Central Bank Review 16 (2016) 53–57

Contents lists available at ScienceDirect

Central Bank Review

journal homepage: http://www.journals.elsevier.com/central-bank-review/

Does the central bank directly respond to output and inflation uncertainties in Turkey?

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ARTICLE INFO

Article history:
Available online 8 June 2016

JEL classification codes:
E43
E52

Keywords:
Uncertainty
Taylor rule
Monetary policy
Turkey
GMM

ABSTRACT

This paper investigates the role of inflation and output uncertainties on monetary policy rules in Turkey for the period 2002:01–2014:02. In the literature it is suggested that uncertainty is a key element in monetary policy, hence empirical models of monetary policy should regard to uncertainty. In this study, we estimate a forward-looking monetary reaction function of the Central Bank of the Republic of Turkey (CBRT). In addition to inflation and output gap variables, our reaction function also includes both the inflation and output growth uncertainties. Our results suggest that the Central Bank of the Republic of Turkey (CBRT) concerns with mainly price stability and significantly responds to inflation and growth uncertainties.

1. Introduction

The Taylor rule indicates that, the central bank should adjust the nominal interest rate in response to deviations of inflation from target and output from potential. According to this rule, the central bank raises the interest rates in response to inflation. On the other hand, it reduces interest rates to stimulate output. While the Taylor rule provides a simple and clear rule for monetary policy and explains monetary policy behaviour in many countries, this rule has some disadvantages. One of these disadvantages is that according to Taylor rule, central bank responds only to the inflation rate and the output gap. However, central banks may respond to other variables such as exchange rate, asset prices, monetary aggregates and so on to achieve price stability. In more open economies, for example, beside output gap and inflation, exchange rate is also important to describe the state of the economy. The other disadvantage is that the changes in the structure of the economy may lead to a change in the coefficients of optimal policy rule (Peersman and Smets, 1999). In the literature, there is not any consensus about what the efficient Taylor rule parameters should be. Taylor (1993) proposed a parameter of 1.5 on inflation and 0.5 on the output gap to explain the Fed's behaviour. While Clarida et al., (1999) estimate similar parameters for some countries other than US, Rudebusch and Svensson (1999) find larger optimal parameters for US. Ball (1997) also argues that an efficient parameter on the output gap should be larger than Taylor (1993)'s estimate. Brainard (1967) provides an explanation for this distinction between actual central bank behaviour and the optimal parameters which is suggested by these studies. He argues that uncertainty about the effects of policy on economy makes policymakers more conservative.

Uncertainties make conduct of monetary policy more complicated. Due to the measurement difficulties, policymakers cannot observe the current values of the inflation and output gap accurately when they set the interest rate. Therefore, they should predict them from the inflation and output gap data. Some studies examine how monetary policy should be conducted under data uncertainty. For example, Aoki (2003) states that if data uncertainty in one variable increases, the policy maker should respond less to the movements in that variable. In addition, Smets (2002), Peersman and Smets (1999), Rudebusch (2001) show that data uncertainty (particularly about the output gap) reduces the optimal coefficient on the output gap in a Taylor rule. Some other studies discuss the effects of inflation uncertainty on interest rates. However, these studies do not provide definite evidence about the effects of inflation uncertainty on nominal interest rates in both theoretical and empirical literature. Juster and Wachtel (1972a, b) and Juster and Taylor (1975) state that if inflation variability and nominal income do not move one for one, the variance of

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Peer review under responsibility of the Central Bank of the Republic of Turkey.

