IE measure.

From this view, the countries that have experienced the episodes of monetary instability (huge spikes in actual inflation or depreciation rate) and that are peculiar by some rare events affecting monetary environment (like change in monetary policy regime, currency restrictions etc.) might be of particular interest. Such kind of environment might contain information that allows detecting the relationships that are hardly identifiable otherwise. For instance, the relationships between IE and actual inflation may exhibit the properties that are not visible under low inflation environment. In a similar manner, IE measures stemming from unstable monetary environment might be informatively richer for studying the properties of IE formation process.

The case of Belarus is a good choice for employing such an approach to studying monetary environment in many respects. First, the informational content of monetary data in Belarus is extremely rich. In its recent history, the country has experienced periods of relative price stability interchanging with currency crises and episodes of huge inflation jumps. Second, Belarusian case contains evidence of IE formation under different monetary policy frameworks. The country has experienced a number of shifts in monetary policy framework: from pure discretion in the beginning of 2000s via different forms of currency peg during 2003–2014 to monetary targeting as of today (with the plans to introduce IT since 2021). Third, IE in Belarus might be the case of «unexplored wilderness», as there were roughly no attempt to anchor expectations from the side of monetary authorities before 2015. Fourth, a rather long time-series for the measure based on financial data [4] is available for the country.

After painful currency crises of 2011 and 2014, Belarusian monetary environment was extremely vulnerable. In 2011 and early 2012 the country faced a three-digit inflation rate. Later on, the inflation rate went down gradually, but until 2017 it was not sufficient to enhance monetary stability in a broader sense. For instance, for nominal interest rates the level of 20 % per annum was an unachievable lower bound until 2016. Moreover, in 2013–2016 upside jumps in nominal interest rates took place regularly. Such combination of nominal interest and inflation rates resulted in an extremely high and volatile level of real interest rates throughout these 4 years. Real returns at the Belarusian financial market fluctuated in 2013–2016 within the range of 10–30 % per annum. For instance, a median (monthly) value of the real interest rate on new loans in 2013–2016 was 17.6 % per annum. So, one may state that real monetary conditions have been extremely tight thorough that period.

Moreover, in 2015–2016 Belarus has dipped into a prolonged and deep recession. During that years the country has lost roughly 7 % of its output. The combination of high real interest rates and recession gave a rise to a naive, but acceptable diagnosis: too high interest rates cause (or at least contribute to) recession. This view became popular in a domestic policy discussion. Furthermore, pretty often this story transformed into «too tight monetary policy causes (or at least contribute to) to output losses». Given this pressure, the National Bank of Belarus (NBB) became accustomed to justifying its policy stance by considerations of financial stability given financial fragility. So, the economic policy discussion got into the discourse of these two extremes. Finally, it squeezed to the question if the monetary environment has stabilized enough in order to soften monetary policy.

Since 2017, monetary environment indeed has stabilized. It was due to considerable improvements in the quality of its macroeconomic policies. The country fell back upon a floating exchange rate, and feasible monetary and fiscal rules. This secured a movement towards macro stability in recent years. For instance, external position is close to be balanced, fiscal position has even become positive, while inflation rate is at its historical lows around 5 %. For Belarus, these achievements are important, taking in mind a «fresh memory» of price

and financial instability. But despite significantly improved macroeconomic landscape, the issue of the monetary policy stance has still been on the agenda during 2017–2019. What is important, this time popular simple explanations, e. g. naive perception of economic policy mechanisms by authorities, etc. are not sufficient for understanding the phenomenon. Besides «archaic growth injection» view, monetary policy nowadays faces more advanced «accusations» that it either causes too restrictive stance of monetary policy in respect to output, or ignores complicated transmission channels. For instance, one may argue that too much emphasis on price and financial stability can actually result in undermining them, given a huge debt burden of Belarusian firms. The quality of a considerable portion of the debts in Belarus tends to be sensitive to output growth rate. Hence, according to this argumentation, monetary policy rule should be «more pro-growth», reflecting debt-growth financial stability linkage inside it. «Translating» this policy agenda to research agenda results in two questions. First, is there a room for more expansionary monetary policy? Second, do financial instability risks require making monetary policy rule «more pro-growth»?

This article aims at shedding more light on these policy questions by means of employing and studying the properties of empirical IE measure for Belarus based on [4] methodology. More precisely, it systemizes theoretical moments of this empirical IE measure in 2003–2019 and shows that significant structural breaks are peculiar to the series. The latter means that regime-switching framework is the best choice for capturing Belarusian data. Corresponding estimations allow to identify three regimes according to Markov-switching framework for IE measure. Moreover, the relationships between IE measure and other monetary variables – actual inflation, nominal interest rate, ex ante and ex post real interest rates – also «switch» among the regimes. This allows considering IE as the «deep root» of monetary environment stance, and extracting the properties of monetary environment from the modeling framework utilized for identifying the IE measure.

A shift towards empirical measures of inflation expectations in macroeconomics

During last 50 years, the issue of measurement of expectations was mainly neglected in theoretical macroeconomics, while prioritizing the focus on the formation process of IE. The logic of this approach presupposes accepting one of the assumptions on expectations formation process and generating the variable of expectations basing on this assumption. Hence, the expectations formation process has become the central element that determines the outcomes of numerous macroeconomic models.

