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BEHAVIOURAL PERSPECTIVE OF THE INFLATION TARGETING STRATEGY: THE CASE OF SERBIA

Bihevioralna perspektiva strategije inflacionog ciljanja – slučaj Srbije

Abstract

Regarding inflation, the lion's share of theory and literature refers to the analysis of its economic determinants. In our empirical analysis, we emphasized some behavioural factors embodied in the short-term inflation expectations of banks and companies, which are regarded as one of the essential factors for reaching desired current inflation dynamics. We considered whether and how the central bank can, through inflation targeting as monetary strategy, nudge the inflation expectations of market participants in the preferred direction. In the paper, we looked into the performances of inflation targeting in the case of Serbia and considered potential explanations of the given (un)success from both a neoclassical and a behavioural theoretical perspective. We found that in the case of Serbia market participants' expectations in one year ahead strongly influences the actual year-on-year inflation rate. Obviously less influence on actual inflation that comes from inflation expectations of the real economic sector in comparison to the financial sector could be attributed to both economic and psychological phenomenon of downward price rigidity in the internal environment of companies, which adjust with a delay to changes in market prices. The success of inflation targeting soundly depends on the way the central bank manages the formation and influences the movements of inflation expectations of market participants, especially banks which could be seen as professional forecasters.

Keywords: *inflation targeting, inflation expectations, ARDL regression, behavioural economics, heuristics*

Sažetak

Značajan deo teorije i literature u oblasti inflacije odnosi se na analizu njenih ekonomskih determinanti. U našoj empirijskoj analizi, naglasili smo pojedine bihevioralne faktore sadržane u kratkoročnim očekivanjima inflacije banaka i kompanija, koja se smatraju jednim od ključnih faktora za postizanje željene dinamike tekuće inflacije. U radu se razmatralo da li i na koji način centralna banka može putem monetarne strategije ciljanja inflacije uticati na kretanje inflacionih očekivanja učesnika na tržištu u preferiranom smeru. U radu smo se bavili performansama ciljanja inflacije u slučaju Srbije i izneli potencijalna objašnjenja datog (ne)uspeha kako iz neoklasične, tako i iz bihevioralne teorijske perspektive. Ustanovili smo da u slučaju Srbije promena inflacionih očekivanja učesnika na tržištu za godinu dana unapred snažno utiče na stvarnu, međugodišnju stopu inflacije. Očigledno manji uticaj na stvarnu inflaciju koji dolazi od očekivanja inflacije privrednog sektora u poređenju sa finansijskim sektorom mogao bi se povezati i sa ekonomskim i psihološkim fenomenom „rigidnosti cena naniže" u internom okruženju kompanija, koje se sa kašnjenjem prilagođavaju promenama u tržišnim cenama. Uspeh ciljanja inflacije u velikoj meri zavisi od načina na koji centralna banka upravlja procesom formiranja i utiče na kretanje inflacionih očekivanja učesnika na tržištu, posebno banaka, koje se mogu smatrati profesionalnim prognositičarima.

Ključne reči: *ciljanje inflacije, inflaciona očekivanja, ARDL regresija, bihevioralna ekonomija, heuristike*

Introduction

Inflation expectations and actual inflation are closely related. When inflation expectations rise, it can lead to higher actual inflation as people and businesses adjust their behaviour accordingly. Inflation expectations, even though they do not always match reality [12, p. 4], significantly affect price dynamics in a country, because companies set their prices and project cash flows regarding the achieved and expected inflation, which banks include in interest rates and into the price of various financial services. With regard to this, it is recommended that the central bank in inflation targeting (hereinafter: IT) regime should steer the expectations of market participants towards unique numerical target for inflation or numerical target with tolerance band in the shortest possible time interval and with as few limitations as possible. As of 2021 and 2022, inflation targets or target ranges were pursued by central banks in 72 countries (34 advanced economies and 38 major emerging market and developing economies)[1]. Effective inflation targeting regime and a rise in the central bank's transparency are associated with better anchoring of inflation expectations in both advanced economies and emerging and developing markets [39, p. 16]. Besides classical economic foundations, in this paper we try to examine some features of IT strategy in Serbia from the perspective of behavioural economics.

Briefly explained, behavioural economics tends to integrate experimental results in the fields of psychology and sociology with the application in microeconomics and macroeconomics. According to the protagonists of behavioural theory, economic people (*homo economicus*) make decisions dominantly relying on scientific facts, which put them in the privileged position of rational individuals. In contrast to them, behaviour of ordinary people (*homo sapiens*) is often bounded-rational or irrational in many ways. A key assumption derived from behavioural empirical research is that people value differently the gains and losses of available alternatives, with the majority naturally being oriented towards avoiding change due to prevailing loss aversion. The reason for this is that, in most cases, limitedly rational people attach a higher specific weight to potential loss compared to gain of the choice with same value, under the influence of numerous psychological factors – emotional, cognitive, and sociological [60, p. 431]. Many individual behaviours have implications for private and public sector organisations, since personal reactions to gains and losses are likely to be congruent with assessments of their executive boards [44, p. 22]. Most economic decision-makers comply with proponents of libertarian paternalism that self-aware individuals, private sector organisations and public sector institutions, such as central banks, have task and legitimate right (but no responsibility) to direct, steer or 'nudge' people's behaviour in a predictable way by small and seemingly insignificant changes in choice architecture, but without limiting or eliminating the options available to them, and with no significant impact through economic incentives. In this way, efforts are made to improve the level of well-being of people and society in terms of wealth, health, and happiness, whereby the judgment about this should be made by every individual and society. Consciously nudging subjects toward a favourable outcome is especially important in cases where they are prone to extremely bad choices due to the lack of attention, incomplete information, insufficient self-control, and limited cognitive reasoning. In this regard, the golden rule says: '*Provide incentives when the decision-makers can be helped to the greatest extent, that is, when they can be harmed to the least extent*' [59, p. 72], meaning the right incentive is the one simple to carry out and avoidable with minimum costs.

From behavioural economics point of view, IT strategy can be understood as the approximation of the central bank's behaviour and decision-making process towards public [63, p. 93]. In that sense, central bank is committed to follow publicly announced inflation target or target range, which enables it to, within its mandate, form and steer inflation expectations by transparent and regular communication with the public. In practice, conducting IT is related to the determining of an optimal level of the key policy rate as the main instrument in achieving low and stable inflation. To do so, central bank makes short and medium-term inflation forecasts based on certain assumptions and then compares the

1 Retrieved from [35], considering the IMF's classification of advanced and emerging and developing countries.

outcomes with inflation target – if projected inflation is above target, the key policy rate is usually raised and vice versa. IT strategy is thus forward-looking and its effects on the real economy are often postponed from one to two years, depending on the efficiency of monetary policy transmission mechanism and intensity of transfer from the key policy rate (and interest rates on lending and deposit facilities) to the market interest rates. However, the whole central bank's judgement process is not purely objective, but prone to subjective assessments of the people who are responsible for making decisions, which is where the insights from the behavioural economics may step in. In parallel with that, market participants do not always respond to the central bank's choices in rational way, since their expectations are also influenced by different psychological factors. In the case of Serbia, it is especially embodied in households' attitudes toward high inflation, as they are still strongly affected by the previous episodes of high inflation during 1990s. Hereof, the empirical analysis in this paper entails only the inflation expectations of the financial and corporate sector.

Literature review

Although many emerging countries, like Serbia, have adopted IT as monetary strategy to ensure price stability in the first place and then pursue other economic goals, there is mixed evidence about the achieved results. Rose [55] concluded that countries with inflation targeting are found to be less prone to sudden capital outflows and consequently less exposed to financial crisis. Mishkin and Schimidt-Hebbel [48] pointed to strong empirical evidence in favour of implementing IT strategy in emerging countries. They recorded close to a 0.8% reduction in headline inflation just after adopting strategy and a 7.0% reduction in the long term compared with non-targeting emerging market countries (results obtained from panel VAR on the sample of 34 industrial and emerging countries before and after the oil-price and exchange-rate shocks). Fifteen years later, Duong [20] showed that IT can help emerging countries to reduce an increase in inflation rate during crises without many trade-offs in the output growth (results obtained from balanced panel data of 54 countries with 15 inflation-targeting countries for the period 2002-2010). On the contrary, Zhang and Wang [65] found that IT framework does not improve countries' macroeconomic performance in terms of growth and inflation (results obtained from dynamic panel on dataset of 68 major advanced countries and emerging markets from 1990 to 2019).

The lion's share of economic theory and literature refers to the analysis of inflation determinants. In our analysis, we put emphasis on inflation expectations of two groups of economic agents – banks and companies. Anchoring these expectations is one the essential factors for inflation controllability and successful implementation of IT strategy in small and open economies like Serbia. The effects of expected inflation on actual inflation were brought up by Phelps [54] and Friedman [24]. Bernanke [7] claimed that the state of inflation expectations largely influences actual inflation and thus the central bank's ability to achieve price stability. Fuhrer [25] investigated short-run relationship between inflation expectations and actual inflation in the US. Salle et al. [56] confirmed strong and positive correlation between inflation and inflation expectations, suggesting predominance of the expectations channel in the monetary policy transition mechanism. Lagoa [40] and Marfatia [46] focused on a strong nexus between inflation expectations and actual inflation by analysing the data for the Eurozone and the UK. Hommes et al. [32] examined how subjects in the experiment create expectations of inflation and output in similar ways. Gülsen and Kara [29] estimated that inflation expectations in Turkey are significantly related to macro-variables such as exchange rates, oil prices, inflation realisations and inflation targets. Verbrugge and Zaman [62] elaborated on the strong influence of inflation expectations on subsequent inflation, so that central banks view them as critical to the monetary policy functioning. Schafer [57] marked inflation expectations as an important factor affecting decisions that determine actual inflation, referring to the classical New Keynesian Phillips curve model in which a firm's expectations of future prices affect its pricing decisions in the current period.