http://dx.doi.org/10.1016/j.cbrev.2016.05.001

consumer's real income increases. Then, consumers intending to protect themselves against inflation will increase savings. As a result, according to loanable funds theory, interest rates decline. This implies a negative relationship between inflation uncertainty and interest rates. Some arguments such as market frictions and a positive relationship between inflation uncertainty and real rates may also give rise to a negative relationship between inflation uncertainty and nominal interest rates (e.g. Jorda and Salyer, 2003; Frankel and Lown, 1994). On the other hand, portfolio theory suggests a positive relationship (e.g. Markowitz, 1952). Namely, the variance of the rate of return is taken as a risk measure. Since inflation uncertainty increase the rate of return variability, risk-averse agents require (desire) higher yields. Asset pricing model, the Fisher hypothesis and the term structure theory also suggest a positive relationship between inflation uncertainty and nominal interest rates (e.g. Cox et al., 1981; Fama, 1975; Chan, 1994). Similarly, while some empirical studies such as Fama and Gibbons (1982), Mishkin (1992) and Berument (1999) find a positive relationship between inflation uncertainty and interest rates, some other studies such as Stulz (1986), Jorda and Salyer (2003), Berument et al. (2005) and Omay and Hasanov (2010) find a negative relationship.

These arguments suggest that uncertainty is a key element in monetary policy, hence empirical models of monetary policy should regard to uncertainty. In this study, we have estimated the monetary reaction function of the CBRT. Apart from the previous studies for Turkey, we consider the reaction of the CBRT to uncertainties. Some studies (see Berument and Malatyalı (2000), Berument and Tasci (2004), Omay and Hasanov (2006), Gozgor (2012)) estimated the different specifications of the monetary policy rules for CBRT. However, none of these studies have concerned with the effect of uncertainty on monetary policy rule. Therefore, to fill this gap, we investigate whether the monetary policy responds to both inflation and output uncertainties by changing the interest rate in the case of Turkey. Additionally, previous studies generally investigate the affect of the uncertainty in the output and inflation on the coefficients of the optimal monetary policy rule. In this study, we focus directly on the parameters of output and inflation uncertainties. These uncertainties are included into the Taylor – type monetary policy rule. We apply Generalized Methods of Moments (GMM) for estimating monetary policy reaction function. Significant coefficients of inflation and output uncertainties suggest that the monetary authority takes these uncertainties into consideration while forming the interest rate rule. On the other hand, insignificant coefficients indicate that uncertainties have no explanatory power for the interest rate decisions. The results show that the CBRT concerns mainly with price stability after the adoption of the inflation targeting. We also conclude that the CBRT considers the inflation and output uncertainties in setting the policy rate.

Another contribution of our study is to include an indicator of global financial liquidity conditions in our reaction function separately. The experience of the global crisis indicates the importance of financial stability especially for emerging market economies. Capital flows towards Turkey like other emerging markets increased as a result of the expansionary monetary policies of advanced economies in the post-global crisis period. This surge in capital inflows supported domestic credit growth and caused appreciation of Turkish Lira. As a consequence of these developments, the current account deficit widened. Since the current account finance mainly depends on the short-term capital movements, the concerns about financial stability increased (Başçı and Kara, 2011). Therefore, since 2010, the CBRT has been implementing a new monetary policy concerning both financial stability and price stability.

In the traditional inflation targeting framework, financial stability is not separately included in the objective function and the central bank reacts to variables related with financial stability only indirectly through their impact on inflation (Kara, 2012). However, since late 2010, the CBRT has been explicitly concerned with financial stability. Since CBRT's reaction function could be affected from this policy shift, we extended our model. To capture the policy stance of advanced countries, we include the change in the ten-year treasury rate of the US Treasury as one of the explanatory variables. Our results show that the CBRT significantly responses to US treasury rate.

The next section introduces the literature. The third section summarizes the monetary policy of the CBRT. The forth section reports empirical model, data and empirical results. The final section concludes the paper.

2. Literature

Many studies investigate the effects of uncertainties on the coefficients in the Taylor rule. Bihan and Sahuc (2002) show that when parameter uncertainty is taken into account, inflation and output gap parameters decline in the optimal reaction function. Smets (1998) argues that output gap uncertainty affects the parameter in the monetary policy rule. He shows that higher uncertainty leads to a fall reaction coefficient on the output gap in simple Taylor rules for the US economy. Peersman and Smets (1999) show that estimation error in the output gap causes the weight of output gap in a Taylor rule to fall for EU5. The amount of this decline in this coefficient depends on the weights in the objective function. Similarly, Swanson (2004) shows that when one variable is more uncertain, the weight on the other variable may be larger. Orphanides (2003) emphasizes that the ignorance of the measurement errors of the data causes misleading decisions about the performance of the activist policies. They suggest less activist policies to provide economic stability when the noise in the data is taken into account. Ehrmann and Smets (2003) show that the performance of the Taylor rule is not affected by output gap uncertainty. Uncertainty about the output gap causes reaction coefficient on the output gap to fall only marginally. Martin and Milas (2009) find that when inflation and output gap are more certain, the weights of these variables are lower. The other finding is that when one variable is more uncertain, the weight of the other variable is larger.