A kind of critical juncture in this history took place in the late 1960s [5], given the idea of expectations augmented Phillips curve (PC) [6–8]. Stating that an IE variable should be included into the PC specification, they faced a challenge of generating such a variable. Rather naturally, they tended to employ the concept of adaptive expectations that was dominating at that time. Basing on this experience, the expectations formation process «adhered» to the PC agenda. This secured its promotion towards the frontier of macroeconomic research together with the latter.

An alternative research paradigm was suggested and promoted by [9; 10]. It assumed «incorporation» of inflation expectations instead of focusing on expectations formation process, but it turned out to be incompatible with the design of the theoretical models of that period. In [5] it is argued that it «gave a strategical advantage to the Friedman-Phelps approach» and later development of the field was driven mainly by their approach.

Adaptive expectations have become the first dominating formation process, but its dominance was not long-lasting. In [11; 12] the authors formalized and used the original idea of rational expectations from [13] for arguing about monetary neutrality. Later on, more evidence on monetary neutrality given the rational expectations hypothesis (REH) was provided by [14]. A theoretical framework developed in these studies conformed to the performance of the US economy during the stagflation of 1970s. Hence, «the big picture» seemed to have been verified by a kind of natural experiment and therefore was widely accepted. While, the whole framework contained the REH as its core element, the REH itself has begun to be treated as if it had obtained empirical verification. So, since 1970s the mechanism of rational expectations has begun to be widely dealt as the most realistic expectations formation process.

Acceptance of the REH as the benchmark approach led further to «reinventing» the macroeconomic modeling framework. The study [15] showed that under the REH, the parameters of macroeconomic models calibrated by the experience from the past are not valid for evaluating economic policy scenarios for today and tomorrow (Lucas critique). The authors of [16] empowered the message, arguing that macroeconomic models should be equilibrium ones with the agents with rational expectations. Falling back upon this prescription, [17] laid the foundation of the dynamic stochastic general equilibrium (DSGE) approach in macroeconomics. Again, the REH played a key role for the mechanics of the whole model.

At the early stages of DSGE development, there were some doubts in feasibility and universality of the approach. More precisely, the solution of the model could be absent or there could be multiple solutions under

some model setups. This challenge was overcome in [18], having formulated the condition and (if it holds) the algorithm for obtaining an explicit solution to models with the rational expectations mechanism. This comprised an additional (extremely important and «pragmatic») argument in favour of the REH within macroeconomic models.

Thus, the REH took a root in both theoretical and applied macroeconomics. It has been roughly accepted as quasi-true expectations formation process, although there were still not much direct empirical support for this. Exploiting this status, the REH correspondingly generated a variable of expectations entering into different fields of applied and empirical research. This approach automatically secures an agreement between theory and generated data for IE, while alternative (empirical) measures of IE frequently led to inconsistency of the data with the modeling framework. In theoretical modeling, the REH has become roughly universal technique that was utilized by different economic schools (real business cycle, new Keynesian, etc.). This was due to a «…relative ease of optimization in comparison to other more complicated formation processes» [19, p. 1451]. Hence, in respect to expectations formation process on its own, the REH has become a dominating framework.

However, explanatory and predictive failures of DSGE and other REH-based models were widening. The study [19] systemizes the following list of such failures to be on the agenda by nowadays:

- the lack of persistence of inflation and the need of adding ad-hoc lags into the NKPC formulation in order to secure it;
- instability and (or) flattening of the NKPC;
- missing disinflation during the Great Recession;
- inferior forecasting relative to naive alternatives;
- sensitivity of the NKPC estimation to the «slack» variable employed.

These failures of DSGE models casted further doubts on assumptions that are behind this class of models. While acceptance of REH was mainly due to modeling convenience, and not empirical evidence, just it attracted much attention. Many researches engaged into testing the REH. Majority of such studies reports doubts in or rejection of the REH basing on different methodologies [20–24].

Doubt in or rejection of the REH seems to be a huge challenge to the consistency and explanatory power of DSGE models, and at a higher level of generality to the entire modern macroeconomics. A number of recent studies suggest a response to this challenge: researchers are to re-orient to «empirical» measures of IE and incorporate them into baseline model frameworks. This idea has been promoted for instance in the study [25]. The author of [5] treats this trend as the resurgence of [9; 10] approach and argues that (in respect to NKPC) the focus on expectations formation process leads to thinking «in the policy orbit of natural rate that does not have justification for higher inflation even if there is permanent inflation – unemployment tradeoff». However, changing the focus from expectations formation process towards incorporation of expectations in NKPC might break this orbit [5]. The study [19] recommends incorporating empirical measures of IE into NKPC framework might become a symbolic acceptance of the new direction in mainstream macroeconomics.

The latter approach assumes a new logic of using IE variables in macroeconomic analysis. First, one should focus on a proper empirical measure of IE, i. e. provide evidence that such a measure is reflecting reality adequately. Second, having got a «good» measure of IE, a researcher may judge the properties of the IE formation process basing on the data, but not on ad-hoc assumptions about expectations formation process. This assumes verifying whether the data corresponds to the expected properties of one of expectations formation process. Third, empirical measures of IE may directly be used for applied purposes (modeling and forecasting) thus closing the gap between theoretical and empirical macroeconomic studies. According to [5] this approach may be treated as incorporation of IE instead of generating them basing on assumption about expectations formation process. A core question arising is as follows: what is a sound measure of IE? Choosing the one from the bundle of available empirical measures of IE is the way to find a solution.

