Maliye Çalışmaları Dergisi - Journal of Public Finance Studies
MCD 2024, 72 : 50–63
DOI: 10.26650/mcd2024-1555315

Araştırma Makalesi / Research Article

Roles of the Government Bond Yield and the Exchange Rate in the Monetary Conditions of Türkiye*

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*"This paper is an adaptation of my thesis, *Analysis of the Monetary Stance of Turkey Between 2011 and 2018 with a New Monetary Conditions Index: The Roles of Government Bond Yields and the Exchange Rate*, submitted to the Graduate School of Social Sciences at Middle East Technical University."

Submitted/Başvuru : 24.09.2024
Revision Requested/ Revizyon Talebi/ : 23.10.2024
Last Revision Received/ Son Revizyon : 01.11.2024
Accepted/Kabul : 04.11.2024

ABSTRACT

The debate over measuring central bank monetary policy stance persists in the literature. Evolving economic dynamics and diverse economic structures render traditional metrics inadequate, prompting the development of comprehensive monetary conditions indexes. In this respect, this study aims to craft a novel monetary conditions index for Türkiye, discovering an important yet neglected tool. This index consists of the real effective exchange rate and a spread that is the difference between the Central Bank weighted cost of funding rate and the benchmark bond yield. The weights of the exchange rate and spread in the index were determined using a VAR model and variance decomposition analysis. According to these weights, we created the monetary conditions index and tested its impact on the prices through the Granger causality analysis. The results indicate that our monetary conditions index significantly affects the prices in Türkiye, which proves the role of the government bond yield in the monetary transmission. It is further found that the exchange rate has a direct impact on the inflation rate and responds significantly to changes in the spread, implying that the spread influences prices primarily through the exchange rate pass-through mechanism.

Keywords: Monetary conditions, fiscal policy, bond yield, exchange rate, inflation

JEL Classification Codes: E43, E52, E63

1. Introduction

Central banks typically express their monetary policies based on the well-known Taylor rule (Taylor, 1993). However, structural shifts in global economies have compelled policymakers to consider new frameworks that can help stabilise markets more efficiently (Curdia and Woodford, 2010). In place of using the short-term interest rate as the primary operational target, some central banks have begun utilising a Monetary Conditions Index (MCI), which combines both the short-term interest rate and the exchange rate (Ericsson et al., 1997). Furthermore, the heightened complexity within the financial sector has significantly complicated the monitoring and interpretation of the monetary stance by the central bank. Considering these developments, many studies have attempted to create comprehensive monetary conditions indexes incorporating unusual variables (Curdia and Woodford, 2010; Ericsson et al., 1997; Goodhart, and Hofmann, 2001; Hatzius et al., 2010; Peng and Leung, 2005).

These developments drew the attention of researchers to Türkiye's monetary conditions index. Kesriyeli and Kocaker (1999) constructed a monetary conditions index for Türkiye using quarterly data from 1987 to 1999, incorporating the interbank rate and a basket of exchange rates as indicators. They used a single error correction model that does not consider the feedback effects between prices and monetary variables. Us (2004) calculated the MCI using a structural macroeconomic model with an IS equation, employing the nominal exchange rate and the real interest rate. Berument (2007) analysed monetary policy using a VAR model without creating an MCI, highlighting the negative impact of the interest rate spread on income, prices and currency appreciation. The Central Bank of the Republic of Türkiye developed a financial conditions index (FCI), incorporating financial variables (Kara et al., 2012). All these studies focused on various monetary variables but neglected the impact of fiscal factors on Türkiye's monetary conditions.

In this vein, we attempt to develop a monetary conditions index (sometimes it's called financial) considering the yield of a government debt instrument in a monetary conditions index to prove the role of fiscal policies in the monetary conditions and its indirect influence on prices. For this purpose, we use a spread, which is the difference between the Central Bank of the Republic of Turkey's (CBRT) weighted average cost of funding rate and the 2-year government bond yield the benchmark bond in Türkiye. The spread variable is in fact an ex-ante real interest rate since we implicitly assume the bond yield as the expected inflation rate. Bond yields are priced according to inflationary expectations and are good proxies for future inflation (Gürkaynak, et al., 2006). If the weighted average funding rate is above this benchmark rate (higher spread), it reflects the degree of monetary tightening of the Central Bank in terms of interest rates. Note that we do not claim that it shows the monetary stance of the Bank but mimics its properties.