Another line of the literature investigates the effects of inflation uncertainty on interest rate within the Fisher hypothesis framework. Berument et al. (2005) show that inflation uncertainty is important to explain interest rate for UK. Similarly, Berument (1999) suggests that expected inflation and inflation uncertainty have positive effect on interest rate for UK. Yuksel and Akdi (2009) find a significant effect of inflation risk on interest rate for US. Omay and Hasanov (2010) suggest a negative relationship between inflation uncertainty and the interest rate for US. They also show that this relationship is regime dependent and it is greater in low-inflationary periods.

Some studies discuss why the central bank should respond to uncertainties. Mishkin (2000) and Goodfriend (2007) provide some principles for central banks to avoid the creation of uncertainties. Montes (2010, p.95) states that “in modern economies, expectations play a decisive role as a transmission mechanism of monetary policies.” Since monetary policy affects the economic performance through expectations in the inflation targeting regime, almost all inflation targeting central banks are concerned with the maintenance of credibility. Therefore, it is conceivable that the central banks respond to uncertainty shocks in order to improve the effectiveness of monetary policy.

Several recent studies explore the behaviour of monetary policy in emerging markets and contain important findings. Taylor (2002) shows that the use of monetary policy rules in emerging economies has some benefits. He states that monetary policy rules increase the anticipation effects of monetary policy. Corbo (2002) finds that Latin American central banks set their interest rates according to inflation and other objectives. Monetary Authority of Singapore (2000) estimates a forward-looking interest rate reaction function for East Asia economies. Their results indicate that the authorities place greater weight on inflation since the currency crisis and are more willing to raise interest rates according to inflation expectations. Mohanty and Klau (2004) state that most central banks in emerging countries change interest rates in response to inflation and exchange rate shocks. Minella et al. (2002) estimate a Taylor-type reaction function for Brazil and show that the Central Bank reacts strongly to inflation expectations. Ncube and Tshuma (2010) suggests that nonlinear Taylor rule holds for South African Bank.

A number of studies have estimated the monetary policy reaction function for Turkey. However, none of these studies have analysed the role of uncertainties in the monetary policy rule. Berument and Malatyalı (2000) state that the CBRT concerns the lagged inflation rate rather than the future rate and implement output-targeting policy during the period 1989:07–1997:03. Berument and Taşçı (2004) conclude that the CBRT deals with the output stability instead of inflation in the period from 1990:01 to 2000:10. Omay and Hasanov (2006) state that backward-looking models explain the CBRT's reaction function for the period of 1990:01–2003:12. They find that while the aim of expansionary monetary policy is to stabilise output, contractionary policies aimed at reducing the inflation rate. Yazgan and Yilmazkuday (2007) report that a forward-looking Taylor rule can describe the CBRT's behaviour for the period of 2001:08–2004:04. Gözgör (2012) find that the reaction function of the CBRT can be explained by Taylor rule specification in inflation targeting.

3. The monetary policy of the CBRT

The Turkish economy has experienced high and volatile inflation during the 1990's and the beginning of 2000's. The inflation rate reached its highest level 107.3% in 1994 and its lowest level 6.16% in 2012. Turkey has undergone two economic crises during this period, in 1994 and in 2001. The Turkish economy declined by 6.1% in 1994 and by 5.7% in 2001. Additionally, the global financial crisis causes GDP to decline by 4.8% in 2009.

