Monetary policy transmission mechanisms in Ukraine

Victor Shevchuk[1]

Abstract

This paper explores monetary policy transmission mechanisms in Ukraine, within a framework of the IS-MP-IA model. We use a six-variable structural VAR model, for the period 2002Q1-2018Q2, encompassing monetary and fiscal variables, to investigate the effects of the National Bank of Ukraine (NBU) interest rate policy. Following an increase in the NBU reference rate, major macroeconomic effects are as follows: (i) a significant decline in inflation, but with a substantial lag of 6 to 8 quarters, (ii) a temporary decrease in the output gap, with the restricting effect disappearing within a year, (iii) an increase in the lending rate, with a slow convergence to the initial level, (iv) improvement in the budget balance, with a two quarters lag, (v) a short-lived depreciation of the real exchange rate (RER) above its equilibrium trend. Among other results, improvement in the budget balance brings about a drop in the inflation rate combined with a temporary appreciation of the RER, while being expansionary in respect to the output gap. It is interesting that budget surplus is associated with a decrease in the NBU reference rate, while not affecting the economy's lending rate. As implied by the IS-MP-IA model, the output gap is inflationary and instrumental in determining of the RER and the NBU reference rate. In accordance with the Taylor rule, the NBU responds to acceleration of inflation on impact, but monetary policy response to the output gap is rather moderate and slow. No monetary policy reaction to the RER undervaluation is detected.

Keywords: *inflation, output gap, budget balance, central bank reference rate, Ukraine*
JEL Classification: *C5, E5, H6*

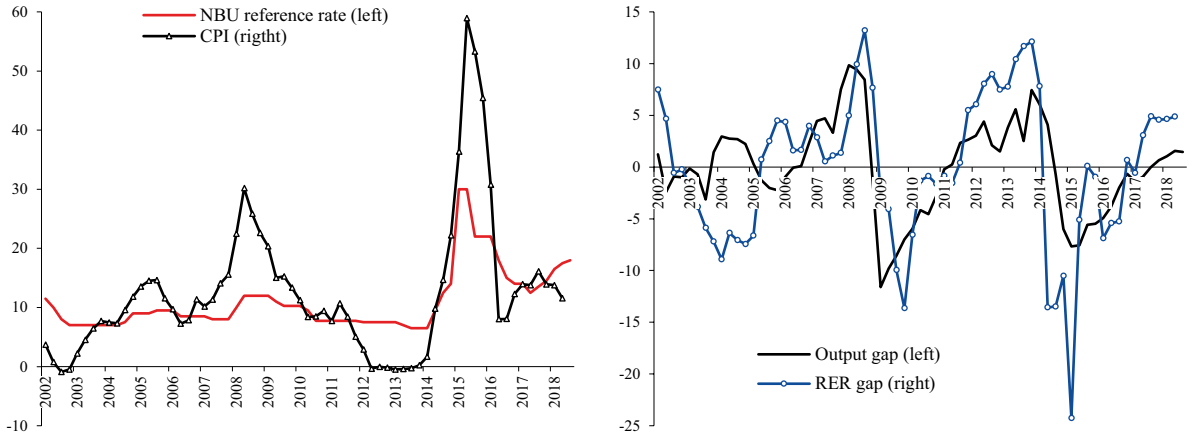
1. Introduction

Since the beginning of the 2000s, the Ukrainian economy has experienced two periods of acceleration of consumer price inflation (CPI) (Fig. 1a). As measured by the level of the National Bank of Ukraine (NBU) reference rate, loose monetary stance was observed in 2007–2009, while monetary tightening was implemented in 2014–2016. The NBU adopted the inflation targeting regime in 2015. Initially, it was a success, but since the beginning of 2016 inflation has accelerated. Even though CPI rates have decreased since the middle of 2017, slow disinflation remains a concern for the monetary authorities. Although higher interest rates could be blamed for a slow recovery from the 2014–2015 financial crisis, the resulting exchange rate appreciation is likely to bring about an opposite expansionary effect. Fig. 1b suggests that the movements of the GDP and relative price gaps are synchronized, with the periods of economic boom coinciding with appreciation of the real exchange rate (RER) and recessions being observed against the backdrop of steep currency depreciations.

