THE MONETARY POLICY OF THE NATIONAL BANK OF ROMANIA IN THE INFLATION TARGETING ERA. A TAYLOR RULE APPROACH

Bogdan CĂPRARU*, Norel Ionuţ MOISE**, Andrei RĂDULESCU***

Abstract: In this paper we analyse the monetary policy of the National Bank of Romania during 2005-2015 by estimating the Taylor rule, on a quarterly basis. We determined the potential GDP by employing the Hodrick-Prescott filter, in order to distinguish between the cyclical and the structural components of the output. Then, we estimated the traditional Taylor rule function (with a classic OLS regression), but slightly modified, as to take into account the forward-looking attitude of the NBR. The results confirm the direct correlation between the monetary policy rate and the output gap on the one hand, and the inflation differential (inflation – inflationtarget) on the other hand. Also, the results show us that NBR paid a higher attention to the dynamics of the inflation versus its target than to the output gap. Last, but not least, the central bank has been also sensitive to the financial stability, as reflected by the results of the incorporation of the ROBOR-EURIBOR spread in the classical Taylor rule.

Keywords: monetary policy, Taylor rule, National Bank of Romania

1. INTRODUCTION

The literature on monetary policy significantly developed after the innovative paper written by Taylor (1993). This American economic researcher analyzed the FED monetary policy during 1987-1992. In the classical approach of this rule, when deciding on the monetary policy, the central banks pay a special attention to the dynamics of the following elements: the potential output, the inflation target, the output gap and the deviation of the inflation from the inflation

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target. In other words, the central banks increase / decrease the interest rates during the economic cycle in order to diminish the output gap and the deviation of inflation from its target.

The rule of Taylor was employed by the central banks in the developed countries before the Great Recession (the most severe global economic and financial crisis since The World War II), as most of them implemented the inflation targeting system starting early 1990s. According to Wyplosz (2006), the Taylor rule turned to the automatic pilot for the central banks, at least before the global crisis.

However, the incidence of the Great Recession (2007) determined important changes in the monetary policy in the developed countries, most of them recurring to non-conventional measures in order to avoid the scenario of Great Depression.

We underline that the central banks in the developing economies have also employed the rule of Taylor, as a benchmark, especially after these institutions started to implement the inflation targeting (as is the case in Romania, since 2005).

The original form of the Taylor rule was the following:

$$i = r^* + \pi_t + \alpha^*(\pi_t - \pi^*) + \beta^*(y_t - y^*_t)$$

(1.1)

where $i$, $r^*$, $\pi^*$, $y_t$ and $y^*_t$ represent the monetary policy rate, the real interest rate, the inflation rate (the average deflator over the past four quarters), the inflation target, the dynamics of GDP and the dynamics of potential GDP, while $\alpha$ and $\beta$ are the parameters reflecting the sensitivity of the central bank regarding the inflation objective and the economic growth objective.

In the above written relation, the higher the $\alpha$ the higher the sensitivity of the central bank in terms of inflation, while the higher the $\beta$ the higher the sensitivity of the central bank regarding the dynamics of the GDP growth (and, consequently, of the unemployment rate).

In this paper we evaluate the monetary policy effectiveness of National Bank of Romania (NBR). In this order, we estimate the Taylor rule for the monetary policy of the NBR during 2005-2015, on a quarterly basis (1Q2005 – 2Q2015). It is well known that in 2005 the central bank of Romania started to implement the inflation targeting mechanism, in order to contribute to the convergence of inflation towards the EU average.

Since NBR launched the inflation targeting system the dynamics of the consumer prices in Romania decreased significantly, from almost 10% YoY in
2005 to almost 0% YoY in 2Q 2015. During 2005-2015 the National Bank of Romania decreased the inflation target, from 7.5% YoY in December 2005 to 2.5% YoY in December 2015.

The rest of the paper is structured as follows. Section 2 reviews the literature on monetary policy rules. Section 3 describes the methodology and data used to estimate the Taylor rule in case of National Bank of Romania. Section 4 discusses the empirical results while Section 5 concludes.

2. LITERATURE REVIEW


Among the backward-looking monetary policy rules these authors mention the Taylor rule, which studies the relation between the monetary policy rate, on the one hand, and the output gap, the inflation deviation from the target, the real interest rate and the inflation target, on the other hand.