Turkey has implemented several stabilization programs to keep inflation under control. In 1999 an exchange rate based stabilisation programme under support of IMF was adopted. However, this programme was abandoned in February 2001 in the face of speculative attacks. The Turkish economy experienced its severest economic crisis in 2001. The law on the Turkish Central Bank was amended in April 2001, and the central bank was reinforced instrument independence. The primary objective of the bank was stipulated as ensuring price stability. Turkey adopted implicit inflation targeting from January 2002 to December 2005. During this period the necessary pre-conditions to implement an explicit inflation targeting regime were tried to be satisfied. Some reforms such as restructuring of the banking system, fiscal reforms, and structural reforms were realized. The explicit inflation targeting regime started to be implemented in January 2006. The CBRT used the short-term interest rate as a primary instrument to implement its disinflation policy.

The experience of the recent global economic developments shows the importance of the financial stability. Therefore, since 2010, the CBRT has been implementing a new monetary policy concerning both financial stability and price stability. The new policy tools like interest rate corridor, liquidity policies and required reserves have been adopted to achieve these objectives (CBRT, 2011).

4. Empirical model, data and empirical results

Following Clarida et al., (1999) we use a forward-looking version of the Taylor rule. Then, we use 'Enriched Taylor-Type' rule (e.g. Berument et al., 2005) where inflation and growth uncertainty is added to Taylor rule. It is widely accepted that because of the official dislike of financial instability, monetary authorities adjust interest rates gradually (see, e.g. Clarida et al., (1999); Ozlale, 2003). Therefore we allow for interest rate smoothing by including two lags of interest rate in the monetary policy rule. We included two lags of interest rate, which was sufficient to overcome the residual autocorrelation.

The model is as follows:

$$i_t = \omega_0 + \omega_1 i_{t-1} + \omega_2 i_{t-2} + \omega_3 \pi_{t+12} + \omega_4 gap_{t+12} + \omega_5 unc\pi_t + \omega_6 uncg_t \tag{1}$$

Where i_t is the nominal interest rate, ω_0 is the intercept term. π_t is the inflation gap (inflation minus inflation target), $gap_t$is the output gap, which is calculated by detrending the index of industrial production using the Hodrick Prescott (HP) filter. In HP filter we specify smoothing parameter as 14 400, which is appropriate for monthly data. We used seasonally adjusted industrial production series. $unc\pi_t$ is the end of year inflation uncertainty and $uncg_t$ is the end of year growth uncertainty. ω_5 and $\omega_6$are coefficients for the inflation and output growth uncertainty, respectively.

4.1. Data and empirical results

We use monthly Turkish data from 2002:01 to 2014:02. The data are gathered from International Monetary Fund-International Financial Statistics. The inflation series is the annual percent change in CPI. Targeted inflation rates are obtained from CBRT. Interest rate is the weighted average of overnight interbank interest rate, which is used as a policy instrument by the CBRT. The output gap is obtained by detrending the index of industrial production using the Hodrick Prescott (HP) filter. Uncertainties in inflation and growth data are obtained from the CBRT's survey of expectations. Inflation uncertainty is the series of the standard deviation of expected annual end-year CPI-based inflation rate. Similarly, growth uncertainty is the series of the standard deviation of expected GDP growth rate.[1]

Figs. 1 and 2 plot graphs of inflation rate and interest rate, respectively. As can be seen from the figures, inflation rate and interest rate had been volatile and high before the 2002. Since 2002 both series have become more stable.

We first test for stationarity of the series using conventional ADF test. The results of the ADF test are presented in Table 1. The results suggest that the series are stationary.

We estimate the Taylor rule using the linear Generalised Method of Moments (GMM). This method is used to avoid a possible correlation between dependent variables and the residuals. We choose the instrument variables regarding two criteria. First, the instrument set should be included in the central bank's information set which it uses to determine interest rate at time t. Second, the instruments should be correlated with the dependent variables.

[1] When the measure of uncertainties are changed, for example when we use a GARCH model to measure inflation and output uncertainties, we found insignificant coefficients. This issue desires further exploration in future research.