Additional understanding of the monetary policy decision-making in the scope of IT strategy has been

recently offered by the behavioural economists, peculiarly in the domain of the inflation expectations formation. In that sense, influencing the inflation expectations can be used as a measure of success in conducting IT strategy. Vega and Winkelried [61] detected that the anchoring of expectations to a defined nominal level can reduce the persistence of inflation if flexible IT is practiced i.e. by slow adjustment to shocks that displace inflation from target. Gnan et al. [26] confirmed that formation process of agents' inflation expectations involves uncertainty and changes over time and may be influenced by non-rational expectations and behavioural heuristics. Bruine et al. [9] argued that individual memories of the past year's changes in prices are biased towards those goods and services that have shown the largest price changes, consequently affecting surveyed inflation expectations. Lambsdorff et al. [41] explained how subjects in the experimental conditions become able to form rational expectations when they learn about inflation dynamics after some repetition. This contemplating process is related to adaptive expectations or trial-and-error learning mechanism that is opposed to the fully rational expectations based on all available information. Lima et al. [43] brought forth the uncertainty in decision making resulting in the formation of norm-based inflation expectations (heterogeneous and time-varying), though their dynamics need not obstruct successful monetary policy measures. Salle et al. [56] observed that inflation expectations and inflation are highly and positively correlated in different scenarios, implying that the expectations channel is predominant in the determination of inflation in the empirical model. Da Silva and Da Silva [16] verified that the inflation target is unlikely to be achieved when private forecasters rely on anchoring heuristics, i.e. favour information they received earlier in the decision-making process. Ehrmann [21] examined behaviour of inflation expectations depending on the inflation level and its persistence – if inflation is low, and particularly in longer period, inflation expectations become more dependent on achieved inflation and vice versa. De Grauwe and Ji [17] assumed in their behavioural macroeconomic model that agents do not have rational expectations because of inherent cognitive limitations, so they reach out simple rules-of-thumb, the so-called 'heuristics', to make personal forecasts. Hommes et al. [32] pointed out that a key difference in outcomes between the macroeconomic models with rational and behavioural expectations is the way of treatment for inflation volatility.

Research methodology

We analysed the results of inflation targeting in the case of Serbia and brought up potential explanations of the (un)success from both a neoclassical and a behavioural theoretical and empirical perspective. The focus was on examining whether and in what way the short-term expectations of inflation rate among companies and banks affect the actual year-on-year inflation, and consequently the targeting of inflation by the central bank. The empirical research covered a fairly lengthy period from January 2009 to December 2021 (before the emergence of multiple global crises and change in the monetary policy stance). Data were used on actual inflation rates and output gap estimates (source: the central bank), expected inflation rates by market participants – companies and banks (source: specialised agencies surveys conducted on behalf of the central bank), real unit labour costs (source: official statistical office and the central bank's estimates). The empirical model is consisted of only domestic determinants of inflation that can be influenced by sovereign monetary policy. In the first part of the research, we estimated linear regression equation with the aim of testing the impact of the short-term inflation expectations of market participants on the actual inflation, measured as year-on-year percentage change in Consumer Price Index. Additionally, real unit labour costs and output gap were inserted in the regression as they are often used as determinants of inflation in empirical analyses. In addition, the analysis carried out in the second part of the research involved examination of the short-term inflation expectations of the financial and corporate sector in the observed thirteen-year period, their deviations from the target inflation and tolerance band, as well as deviations from the actual (year-on-year) inflation with quarterly dynamics.

The National Bank of Serbia (hereinafter: the central bank) has been applying an IT strategy as of 2006 implicitly and then explicitly starting from January 1, 2009, with

the priority to achieve and preserve low and stable overall price movements in accordance with the criteria defined under the EU accession process. The main principles of IT strategy have been gradually introduced into practice by the central bank's 'Memorandum on Inflation Targeting as Monetary Strategy': (1) the inflation target, defined in terms of the annual percentage change in the Consumer Price Index, is the only numerical guideline for the monetary policy, (2) the inflation target will be achieved by changing the interest rate when conducting main monetary policy operations (currently the interest rate on one-week repo operations), (3) managed floating exchange rate regime will be pursued and (4) transparency of monetary policy will be enhanced and efficient communication with the public upgraded. Besides the priority of reaching and preserving price stability prescribed by the law, IT regime should have contributed to ensuring financial stability in the long term, boosting confidence in the domestic currency and thus encouraging its greater use in everyday transactions, as well as increasing the economy's resistance to different endogenous and exogenous shocks. IT strategy in Serbia was adopted after the failure of the previously applied monetary strategies, namely targeting the exchange rate and targeting monetary aggregates, to deal with relatively high and volatile inflation and pronounced internal and external imbalances in a sustainable manner. Strengthening credibility, as the ability of the central bank to anchor the medium- to long-term inflation expectations of market participants and to avoid persistently high or extremely low inflation rates, was one of the key reasons to reorient towards IT strategy. The decision of the central bank's executive board to switch to new monetary framework was also supported by solid experiences of the central banks in emerging and transition economies comparable with Serbia, which already recorded some positive macroeconomic changes following fixed target or target range for inflation.

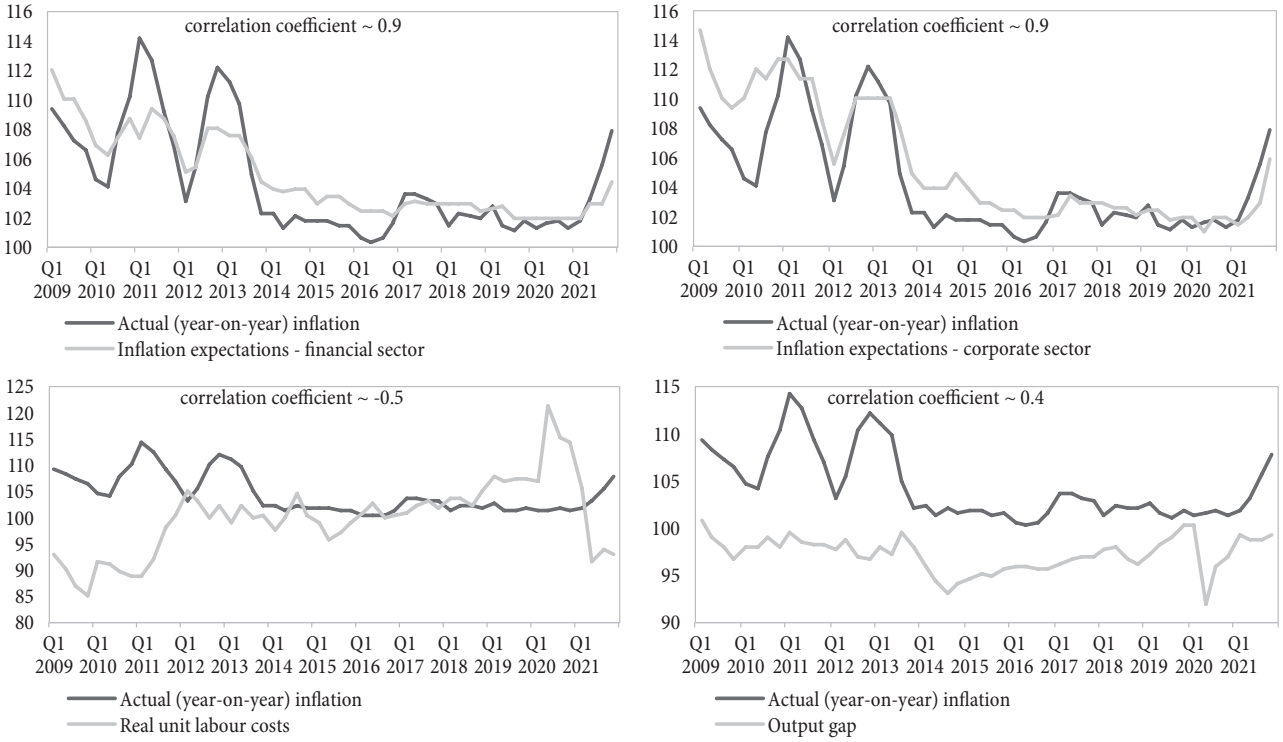
Results and discussion: Part 1

Taking into account empirical findings of the studies which focused on the inflation determinants (particularly [42], [50] and [3]) as a convenient econometric approach we constructed an Autoregressive Distributed Lag (ARDL) model applicable for both non-stationary time series as well as for times series with mixed order of integration [58, p. 79], given the fact that real economic data do not often express stationary behaviour. In case of selected variables for Serbia, most time series expressed non-stationary nature in the observed period (from Q1 2009 to Q4 2021), which was the main reason we opted for the ARDL model, which could have provided realistic and efficient estimates. Another reason was to deliberately separate short-run and long-run effects between variables. Besides it can be applied whether the regressors are $I(1)$ and/or $I(0)$, ARDL possesses other important features: 1) it is more statistically significant approach to determine the cointegration relation in small samples like ours – around 50 observations [28, p. 265], [18, p. 316]; 2) it allows that the variables may have different optimal lags, 3) it is useful to track dynamic adjustments between variables over time and 4) it employs a single reduced form equation instead of a system equations requested by conventional procedures [51, p. 1939].