Data and methodology

The strategy of identifying IE based on market data is the one suggested by [4], which generalizes and «fine-tunes» approach by [26; 27]. Nominal interest rate is viewed as consisting of ex ante real interest rate and expected inflation:

$$i_t = rea_t + \pi_t^e, \tag{1}$$

where i_t is nominal interest rate; rea_t is ex ante real interest rate; π_t^e is expected inflation.

Further, a simplified version of Fischer equation is used for the analysis:

$$rep_t = i_t - \pi_t, \tag{2}$$

where rep_t is ex post real interest rate; π_t is actual inflation.

A next variable of interest is the inflation forecast error, which is introduced according to

$$\Delta_t = \pi_t^e - \pi_t, \tag{3}$$

where Δ_t is inflation forecast error.

Combining (1) and (2) one can derive the relationship between real ex ante and ex post real rates using inflation forecast error:

$$rep_t = rea_t + \pi_t^e - \pi_t = rea_t + \Delta_t. \tag{4}$$

The next step is focusing on dynamic characteristics of individual variables engaged into the analysis. It is expected that $i_t \sim I(1)$, $\pi_t^e \sim I(1)$, $\pi_t \sim I(1)$, while $rea_t \sim I(0)$, $rep_t \sim I(0)$, and $\Delta_t \sim I(0)$[1]. As shown in [4] this allows considering the data generation processes (DGPs) for Δi_t[2] and rep_t to:

$$\begin{cases} \Delta i_t = \mu_t^{\Delta i} + \sum\limits_{i=0}^{n} \alpha_i^{rea} \nu_{t-i}^{rea} + \sum\limits_{i=0}^{n} \alpha_i^{\pi^e} \nu_{t-i}^{\pi^e}, \\ rep_t = \mu_t^{rep} + \sum\limits_{i=0}^{n} \beta_i^{rea} \nu_{t-i}^{rea} + \sum\limits_{i=0}^{n} \beta_i^{\pi^e} \nu_{t-i}^{\pi^e}, \end{cases} \tag{5}$$

where $\mu_t^{\Delta i}$ and μ_t^{rep} are expected values of Δi and rep; ν^{rea} and ν^{π^e} are shocks to rea and π^e correspondingly; α_i^{rea}, $\alpha_i^{\pi^e}$, β_i^{rea}, $\beta_i^{\pi^e}$ are coefficients.

System (5) is to be estimated first as a reduced-form vector autoregression (VAR), and afterwards as the structural one (SVAR), having got the theory-based restriction of zero long-run response of Δi_t to ν^{rea}:

$$\sum_{i=0}^{n} \alpha_i^{rea} = 0. \tag{6}$$

Identification of structural innovations and structural impulse responses allows representing SVAR in a moving average form

$$\begin{bmatrix} \Delta i_t \\ rep_t \end{bmatrix} = \begin{bmatrix} \overline{\Delta \imath} \\ \overline{rep} \end{bmatrix} + \Phi(L) \begin{bmatrix} u_t^i \\ u_t^{rep} \end{bmatrix}, \tag{7}$$

where $\Phi(L) = \begin{bmatrix} \Phi_{i,i}(L) & \Phi_{i,rep}(L) \\ \Phi_{rep,i}(L) & \Phi_{rep,rep}(L) \end{bmatrix}$, u_t^i, u_t^{rep} are structural innovations.

A term $\Phi_{rep,rep}(L) u_t^{rep}$ in the second equation of (7) may be interpreted as the transitory component of rea_t (i. e. its deviation from a correspondent mean). Hence, once knowing $\overline{rea}$ one can estimate rea_t. But, as shown in [4] this strategy may face two severe challenges, especially for unstable monetary environments. First, an estimate of $\overline{rea}$ may be a challenging task. Second, the system (5) implicitly «equates» shocks in actual inflation with a shock in IE (ν^{π^e}).

In the context of this article, the mechanism of mitigating the first problem is more crucial. It treats DGP for rep_t which in a general form is specified according to

$$rep_t = c^{rea} + \sum_{j=1}^{l} LS_j D_j + \Delta_t + \varepsilon_t^{rea} = c^{rea} + \sum_{j=1}^{l} LS_j D_j + \sum_{i=1}^{k} LS_i D_i + \varepsilon_t^{rea}, \tag{8}$$

where $\sum\limits_{j=1}^{l} LS_j D_j$ is «normal» level shifts (i. e. reflecting fundamental changes), and $\sum\limits_{i=1}^{k} LS_i D_i$ is level shifts due to monetary instability.

[1] The procedure also assumes testing whether these assumption hold in reality. For the datasets in [26; 27] these assumptions are supported by tests.

[2] One may equivalently consider the data generation process for i_t in levels (consisting of the same shocks). But using the first difference here is more convenient for a further move towards SVAR context.

The mechanisms of a level shifts may be associated with regime-switching mechanism, i. e. they generate periods with different values of a constant term. Hence, the specification (8) can be properly estimated through the regime-switching framework, which for a general case looks like:

$$y_t = X_t'\varphi_m + Z_t'\psi + \sigma(m)\varepsilon_t, \tag{9}$$

where y_t is the dependent variable; X_t, Z_t column are vectors of exogenous variables; φ_m is the column vector of coefficients indexed by regime; ψ is the column vector of regime invariant coefficients; ε_t is residual term ($(\sigma(m)\varepsilon_t)$ denotes regime dependent σ of a residual term).