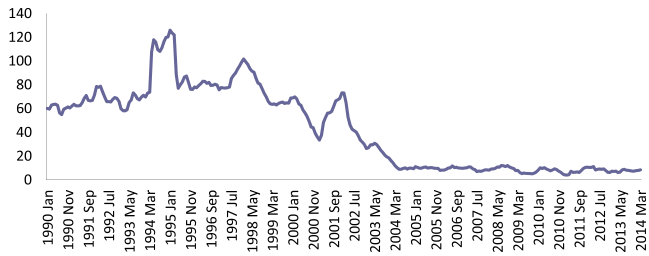

Fig. 1. Inflation rate.

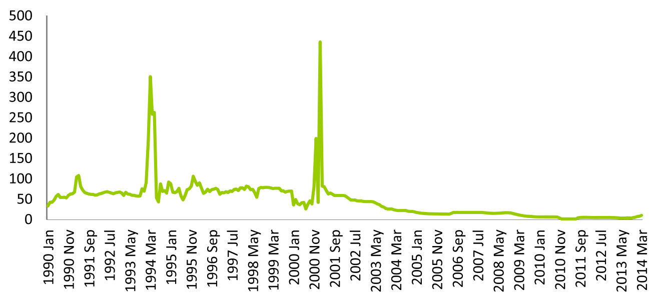

Fig. 2. Interest rate.

Table 1
ADF unit root test results.

i	−3.193 (0.09)
π	−6.954 (0.000)
gap	−3.812 (0.000)
$unc\pi_t$	−4.123 (0.000)
$uncg_t$	−3.567 (0.008)

P-values are reported in parentheses.

Following the Clarida et al., (1999), we choose the inflation forecast horizon of 12 for monthly estimate of the Taylor rule for Turkey. The instrument set used in the model includes lagged values of the output gap and the inflation rate. Additional instruments include the lagged values of annual changes of nominal exchange rate and annual M1 growth that help forecast inflation and output. We use the *Hansen's J-test* to test the validity of over identifying restrictions.

The evidence from Table 2 shows that while the coefficients for the expected inflation are positive and statistically significant, the coefficients for the output gap in both specifications are statistically insignificant. This implies that the CBRT mainly targeted price stability after the adoption of the inflation targeting. The results also show that the CBRT considers the inflation and output uncertainties in setting the policy rate. The coefficient of inflation uncertainty is positive and statistically significant. That is, the CBRT targeted inflation uncertainty in addition to inflation targeting. This result may imply that the CBRT presumes a positive link between inflation and inflation uncertainty as suggested by Okun (1971) and Friedman (1977). The high inflation experience of Turkish economy for more than twenty years provides supporting evidence to this expectation. Inflationary process makes public's expectations about future inflation more persistent. Since the CBRT expects that increases in inflation expectation leads to an increase inflation rates, the monetary policy becomes responsive to inflation expectations. The results also show that the coefficient of growth uncertainty is negative and statistically significant. This implies that although the monetary policy authorities do not target the output, they concern growth uncertainty. The CBRT reduces the interest rates in response to increased growth uncertainty to stimulate output. In other word, the CBRT tries to smooth fluctuations in output.

Table 2
Estimates of the monetary policy reaction function: 2002:01–2014:02.

Constant	−0.018 *(0.828)*	0.039 *(0.806)*
i_{t-1}	1.453* *(0.000)*	1.600* *(0.000)*
i_{t-2}	−0.471* *(0.000)*	−0.602* *(0.000)*
π_{t+1}	0.045* *(0.000)*	−0.008 *(0.280)*
gap_{t+12}	−0.001 *(0.788)*	−0.0002 *(0.889)*
$unc\pi_t$	0.157* *(0.000)*	−0.073 *(0.205)*
$uncg_t$	−0.199** *(0.014)*	−0.202* *(0.000)*
iusa		0.036 *(0.377)*
dummy		−4.232* *(0.000)*
$i_{t-1}dummy$		0.134** *(0.006)*
$i_{t-2}dummy$		0.330* *(0.000)*
$\pi_{t+12}dummy$		−0.012 *(0.661)*
$gap_{t+12}dummy$		0.010 *(0.105)*
$unc\pi_t dummy$		1.130* *(0.000)*
$uncg_t dummy$		−1.191* *(0.000)*
usdummy		1.666* *(0.000)*
J−test	0.11	0.16

Notes: The instrument set includes lagged values up to 6 lags and 9 lags of inflation, the output gap, nominal exchange rate and money growth in the first column and in the second column, respectively. P-values are reported in parentheses *, **, and *** denotes significance of the coefficient at the 1%, 5%, and 10% level.