Though a mere correlation between output and RER and/or NBU reference rate and CPI is not sufficient to determine the direction of the relationship between the variables that they are all endogenously determined, visual analysis of data series provides a hint on possible causal links between them. As implied by the IS-MP-IA (or Taylor-Romer) model, inflation target can

[1] Corresponding author: Cracow University of Technology, Institute of Economy, Sociology and Philosophy, 24 Warszawska St., 31-155 Cracow, Poland, e-mail: vshevchuk@pk.edu.pl.

be achieved by setting the central bank policy rate at the level of the natural rate of interest, with both output gap and expected inflation accounted for. However, the monetary transmission mechanisms used to be dependent upon the exchange rate effects, with the fiscal policy also playing its part.



a) NBU reference rate and CPI (%)

b) output gap and the inverted RER gap (deviation from trend, %)

Note: GDP and RER are de-trended with the Hodrick-Prescott filter. An increase in the inverted RER gap reflects real appreciation of the exchange rate.
Source: IMF *International Financial Statistics*, National Bank of Ukraine

Fig. 1. Ukraine: selected macroeconomic indicators, 2002–2018

The aim of this study is to examine monetary policy transmission mechanisms in Ukraine, in the presence of fiscal and exchange rate effects. We implement structural vector auto-regression (SVAR) approach for modeling the inter-dependencies between monetary and fiscal policies, output gap and CPI.

The rest of the paper is organized as follows. Section 2 provides a brief outline of analytical issues. Section 3 describes data and outlines the structure of SVAR model. Section 4 discusses empirical results and Section 5 offers some concluding remarks.

2. Analytical framework

As proposed by Romer (2000), the IS-MP-IA model is considered as a simple but informative tool applied in the analysis of the inflation-output relationship and the monetary policy effects by focusing on the interest rate rather than on money supply. While traditional IS and Phillips curves are kept, the LM curve is replaced with a Taylor-type interest rate (Taylor, 2000). If extended by fiscal variables (Bofinger et al., 2006; Clark and Hsing, 2005), the modeling framework enables the analysis of fiscal policy effects as well. For open economies, it is suggested to include real exchange rate (RER) into the reaction function (Ball, 1999; Caporale et al., 2018; Heipertz et al., 2017; Nojković and Petrović, 2015), such approach is also criticised (Leitemo

and Söderström, 2005). As the RER affects both aggregate demand and inflation, it further complicates monetary policy.

The extended IS-MP-IA model is presented below:

$$y = \alpha_0 - \alpha_1(i - p^e) - \alpha_2 b + \alpha_3 q, \tag{1}$$

$$i = \bar{r} + p^e + y_1(p - \bar{p}) + y_2 y + y_3 q, \tag{2}$$

$$p = p^e + \beta_1 y + \beta_2 q, \tag{3}$$

where y is the real output gap, q is the RER gap (an increase in the value of q means undervaluation of the real exchange rate), b is the budget surplus, i is the central bank reference rate, r is the 'natural' rate of interest, p and p^e are actual and expected inflation rates, respectively and p is the inflationary target.

The first equation is the IS curve, characterising the inverse relation between real interest rate and output. The budget surplus and the RER overvaluation are expected to be restrictionary. Equation (2) presents a Taylor-type monetary policy rule that implies the response of the central bank reference rate to inflation, output and RER gaps. Although accounting for the exchange rate is not required in the case of the developed economies, it might be of importance in the emerging economies (Caporale et al., 2018). In Equation (3), the aggregate supply is given by the positive short-run open economy Phillips curve. Lags of the variables entering the model could be added.

Policy implications of the IS-MP-IA model in general and the Taylor rule in particular are extensively tested. For example, it was empirically established that over the pre-crisis period of 1989–2007 interest rate forecasts were consistent with Taylor-type rules for the G7 countries (Fendel et al., 2011). Earlier it was found that the interest rate in Germany and the euro area could be described by a Taylor rule with the interest rate smoothing (Peersman and Smets, 1998). For the CEE countries, a clear shift of the interest rate setting in favour of targeting inflation is found in the Czech Republic, Hungary and Poland, with slightly weaker results for Slovenia and Romania (Frömmel et al., 2011). Similar results were obtained more recently in several other studies (Feldkircher et al., 2016; Ryczkowski, 2016; Wang et al., 2015).

There is empirical evidence that central banks in the Czech Republic, Poland, Hungary and Serbia react to the RER gap, while in Romania and Albania there is response to the changing rate of RER (it implies that only accelerated RER developments affect policy decision on interest rate, while the constant rate of change does not trigger any policy shifts) (Nojković and Petrović, 2015). In several emerging countries (Indonesia, Israel, South Korea, Thailand, Turkey) the exchange rate has impact on the reaction function of monetary authorities under the high inflation regime but not under the low inflation regime (Caporale et al., 2018).