For a specific case of rep_t it will include only regime specific constant term, which should reflect $\sum_{j=1}^{l} LS_j D_j$ and $\sum_{i=1}^{k} LS_i D_i$ in it. So, the next specification is to be estimated:

$$rep_t = c_m^{rea} + \sigma(m)\varepsilon_t, \tag{10}$$

where c_m^{rea} is a constant term for real ex post real interest rate under regime m; $\sigma(m)$ is regime specific variance term; ε_t is a residual term.

The prior objective of estimating (10) is not getting the estimates of c_m^{rea}, but detecting and segregating among regimes. The objective for the researcher herewith is to dissect between the types of regimes, i. e. between those corresponding to requlars level shift and those associated with the periods of monetary instability. For identifying the value of IE, constants c_m^{rea} corresponding to the former might be captured in $\overline{rea}$ term of (10), while those corresponding to the latter must be skipped, as it denotes shifts Δ_t not in $\overline{rea}$. However, this intermediary challenge of dissecting the regimes in majority of cases is likely to be skipped as well, as usually (8) does not include requlars level shifts (i. e. $\sum_{j=1}^{l} LS_j D_j$) and swings in mean are associated just with the periods of monetary instability. So, in this case:

$$\overline{rea} = c_0^{rea}, \tag{11}$$

where $c_0^{rea} - c^{rea}$ corresponding to regime 0, i. e. to the regime of monetary stability (hence 1, 2, …, will mean types of monetary instability).

For identifying the value of IE measure remainder of the procedure is as follows[3]

$$rea_t = \overline{rea} + \Phi_{rep,\,rep}(L)u_t^{rep}, \tag{12}$$

$$\pi_t^e = i_t - rea_t. \tag{13}$$

For the analysis of monetary policy, I introduce one more variable – mps_t – as a measure of monetary policy stance according to

$$mps_t = \frac{\sum_{i=0}^{2} rep_{t-1}}{3} - rea_t.$$

Monetary policy, as a rule, aims to be counter-cyclical, i. e. generate expansionary incentives during cyclical downturns, and vice versa. In this respect, its stance should be matched to the estimate of output gap. However, analyzing the stance of monetary policy together with the estimates of output gap is not a univocal option, especially given doubts about the consistency of any estimate of output gap [28]. From this point of view, direct measurement of the monetary policy stance, i. e. through mps_t is a worthwhile alternative. If ex post real interest exceeds ex ante rate, it means that interest rate policy by a central bank is restrictive, while an opposite situation witnesses its expansionary stance [27]. This logic assumes that positive value of mps_t means restrictive policy (the higher the value, the more restrictive the policy is), while negative value means loose policy stance.

While this article is aimed at studying the Belarusian monetary environment through the breakdown of different monetary regimes (not identification of IE measure), the key equation for subject-matter is (10). Directly,

[3] In this article, I skip the remainder of the methodology associated with a transitory component of ex ante real interest rate needed for proper identification of IE measure, as it outsteps the boundaries of the analysis. However, one should take in mind that it is crucial for identification procedure and the series of IE presented in this article is generated employing this step as well. For more details of the full identification procedure see [4].

from estimated equation (10) one can extract time-horizons for different regimes of monetary environment and regime specific values for rep_t. These time-horizons can further be used out of the boundaries of the IE identification procedure. More precisely, further they are used as specific subsamples for studying the stance of Belarusian monetary environment in different regimes.

For doing this, first, I systemize statistical properties (theoretical moments, correlations, cross- and auto-correlations, etc.) of all monetary variables on a regime-specific basis. If these properties are significantly different, it signals that differentiating among such regimes is meaningful for a monetary environment in a broad sence (rather than only for IE).

Second, for different regimes I estimate (in natural logarithms first order autoregressive specification (AR(1)) for π_t and augment it with a π_t^e variable (contemporary and lagged values) according to

$$\ln\left(\pi_t^R\right) = c_\pi^R + \rho_\pi^R \ln\left(\pi_{t-1}^R\right) + \sum_{i=0}^{n} \gamma_{t-i}^R \ln\left(\pi_{t-i}^{e,R}\right) + \varepsilon_t^R, \quad (14)$$

where sub-index $R \in (1; m)$ denotes a regime; c_π^R, ρ_π^R, γ_{t-i}^R are coefficients; ε_t^R is residual term.

The purpose of this exercise is to compare c_π^R and γ_{t-i}^R among different regimes, which is to shed some light on the role of expected inflation in generating the actual one. Third, I run Granger-causality test, which does a similar job, but for both directions (between π_t and π_t^e and vice versa).

The suggested methodology requires relatively modest data set as an initial input: i_t and π_t. For i_t I use simple mean of three most nominal important interest rates in Belarus: interbank one, and rates on short-term (less than 1 year) and long-term (over 1 year) household deposits. The source of this data is the NBB. For π_t a standard approach of employing CPI-based inflation rate (reported by Belstat) is realized. Dataset comprises of corresponding seasonally-adjusted time-series on a monthly basis for the period of January 2003 and December 2019.

Results and discussion

Figure 1[4] reports the IE measure (π_t^e) generated basing on exercise (1)–(13) together with the actual inflation rate (π_t) and monetary policy stance (mps_t).

Figure 2[5] reports the decomposition of nominal interest rate (i_t) by real ex ante interest rate (rea_t) and inflation expectations (π_t^e).