In addition, to see the effect of the CBRT's modification of its inflation targeting framework at the end of 2010 on the CBRT's reaction function, we extended our model. We include the ten-year treasury rate of the U.S. Treasury as one of the explanatory variables. This variable would be useful to capture the policy stance of advanced countries. In addition, we include a dummy variable to see whether there has been a shift in all the reaction parameters since November 2010. The dummy variable is interacted with all the parameters. The results are presented in the second column of Table 2. We find that the coefficients of inflation, output gap, inflation uncertainty and treasury rate of the U.S. are insignificant before November 2010. The results show that the CBRT reduced the interest rate in response to an increase in growth uncertainty during this period. On the other hand, we see that the CBRT has responsed to treasury rate of the U.S., inflation uncertainty and growth uncertainty after November 2010. These results imply that since the adoption of unconventional monetary policy at the end of 2010, the CBRT has responsed the global liquidity conditions. The parameters of the reaction function also imply that the monetary policy has become more responsive to growth uncertainty since November 2010.

The results show that using a dummy variable changes the coefficients of the Taylor rule. This might be due to several factors. First, when the sample is divided into two sub-periods, there might be a short-sample problem, especially in the later sub-period. Second, a simple Taylor rule may not be suitable to represent the reaction of the monetary policy since the global financial crisis. After the global financial crisis many central banks around the world have started to care more about financial stability. Hence, the Taylor rule might need to be modified to incorporate the financial stability objective.

Overall, our results indicate that the CBRT concerns the market perception. It is important for credibility of monetary policy under inflation targeting. In addition to credibility, the main essential characteristics of inflation targeting are an explicit inflation target, ability to conduct an independent monetary policy from fiscal policy and a high degree of transparency and accountability. The central bank must announce targets and policy plans to the public and explain the reasons of policy changes. Our results suggest that when uncertainties rise the CBRT responds immediately to restrict these changes. That is, if there is an uncertainty in inflation, the monetary authorities increase the interest rate. However, if growth uncertainty increases they reduce the interest rate.

5. Conclusion

Central banks face a number of uncertainties, thus uncertainty is a key element in monetary policy. The effects of uncertainties on the monetary policy have been discussed in both theoretical and empirical literature. Some studies investigate the effects of uncertainties on the coefficients in the Taylor rule. Another line of the literature investigates the effects of inflation uncertainty within the Fisher hypothesis framework. These studies emphasize that the ignorance of the uncertainties may cause misleading decisions. Although the monetary policy rule for the CBRT has been investigated in the literature, the response of the CBRT to uncertainties is not discussed. In this study, we assess the role of inflation and output uncertainties in policy formulation of the CBRT. These uncertainties are included into the Taylor −type monetary policy rule.

We apply Generalized Methods of Moments (GMM) for estimating monetary policy reaction function. The results indicate that the CBRT concerns mainly with price stability after the adoption of the inflation targeting programme. We also conclude that the CBRT considers inflation and output growth uncertainties in setting the policy rate. This indicates that monetary authorities consider economic stability to achieve their objectives. The CBRT tends to apply tight monetary policy to reduce both inflation and inflation uncertainty. This implies that inflation uncertainty causes a decline in output further through interest rate channel. According to our estimates, the coefficient of the output growth uncertainty is negative and statistically significant. While monetary policy authorities do not target the output, they want to smooth fluctuations in output. The CBRT reduces the interest rate to decline growth uncertainties. When we consider the policy shift of the CBRT, we conclude that the monetary authority significantly responses the policy stance of the advanced countries.