3. Data and statistical model

The quarterly series used in the SVAR are the NBU reference rate (%), i_t, lending rate (%), rl_t, CPI (%), p_t, the cyclical components of real output (deviations form trend, %), y_t, RER (devia-

tions form trend, %), q_t, and the budget balance (% of GDP), b_t. The data set for the sample period of 2002Q1:2018Q2 was collected from IMF International Financial Statistics (IFS) and Ukraine's State Committee of Statistics. All data were seasonally adjusted using the Census X12 procedure, except for CPI and RER. Both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) stationarity tests indicate that all the macroeconomic variables are stationary at the 5% significance level (not reported).

Structural VARs enable us to separate out systematic responses to changes in interest rates from exogenous monetary policy shocks. Omitting details of a general specification for the economy described by a structural form equation of a linear, stochastic dynamic form, our SVAR presents as follows (in terms of the contemporaneous innovations):

$$b = u_1 + a_{12}\gamma + a_{15}rl, \tag{4}$$

$$\gamma = u_2 + a_{24}i + a_{26}q, \tag{5}$$

$$p = a_{31}b + a_{32}\gamma + u_3, \tag{6}$$

$$i = a_{42}\,\gamma + a_{43}\,p + u_4, \tag{7}$$

$$r\,l = a_{53}\,p + a_{54}\,i + u_5, \tag{8}$$

$$q = a_{61}\,b + a_{62}\,\gamma + a_{63}\,p + a_{64}\,i + a_{65}\,r\,l + u_6. \tag{9}$$

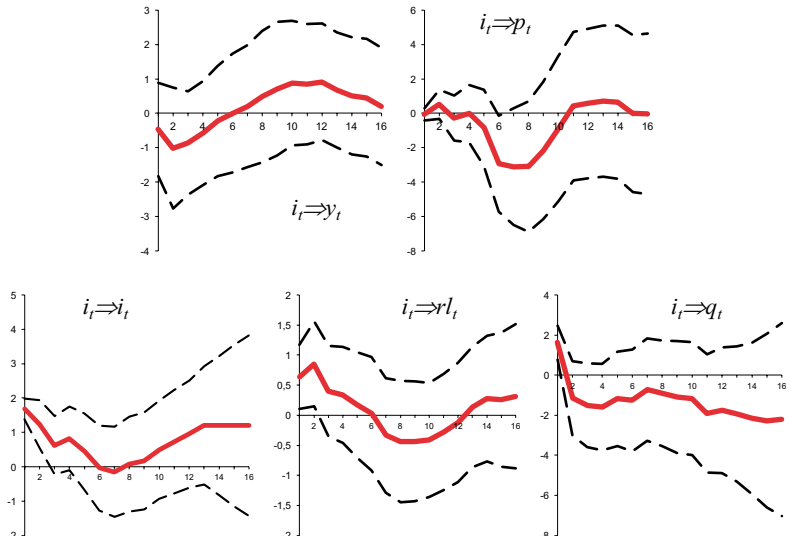
All variables in equations (4)-(9) represent the first stage VAR residuals. It is assumed that the budget balance responds to changes in the output gap and lending rate (equation (4)). As implied by the IS curve, the output gap is influenced by the NBU reference rate and the RER gap (equation (5)). Inflation in the current period is affected by fiscal policy and output gap (equation (6)). Thus, it is assumed that monetary policy exerts its inflationary effects through its impact upon the output gap. As argued by Giordani (2004), using the output gap instead of the level of real output helps to avoid the price puzzle when monetary tightening does not bring about a deceleration of inflationary dynamics.

The NBU reference rate is a function of output and CPI shocks (equation (7)). The lending rate reacts to changes in inflation and the NBU reference rate (equation (8)). It is assumed that the correction of the RER misalignment is not among the central bank priorities in the short run. Finally, the RER gap is affected by all other endogenous variables in the current period (equation (9)). Among exogenous variables, our SVAR includes a dummy variable to control for the financial turmoil of 2014–2016. In estimation, we use five lags of each endogenous variable, as implied by most of the lag length criteria. It is worth mentioning that using of terms-of-trade (TOT) or foreign direct investments (FDI) as exogenous variables does not change the results significantly.

