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Financial stability and monetary policy rules: evidence from Tunisia

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Abstract. *This paper aims to identify the role of monetary policy in ensuring not only price stability but also financial stability for the central bank of Tunisia. We employ the generalized method of moments on quarterly data during the period 2000-2020 for the Tunisian context to estimate various types of monetary policy rules. We compare the standard Taylor rule with the augmented version that incorporates non-performing loans as a financial variable. Our findings indicate a significant and positive impact of this variable on the monetary policy reaction function. Furthermore, our analysis highlights the ability of monetary policy to effectively balance the trade-off between its dual objectives of price and financial stability.*

Keywords: monetary policy, financial stability, Taylor rule, GMM model.

JEL Classification: E52, E58.

1. Introduction

The global financial crisis of 2008 has raised challenges regarding the role of monetary policy in ensuring low inflation and maintaining financial stability. In this context, it is essential to understand whether the objective of financial stability will be placed in the existing monetary policy framework.

Since the 1980s, price stability has been the fundamental objective of most central banks, with interest rates seen as the main instrument of the monetary policy to achieve it. Theoretically, this objective represents a significant contribution of monetary policy to macroeconomic stability. Following the financial imbalances experienced by the global crisis, this perspective has been challenged. Significant financial crises occurred in time of low and stable inflation, indicating that price stability cannot be sufficient to maintain financial stability. Historical evidence suggests that price stability is a necessary, but insufficient condition for ensuring financial stability. Consequently, the stability of the financial system has become a major concern for monetary authorities, alongside ensuring price stability. Recently, many central banks have expanded their mandate to explicitly include financial stability as a mandate of their monetary policy.

The Tunisian monetary policy has undergone several changes. In order to eliminate ambiguity surrounding the mission of the Central Bank of Tunisia (CBT), the principal objective explicitly assigned since 2006 to maintain price stability, by adopting interest rate as an operational objective. While focusing on maintaining this objective, the CBT has worked on developing and modernizing its monetary policy which is enriched by a diverse range of indicators such as the inflation and output gap.

According to the recent status of April 2016, the CBT has extended its mandates by explicitly incorporating the financial stability objective into its monetary policy in addition to price stability. This novel approach enhances our understanding of the dynamics between monetary policy and financial stability, providing the impact of financial variable on the conduct of monetary policy.

The contribution of this paper, in contrast to previous studies in Tunisia (Amiri and Talbi, 2013; Lajnaf, 2014; Mna and Kilani, 2023) is to integrate non-performing loans as a financial variable in the Taylor rule. We propose an empirical estimation of various specifications of the Taylor rule reaction functions for the Tunisian monetary authorities, using the GMM model with instrumental variables for quarterly data during 2000 to 2020.

The rest of the paper was organized as follows: Section 2 provides a brief empirical literature review. Section 3 describes the data set and model specifications used in the empirical analysis. Section 4 presents the empirical findings.

2. Empirical literature review

Financial stability is a concept that remains difficult to be defined (Allen and Wood, 2006). Generally, it is defined by its opposite, as the absence of financial instability, but the causes of instability are not yet fully specified. It can be identified across a multitude of observable and measurable variables (Schinasi, 2004).

Several studies examine the interaction between monetary policy and financial stability. Some authors estimate an augmented Taylor rule including asset prices and test the response of a monetary policy to this variable (Cecchetti et al., 2000; Chadha et al., 2004; Siklos et al., 2004). All of these papers suggest that financial imbalances accumulate even in a low inflation environment, which is typically favorable to financial stability. Indeed, the side effect of low inflation is that excess demand pressures may initially appear in credit aggregates and asset prices. Moreover, the authors emphasize that asset prices represent an important aspect of monetary policy and observe a significant impact of the stock prices during the period of estimation. Consequently, monetary authorities use asset prices not only to enhance their inflation and growth forecasts but also to set the interest rate.

Martin and Milas (2010) estimated a monetary policy rule augmented by the gap between policy rates and the three-month base rate using monthly data in order to analyze the impact of this indicator on the United Kingdom monetary policy. They found that the rise in this spread is due to unsecured credit risk, suggesting that the perceived risk of these loans in the interbank market was the primary source of credit.

Other authors examined the reaction of central banks to the credit gap (Borio and Lowe, 2004; Cúrdia and Woodford, 2010). According to Käfer (2014), the study of Borio and Lowe (2004) is probably the most influential empirical study concerning the role of credit in the monetary policy. The authors estimated an augmented Taylor rule with credit gaps for the United States, Australia, Japan, and Germany. They analyzed the response of the four central banks to financial imbalances measured against the credit of the private sector to GDP. The results vary among these countries, with the clearest evidence of some considerations for financial stability found in the case of the United States. Additionally, central banks response to financial imbalances. The analysis of this study suggests that credit is an important indicator of the accumulation of financial risks and can also reduce fluctuations in output and inflation.