As regards the category of forward-looking rules the above mentioned economists underline the model introduced by Clarida et al (1997):

\[
i^*_t = i^* + \beta^*(E[\Pi_{t,k} | I_t] - \Pi^*) + \gamma E[y_{t,q} | I_t]
\]

(2.1)

where \(i^*_t\), \(\Pi_{t,k}\), \(\Pi^*\) and \(y_{t,q}\) are the interest rate target for period \(t\), the inflation rate for the following \(k\) periods, the inflation target and the output gap average for the following \(q\) periods.

Last, but not least, in the category of generalized rules Fourçans and Vrânceanu (2006) mention the rules incorporating other elements beyond the inflation deviation from its target and the output gap, such as: the money supply, the exchange rate, etc.

The incidence of the Great Recession determined a new era for the literature on monetary policy rules. Despite the change of the monetary policy paradigm, from orthodox to non-conventional, the central banks in the developed countries seemed to have not abandoned the benchmarks established by the classical rules.
However, the change of paradigm in terms of monetary policy after the incidence of the Great Recession contributed to the development of complex/non-linear monetary policy rules.

For instance, Conrad and Eife (2012), Lee and Son (2013), Olsen et al. (2012), Kempa and Wilde (2011) and Kolman (2013) employed non-linear Taylor rules in order to analyze the monetary policy in several developed countries: United States, Euro Area, Japan, United Kingdom and Canada.

Similarly, according to the paper of Su et al (2015) (estimating non-linear Taylor rules for several Central and Eastern Europe) the monetary policy decisions in the region are also dependent on global macro-financial climate. This conclusion seems normal, given the high dependence of this region on the foreign demand and international financing.

We underline that several recent papers introduced financial stability elements in analyzing the monetary policy rules employed by the central banks. This seems also normal, as, after the incidence of the Great Recession the central banks around the world added a new monetary policy objective: the financial stability. As an example, Albulescu (2013) employed a classical Taylor rule complemented by a financial stability indicator in order to study the monetary policy in the Euro Area.

Last, but not least, we mention that over the past years the attention of the researchers on monetary policy rules (based on Taylor rule) extended to the emerging countries. In this context, we mention the contributions of Gadanecz et al. (2015), Nojković and Petrović (2015), Petreski and Jovanovic (2013), Baranowski and Gajewski (2015), Frömmela et al (2015) and De Melo Modenesi et al 2013.

Our paper contributes to the literature in several ways. On the one hand, there are very few studies that analyze the monetary policy in Romania (see e.g. Andrieș, 2008; and Mutascu et al., 2013) by employing the Taylor rule. On the other hand, it assesses the entire period of inflation targeting in Romania, from 1Q 2005 to 2Q 2015. Also, we included in the monetary policy rule additional variables, like the 1 year CDS (credit default swap) for Romania and the 3 months interest rate spread (Romania vs. Euro Area), in order to obtain a better estimations of central bank behavior function. In this context, we can draw some considerations...
regarding the effectiveness of the implementation of the inflation targeting mechanism Romania.

3. METHODOLOGY AND DATA

Our assessment is organized in two steps. First of all we estimate the potential output by employing the Hodrick-Prescott filter, one of the most used methods by economists in order to distinguish between the cyclical and the structural components of the GDP. This method is based on the following mathematics relation:

$$\text{Min} \sum_{t=1}^{T} (Y_t - Y_t^*)^2 + \lambda \sum_{t=2}^{T-1} ((Y_{t+1}^* - Y_t^*) - (Y_t^* - Y_{t-1}^*))^2$$

(3.1)

where $Y_t$ and $Y_t^*$ represent the GDP dynamics and the potential GDP dynamics, while $\lambda$ is the parameter of smoothness (we employ a value of 100, similar to that used by Hodrick-Prescott (2015)).

Afterwards, we estimate the traditional Taylor rule function (with a classic OLS regression), but slightly modified, as to take into account the forward-looking attitude of the NBR. The estimated equation is represented mathematically by the relation (1.3).

$$i_t = c(1) + c(2)(\text{inflation}_{t+1} - \text{inflation target}_t) + c(3)(\text{GDP}_{t-2} - \text{Potential GDP}_t) + c(4) \times \text{CDSRO1YR}$$

(3.2)

where $i_t$ is the monetary policy rate, inflation$_{t+1}$ is the dynamics of the consumer prices during $t+1$, inflation target$_t$ is the NBR YoY target for inflation, GDP$_{t-2}$ is the dynamics of the GDP during period $t-2$ and potential GDP$_t$ is the estimated dynamics of the potential GDP during period $t$.

In order to better understand the monetary policy decisions taken by NBR over the past decade we introduced new variables in the classical Taylor rule: the 1 year CDS (credit default swap) for Romania and the 3 months interest rate spread (Romania vs. Euro Area).