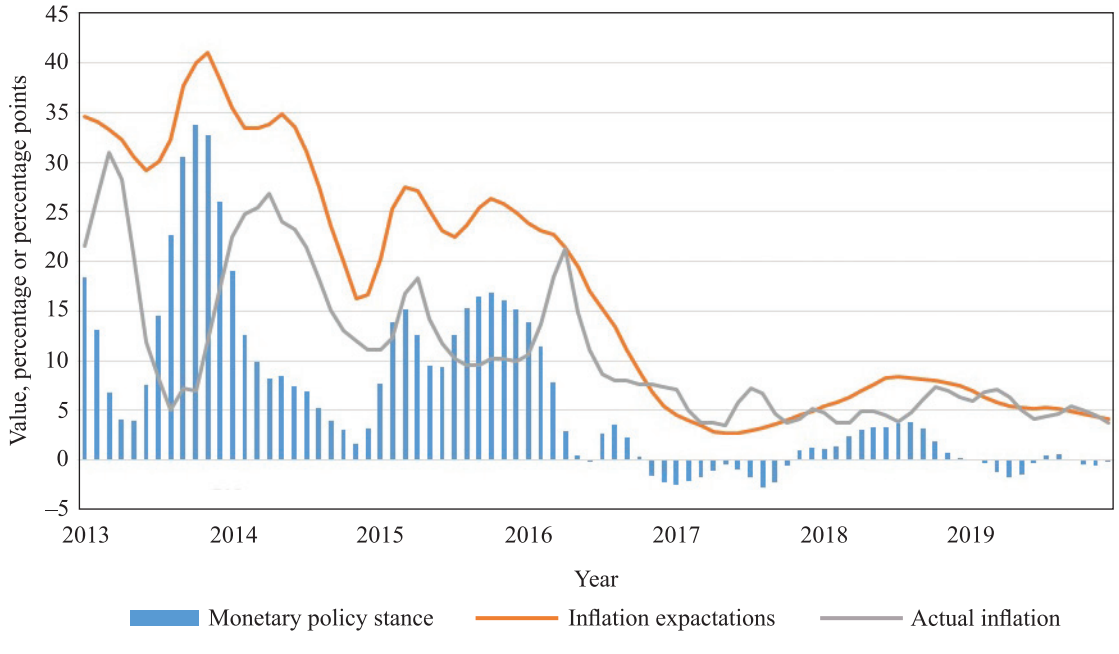

Fig. 1. Expected and actual inflation rates in Belarus in 2013–2019

[4] I report the results for the subsample of 2013–2019, as massive level shifts in previous periods (especially in 2011–2012) distort the perception of the whole sample.

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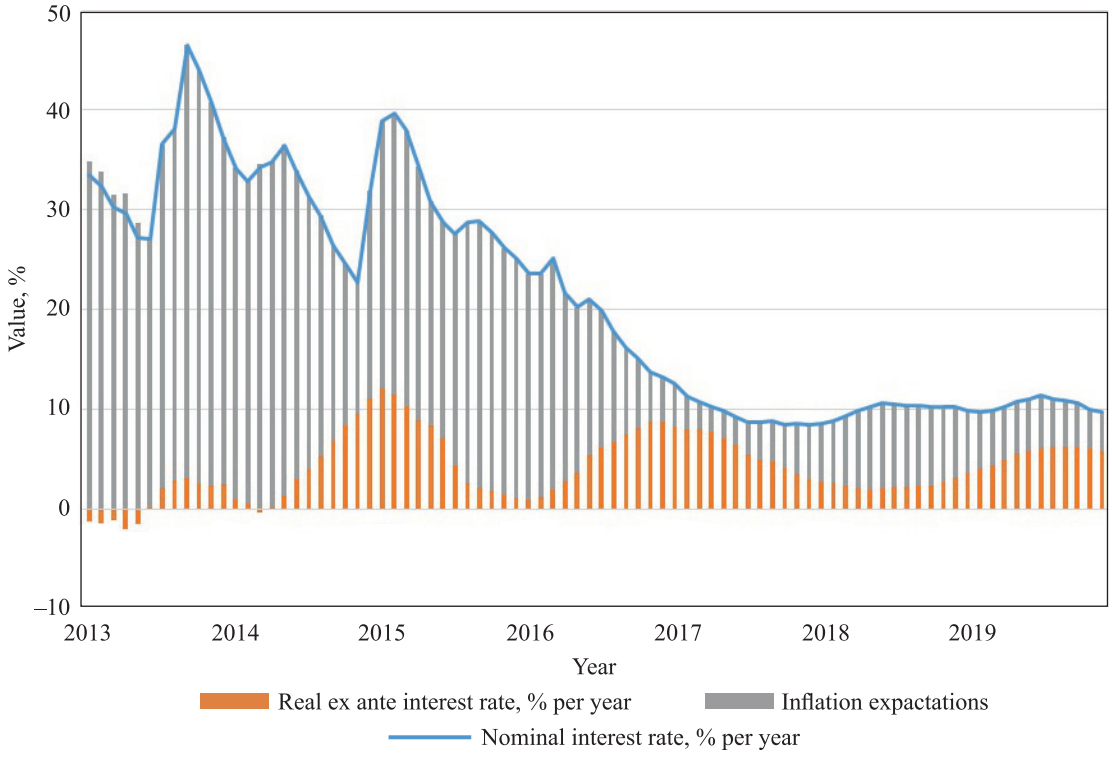

Fig. 2. Decomposition of nominal interest rate in Belarus in 2013–2019

Visualization of the IE measure strengthen the suspicion that the turbulence in Belarusian monetary environment was tightly linked with the dynamics of IE. Hence, the step associated with a regime-specific analysis of monetary environment seems to be worthwhile.