We observe that using a dummy variable changes the coefficients of the Taylor rule. This change might be due to several factors: When the sample is divided into two sub-periods, there might be a short-sample problem. In addition, after the global financial crisis, the Taylor rule might need to be modified to incorporate the financial stability objective. This issue deserves further attention in future research.

References

Aoki, K., 2003. On the optimal monetary policy response to noisy indicators. J. Monetary Econ. 50, 501–523.

Ball, L., 1997. Efficient Rules for Monetary Policy. National Bureau of Economic Research. Working Paper 5952.

Başçı, E., Kara, H., 2011. Financial Stability and Monetary Policy. Central Bank of the Republic of Turkey. Working Paper No: 11/08 (May), 1–16.

Berument, H., 1999. The impact of inflation uncertainty on interest rates in the UK. Scott. J. Political Econ. 46, 207–218.

Berument, H., Malatyalı, K., 2000. The implicit reaction function of the central bank of republic of Turkey. Appl. Econ. Lett. 7, 425–430.

Berument, H., Taşcı, H., 2004. Monetary policy rules in practice: evidence from Turkey. Int. J. Finance Econ. 9, 33–38.

Berument, H., Kilinc, Z., Ozlale, U., 2005. The missing link between inflation uncertainty and interest rates. Scott. J. Political Econ. 52, 222–240.

Bihan, H.L., Sahuc, J.G., 2002. Implications of parameter uncertainty for monetary policy in a simple euro area model. Appl. Econ. Lett. 9, 553–556.

Brainard, W., 1967. Uncertainty and the effectiveness of policy. Am. Econ. Rev. 57, 411–425. Papers and Proceedings.

CBRT., 2011. Monetary and Exchange Rate Policy for 2012. December. Central Bank of Republic of Turkey, Ankara.

Chan, L.K.C., 1994. Consumption, inflation risk, and real interest rates: an empirical analysis. J. Bus. 67, 69–96.

Clarida, R., Gali, J., Gertler, M., 1999. The science of monetary policy: a new Keynesian perspective. J. Econ. Literature 37 (4), 1661–1707.

Corbo, V., 2002. Monetary policy in Latin America in the 1990s. In: Loayza, N., Schmidt-Hebbel, K. (Eds.), Monetary Policy: Rules and Transmission Mechanisms. Central Bank of Chile, Santiago.

Cox, J.C., Ingersoll, J.E., Ross, S.A., 1981. A Re-examination of traditional hypotheses about the term structure of interest rates. J. Finance 36, 769–799.

Ehrmann, M., Smets, F., 2003. Uncertain potential output: implications for monetary policy. J. Econ. Dyn. Control 27 (9), 1611–1638 (July).

Fama, E., 1975. Short term interest rates as predictor of inflation. Am. Econ. Rev. 65 (3), 269–282.

Fama, E., Gibbons, M., 1982. Inflation, real returns and capital investment. J. Monetary Econ. 9 (3), 297–323.

Frankel, J.A., Lown, C.S., 1994. An indicator of future inflation extracted from the steepness of the interest rate yield curve along its entire length. Q. J. Econ. 109, 517–530.

Friedman, M., 1977. Nobel lecture: inflation and unemployment. J. Political Econ. 85 (3), 451–472.

Goodfriend, M., 2007. How the world achieved consensus on monetary policy. J. Econ. Perspect. 21 (4), 47–68 (Fall).

Gozgor, G., 2012. Inflation targeting and monetary policy rules: further evidence from the case of Turkey. J. Appl. Finance Bank. 2 (5), 127–136.

Jorda, O., Salyer, K.D., 2003. The response of term rates to monetary policy uncertainty. Rev. Econ. Dyn. 6, 941–962.

Juster, F.T., Taylor, D., 1975. Towards a theory of saving behavior. Am. Econ. Rev. 65, 203–209.

Juster, F.T., Wachtel, P., 1972a. Inflation and the consumer. Brookings Pap. 1, 71–114.

Juster, F.T., Wachtel, P., 1972b. A note on inflation and saving rate. Brookings Pap. 3, 765–778.

Kara, A.H., 2012. Monetary Policy in Turkey after the Global Crisis Central Bank of the Republic of Turkey. Working Paper 12(17).