In other words, we estimated the following equations:

$$i_t = c(1) + c(2)(\text{inflation}_{t+1} - \text{inflation target}_t) + c(3)(\text{GDP}_{t-2} - \text{Potential GDP}_t) + c(4) \times \text{CDSRO1YR}$$

(3.3)

$$i_t = c(1) + c(2)(\text{inflation}_{t+1} - \text{inflation target}_t) + c(3)(\text{GDP}_{t-2} - \text{Potential GDP}_t) + c(4) \times \text{SPREAD3M}$$

(3.4)
where CDSRO1YR represents the risk of entering in sovereign default within 1 year, while SPREAD3M represents the spread for the 3 months money market interest rate (Romania vs. Euro Area) (ROBOR3M – EURIBOR3M).

By applying these equations we tried to estimate to what extent the monetary policy decisions of NBR took into account the Romanian macro-financial risk perception (also influenced by the domestic policy-mix), reflected either by the level of the credit default swap or by the interest rate spread.

In our analysis we employed the Eurostat data for quarterly GDP, from 1Q2005 to 2Q2015 in order to determine the potential GDP. At the same time, we used the Statistics Office monthly data for the dynamics of the consumer prices and we computed the quarterly averages. We also computed the quarterly averages for CDS and for the 3M interest rate spread, these data being gathered from Bloomberg. Last, but not least, we employed the NBR data for monetary policy interest rate and for the inflation target.

4. RESULTS AND DISCUSSIONS

The Table 1 presents the estimates of the equations 3.2., 3.3., 3.4.

<table>
<thead>
<tr>
<th>Dependent variable: $i_t$ - the monetary policy rate</th>
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<tbody>
<tr>
<td>Independent variables</td>
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<tr>
<td>(inflation $t+1$ – inflation target $t$)</td>
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<tr>
<td>(GDP $t-2$ – PotentialGDP $t$)</td>
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<td>CDSRO1YR</td>
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<td>SPREAD3M</td>
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<tr>
<td>R-squared</td>
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<td>Adjusted R-squared</td>
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Note: Standard deviations are presented between brackets.

*, **, *** indicates significance levels at 10%, 5% and 1%

As can be easily noticed in Table 1., the estimated coefficients of equation (3.2) are statistically significant. At the same time, if we look at the sign of the coefficients, we may see that the economic relations are respected: there is a direct
relation between the monetary policy rate and the output gap on the one hand, and the inflation differential (inflation – inflation target) on the other hand.

Last, but not least, from the estimated equation there resulted that, during 2005-2015, NBR paid a higher attention to the dynamics of the inflation versus its target than to the output gap, as the estimated inflation differential’s coefficient is higher than the output gap’s coefficient. This aspect reflects the rationale of the implementation by NBR of the inflation target mechanism: the convergence of the dynamics of the consumer prices to the EU average.

In this equation the coefficient $c(1)$ may be interpreted as the sum between the real interest rate and the average inflation, for the period 2005-2015, except for the period of the VAT shock increase (from 19% to 24%) (3Q2010-2Q2010). Excluding those 4 quarters, the average real interest rate and the average inflation rate presented values of 2.1% YoY and 4.9% YoY during 2005-2015.

The following figure presents the relation between the dynamics of the NBR monetary policy rate and the dynamics of the interest rate as resulted from the estimated Taylor rule:

![Figure 1: NBR monetary policy rate vs. Taylor rule interest rate (%)](image)

Source: NBR, own estimates according to the above mentioned methodology

As can be noticed from Figure 1., the NBR closely followed the Taylor rule guide during the period 2005-2015. However, over the past quarters, there seems that NBR monetary policy rate undershoot the Taylor rule rate. This evolution might be explained by the fact that the downward trend of consumer prices (due to
supply factors) was not accompanied to the same extent by the reduction of the NBR’s inflation target. At the same time, there are differences in what regards the output gap, between our estimates and the NBR’s macroeconometric models.

The importance of the current analysis for the future monetary policy in Romania is immediately. On the one hand, as can be noticed from Figure 2., the deviation of inflation from NBR’s target is at its record low levels at present. On the other hand, the Government announced the implementation of several tax cuts in the short and mid-run. Taking these aspects into account and the results of the Taylor rule estimates for Romania, it seems very likely that, in the following quarters the Central Bank of Romania would pay a higher attention to the output gap in establishing the monetary policy rate.