We employed the ARDL regression to estimate the existence of the short- and long-run dynamics between the actual inflation (measured as year-on-year percent change in Consumer Price Index) and its determinants – short-term inflation expectations of corporate and financial sector in Serbia, real unit labour costs and output gap. In our focus were the short-term inflation expectations instead of the medium/long-term on account of two main reasons: 1) longer and uninterrupted data series (from 2009) in case of short-term inflation expectations in comparison to shorter and interrupted data series (from 2013) in case of medium-term inflation expectations and 2) IT strategy effectiveness from the moment it was adopted in 2009 onwards can be assessed only in case of the short-term inflation expectations. Besides expectations, real unit labour costs and output gap are also added in the regression analysis, thereby, we encompassed only domestic factors of inflation, similar to Mihajlović [47]. These factors can be influenced to a certain extent by monetary policy of the NBS, without considering global factors (e.g. import prices, foreign trade balance, risk premia, price movements on global commodity and financial markets, etc.). It seems that the

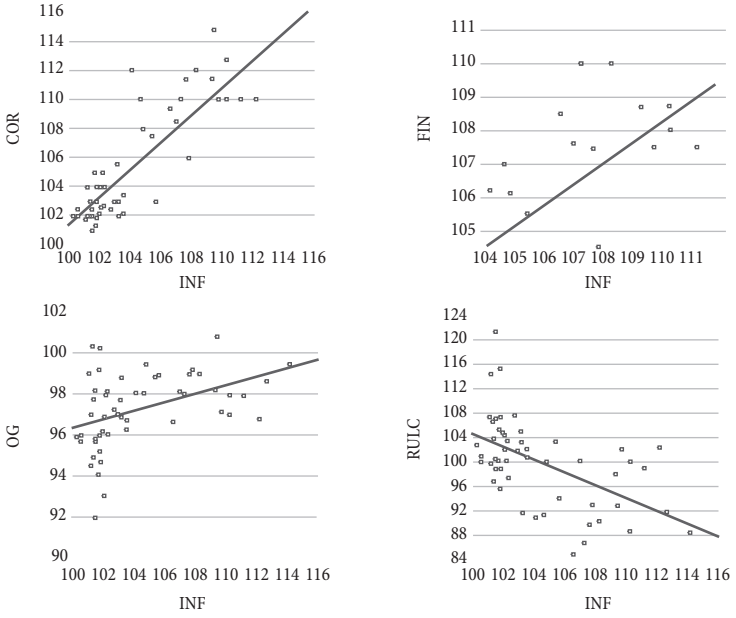
actual inflation in year-on-year terms and the expected inflation of both financial and corporate sector had very similar movements, and after 2014 their values converged even more (see Figure 1), which can be an initial signal of a significant relationship. In the same period there was also a positive relationship between the output gap and the actual inflation, while the ordinary correlation with real unit labour costs was negative. Another preliminary analysis of the relationships between the observed variables, through scatter diagrams, also indicated that there was a positive connection between the actual inflation and almost all independent variables, except real unit labour costs (see Figure 2).

Figure 1: Dynamics of the actual inflation and independent variables



Source: Central bank's databases and authors' calculation and illustration in EViews.

Figure 2: Scatter diagrams of the actual inflation and independent variables



Source: Central bank's databases and authors' calculation and illustration in EViews.

We conducted two types of tests to check for the stationarity of the selected variables – Augmented Dickey-Fuller (ADF) tests (results presented in Table 1) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests (results presented in Table 2). To decide on whether intercept or intercept with trend should be reported as deterministic components, common Stock-Watson test was carried out and approved of using intercept component (noted as τμ) instead of intercept and trend component (noted as τt statistic). The results of all ADF and KPSS tests indicated that almost all series, except output gap, exhibit non-stationary movements in level. Our finding that inflation exhibited non-stationary movements in the observed period is in accordance with Charemza et al. [11], who tested 107 world-wide inflation series for unit roots by using ADF tests and found non-stationarity in 93 inflation series, while 14 series were proved to be stationary. Among others, Evans and Lewis [22], Crowder and Hoffman [14], Crowder and Wohar [15] also identified unit root in the inflation series. The unresolved question of whether inflation series should be regarded as stationary or nonstationary has varying test results across countries and is heavily influenced by the specific statistical methods employed. While it is impossible to comprehensively review the extensive literature on this subject here, it is noteworthy that a paper by Ng and Perron [49] applied a range of unit root tests to quarterly inflation data from G7 countries and failed to arrive at firm conclusions regarding the inflation stationarity. As previously noted, in order to apply ARDL model, it is necessary that underlying variables are *I*(0), *I*(1) or a combination of both, which was verified by obtaining first differences of the selected variables within both tests (ADF and KPSS).

Taking into account the results of unit root testing, we specified the regression equation ARDL (1, 4, 1, 2, 2) for the actual (year-on-year) inflation:

$$INF_i = \beta_0 + \beta_1 INF(-1) + \beta_2 FIN + \beta_3 FIN(-1) + \beta_4 FIN(-2) + \beta_5 FIN(-3) + \beta_6 FIN(-4) + \beta_7 COR + \beta_8 COR(-1) + \beta_9 RULC + \beta_{10} RULC(-1) + \beta_{11} RULC(-2) + \beta_{12} OG + \beta_{13} OG(-1) + \beta_{14} OG(-2) + \beta_{15} V_1 + \beta_{16} V_2 + \beta_{17} V_3 + \beta_{18} V_4 + \varepsilon_i$$

where: FIN represent the short-term inflation expectations of the financial sector (in %); COR are the short-term inflation expectations of the corporate sector (in %); RULC are the real unit labour costs (in %); OG is the output gap (in %); V1, V2, V3 and V4 are dummy variables related to the highest levels of inflation in Q1 2011, Q4 2012, Q1 2013 and Q3 2021, respectively, while ε_i is random error of the model. Using Akaike Information Criterion, ARDL (1, 4, 1, 2, 2) was chosen as an optimal model among total of 2,500 models and top 20 models (see Figure 3), where

Table 1: Results of unit root testing using ADF test

Variables	in level			1st difference		
	t-Statistic	critical values	unit root	t-Statistic	critical values	unit root
Actual inflation	$\tau_\mu = -2.38$	$\tau_\mu^k = -2.93$	I(1)	$\tau_\mu = -3.70^{(**)}$	$\tau_\mu^k = -2.93$	I(0)
Financial sector inf. expect.	$\tau_\mu = -1.61$	$\tau_\mu^k = -2.92$	I(1)	$\tau_\mu = -6.28^{(**)}$	$\tau_\mu^k = -2.93$	I(0)
Corporate sector inf. expect.	$\tau_\mu = -2.56$	$\tau_\mu^k = -2.93$	I(1)	$\tau_\mu = -4.18^{(**)}$	$\tau_\mu^k = -2.93$	I(0)
Real unit labour costs	$\tau_\mu = -2.55$	$\tau_\mu^k = -2.93$	I(1)	$\tau_\mu = -5.74^{(**)}$	$\tau_\mu^k = -2.93$	I(0)
Output gap	$\tau_\mu = -3.88^{(**)}$	$\tau_\mu^k = -2.92$	I(0)	/	/	/

Note: The results are statistically significant at **5%.
Source: Authors' calculation in EViews.

Table 2: Results of unit root testing using KPSS test

Variables	in level			1st difference		
	t-Statistic	critical values	unit root	t-Statistic	critical values	unit root
Actual inflation	LM = 0.59	$LM^k = 0.46$	I(1)	LM = 0.21(**)	$LM^k = 0.46$	I(0)
Financial sector inf. expect.	LM = 0.86	$LM^k = 0.46$	I(1)	LM = 0.36(**)	$LM^k = 0.46$	I(0)
Corporate sector inf. expect.	LM = 0.83	$LM^k = 0.46$	I(1)	LM = 0.28(**)	$LM^k = 0.46$	I(0)
Real unit labour costs	LM = 0.57	$LM^k = 0.46$	I(1)	LM = 0.12(**)	$LM^k = 0.46$	I(0)
Output gap	LM = 0.24(**)	$LM^k = 0.46$	I(0)	/	/	/

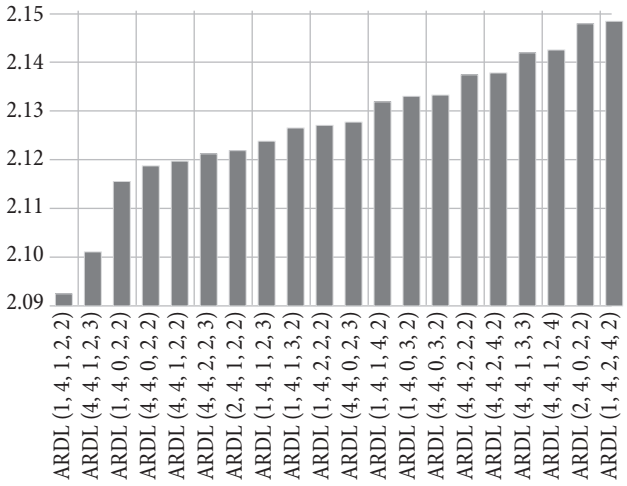
Note: The results are statistically significant at **5%.
Source: Authors' calculation in EViews.

the number in brackets denotes the number of lags for each explanatory variable.

The estimated equation of ARDL (1, 4, 1, 2, 2) with the lowest value of AIC and Newey-West procedure to provide robust standard errors in the presence of autocorrelation or/and heteroskedasticity is as follows:

$$\widehat{INF} = -44.04 - 0.03INF(-1) + 1.95FIN - 0.67FIN(-1) + 0.51FIN(-2) - 0.28FIN(-3) - 0.48FIN(-4) + 0.39COR - 0.18COR(-1) + 0.05RULC - 0.08RULC(-1) + 0.10RULC(-2) + 0.10OG - 0.05OG(-1) + 0.23OG(-2) - 5.62V1 - 2.76V2 - 1.40V3 - 1.28V4$$

Figure 3: Criteria graph for top 20 ARDL models



Source: Authors' illustration in EViews.