4. Estimation results

The impulse response functions to an unexpected increase in the NBU reference rate are presented in Fig. 2. The horizontal axis indicates quarters after shock, and the vertical axis repre-

sents percentage changes of endogenous variables. Output gap declines temporarily, with the downward effect reaching a peak in the second quarter but the effect is not significant. For more than year inflation does not react to a higher NBU reference rate and only thereafter it starts to decline. The lending rate increases significantly on impact but then tends to decline to its initial level, in line with weakening of the monetary shock. Though there is a short-lived depreciation of the RER, it is reversed after a quarter. An increase in i_t seems to be neutral in respect to the budget balance.



Note: Solid lines are the point estimates of the impulse-response mean. Dashed lines are the point estimates ± 2 standard deviations.

Fig. 2. Macroeconomic effects of higher NBU reference rate

A combination of restrictionary impact on the output gap in the short run and slow disinflation effect, accompanied by increase in the lending rate and the exchange rate depreciation, can be easily (and mistakenly) interpreted as monetary policy "inefficiency" in the disinflation process. Consequently, it may lead to intense interest group pressure for the reversal of monetary policy tightening. After 6 quarters the NBU reference rate returns to its initial level, which is not viable in the long run. Therefore, it is necessary to return to an increase in i_t.

As seen in Fig. 3, the budget surplus increases the output gap, but the effect is only significant on impact. The anti-inflationary effect of b_t becomes significant after two quarters, much faster in comparison to the monetary shock. The improvement in the budget balance is associated with the RER appreciation on impact and decline in the NBU reference rate, with 3 quarters lag. Only the lending rate does not respond in the expected way.

Undervaluation of the RER reduces the output gap and improves the budget balance (Fig. 4). The effect of q_t on inflation peaks after 4 quarters, but inflationary pass-through is not persistent. There is no evidence of significant NBU reaction to a RER shock, although there is an increase in i_t after 3 quarters, with a downward correction after 9 quarters. The exchange rate instability can help reduce price volatility (Ball, 1999) or lead to welfare gains (Heipertz

et al., 2017). However, this approach is also criticised. For example, it is argued that the Taylor rule without exchange rate seems more robust in modeling uncertainty in the open economy (Leitemo and Söderström, 2005).