In the Tunisian context, several authors have examined the conduct of monetary policy using the Taylor rule. Some of them estimated this rule in its original form (Boughrara, 2007; Mansour, 2009) showing that CBT employs the Taylor rule with different weights on the inflation and output gap. Others have estimated different specifications of the Taylor rule including the exchange rate as an additional variable (Amiri and Talbi, 2013; Chaouech, 2015). Furthermore, Ben Tahar and Rahmani (2006) evaluated the behavior of the Tunisian monetary authorities towards the asset prices and the exchange rate by estimating a Taylor rule. Their results indicate that the CBT does not react to either the evolutions of the stock market index or the exchange rate.

3. Model

According to the literature, the most appropriate response function for monetary policy is the Taylor rule.

3.1. Standard version of Taylor rule

The traditional version of this rule was proposed by Taylor (1993), which depends on the inflation and output gap. Monetary authorities adjust their interest rate according to the following equation Taylor (1999):

$$r_t = \bar{r} + \pi^* + \gamma_1(\pi_t - \pi^*) + \gamma_2(y_t - \hat{y}) \quad (1)$$

Where:

r_t is the short-term interest rate, $\bar{r}$ is the equilibrium interest rate, π_t is the inflation rate, π^* represents its target level and $(y_t - \hat{y})$ represents the deviation of current output from its potential level.

3.2. Dynamic Taylor rule

Some studies added an interest rate smoothing in the traditional Taylor rule (Clarida et al., 1998). The equation is represented as the following form:

$$\mathrm{r_t} = \rho r_{t-4} + (1-\rho) \times [\alpha_0 + \gamma_1(\pi_t - \pi^*) + \gamma_2(y_t - \hat{y})] \quad (2)$$

Which ρ is the smoothing parameter of the interest rate and the constant α_0 represents $\bar{r} + \pi^*$.

3.3. Forward-looking Taylor rule

Therefore, we introduced an anticipated inflation and assumed that the CBT reacts to π_{t+4}. The forward-looking dynamic Taylor rule is represented as the following form (Clarida et al. 1998, 2000; Kozicki, 1999):

$$r_t = \rho r_{t-4} + (1-\rho) \times [\alpha_0 + \gamma_1(E(\pi_{t+4}) - \pi^*) + \gamma_2(y_t - \hat{y})] \quad (3)$$

E is the expectation operator.

3.4. Augmented Taylor rule

Many studies have modified the structure of this rule by including additional variables, aiming to evaluate the behavior of the monetary authority. In this context, the CBT has explicitly included the financial stability objective into its monetary policy framework. Consequently, we examine whether a variable indicating financial instability could influence the decision-making process of Tunisian monetary authorities when adjusting policy rates.

The contribution of this study is to integrate the non-performing loans (NPL) into an augmented Taylor rule as presented in the following equation:

$$r_t = \rho r_{t-4} + (1-\rho) \times \left[\alpha_0 + \gamma_1\left(E(\pi_{t+4)} - \pi^*\right) + \gamma_2(y_t - \hat{y}) + \gamma_3 \hat{S}_t\right] \quad (4)$$

Where:

$\hat{S}_t = NPL_t - NPL_{t-4}$ represents the gap of NPL_t and its lagged level by 4 periods.

4. Data and methodology

The data used in this study correspond to quarterly data for the period ranging from 2000 to 2020 from the World Bank and CBT databases.

The Money Market Rate (MMR) is used as a proxy for the interest rate. As for the inflation gap, we use an annual target inflation rate equal to 3% determined implicitly by the change in the Consumer Price Index (CPI). The output gap was measured, as the percentage deviation of the observed GDP from the potential trend. We adopted the filtering method of Hodrick and Prescott to extract the trend component from time series data recommended a degree of smoothing λ equal to 1600 for quarterly data (Ravn and Uhlig, 2002).

To estimate the central bank's reaction function, presented in our model by the Taylor rule, we employed the GMM technique (Hansen, 1982). This method is particularly useful when analyzing time series, since an exercise can allow for heteroscedasticity and autocorrelation between the regressors and the error term. It also used to overcome potential endogeneity bias in the empirical investigations (Clarida et al., 1998, 2000). The application of this method necessitates an effective choice of the instrumental variables that must satisfy the orthogonality conditions. To realize the best choice for these instruments, we refer to the literature that estimates this type of function. In our model the instrument set includes 1 to 6 lagged values of the interest rates, inflation and output gap.

In order to assess the validity of our specification, we test the Hansen J-test of overidentifying restrictions. Also, The Durbin Watson (DW) statistic is a test for autocorrelation in the residuals from a statistical regression analysis.

5. Results

The results obtained by estimating the standard Taylor rule are shown in Table 1.

Table 1. *Estimation of the Standard Taylor rule (Eq.1)*

Variables	Coefficients	Standard.Errors	P-values
α_0	4.095	0.378	0.000
γ_1	0.234**	0.093	0.012
γ_2	-0.120	0.103	0.243
J-statistic	42.6743	-	0.000
D-W statistic	0.2643	-	-

***, **, * indicate the significance level at 1%, 5% and 10%, respectively. The set of instruments:6 lags of inflation, output gap and interest rate.