![Figure 2](image_url)

**Figure 2. Deviation of inflation from NBR’s target (pp)**

Source: NBR, own estimates according to the above mentioned methodology

In Table 1. column “equation (3.3)”, it is presented the estimates of the equation (3.3) for the period 1Q 2007 – 1Q 2015. We selected this time interval as the degree of economic and financial integration of Romania with the EU increased after the country joined the European Union (1st of January 2007).

As can be noticed, the estimated coefficients are statistically significant. More important, compared with the previous estimates, the level of the adjusted R-squared is significantly higher, more than 51%. In other words, the monetary policy rate of NBR is better explained by incorporating the level of CDS in the classic Taylor rule.
At the same time, the sign of the coefficients confirms the economic relations between variables - a direct correlation between the monetary policy rate and: the output gap, the inflation differential (inflation – inflation target) and the 1 YR credit default swap.

Last, but not least, the current estimates also confirm the previous results: the fact that NBR paid a higher attention to the dynamics of the inflation versus its target than to the output gap or to the 1 YR CDS during 2007-2015, as the estimated inflation differential’s coefficient is higher than the output gap’s and the CDS’ coefficients.

In the Table 1. column “equation (3.4)”, it is presented the estimates of the equation (3.4) for the period 4Q 2006 – 1Q 2015. As can be noticed, the estimated coefficients are statistically significant. At the same time, the level of the adjusted R-squared hit the highest level of all estimated equations (almost 68%).

Similarly to the previous results, the sign of the coefficients confirm the economic relations between variables - a direct correlation between the monetary policy rate and: the output gap, the inflation differential (inflation – inflation target) and the 3 months interest rate spread (Romania vs. Euro Area).

However, these results (the levels of the estimated coefficients) suggest that the central bank paid a higher to the 3 months interest rate spread (ROBOR 3 M – EURIBOR 3M) since 2007. This result reflects the prudence of NBR in the context of the incidence of the Great Recession (the level of 3M interest rate spread’s coefficient is higher than the levels of the inflation differential’s and output gap’s coefficients). This prudence was determined by the fact that Romania entered the most severe global financial and economic crisis since the end of The World War Two with high deficits (both current account and public finance).

Overall, the current estimates also confirm the previous results: the fact that NBR paid a higher attention to the dynamics of the inflation versus its target than to the output gap during 2007-2015: the estimated inflation differential’s coefficient is higher than the output gap’s coefficient.

In the end of our analysis we put together the results in one graph: the estimated monetary policy rate obtained by applying the Taylor rule in the three versions and the NBR reference interest rate over the past decade (Figure 3).

As can be noticed in this Figure, during 2007-2015 the monetary policy of NBR followed more closely the Taylor rule augmented with the 3 months interest
rate spread. This evolution can be explained by the high level of risk perception Romania faced since the incidence of the Great Recession (second half of 2007) until the end of 2014. These results also reflect the re-launch of convergence towards the Euro Area (starting 2013) after the severe adjustment of the deficits (current account and public finance).

**Figure 3:** NBR monetary policy rate vs. Taylor rule interest rate (%) in the estimated scenarios

*Source: NBR, own estimates according to the above mentioned methodology*

### 5. CONCLUSIONS

In this paper we estimated the Taylor rule in several alternatives in order to analyze the monetary policy of the National Bank of Romania during 2005-2015.

According to our results there is a direct relation between the monetary policy rate and the output gap, on the one hand, and the inflation differential (inflation – inflation target), on the other hand.

At the same time, especially after 2007, the central bank has paid a higher attention to the risk perception regarding the Romanian economy, as reflected by the credit default swap and by the interest rate spread (ROBOR vs. EURIBOR). This attitude reflected the prudence of the central bank in the context of the
incidence of the Great Recession (which surprised the Romanian economy in an overheating stance). These results are in line with economic fundamentals and the empirical literature (Nojković and Petrović, 2015; Frömmela et al, 2015).

A secondary results is that, during 2005-2015, NBR paid a higher attention to the dynamics of the inflation versus its target than to the output gap.

In this context, taking into account the Government’s intentions for implementation of several tax cuts in the short and mid-run, it seems very likely that, in the following quarters the Central Bank of Romania would pay a higher attention to the output gap in establishing the monetary policy rate.

Consequently, we expect that the impact of inflation differential to decrease and those of the output gap, CDS and interest rate spread to increase in the mid-run, as the New Fiscal Act and the change of the policy mix perspectives (with impact for the financial stability) would be the main challenges for the monetary policy in Romania.

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