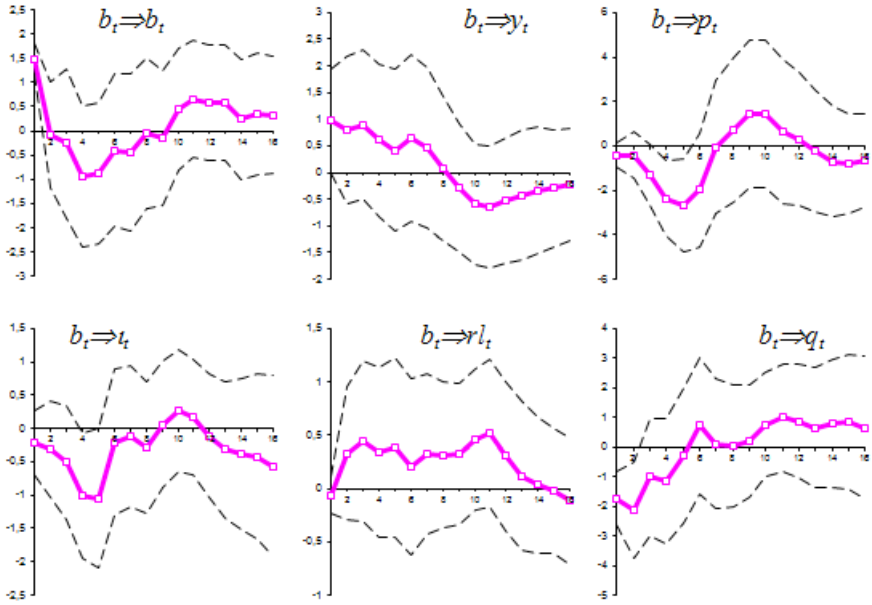


Fig. 3. Macroeconomic effects of the budget surplus

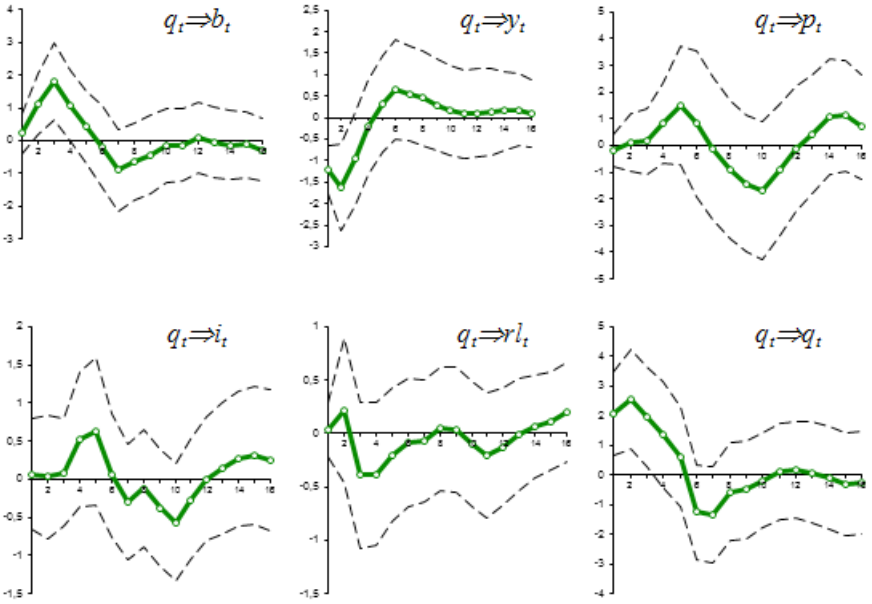


Fig. 4. Macroeconomic effects of the RER gap

The reaction of NBU reference rate to other macroeconomic shocks is reported in Fig. 5. As expected, there is an immediate increase of i_t in response to inflation, but the reaction is rather weak and it reverses after two years. As for the output gap, the reaction appears to be slow, with an increase of i_t four quarters after a shock, and quite weak (this effect is not statistically

significant). At the same time, there is an asymmetric reaction to an increase in the lending rate, in 7 quarters after the shock. The similarity of our results to those found in CEE country studies in respect to the central bank policy rate effects (Fig. 2) does not contradict the possibility of successful inflation targeting in Ukraine, but the response to inflation and output gap should be much stronger. Also, a monetary policy shock should be more persistent. It cannot be ruled out that the above mentioned weaknesses of the NBU response to adverse macroeconomic shocks stand behind slow reaction of inflation to monetary tightening. Assuming significant real effects of the RER undervaluation, it is open to discussion whether the NBU should not react to such shocks. Also, it seems that fiscal policy plays some role in inflationary dynamics.

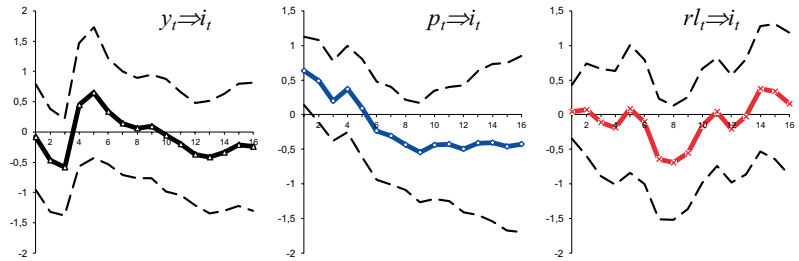


Fig. 5. Response of the NBU reference rate to macroeconomic shocks

The forecast error variance decomposition (FEVD) confirms that the contribution of both output gap and inflation shocks to the NBU reference rate is rather limited and comparable with the contribution of the fiscal shock (Table 1). The NBU reference rate determines up to 16% of the output gap but its share in the FEVD of CPI gradually increases to 27% over time. At the end of the second year the contribution to RER volatility is below 20% and it increases to 36% till the end of the sample period. Interest rate shocks and RER together account for more than a half of output variability at any horizon. In the short run prices are quite sticky but after two years and onwards monetary factors determine above 40% of CPI variability. Shocks to fiscal policy account for 16–18% of the fluctuations in the output gap and 20–25% of the fluctuations in CPI and RER.