These results indicate that the coefficient γ_1 = 0.234 associated with the inflation gap is positively related to the interest rate, while the negative coefficient (γ_2 = -0.120) of the output gap, appears unsatisfactory. Consequently, this equation does not align with the behavior of the CBT. J-statistics indicates the validity of the instruments.

We proceeded to modify the model by introducing a smoothing interest rate coefficient (ρ). This parameter leads to certain modification in the estimated parameters.

Table 2. *Estimation of the dynamic Taylor rule (Eq.2)*

Variables	Coefficients	Standard.Errors	P-Values
$\alpha 0$	0.3477	0.551	0.528
ρ	0.885***	0.0955	0.000
$\gamma 1$	0.117**	0.057	0.041
$\gamma 2$	0.263***	0.068	0.000
J-statistic	30.1948	-	0.011
D-W statistic	1.0139	-	-

***, **, * indicate the significance level at 1%, 5% and 10%, respectively. The set of instruments: 6 lags of inflation, output gap and interest rate.

The results shown in Table 2 indicate that the smoothing coefficient ρ= 0.88 is close to unity, which shows that the CBT tend to determine the current interest rate with reference to that of the previous year. The coefficients of the inflation gap $\gamma_1 = 0.117$, while the output gap γ_2= 0.263, both showing significance and a positive correlation with the interest rate. Therefore, the coefficient γ_2 is more important than γ_1. This contradicts the hierarchical mandate of the CBT, which prioritizes inflation stability foremost.

In order to overcome this deficiency, we procced to estimate a forward-looking Taylor rule.

Table 3. *Estimation of the Forward-Looking Taylor rule (Eq.3)*

Variables	Coefficients	Standard.Errors	P-Values
$\alpha 0$	0.424	0.494	0.390
ρ	0.933***	0.080	0.000
$\gamma 1$	0.274***	0.053	0.000
$\gamma 2$	0.164***	0.044	0.000
J-statistic	26.665	-	0.031
D-W statistic	0.3494	-	-

***, **, * indicate the significance level at 1%, 5% and 10%, respectively. The set of instruments: 6 lags of inflation, output gap and interest rate.

The results presented in Table 3 indicate that the smoothing coefficient is 0.933. The coefficients associated with the gap between the expected inflation in one year and the implicit target of inflation is more important γ_1=0.274 than that related to the output gap γ_2=0.16. Additionally, the results demonstrate that the inflation and the output gap are statistically significant at 5% and 1% levels respectively.

In the light of these results, the coefficients seem to be more satisfactory with a remarkable significance and confirm the overriding objective of the monetary policy, namely inflation stability. Considering the case of the traditional central bank objectives, Equation (3) can conform to the behavior of the Tunisian monetary authority.

Table 4. *Estimation of the augmented Taylor rule (Eq.4)*

Variables	Coefficients	Standard.Errors	P-values
α_0	1.350	0.569	0.017
ρ	0.562***	0.080	0.000
γ_1	0.372***	0.056	0.000
γ_2	0.367***	0.050	0.000
γ_3	0.144***	0.0253	0.000
J-statistic	31.863	-	0.044
D-W statistic	0.5331	-	-

***, **, * indicate the significance level at 1%, 5% and 10%, respectively. The set of instruments: 6 lags of inflation, output gap and interest rate.

Based on Table 4, the coefficients for both the inflation and production gaps, standing at 0.37 and 0.36 respectively, are statistically significant and positively signed. J-statistics indicates that the validity of the instruments is not rejected.

Furthermore, the results show that the interest rate is positively sensitive to the non-performing loans γ_3=0.144. In other words, the Tunisian monetary authorities took into account this variable when adjusting the interest rate. Although the coefficient of credit gap seems to be low, financial stability can be considered as another mandate for the CBT in addition to the traditional objective of price stability.

These results validate the recent decision of the CBT to formally declare financial stability as an explicit objective of their monetary policy. Although the monetary authorities took into account the financial imbalance into their behavior, they are claiming it in a formal way, recently. In fact, most central banks have focused on financial stability in the conduct of monetary policy only after the subprime crisis.

Therefore, the adjusting of the interest rate by the CBT appears related to the smoothing interest rate, anticipated inflation rate, output gap and credit spread.

6. Conclusion

This paper investigates the relationship between monetary policy and financial stability within the Tunisian context. We estimated Taylor rules by Generalized Method of Moments (GMM) model over the period of 2000-2020 to compare various types of Taylor rules.

The obtained results imply that the coefficients responses of dynamic Forword-looking Taylor rule are notably more satisfactory than those of standard and dynamic versions. The findings reveal that the CBT incorporates inflation expectations into interest rate adjustments. Furthermore, we examine the response of non-performing loans, considered as an indicator of financial instability in the augmented Taylor rule. The empirical results show that this indicator is statistically significant and affects positively the interest rate, improving the response of the other variables.

This study justifies that policy rate can be common instrument to ensure price stability and to contain financial instabilities.

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