Table 3: Estimated ARDL (1, 4, 1, 2, 2) – short-run dynamics

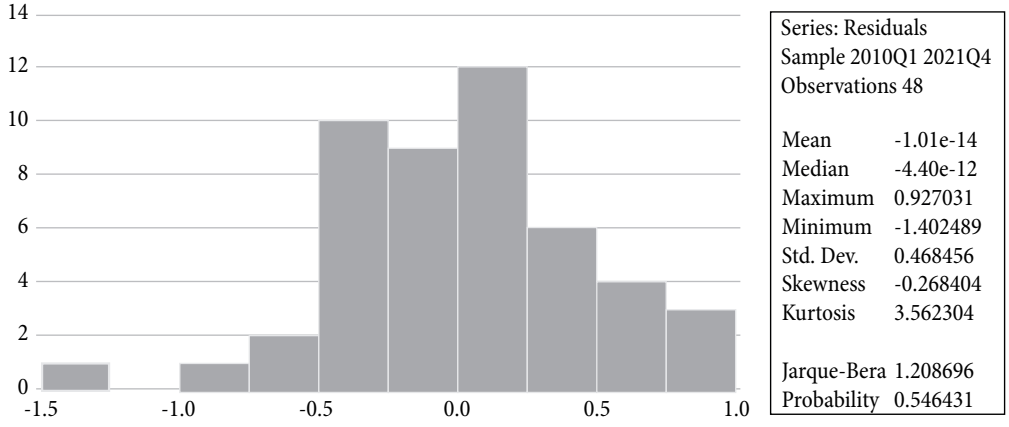
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-44.03597	16.59799	-2.653090(**)	0.0128
INF (-1)	-0.028918	0.103481	-0.279455	0.7819
FIN	1.950706	0.276551	7.053704(***)	0.0000
FIN (-1)	-0.670614	0.151912	-4.414478(***)	0.0001
FIN (-2)	0.507475	0.130134	3.899647(***)	0.0005
FIN (-3)	-0.275784	0.176968	-1.558388	0.1300
FIN (-4)	-0.484483	0.122949	-3.940502(***)	0.0005
COR	0.393148	0.131918	2.980239(***)	0.0058
COR (-1)	-0.179998	0.128744	-1.398107	0.1727
RULC	0.049927	0.033550	1.488142	0.1475
RULC (-1)	-0.083640	0.062288	-1.342806	0.1898
RULC (-2)	0.095805	0.046253	2.071349(**)	0.0473
OG	0.100792	0.079470	1.268300	0.2148
OG (-1)	-0.054269	0.089708	-0.604955	0.5499
OG (-2)	0.227167	0.076823	2.957005(***)	0.0061
V1	-5.619051	0.781125	-7.193539(***)	0.0000
V2	-2.761329	0.470120	-5.783669(***)	0.0000
V3	-1.400059	0.457256	-3.061870(***)	0.0047
V4	-1.279778	0.775396	-1.648357	0.1101
R-squared	0.983775	Mean dependent var		104.1553
Adjusted R-squared	0.973704	S.D. dependent var		3.678351
S.E. of regression	0.596482	Akaike info criterion		2.092227
Sum squared resid	10.31795	Schwarz criterion		2.832911
Log likelihood	-31.21346	Hannan-Quinn criter.		2.372133
F-statistic	97.68595	Durbin-Watson stat		1.691264
Prob(F-statistic)	0.000000			

Note: The results are statistically significant at ***1% and **5%.
Source: Authors' calculation in EViews.

Estimated coefficients of the explanatory variables in Table 3 represent short-run effects on the actual inflation. Positive signs of the estimated coefficients for variables FIN and COR correspond to the economic theory and experience of countries with IT regime. In other words: 1) the higher short-term inflation expectations of the financial sector, the higher the actual inflation and 2) the higher short-term inflation expectations of the corporate sector, the higher the actual inflation. The model also showed that the increase in the real unit labour costs and the output gap impact actual inflation in the short run. The results of *t*-tests indicate that the inflation expectations of both financial and corporate sector for one year ahead have statistically significant impact on the actual inflation. On the contrary, the real unit labour costs and the output gap do not show significant influence on the actual inflation in this model (observed in level). The results of *F*-test indicate that all independent variables in the model make statistically significant impact on actual inflation (at 1% level of significance). The movements of independent variables in the model account for around 97% of all variations in the actual inflation, according to the adjusted R-squared (see Table 3). The estimated ARDL regression equation has passed standard diagnostic statistical tests conducted in EViews (results presented in Table 4).

Breusch-Godfrey Serial Correlation LM test for autocorrelation reported that the null hypothesis cannot be rejected, hence there is no serial correlation among random errors in model at up to two lags. Furthermore, Breusch-Pagan-Godfrey test and Glejser test for heteroskedasticity reported that the null hypothesis cannot be rejected, so random errors possess constant variances for all observations. Jarque-Berra test for normality also showed that the null hypothesis cannot be rejected, hence empirical distribution of the residuals in the model does not significantly deviate from normal distribution (see Figure 4). The absolute values of *t*-statistics for statistically significant explanatory variables in the estimated regression equation are greater than two, which empirically indicates the absence of multicollinearity.

Figure 4: Results of the statistical test for normality



Source: Authors' illustration in EViews.

Table 4: Results of the statistical tests for autocorrelation and heteroskedasticity

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.344745	Prob. F(2,27)	0.7115
Obs*R-squared	1.195237	Prob. Chi-Square(2)	0.5501
Glejser Test			
F-statistic	0.858176	Prob. F(18,29)	0.6259
Obs*R-squared	16.68192	Prob. Chi-Square (18)	0.5451
Scaled explained SS	11.27696	Prob. Chi-Square (18)	0.8822
Breusch-Pagan-Godfrey			
F-statistic	0.392745	Prob. F(18,29)	0.9792
Obs*R-squared	9.407749	Prob. Chi-Square (18)	0.9495
Scaled explained SS	4.385443	Prob. Chi-Square (18)	0.9995

Source: Authors' calculation in EViews.

Finally, Ramsey RESET test has shown that the null hypothesis cannot be rejected, hence the model has correct specification, meaning that the linear regression on the whole is statistically significant (based on *F*-test); evaluated coefficients of all independent variables of interest – short-term financial sector and corporate sector inflation expectations – are statistically significant (based on *t*-tests) and have the appropriate positive sign in relation to the actual inflation; there is no autocorrelation and heteroskedasticity in the model while residuals are normally distributed (see Table 5).

Table 5: Results of the Ramsey RESET test

Specification: INF INF(-1) FIN FIN(-1) FIN(-2) FIN(-3) FIN(-4) COR COR(-1) RULC RULC(-1) RULC(-2) OG OG(-1) OG(-2) V1V2 V3 V4 C			
	Value	**df**	**Probability**
t-statistic	0.053426	28	0.9578
F-statistic	0.002854	(1,28)	0.9578
Likelihood ratio	0.004893	1	0.9442

Source: Authors' calculation in EViews.

Relationship between variables in the short run

From the estimated ARDL regression equation and the obtained results in case of Serbia, it can be concluded that the financial and corporate sector expectations for one year ahead have statistically significant and positive impact on the actual inflation in the short run, which is in line with economic literature and empirical evidence in Serbia. Specifically, if the short-term financial sector inflation expectations are raised by 1.00%, actual inflation rises by about 1.95%, while the uptick in the short-term corporate sector inflation expectations by 1.00% affects the rise in actual inflation by about 0.39%. A noticeable lower impact on actual inflation that comes from the corporate sector inflation expectations in comparison to financial sector inflation expectations could be attributed to the economic and behavioural phenomenon of downward price rigidity in the internal environment of companies, which adjust with a delay to changes in overall market prices. Some companies continue to set prices based on outdated information, as their past expectations of current economic conditions become relevant to current behavior and account for the sluggishness of adjustments [41, p. 3]. Therefore, it is not surprising that the inflation expectations of companies were moving on the higher levels in contrast to the expectations of banks and consequently above the actual inflation for the largest number of quarters, especially during 2009 and 2010. It is unveiled that the inflation expectations of the corporate sector were above achieved inflation for 36 months out of a total 48 months in the observed subperiod of 2009-2012, while the inflation expectations of the financial sector exceeded achieved inflation for 26 months (see Table 6). It is consistent with

Table 6: Deviation from actual inflation* of short-term inflation expectations of the financial and corporate sector in Serbia in the observed subperiod 2009-2012 (in percentage points)

Inflation expectations	**Jan.2009**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	-	-	-	-	-	-	-	-	-	-	-	-
Financial sector (Ipsos)	0.5	0.7	-2.6	-3.0	-0.9	-1.7	-1.5	-2.0	-2.7	-3.8	-2.1	-1.9
Corporate sector (Ipsos)	-2.0	0.7	-5.3	-3.2	-2.9	-3.7	-3.5	-3.0	-2.7	-4.8	-3.1	-2.8
Inflation expectations	**Jan.2010**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	-	-	-	-	-	-	-	0.9	1.4	2.4	2.3	3.1
Financial sector (Ipsos)	-3.2	-3.7	-2.3	-1.9	-2.5	-2.0	-2.4	-0.8	0.2	1.5	2.2	1.5
Corporate sector (Ipsos)	-4.1	-6.2	-5.3	-5.7	-6.3	-7.8	-4.9	-4.7	-3.7	-1.8	-0.4	-2.4
Inflation expectations	**Jan.2011**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	3.7	5.1	5.8	6.7	5.4	4.7	4.1	2.5	1.3	1.7	1.4	1.0
Financial sector (Ipsos)	3.8	5.2	6.7	7.3	5.3	3.3	3.4	2.4	0.6	1.3	-0.4	-0.6
Corporate sector (Ipsos)	-4.2	1.2	1.4	3.3	-2.0	1.3	0.7	0.5	-2.1	-1.3	-0.9	-1.5
Inflation expectations	**Jan.2012**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	-0.4	-1.1	-2.6	-3.5	-1.6	-0.5	0.1	1.6	3.0	5.8	3.9	4.2
Financial sector (Ipsos)	-1.4	-1.1	-1.9	-2.3	-0.1	0.0	-0.9	1.4	2.3	4.9	3.9	4.2
Corporate sector (Ipsos)	-2.0	-3.1	-2.4	-1.8	0.2	-2.0	-1.9	-2.1	0.3	2.9	1.9	2.2

Source: Authors' calculation on the NBS data. *Note: Negative deviations display inflation expectations above the actual inflation.

the observation that there is much more volatility in the inflation expectations of households and firms than of informed agents [13, p. 2] like banks and professional agencies, more disagreement both in terms of their beliefs about future as well as past inflation, and more uncertainty in their individual forecasts.