Conclusions

The IS-MP-IA model implies that inflation target can be achieved with the response of the central bank policy rate to the output gap and inflationary pressure. Our findings seem to support such policy option but the reaction of inflation to an increase in the NBU reference rate seems to be very slow, as it takes 6 to 8 quarters for the inflation rate to decline. On the other hand, there is a negative impact on the output gap on impact, with an increase in the lending rate and a short-lived depreciation of the RER above its equilibrium trend. In the presence of a slow disinflation effect, it can be mistakenly interpreted as monetary policy "inefficiency" in the disinflation process and cause pressure for the reversal of monetary policy tightening. No monetary policy reaction to the RER undervaluation is found, despite its negative effects upon

inflation and output. A positive link between weak currency and the budget balance can justify such policy stance, but it could weaken efforts aimed at permanent improvement in the budget balance. Contrary to standard predictions of the IS curve, the budget surplus is expansionary, while contributing to a decline in both inflation and the RER undervaluation. As the budget surplus is associated with a decrease in the NBU refinancing rate (not affecting the economy's lending rate), an increase in the NBU reference rate is likely to bring about an improvement in the budget balance.

Table 1. Forecast error variance decomposition of selected endogenous variables

Responses of	**Innovations in**	**Forecast horizons**			
		4	**8**	**12**	**16**
y	*b*	16	18	17	18
(real output)	*y*	26	26	23	22
	p	3	6	5	5
	i	13	11	15	16
	rl	13	13	17	17
	q	29	26	22	21
p	*b*	25	21	20	20
(inflation)	*y*	1	15	14	13
	p	60	21	17	16
	i	1	27	26	25
	rl	11	10	14	14
	q	3	5	10	12
i	*b*	17	22	17	14
(the NBU	*y*	8	11	9	7
reference rate)	*p*	9	9	13	12
	i	62	44	45	55
	rl	1	8	8	6
	q	4	7	8	6
q	*b*	25	21	20	18
(RER)	*y*	8	7	8	7
	p	2	4	6	6
	i	17	19	25	36
	rl	8	7	7	7
	q	41	41	33	26

References

Ball, L. (1999). Policy rules for open economies. In: Taylor, J.B. (ed.), *Monetary Policy Rules*, University of Chicago Press, 127–156.

Bofinger, P., Mayer, E., & Wollmershauser, T. (2006). The BMW Model: A New Framework for Teaching Monetary Economics. *Journal of Economic Education*, 37(1), 98–117.

Caporale, G.M., Helmi, M.H., Çatık, A.N., Ali, F.M., & Akdeniz, C. (2018). Monetary policy rules in emerging countries: Is there an augmented nonlinear Taylor rule? *Economic Modelling*, 72(C), 306–319.

Clark, D.P., & Hsing, Y. (2005). Application of the IS-MP-IA Model and the Taylor Rule to Korea and Policy Implications. *The Journal of the Korean Economy*, 6(2), 297–311.

Fendel, R., Frenkel, M., & Rülke, J.C. (2011). 'Ex-ante' Taylor rules – Newly discovered evidence from the G7 countries. *Journal of Macroeconomics*, 33(2), 224–232.

Frömmel, M., Garabedian, G., & Schobert, F. (2011). Monetary Policy Rules in Central and Eastern European Countries: Does the Exchange Rate Matter? *Journal of Macroeconomics*, 33(4), 807–818.

Giordani, P. (2004). An alternative explanation of the price puzzle. *Journal of Monetary Economics*, 51(6), 1271–1296.

Heipertz, J., Mihov, I., & Santacreu, A. M. (2017). The Exchange Rate as an Instrument of Monetary Policy. *FRB of St. Louis Working Papers*, 2017–28, Federal Reserve Bank of St. Louis.

Leitemo, K., & Söderström, U. (2005). Simple monetary policy rules and exchange rate uncertainty. *Journal of International Money and Finance*, 24(3), 481–507.

Nojković, A., & Petrović, P. (2015). Monetary policy rule in inflation targeting emerging European countries: A discrete choice approach. *Journal of Policy Modeling*, 37(4), 577–595.

Peersman, G., & Smets, F. (1998). Uncertainty and the Taylor rule in a simple model of the euro-area economy. Ghent University Working Paper.

Romer, D. (2000). Keynesian Macroeconomics without the LM Curve. *Journal of Economic Perspectives,* 14(2), 149–169.

Ryczkowski, M. (2016). Poland as an inflation nutter: The story of successful output stabilization. *Zbornik radova Ekonomskog fakulteta u Rijeci,* 34(2), 363–392.

Taylor, J. (2000). Reassessing Discretionary Fiscal Policy. *Journal of Economic Perspectives,* 14(3), 21–36.

Wang, Y., Jiang, C., Chang, H.-L., & Su, C.-W. (2015). Are Taylor Rules Valid in Central Eastern European Countries? *Ekonomický časopis*, 63(7), 665–685.