Markowitz, H.M., 1952. Portfolio selection. J. Finance 7, 77–91.

Martin, C., Milas, C., 2009. Uncertainty and monetary policy rules in the United States. Econ. Inq. 47 (2), 206–215 (April).

Minella, A., Paulo de Freitas, S., Goldfajn, I., Muinhos, M.K., 2002. Inflation Targeting in Brazil: Lessons and Challenges. Central Bank Brazil.. Working Paper Series 53 (November), 1–47.

Mishkin, F.S., 1992. Is the fisher effect for real? J. Monetary Econ. 30, 195–215.

Mishkin, F.S., 2000. What Should Central Banks Do? Federal Reserve Bank of St Louis Review November- December: 1–13.

Mohanty, M.S., Klau, M., 2004. Monetary Policy Rules in Emerging Market Economies: Issues and Evidence BIS. Working Papers 149, March.

Monetary Authority of Singapore, 2000. Kicking the Habit and Turning over a New Leaf: Monetary Policy in East Asia after the Currency Crisis. Occasional Paper 21. Singapore.

Montes, G.C., 2010. Uncertainties, monetary policy and financial stability: challenges on inflation targeting (117). Braz. J. Political Econ. 30 (1), 89–111 (January-March).

Ncube, M., Tschuma, M.M., 2010. Monetary Policy Conduct Based on Non-linear Taylor Rule: Evidence Form South Africa. African Development Bank Group Working Paper 113, August.

Okun, A., 1971. The mirage of steady inflation. Brookings Pap. Econ. Activity 2, 485–498.

Omay, T., Hasanov, M., 2006. A Nonlinear Estimation of Monetary Policy Reaction Function for Turkey. Munich Personal RePEc Archive. MPRA Paper No. 20154.

Omay, T., Hasanov, M., 2010. The effects of inflation uncertainty on interest rates: a nonlinear approach. Appl. Econ. 42, 2941–2955.

Orphanides, A., 2003. Monetary policy evaluation with noisy information (April). J. Monetary Econ. 50 (3), 605–631.

Ozlale, U., 2003. Price stability vs. Output stability: tales of federal reserve administrations. J. Econ. Dyn. Control 27, 1595–1610.

Peersman, G., Smets, F., 1999. The Taylor rule: a useful monetary policy benchmark for the euro area? Int. Finance 2, 85–116.

Rudebusch, G., 2001. Is the fed too timid? monetary policy in an uncertain world. Rev. Econ. Statistics 88, 203–217.

Rudebusch, G., Svensson, L.E.O., 1999. Policy rules for inflation targeting. In: Taylor, J.B. (Ed.), Monetary Policy Rules. University of Chicago Press, Chicago, pp. 203–262.

Smets, F., 1998. Output Gap Uncertainty: Does it Matter for the Taylor Rule? Bank for International Settlements 60 (November).

Smets, F., 2002. Output gap uncertainty: does it matter for the Taylor rule? Empir. Econ. 27, 113–129.

Stulz, R.M., 1986. Interest rates and monetary policy uncertainty. J. Monetary Econ. 17, 331–347.

Swanson, E., 2004. On signal extraction and non-certainty- equivalence in optimal monetary policy rules. Macroecon. Dyn. 8, 27–50.

Taylor, J.B., 1993. Discretion versus policy rules in practice. Carnegie-Rochester Conf. Ser. Public Policy 39, 195–214.

Taylor, J.B., 2002. Using Monetary Policy Rules in Emerging Market Economies. Forwarded in Stabilisation and Monetary Policy—The International Experience. Papers presented at Banco de Mexico's Anniversary Seminar. Mexico City, November 14–15, 2000. Banco de Mexico, Mexico City.

Yazgan, M.E., Yilmazkuday, H., 2007. Monetary policy rules in practice: evidence from Turkey and Israel. Appl. Financ. Econ. 17 (1), 1–8.

Yuksel, E., Akdi, Y., 2009. The Effect of Different Inflation Risks on Interest Rates of the US. Appl. Econ. Lett. 16, 169–175.