Corresponding exercise based on equations (9)–(10) allows detaching three regimes. I use names «normal», «subnormal», and «emergency» ones for them. Figure 3 reports the probabilities of these regimes.

Basing on these probabilities, the following exact time horizons are associated with these regimes. Normal: April 2004 – September 2007, September 2008 – January 2009, October 2016 – December 2019. Subnormal: January 2003 – March 2004, October 2007 – August 2008, July 2010 – February 2011, March 2012 – August 2016. Emergency: March 2011 – February 2012.

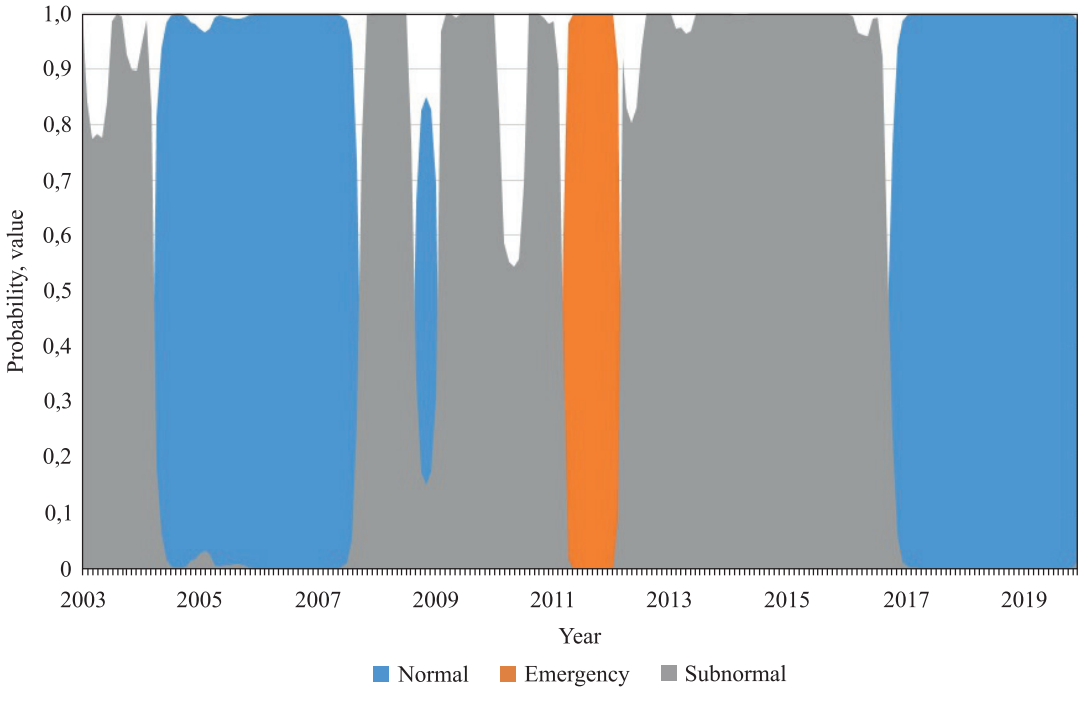

Fig. 3. The probabilities of different regimes of monetary environment

Tables 1–3 present regime-specific descriptive statistics for the variables of monetary environment (14). Table 4 reports the coefficients (c_π^R, ρ_π^R and γ_{t-i}^R) of the estimated equation (14) and the results of pairwise Granger causality test for π_t and π_t^e (both a regime-specific basis).

Table 1

Descriptive statistics and properties of «normal» regime of monetary environment

Variable/indicator	π_t	π_t^e	Δ_t	rea_t	rep_t	mps_t
Mean or value	7.71	7.83	0.13	4.43	4.56	0.19
Standard deviation	3.61	4.29	2.64	1.98	1.97	2.67
Median	7.07	7.00	0.17	4.25	4.52	0.15
Minimum	3.50	2.56	–5.65	1.85	0.30	–7.79
Maximum	18.45	19.74	5.60	8.80	8.98	6.10
Correlation with π_t^e	0.79	1	0.55	–0.65	0.08	0.58
Lag or lead of π_t^e	0	–	0	0	$t-4$	0

Note. «Lag/lead of π_t^e» reports the lag or lead with maximum correlation coefficient between X_t and $\pi_{t\pm i}^e$ based on cross-correlation function. This reflect lag or lead effect of π_t^e for the variable of interest.

Table 2

Descriptive statistics and properties of «subnormal» regime of monetary environment

Variable/indicator	π_t	π_t^e	Δ_t	rea_t	rep_t	mps_t
Mean or value	17.44	21.84	4.40	5.03	9.43	4.04
Standard deviation	8.20	10.46	11.29	3.51	10.19	11.94
Median	16.21	23.15	4.61	5.38	9.62	3.75
Min	1.32	3.27	–15.76	–1.99	–10.11	–41.15
Max	43.92	43.44	36.22	12.10	39.30	33.82
Correlation with π_t^e	0.29	1	–0.46	–0.02	–0.52	–0.44
Lag or lead of π_t^e	0	–	0	$t-1$	0	0

Table 3

Descriptive statistics for «emergency» regime of monetary environment

Variable/indicator	π_t	π_t^e	Δ_t	rea_t	rep_t	mps_t
Mean or value	114.68	29.09	–85.60	4.72	–80.88	–83.00
Standard deviation	53.07	12.35	43.35	3.25	46.02	43.07
Median	129.59	31.56	–99.76	3.53	–96.23	–94.17
Minimum	29.71	8.20	–146.77	0.65	–144.65	–129.63
Maximum	190.15	48.16	–21.50	11.79	–14.21	–14.05

Note. Equation (14) was not estimated for this regime because of the lack of observations with it (12). Hence, the values of c_π^R, ρ_π^R and γ_{t-i}^R are not reported for this regime. The table does not report the results of correlation and cross-correlation analysis, as the number of observations for this regime is not enough for them.