On the contrary, the real unit labour costs and the output gap did not exhibit statistically significant influence on the actual inflation in this model. There can be several reasons for such an outcome. Concerning output gap, since it is not subject to direct measuring, it was obtained by applying the Hodrick-Prescott filter, which tries to identify a linear trend at the series [2, p. 17] and whose estimates of output gap are often highly persistent [27, p. 2]. Hodrick-Prescott filter sets the potential component of output to minimise the loss function. The application of other time series decomposition techniques, such as Kalman filter, Band-pass filter, etc. would potentially generate different output gap estimates and inevitably lead to inconsistent results. Concerning real unit labour costs, it should be noted that the real wage growth in the observed period Q1 2010 – Q4 2021 was not followed by the inflation growth of similar intensity, which complies with the latest empirical finding of the IMF staff [34] of low probability wage-price spiral opening in the long term. Dynamic interaction between prices and wages is time-varying and depends on the state of the economy, thereby pass-through is systematically lower in periods of low inflation [7, p. 33], which were predominant for the observed period.

Relationship between variables in the long run

Although they are not in the focus of our analysis, the ARDL method estimates the long-run effects jointly with the short-run effects. Based on the values of the ARDL Bounds Test presented in Table 7, the *F*-statistic is above the upper bound *I*(1), at all levels of significance. This implies the rejection of the null hypothesis, which means that the observed variables express meaningful cointegration relationships. Hence, the ARDL model is also appropriate for examination of the long-run relationships between variables.

Table 7: ARDL *F*-Bounds Test

Null Hypothesis: No long-run relationships in the level

Test Statistic	Value	k
F-statistic	16.15769	4
Actual Sample Size = 48 Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	2.20	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

Source: Authors' calculation in EViews.

The long-run relationship between the actual inflation and the explanatory variables is estimated by the ARDL (1, 4, 1, 2, 2) regression. Table 8 displays the estimates of long-run variables, their standard errors computed using delta method as in Pesaran-Shin [53], their *t*-statistics, as well as the appropriate *p*-values. Underneath *Error Correction* equation is provided, which refers to the nexus between short-run and long-run dynamics.

Table 8: Estimated ARDL (1, 4, 1, 2, 2) – long-run dynamics

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FIN	0.998428	0.252691	3.951180(***)	0.0005
COR	0.207159	0.148815	1.392058	0.1745
RULC	0.060347	0.018333	3.291663(***)	0.0026
OG	0.265997	0.067466	3.942670(***)	0.0005
C	-42.79832	13.13228	-3.259017(***)	0.0029

Note: The results are statistically significant at ***1%.
Source: Authors' calculation in EViews.

Cointegration Equation (EC) = INF – (0.9984*FIN + 0.2072*COR + 0.0603*RULC + 0.2660*OG – 42.7983)

According to the results of estimated long-run effects of ARDL (1, 4, 1, 2, 2) regression shown in Table 8 and the following cointegration equation, the coefficients of the variables FIN, RULC and OG have positive and statistically significant influence on INF, at 1% level of significance (the estimated coefficient of COR is also positive, but statistically insignificant). These results suggest that there is a long-run positive relationship between FIN (the financial sector inflation expectations for one year ahead), RULC (the real unit labour costs) and OG (the output gap) as independent variables and INF (the actual inflation expressed in year-on-year terms) as dependent variable. Specifically, 1.00% increase in FIN, RULC and OG leads to around 1.0%, 0.06%

and 0.26% increase in INF, respectively. The corporate sector inflation expectations for one year do not impact the actual inflation in the long run. By running ARDL Error Correction Regression, we obtained Error Correction Term (ECT_{t-1}), which indicates the speed of adjustment from short run to long run equilibrium [5, 3,984]. High estimated coefficient of the ECT_{t-1}, which is both negative and statistically significant (at 1% significance level), revealed that potential disequilibrium in the ARDL model can be adjusted in the long run with higher speed in case of any type of shock in the explanatory variables [10, p. 147].

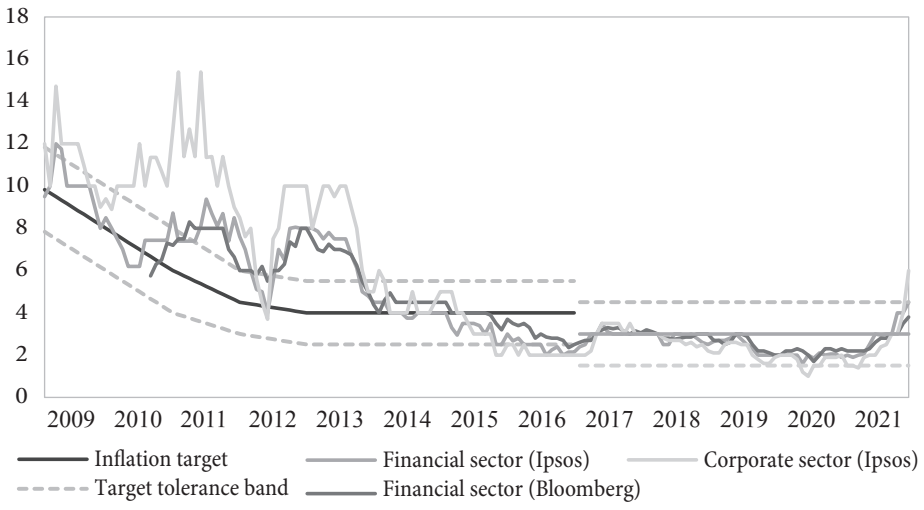
Results and discussion: Part 2

Credibility and transparent communication are preconditions for less uncertain and more predictable monetary and financial conditions, strengthening of institutional trust in the monetary authorities and effective anchoring of expectations among market participants. In the case of Serbia, inflation expectations dynamics of the financial and corporate sector is shown in Figure 5, together with inflation target and tolerance band. At first glance the inflation expectations of both financial and corporate sector exhibited quite volatility from 2009 to 2013, i.e., the first years of the inflation targeting.

In the first years of inflation targeting from 2009 to 2012, the inflation expectations of the corporate sector were only 9 months within the target tolerance band out of a total 48 months, while the inflation expectations of the financial sector were within the range for 29 months (see Table 9). According to the results of surveys carried out by the specialised agencies under the auspices of the central bank, the majority of companies in Serbia perceived inflation to be higher than the upper bound of the target tolerance band in the observed subperiod (2009-2012), while the net percentage of banks which projected inflation above the upper bound of the tolerance band increased, especially during 2011 and 2012. Therefore, short-term inflation expectations were not well anchored for both groups of market participants. After that, they stabilised throughout eight-year period in parallel with lower inflation target and range, till the very end of 2021, when global energy crisis hit.

Economic reasons for notable deviation of inflation expectations from target tolerance band can be found in 1) frequent alternation of tight and expansionary monetary policy, 2) pronounced short-term volatility of year-on-year inflation and foreign exchange rate, as well as 3) incomplete coordination of fiscal and monetary policies. It is important to highlight that the inflation expectations growth from 2009 to 2012 was dominantly stimulated by unfavourable international circumstances and the far-reaching consequences of the Global Financial Crisis (GFC) that were unexpected and inevitable. The central

Figure 5: Inflation expectations of the financial and corporate sector in Serbia for one year ahead, according to the official survey results* (in %)



Source: Specialised agencies' surveys held on behalf of the central bank of Serbia.

bank did not manage to lower the elevated inflation expectations of companies permanently and keep them within the target tolerance band. In addition, the central bank had only partial success in reducing the short-term inflation expectations of the banks, in part thanks to their better reasoning of the context and more direct reaction on the regulatory measures taken to mitigate the negative effects of the GFC. Evident volatility and occasional anchoring of short-term inflation expectations of both financial and corporate sector in the first years of inflation targeting might also point to the lack of more effective and transparent communication between the central bank on the one side and market participants on the other side. This might mean that proclaimed inflation target had not yet become a nominal anchor for inflation expectations by binding them to the unique numerical target value (inflation rate in level or range). Aversion to the unknown could have certain effect on the central bank executive board's decision to pay more attention to assessments of leading analysts and credit rating agencies at that time, which proved to be wrong and misleading at global and local level. With a certain degree of narrowed focus, the central bank allowed foreign exchange rate fluctuations and thus further induced price pressures. In the episodes of pronounced inflation upswings, foreign exchange interventions are not in a strong conflict with the inflation targeting regime, according to three basic criteria: target consistency, regime consistency and procedural transparency, as verified in case of Czech Republic [30]. Moreover, the reluctance of the central bank to raise key interest rates earlier and with stronger intensity could be related to empirical finding that board members rely on professional status and beliefs [8, p. 370] rather than taking timely responses to the seriously and deeply transformed macroeconomic setup.