Table 4

Relationship between π_t and π_t^e: estimated regression coefficients and the results of granger causality test

Regressor indicator	Normal regime	Subnormal regime
c_π	1.04***	2.09***
ρ_π	0.87***	0.834***
γ_{t-1}	0.50***	0.22***
H0: π_t does not Granger cause π_t^e	4.23***	0.63
H0: π_t^e does not Granger cause π_t	1.58	0.88

Note. *** denotes significance at 1 % level. For Granger causality the table reports F-statistic and its significance for the corresponding test specified with 6 lags. Rejecting H0 (denoted by ***) signals about Granger causality in corresponding relationship. The table reports the results for «normal» and «subnormal» regimes only, as for the «emergency» regime the number of observations (12) is not enough for statistical inferences.

The obtained results may be summarized in the following stylized facts about Belarusian monetary environment:

1. Belarusian monetary environment used to function in three considerably and significantly different regimes.

2. «Normal» regime is peculiar by reasonable theoretical moments and relationships among monetary variables. There's a strong relationship between π_t and π_t^e (although in terms of Granger causality its direction is one-sided: from π_t to π_t^e), which makes monetary environment stable, given acceptably low level of π_t^e. Hence, just the «normal» regime secures near-neutral stance of the monetary policy (which may be treated as a desirable one on an average basis, i. e. without relating it to the stance of the business cycle).

3. Inflation expectations in Belarus are highly volatile: even in «normal» regime its variance considerably exceeds the one of actual inflation, while other regime result in much higher volatility. Moreover, IE display the signs of backward-looking formation (at least, in normal regime), without any signals of forward-looking formation in any regime (this conclusion stems from cross-correlation properties and Granger causality tests). This means that IE are not anchored (i. e. have a steady-state level) in Belarus, while sensitive to numerous exogenous shocks.

4. «Subnormal» regime is likely to stem from the jump in the level of inflation expectations (given its sensitivity to exogenous shocks). In order to prevent the realization of high inflation expectation in actual inflation, the monetary authorities are likely to respond by restrictive policy stance ($mps_t \approx 4$, i. e. sensitively restrictive). This forced restrictiveness leads to the situation when the real ex post interest rate (rep_t) considerably exceeds the ex ante one (rea_t), which also results in a lower (in comparison to the «normal» regime) effect of π_t^e on π_t (i. e. $\gamma_t^{\text{Subnormal}} < \gamma_t^{\text{Normal}}$). The situation tends to become sustainable, unless the agents reduce their IE in order to secure $\Delta_t \approx 0$. But while in this regime actual inflation affects IE weakly, quitting from this regime may become problematic and takes time.

5. If the monetary authorities want to avoid the situation of «forced restrictiveness» in monetary policy, given high IE (ceteris paribus), expected inflation tend to transform into the actual one. This gives a rise to the «emergency» regime of monetary environment with abnormal values and relationships among the corresponding variables.

Explaining the periods of «forced restrictiveness» of monetary policy in Belarus

Stylized facts assume that if inflation expectations have jumped (due to any reason), a kind of trap for monetary environment can arise. If the authorities react and raise interest rate, basing on the expected inflation, the impact of expectations on actual inflation will be mitigated, but the losses, say in terms of output, will be high as well, because of extremely high ex post real interest rates. If they ignore such a challenge (or moreover facilitate the rapid reduction of nominal interest rates), a rise in actual inflation is highly likely. This can also be treated as the mechanism of self-fulfilling prophecy at work.

A similar trap took place in Belarus throughout 2011–2016. In 2011–2012, the lack of policy response given unexpected shock of actual inflation and further shock to IE led the monetary environment to the «emergency» regime. Hence, in 2011 and early 2012 the country faced a three-digit inflation rate. Later on, the inflation rate

went down gradually, but it was not sufficient to enhance monetary stability in a broader sense. For instance, for nominal interest rates the level of 20 % per year has become an unachievable lower bound until 2016. Moreover, in 2013–2016 upside jumps in nominal interest rates took place regularly (see fig. 2).

Such combination of nominal interest and inflation rates resulted in an extremely high and volatile level of real interest rates throughout 2013–2016. During that period real returns at the Belarusian financial market fluctuated within the range of 10–30 % per year. For instance, a median (monthly) value of the real interest rate on new loans in 2013–2016 was 17.6 % per year. So, one may state that real monetary conditions have been extremely tight in the last couple of years.

At the same time, in 2015–2016 Belarus has dipped into a prolonged and deep recession. During that two years the country has lost roughly 7 % of its output. The combination of high real interest rates and recession gave a rise to a naive, but acceptable diagnosis: excessively high interest rates cause (or at least contribute to) recession. This view became popular in a domestic policy discussion. Furthermore, pretty often this story transformed into «too tight monetary policy causes (or at least contributes to) recession». Given this pressure, the NBB became accustomed to justifying its policy stance by considerations of financial stability given financial fragility. So, the economic policy discussion got into the discourse of these two extremes. Finally, it boiled down to the question if the monetary environment has stabilized enough in order to soften monetary policy.

However, a naive story about the stance of monetary policy and the business cycle is not true in case of Belarus in several respects. First, high interest rates at the financial market were not because of excessively high policy rate. It happened due to volatile but still persistently high inflation expectations (see fig. 1). The latter visualized the loss of monetary policy credibility by the general public. Until 2016, the level of inflation expectations was persistently higher than actual inflation, demonstrating extremely slow (if any) convergence (see fig. 1). At the same time, ex ante level of real returns has remained relatively stable. When setting its policy rate, the NBB has taken into consideration existing inflation expectations. Otherwise, high expected inflation would have been realized. So in recent past the stance of the monetary policy could hardly be accused of generating too tight monetary conditions through setting improper policy rate. The problem was more severe and one can argue about the inability of the NBB to anchor inflation expectations.

In late 2016 and early 2017 expected and actual inflation rate converged, mainly due to the contraction of the former. This enhanced more stability into the monetary environment in a broader sense. The turn of 2016–2017 has become a breakpoint for the monetary environment to return into a «normal» stance (see fig. 3).

Implications for monetary policy

Throughout 2017–2019 the situation in monetary environment has severely improved and an «average» stance of monetary tends to be neutral, i. e. the situation of «forced restrictiveness» seem not to be on the agenda (see fig. 1). This also may be considered as the disappearance of the «expectations overhang». Does this mean that monetary policy since 2020 can be more effective and the room for maneuver in it has expanded? In other words, if the need in expansionary monetary policy arises (say, because of cyclical downturn in output), can the NBB *unconditionally* satisfy such kind of demand?

A short answer to this question – no, the NBB cannot do this. Given the stylized facts about Belarusian monetary environment, I argue that the stance of monetary policy in Belarus is very sensitive to the stance of inflation expectations. At the same time, inflation expectations in Belarus suggest that despite reduction of their level, the issue of it being unanchored is still on the agenda. In this respect, expected inflation in Belarus tends to be sensitive to numerous kinds of actual and information shocks, e. g. domestic and global output dynamics, interest rate levels and spreads, exchange rate, financial stability issues, etc. Hence, the NBB had to take into account a mark-up in the expected inflation in respect to the actual one and to transform it to the mark-up to the interest rate. If the NBB ignores such kind of shock and nevertheless softens monetary policy, it will undermine price stability due to a powerful transmission effect from expected inflation to the actual one. Moreover, a reverse linkage from actual inflation to the expected one is likely to result in a prolonged inflationary period, causing a so-called «emergency» stance of monetary environment.

A generalized policy diagnosis for today looks like as follows. Monetary policy has reached a roughly neutral level due to a considerable reduction of inflation expectations. The latter, in turn, happened due to a prolonged period of restrictive policy stance (in 2015–2016), which suppressed actual inflation by means of sacrificing output in a sense (the period of cyclical downturn could have been shorter without such kind of limitations for monetary policy). But IE still remain unanchored and sensitive to shocks. Hence, unless expectations had been anchored, the monetary policy would still suffer from the lack of power. The latter means that just anchoring inflation expectations is the core precondition for normalizing monetary environment and the power of monetary policy.

In terms of monetary policy rule, this means that it cannot become more «pro-growth», even keeping in mind the risks to output and (or) financial stability. Otherwise, it can spur price destabilization, which may also become a trigger for financial instability. Hence, the logic of «lesser evil» does not work. Indeed, there are risks to financial stability stemming from poor growth. But struggling against them through more «pro-growth» policy will cause price instability and financial instability stemming from the latter. But what is more important, the logic of «lesser evil» itself is doubtful in respect to monetary policy. Recognizing the linkage between monetary policy and financial stability does not mean that risks to the latter should be directly traced by the former. Foremost financial stability issues can and should be tackled through macroprudential tools.

Conclusions

This article explores empirical SVAR-based measure of inflation expectations for Belarus. Basing on it, it suggests a regime-switching view of Belarusian monetary environment. Belarusian monetary environment can function in different regimes with different relationships and causalities among monetary variables. Historically, three substantially different regimes are detected. This results in a sophisticated schedule for the monetary policy in the country, which even can turn out into a kind of trap. In case of the latter, monetary policy in Belarus may suffer from the lack of room for maneuver and have to choose between either inflation spike or sensitive losses in output. Regime-switching view allows explaining the phenomenon of the prolonged period of extremely high real interest rates in Belarus' recent past. From this view, that was a period of «forced restrictiveness» in monetary policy, while inflation-depreciation slalom was an alternative to it. By today, the intensity of the problem has mitigated, but this does not mean that it cannot resurge again. Hence, Belarusian monetary policy still suffers from the lack of effectiveness.

Unanchored inflation expectations that are sensitive to numerous shocks is a deep root of this problem. Just it refrains monetary policy from being more effective and powerful. Hence, chronic policy discussion in Belarus that is extensively concentrated on the relationship between monetary policy and its effect of output ceteris paribus is a mistake in itself. Unless inflation expectations have been anchored, any discussion about reshaping of monetary policy and making it «pro-growth» is meaningless. Today for Belarus, anchoring inflation expectations is a worthwhile unconditional priority for monetary policy agenda.

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Received by editorial board 25.01.2020.