The decision-making process of the central bank is not solely based on objective criteria, but rather intertwined with subjective assessments. In this context, some insights from behavioural economics may prove useful. Alongside, the market participants' responses to the central bank's decisions are not always rational, since their expectations can be affected not only by purely rational but also by non-rational and irrational factors. Using specific behavioural models, some authors [23, p. 227] concluded that the monetary policy could have more permanent effects on the real and financial sector than predicted by standard macroeconomic models with the underlying assumption of utility (rather than value) maximization. A lot of researchers and practitioners are turning to behavioural economics postulates to look into microeconomic foundations for better macroeconomic predictions, which imply the examination of different equilibrium models, market expectations formation and nominal wages determination policies [19, p. 135]. An

Table 9: Deviations from the upper bound of the target tolerance band* of short-term inflation expectations of the financial and corporate sector in Serbia in the observed subperiod 2009-2012 (in percentage points)

Inflation expectations	**Jan.2009**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	-	-	-	-	-	-	-	-	-	-	-	-
Financial sector (Ipsos)	2.3	1.7	-0.5	-0.4	1.2	1.0	0.8	0.7	0.5	1.3	2.2	1.5
Corporate sector (Ipsos)	-0.2	1.7	-3.2	-0.7	-0.8	-1.0	-1.2	-0.3	0.5	0.3	1.2	0.6
Inflation expectations	**Jan.2010**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	-	-	-	-	-	-	-	2.9	2.2	1.8	0.9	0.8
Financial sector (Ipsos)	1.8	2.2	2.5	3.1	3.0	2.8	1.4	1.2	1.1	0.9	0.7	-0.7
Corporate sector (Ipsos)	0.9	-0.3	-0.5	-0.7	-0.8	-3.0	-1.2	-2.7	-2.8	-2.4	-1.8	-4.7
Inflation expectations	**Jan.2011**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	0.3	0.2	-0.8	-0.7	-0.8	-1.0	-1.2	-1.3	-1.5	-0.7	-0.5	0.0
Financial sector (Ipsos)	0.4	0.3	0.1	-0.1	-0.9	-2.4	-1.9	-1.4	-2.2	-1.1	-2.3	-1.6
Corporate sector (Ipsos)	-7.6	-3.7	-5.2	-4.1	-8.2	-4.4	-4.6	-3.3	-4.9	-3.7	-2.8	-2.5
Inflation expectations	**Jan.2012**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	0.0	-0.1	0.1	-0.4	0.3	-0.3	-0.3	-0.6	-1.7	-1.6	-2.5	-2.5
Financial sector (Ipsos)	-1.0	-0.1	0.8	0.8	1.8	0.3	-1.3	-0.8	-2.4	-2.5	-2.5	-2.5
Corporate sector (Ipsos)	-1.6	-2.1	0.3	1.3	2.1	-1.8	-2.3	-4.3	-4.4	-4.4	-4.5	-4.5

Source: Authors' calculation on the NBS data. *Note: Negative deviations display inflation expectations above the upper bound of the target tolerance band.

empirical micro-foundation, using laboratory experiments, survey data and other micro data, should play a pivotal role in developing behavioural agent-based macro models for more realistic analysis [31, p. 86]. Incompletely rational behaviour of market participants is significantly tested by the neo-Keynesian inflation projection model, which is elaborated in detail by Yellen [64] with special emphasis on the redesign of the Phillips curve and the pricing policy of companies. The phenomena such as the downward price and wage rigidity, the illusion of money and fairness affect the inflation-unemployment dynamics and their trade-off [1, p. 420]. In the standard neo-Keynesian model that combines rational expectations from new classical macroeconomics and the Keynesian concept of rigid prices and wages, companies only occasionally change the prices, while regularly updating their inflation expectations. However, some authors reversed the previous setting, so that resistance to changes is more manifested in current information and expectations than in prices and wages [45, p. 1296]. When the previous assumption is valid, the Phillips curve can more accurately reflect inflation dynamics than the models. Another observation is that economic agents form inflation expectations based on the historical values of a single obvious variable [4, p. 9] rather than reviewing a wider set of economic factors. During the past half century, such an approach has been widely used to examine a close relationship between previous and current inflation, which could be disrupted only in the event of a forced change in the monetary policy stance and abrupt destabilisation of inflation expectations. Apart from that, noticeable deviation of inflation expectations from the central bank's target tolerance band and actual inflation from 2009 to 2012 (see Figure 5, Table 6, and Table 9) was also consequence of inertia in prices usually passed onto inflation expectations, which reversely caused persistent inflation pressures.

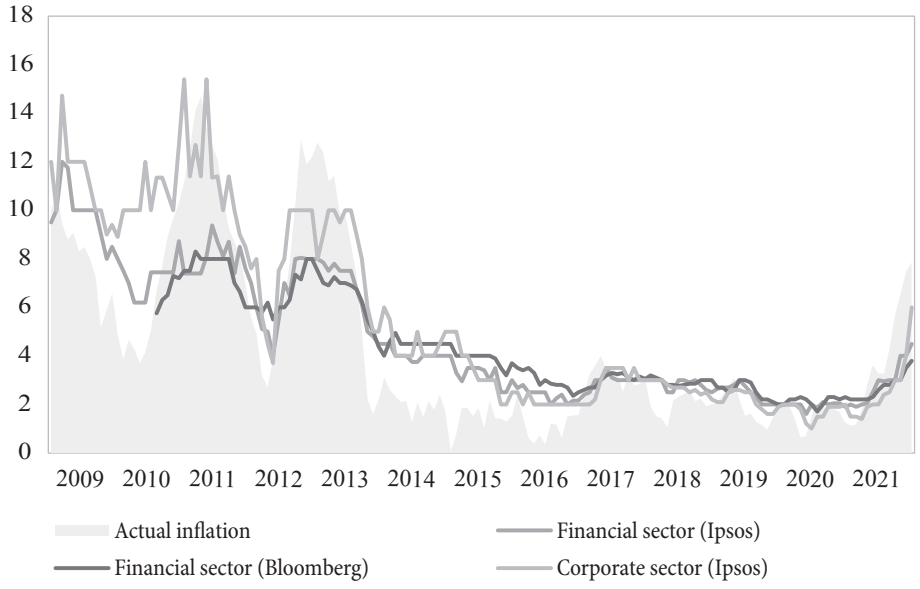
Unlike the classical model which assumes that managers are highly rational and sophisticated in deciding on wages and prices of products and services and recognising relevant constraints, they are often guided by mental shortcuts or heuristics that often cause significant errors in evaluations and plans. One of the possible behavioural explanations is that managers are frequently bad at forecasting due to their overconfidence. Huffman et al. [33] found that managers make overconfident predictions about future performance and have overly positive memories of past performance, hence these findings can be traced to an individual level. Close to this is over-optimism of decision-makers when projecting outcomes of their plans and trying to control for the factors out of their reach, e.g. price movements on international financial and commodities markets. Market participants already had numerous difficulties operating in the conditions of a strong exogenous shock that was soon transmitted to the domestic macroeconomic environment. In such circumstances characterised by heightened uncertainty, market participants provided considerably divergent estimates of price trends in Serbia in comparison to target tolerance band of the central bank, especially in short-term. They were heavily relying on the last available information when making personal assumptions, which may be a consequence of the availability heuristics. Once their short-term inflation expectations were lifted and breached inflation target, it could have induced higher expectations in the long term, which behavioural economists label as momentum. Additionally, it evoked conservatism in the behaviour of banks and companies, even though the actual inflation gradually returned to the target tolerance band, which could be the upshot of ignoring ongoing data, in contrast to the heuristic of representativeness. That created dilemmas and misjudgements in responses of companies and banks in the surveys about their expectations of future inflation, though they seemed rather uncertain about the actual inflation movements in the first years of inflation targeting (see Figure 6).

In the period 2013-2021, the priorities of the central bank, defined as maintaining price and financial stability, were gradually achieved by the continuous relaxation of the monetary policy for almost nine years (ending in April 2022) while ensuring the relative stability of the exchange rate by timely interventions on the FX market. In that way, banks in Serbia were spurred to provide favourable financing and lending conditions, and at the same time companies in Serbia were provided with more stimulating business and investment ambience. According to the surveys of specialised agencies carried out on behalf of the central bank, out of a total of 108 months short-

term inflation expectations of the banks were within the target for 99 months from the beginning of 2013 to the end of 2021. At the same time, the short-term inflation expectations of the companies were within the target range for 96 months (see Table 10). More effective and consistent implementation of the IT strategy contributed to successful anchoring of inflation expectations (yet closer to the lower limit of the target tolerance band), that was backed up by more intensive and transparent communication with the market participants and wider public. Effective anchoring of the inflation expectations contributed to low year-on-year inflation (2% on average) from middle of 2013 to summer of 2021, when headline inflation started to rise in Serbia prompted by the sharp increase in the world prices of energies and industrial inputs due to the escalation of energy crisis and unresolved "bottlenecks" in global supply channels.

It is important to say once more that aim of the central bank in IT regime is to achieve and maintain low and stable actual (year-on-year) inflation rate by managing and directing inflation expectations of the market participants towards publicly announced inflation target. In our analysis, we intended to demonstrate the importance of inflation expectations of the financial and corporate sector for managing inflation dynamics in the short run, with repercussions in the long run. The expected rate of inflation, which is usually affected by mixed economic and behavioral factors, can be viewed, to a certain extent, as a measure of the monetary policy credibility and its (un) success to anchor inflation expectations. In other words, the more credible the monetary policy is, the closer the inflation expectations are to declared inflation target. Deviations between actual and expected inflation during the observed period (2009-2021) can be explained not only by macroeconomic circumstances and policy decisions, but also by psychological biases and heuristics of the decision makers in both central bank and other public institutions, on the one side, and financial and corporate sector in Serbia on the other side. Taking into account that inflation expectations are not merely an economic phenomenon, but also fundamentally influenced by psychological factors, we judge that central banks may have some benefits from behavioral insights applied to the decision-making process of the executive board, as well as in the rapidly developing area of communication channels with market participants [37, p. 49]. Identifying and addressing the psychological aspects of inflation expectations can lead to more effective monetary policy implementation and economic stability not only in the short term, but rather in the long term.

Figure 6: Actual inflation and short-term inflation expectations of the financial and corporate sector in Serbia in the period 2009-2021 (in %)



Source: Central bank of Serbia

Table 10: Deviation of short-term inflation expectations of the financial and corporate sector in Serbia from the upper bound of the target tolerance band* in the observed subperiod 2013-2021 (in percentage points)

Inflation expectations	Jan.2013	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Financial sector (Bloomberg)	-2.0	-1.5	-1.4	-1.8	-1.5	-1.5	-1.4	-1.3	-0.8	0.0	0.5	1.1
Financial sector (Ipsos)	-2.5	-2.4	-2.0	-2.3	-2.0	-2.0	-2.0	-1.3	-0.6	0.5	0.7	1.0
Corporate sector (Ipsos)	-2.5	-3.5	-4.5	-4.5	-4.0	-4.5	-4.5	-3.5	-2.5	-0.5	0.5	0.5
Inflation expectations	**Jan.2014**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	1.5	0.9	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Financial sector (Ipsos)	1.0	1.0	1.5	1.5	1.5	1.8	1.8	1.5	1.5	1.5	1.5	1.5
Corporate sector (Ipsos)	-0.5	0.0	1.5	1.5	1.5	1.5	0.5	1.5	1.5	1.5	1.0	0.5
Inflation expectations	**Jan.2015**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.6	2.0	2.3	1.8
Financial sector (Ipsos)	1.5	2.2	2.6	2.0	2.0	2.0	2.1	2.5	2.0	3.0	3.0	2.5
Corporate sector (Ipsos)	0.5	0.5	1.5	1.5	2.0	2.5	2.5	2.5	2.5	3.5	3.5	3.0
Inflation expectations	**Jan.2016**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	2.0	2.1	2.0	2.2	2.7	2.5	2.7	2.7	2.7	2.8	3.2	3.0
Financial sector (Ipsos)	2.8	2.7	3.0	3.0	3.0	3.0	3.5	3.3	3.1	3.5	3.4	3.4
Corporate sector (Ipsos)	3.0	3.5	3.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Inflation expectations	**Jan.2017**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	1.9	1.8	1.8	1.5	1.3	1.2	1.3	1.2	1.4	1.5	1.4	1.5
Financial sector (Ipsos)	2.1	2.0	1.5	1.5	1.0	1.4	1.5	1.5	1.5	1.5	1.5	1.5
Corporate sector (Ipsos)	2.5	2.5	2.3	1.5	1.0	1.0	1.0	1.0	1.5	1.0	1.5	1.5
Inflation expectations	**Jan.2018**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	1.3	1.4	1.5	1.7	1.7	1.8	1.7	1.7	1.7	1.5	1.5	1.5
Financial sector (Ipsos)	1.5	1.5	1.5	2.0	2.0	1.5	1.5	1.6	1.5	1.7	1.9	2.0
Corporate sector (Ipsos)	1.5	1.5	1.5	1.7	1.8	1.8	1.8	2.0	1.9	2.1	2.0	2.3
Inflation expectations	**Jan.2019**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	1.8	1.8	2.0	1.9	1.5	1.5	1.6	2.0	2.3	2.3	2.4	2.5
Financial sector (Ipsos)	1.9	1.8	1.8	1.7	1.5	1.8	2.0	2.2	2.5	2.5	2.5	2.5
Corporate sector (Ipsos)	2.4	2.4	2.0	1.9	1.9	2.0	2.0	2.5	2.7	2.9	2.9	2.6
Inflation expectations	**Jan.2020**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	2.5	2.3	2.3	2.2	2.3	2.5	2.8	2.5	2.2	2.2	2.3	2.2
Financial sector (Ipsos)	2.5	2.5	2.5	2.5	2.9	2.5	2.7	2.4	2.5	2.5	2.5	2.6
Corporate sector (Ipsos)	2.5	2.5	2.5	2.7	3.3	3.5	3.0	3.0	2.6	2.6	2.6	2.5
Inflation expectations	**Jan.2021**	**Feb.**	**Mar.**	**Apr.**	**May**	**June**	**July**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Financial sector (Bloomberg)	2.3	2.3	2.3	2.3	2.2	1.9	1.7	1.7	1.5	1.5	1.0	0.7
Financial sector (Ipsos)	2.5	2.6	2.5	2.5	2.0	1.5	1.6	1.5	1.5	0.5	0.5	0.0
Corporate sector (Ipsos)	3.0	3.0	3.1	2.6	2.5	2.5	2.1	2.0	1.5	1.5	0.5	-1.5

*Note: Negative deviations display inflation expectations above the actual inflation.
Source: Authors' calculation on the NBS data.

Conclusion

Our analysis plunged into the effectiveness and implications of the inflation targeting regime in Serbia, which the central bank has been explicitly applying from January 2009. The study took a multi-dimensional approach, considering both neoclassical and behavioural theoretical frameworks, alongside empirical findings. Through meticulous examination of the relationship between short-term inflation expectations of market participants, actual year-on-year inflation, and the central bank's efforts to target inflation, this study shed light on their interactions within the Serbian economy. The empirical research spanned a substantial period from Q1 2009 to Q4 2021, incorporating data sources on actual inflation rates, real unit labour costs and output gap estimates, as well as inflation expectations from both corporate and financial sectors. Employing the ARDL regression, the study assessed the intricate relationships between these variables, providing insights into the short term and the long term. The study's findings revealed that short-term inflation expectations of the financial and corporate sectors hold a statistically significant influence on actual inflation in the short run. The real unit labour costs and the output

gap, however, did not exhibit a significant impact on actual inflation within this model. The examination of the long-run relationships suggested a positive and significant influence of the financial sector inflation expectations, the real unit labour costs, and the output gap on the actual inflation. These results underline the complex interplay between inflation expectations, as economic fundamentals, and the actual inflation rate.

Furthermore, the analysis delved into the credibility and transparency of the central bank's decisions. In the early years of inflation targeting, inflation expectations often deviated from the target tolerance band due to a range of factors including market volatility, incomplete coordination of fiscal and monetary policies, and communication challenges. However, the analysis emphasizes that inflation expectations are not solely driven by economic factors but are profoundly influenced by psychological biases. Recognizing and addressing these behavioural aspects could enhance the effectiveness of monetary policy implementation and foster long-term economic stability. The study acknowledged the importance of behavioural aspects on market participants' expectations, highlighting phenomena like overconfidence, momentum, and conservatism that can influence inflation expectations. In subsequent years, more effective implementation of inflation targeting strategies, coupled with enhanced communication with market participants, led to better anchoring of inflation expectations within the target range. The central bank's approach of gradually relaxing the monetary policy while maintaining the exchange rate stability contributed to successful inflation targeting and low year-on-year inflation rates, thereby achieving the goals set forth in the IT monetary framework.

This study's examination of Serbia's inflation targeting experience can provide valuable insights for policymakers and economists alike. It underscores the intricate relationship between inflation expectations, actual inflation, and the central bank's monetary policy, while recognizing the importance of behavioural aspects in shaping market prices dynamics. The findings emphasize a critical role of clear communication, credible inflation targeting strategy, and a nuanced understanding of the market participants' behaviour in achieving successful inflation targeting outcomes.

Since ARDL model assumes a linear relation between variables, the constraint of our research from the econometric perspective could be the lack of inspection into non-linear relation between the variables of interest. From the perspective of economic theory and empirical evidence, the drawback of the model could be the absence of assessing the reverse causal relationship between actual inflation and expectations. Proper looking into research limitations can sow the seeds for future research.

References

1. Akerlof, G. (2002). Behavioral Macroeconomics and Macroeconomic Behavior. *The American Economic Review*, *92*(3), 411-433.
2. Areosa, M. B. M. (2004). Combining Hodrick-Prescott Filtering with a Production function Approach to Estimate Output Gap. In conference: *Seminário 5 Anos de Metas de Inflação, Banco Central do Brasil*, Central Bank of Brazil.
3. Asfuroğlu, D. (2021). The determinants of inflation in emerging markets and developing countries: A literature review. *Anadolu Üniversitesi Sosyal Bilimler Dergisi*, *21*(2), 483-504.
4. Ball, L. (2000). *Near-rationality & inflation in two monetary regimes* (NBER Working Papers, No. 7.988) 1-47.
5. Banerjee, A., Dolado, J., & Mestre, R. (1998). Error-correction mechanism tests for cointegration in a single-equation framework. *Journal of Time Series Analysis*, *19*(3), 267-283.
6. Bernanke, B. S. (2007, July). *Speech on inflation expectations and inflation forecasting*. In: Monetary Economics Workshop, National Bureau of Economic Research Summer Institute, Cambridge, Massachusetts.
7. Bobeica, E., Ciccarelli, M., & Vansteenkiste, I. (2019). The link between labor cost and price inflation in the euro area. ECB *Working Paper*, No. 2235, 1-65. DOI: https://doi.org/10.2866/894414
8. Brada, J. C., Kubíček, J., Kutan, A. M., & Tomšík, V. (2015). Inflation Targeting: Insights from Behavioral Economics. *Eastern European Economics*, *53*(5), 357-376. DOI: 10.1080/00128775.2015.1089733
9. Bruine de Bruin, W., van der Klaauw, W., & Topa, G. (2011). Expectations of inflation: The biasing effect of thoughts about specific prices. *FRB of New York Staff Report*, No. 489.
10. Chandio, A. A., & Jiang, Y. (2019). Using the ARDL-ECM approach to investigate the nexus between support price and wheat production: Empirical evidence from Pakistan. *Journal of Asian Business and Economic Studies*, *26*(1), 139-152. DOI 10.1108/JABES-10-2018-0084
11. Charemza, W. W., Hristova, D., & Burridge, P. (2005). Is inflation stationary? *Applied Economics*, *37*(8), 901-903.
12. Church, J. D. (2019). Inflation expectations and inflation realities: a comparison of the Treasury Breakeven Inflation curve and the Consumer Price Index before, during, and after the Great Recession. U.S. Bureau of Labor Statistics - *Monthly Labor Review*, 1-20.

13. Coibion, O., Gorodnichenko, Y., Kumar, S., & Pedemonte, M. (2020). Inflation expectations as a policy tool? *Journal of International Economics*, *124*, 1-27.
14. Crowder, W. J., & Hoffman, D. L. (1996). The long-run relationship between nominal interest rates and inflation: the Fisher equation revisited. *Journal of money, credit, and banking*, *28*(1), 102-118.
15. Crowder, W. J., & Wohar, M. E. (1999). Are Tax Effects Important in the Long-Run Fisher Relationship? Evidence from the Municipal Bond Market. *The Journal of Finance*, *54*(1), 307-317.
16. Da Silva, E., & Da Silva, S. (2015). Anchoring heuristic messes with inflation targeting. *Open Access Library Journal*, *2*(4), 1-11. DOI: http://dx.doi.org/10.4236/oalib.1101450
17. De Grauwe, P., & Ji, Y. (2017). Speech on Inflation targets and the zero lower bound in a behavioural macroeconomic model. In: The Twenty-Third Dubrovnik Economic Conference. Organized by the Croatian National Bank, Dubrovnik, Croatia.
18. De Jong, R. M., Amsler, C., & Schmidt, P. (2007). A robust version of the KPSS test based on indicators. *Journal of Econometrics*, *137*(2), 311-333.
19. Driscoll, J. C., & Holden, S. (2014). Behavioral economics & macroeconomic models. *Journal of Macroeconomics*, *41*, 133-147. DOI: http://dx.doi.org/10.1016/j.jmacro.2014.05.004
20. Duong, T. H. (2022). Inflation targeting and economic performance over the crisis: Evidence from emerging market economies. *Asian Journal of Economics and Banking*, *6*(3), 337-352.
21. Ehrmann, M. (2015). Targeting inflation from below-how do inflation expectations behave? *International Journal of Central Banking*, *11*(S1), 213-249.
22. Evans, M. D., & Lewis, K. K. (1995). Do expected shifts in inflation affect estimates of the long-run Fisher relation? *The Journal of Finance*, *50*(1), 225-253.
23. Fehr, E., Goette, L., & Zehnder, C. (2009). The Behavioral Economics of the Labor Market: Central Findings & Their Policy Implications. In: C. L. Foote, L. Goette, & S. Meier (Eds.), *Policymaking Insights from Behavioral Economics* (169-258). Boston, MA: Federal Reserve Bank of Boston.
24. Friedman, M. (1968). The role of monetary policy. *American Economic Review*, *58*, 1-17.
25. Fuhrer, J. C. (2011). *The role of expectations in US inflation dynamics* (Federal Reserve Bank of Boston Working Papers, No. 11), 1-34.
26. Gnan, E., Langthaler, J., & Valderrama, M. T. (2010). *Understanding Inflation Expectations Uncertainty in the Euro Area. Does Psychology Help*? Mimeo.
27. Grant, A. L., & Chan, J. C. (2017). Reconciling output gaps: Unobserved components model and Hodrick–Prescott filter. *Journal of Economic Dynamics and Control*, *75*, 114-121.
28. Guadagnoli, E., & Velicer, W. F. (1988). Relation of sample size to the stability of component patterns. *Psychological bulletin*, *103*(2), 265-275.
29. Gülsen, E., & Kara, H. (2021). Policy Performance and the Behavior of Inflation Expectations. *International Journal of Central Banking*, *17*(70), 179-224.
30. Holub, T. (2004). Foreign exchange interventions under inflation targeting: the Czech Experience. *Deutsche Bank Research Notes*, No. 17, 1-25.
31. Hommes, C. (2018). Behavioral & experimental macroeconomics and policy analysis: a complex systems approach. ECB *Working Paper Series*, No. 2201, 1-103. DOI: https://doi.org/10.2866/847438
32. Hommes, C., Massaro, D., & Weber, M. (2019). Monetary policy under behavioural expectations: Theory and experiment. *European Economic Review*, *118*, 193-212. DOI: https://doi.org/10.1016/j.euroecorev.2019.05.009
33. Huffman, D., Raymond, C., & Shvets, J. (2022). Persistent overconfidence and biased memory: Evidence from managers. *American Economic Review, 112*(10), 3141-3175. DOI: https://doi.org/10.1257/aer.20190668
34. IMF WEO. (2022). *Chapter 2: Wage Dynamics Post–Covid-19 and Wage-Price Spiral Risks*. Retrieved from https://www.imf.org/en/Publications/WEO/Issues/2022/10/11/world-economic-outlook-october-2022
35. IMF WEO. (2023). *Chapter 1: Global Prospects and Policies*. Retrieved from https://www.imf.org/en/Publications/WEO/Issues/2023/04/11/world-economic-outlook-april-2023
36. Keel, L., & Kelly, N. J. (2005). Dynamic Models for Dynamic Theories: The ins and outs of Lagged Dependent Variables. *Political Analysis*, *Vol. 14*, 186–205. DOI:10.1093/pan/mpj006
37. Khan, A. (2018). A behavioral approach to financial supervision, regulation, and central banking. IMF *Working Paper*, *18*(178), 1-56.
38. Khanal, A. (2021). The role of ICT and energy consumption on carbon emissions: Australian evidence using cointegration test and ARDL long-run and short-run methodology. *International Journal of Energy Economics and Policy*, *11*(5), 441-449.
39. Kose, M. A., Matsuoka, H., Panizza, U., & Vorisek, D. (2019). Inflation expectations: review and evidence. Koç University-TÜSİAD Economic Research Forum *Working Paper*, No. 1904.
40. Lagoa, S. (2017). Determinants of inflation differentials in the euro area: Is the New Keynesian Phillips Curve enough? *Journal of Applied Economics*, *20*(1), 75-103.
41. Lambsdorff, J. G., Schubert, M., & Giamattei, M. (2011). On the role of heuristics - Experimental evidence on inflation dynamics. *Journal of Economic Dynamics and Control*, No. V-63-11, 1-25.
42. Lim, Y. C., & Sek, S. K. (2015). An examination on the determinants of inflation. *Journal of Economics, Business and Management*, *3*(7), 678-682.
43. Lima, G. T., Setterfield, M., & da Silveira, J. J. (2013). Inflation targeting and macroeconomic stability with heterogeneous inflation expectations. Department of Economics, FEA-USP *Working Paper Series*, No. 2013-11, 1-28.
44. Lovallo, D. P., & Sibony, O. (2006). Distortions & Deceptions in Strategic Decisions. *McKinsey Quarterly*, *43*(1), 19-26.
45. Mankiw, G. N., & Reis, R. (2002). Sticky Information versus Sticky Prices: A Proposal to Replace the New Keynesian Phillips Curve. *Quarterly Journal of Economics*, *117*(4), 1295-1328.
46. Marfatia, H. A. (2018), Estimating the New Keynesian Phillips Curve for the UK: evidence from the inflation-indexed bonds market. *The B.E. Journal of Macroeconomics*, *18*(1), 1-18.
47. Mihajlović, V. (2020). Novokejnzijanska Filipsova kriva i efekti domaćih pokretača inflacije u Republici Srbiji. Ekonomski horizonti, *22*(2), 89-105. DOI:10.5937/ekonhor2002089M
48. Mishkin, F. S., & Schmidt-Hebbel, K. (2007). Does inflation targeting make a difference? NBER *Working Paper*, No.12876, 1-64.

49. Ng, S., & Perron, P. (2001). Lag length selection and the construction of unit root tests with good size and power. *Econometrica*, *69*(6), 1519-1554.
50. Osman, A. M., Ahmed, A. O., Eltahir, M. N., Mohamed, A. S., Shidwan, O. S., & Ghada, M. (2019). Investigating the causes of inflation in Saudi Arabia: an application of autoregressive distributed lag (ARDL) model. *International Journal of Applied Engineering Research*, *14*(21), 3980-3986.
51. Ozturk, I., & Acaravci, A. (2010). The causal relationship between energy consumption and GDP in Albania, Bulgaria, Hungary and Romania: Evidence from ARDL bound testing approach. *Applied Energy*, *87*(6), 1938-1943.
52. Pesaran, M. H. and Shin, Y. (1999). An autoregressive distributed lag modelling approach to cointegration analysis. In Strom, S. (Ed.), *Econometrics and Economic Theory in the 20th Century*: *The Ragnar Frisch Centennial Symposium*. Cambridge University Press, Cambridge.
53. Pesaran, M. H., & Shin, Y. (1998). Impulse Response Analysis in Linear Multivariate Models. *Economics Letters*, *58*, 17-29.
54. Phelps, E. S. (1967). Phillips curves, expectations of inflation and optimal unemployment over time. *Economica*, *34*, 254-281.
55. Rose, A. K. (2007). A stable international monetary system emerges: Inflation targeting is Bretton Woods, reversed. *Journal of International Money and Finance*, *26*, 663-681.
56. Salle, I., Sénégas, M. A., & Yildizoglu, M. (2013). How Transparent about Its Inflation Target Should a Central Bank be? An Agent-Based Model Assessment. *Cahiers du GRETHA*, *24*(1), 41.
57. Schafer, J. (2022). Inflation Expectations and Their Formation. Congressional Budget Office *Working Paper Series*, 1-32.
58. Shrestha, M. B., Bhatta, G.R. (2018). Selecting appropriate methodological framework for time series data analysis. *The Journal of Finance and Data Science*, *4*, 71-89.
59. Thaler, R. H., & Sunstein, C. S. (2008). *Nudge: Improving Decisions about Health, Wealth, & Happiness*. New Haven & London: Yale University Press.
60. Todorović, M., & Ivanišević, M. (2021). *Poslovne finansije – treće izmenjeno i dopunjeno izdanje*. Beograd: Centar za izdavačku delatnost.
61. Vega, M., & Winkelried, D. (2005). Inflation targeting and inflation behavior: a successful story? *International Journal of Central Banking*, *1*(3), 153-175.
62. Verbrugge, R. J., & Zaman, S. (2021). Whose inflation expectations best predict inflation? *Economic Commentary*, No. 2021-19, 1-8, DOI: 10.26509/frbc-ec-202119
63. Vránková, M. (2012). Inflation Targeting and Behavioural Economics: Introduction. *Proceedings of FIKUSZ'12*, 91-100.
64. Yellen, J. L. (2007). Implications of behavioral economics for monetary policy. In: C. L. Foote, L. Goette, & S. Meier (Eds.), *Policymaking Insights from Behavioral Economics* (379-393). Boston, MA: Federal Reserve Bank of Boston.
65. Zhang, Z., & Wang, S. (2022). Do Actions Speak Louder Than Words? Assessing the Effects of Inflation Targeting Track Records on Macroeconomic Performance. IMF *Working Paper*, *22*(227), 1-45.

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