We followed the Vector Autoregression (VAR) methodology and used the variance decomposition results to calculate the weights of the components in the MCI considering the monthly data spanning from February 2011 to December 2019. After calculating the MCI for Türkiye, we tested the causality running from the MCI to inflation and the reaction of MCI to inflation. In addition, the nexus between the interest rate, exchange rate and inflation is analysed through impulse responses. On the basis of the findings of the study, we provided critical policy implications for both monetary and fiscal authorities along with further research intriguing questions.

The remainder of the paper is organised as follows: the next section reviews the literature on monetary condition indexes. Following that, we present the data and methodology used in the empirical analysis. Section four discusses the results of the empirical analysis, and finally, we conclude with the main findings and their policy implications.

2. Literature Review on MCI

MCIs are widely regarded as effective tools for understanding central bank actions and forecasting macroeconomic variables (Debuque-Gonzales and Gochoco-Bautista, 2017; Memon and Jabeen, 2018; Nucu and Anton, 2019; Zhu et al., 2021). For example, Juhro and Njindan Iyke (2019) developed an MCI for Indonesia, demonstrating how it reflects key events in Indonesia's economic and financial history, such as the Indonesian banking crisis and the Global Financial Crisis. Nucu and Anton (2019) found that MCI effectively captures monetary policy trends in Central and Eastern European countries. Similarly, Debuque-Gonzales and Gochoco-Bautista (2017) used MCIs to analyse the co-movement of monetary policies in selected Asian economies, enabling predictions on inflation and output. Memon and Jabeen (2018) also constructed MCIs for Gulf countries and showed MCI's significance in forecasting inflation and economic growth, confirming its substantial impact on these macroeconomic variables.

Early studies on MCI, including those by Freedman (1994), Ericsson et al. (1997), Goodhart and Hoffman (2001), and Peng and Leung (2005), focused primarily on interest rates and exchange rates as key MCI components. However, more recent research has expanded to include a broader set of financial and macroeconomic variables. For instance, Juhro and Njindan Iyke (2019) incorporated the MSCI Share Price Index, business confidence index, and consumer confidence index in their MCI for Indonesia, while Zhu et al. (2021) included variables such as private sector credit spreads, mortgage rates, and the FTSE volatility index in their MCI for the United Kingdom. Nucu and Anton (2019) added the loan-to-deposit ratio in their MCI for Central and Eastern European countries, and Debuque-Gonzales and Gochoco-Bautista (2017) integrated financial stress indicators and credit surveys into MCIs for Asian economies. Overall, recent studies indicate a trend towards including various financial indicators in MCIs to better reflect complex monetary conditions.

Research on Türkiye's MCI generally emphasises traditional monetary variables, notably interest rates and exchange rates (Kesriyeli and Kocaker, 1999; Us, 2004; Berument, 2007; Kara et al., 2012). In addition to these variables, we see output variables and some financial variables like stock market index, credit ratio, and commodity prices (Berument, 2007; Kara et al., 2012). Kesriyeli and Kocaker (1999) created an MCI consisting of the interest rate and the exchange rate by using quarterly data for the period from 1987 to 1999. The interbank rate is used as an indicator for the interest rate, and the exchange rate indicator is an exchange rate basket consisting of 1.5 units of Deutsche Mark and 1 unit of US dollars. They used a single error correction model by considering the co-integration between monetary variables and estimated the coefficients of the interest rate and the exchange rate to calculate the MCI weights. They estimated the variable weights in the MCI using a price equation rather than an aggregate demand equation. However, this study uses a single error correction model, which can mislead the results. Because prices are not only affected by the exchange rate and the interest rate but also affect them. Therefore, a vector error correction model might be better since it considers the feedback from the dependent variable to the independent variables.

Us (2004) developed a small structural macroeconomic model for Türkiye and calculated the MCI using an open-economy IS equation, where the output gap served as the dependent variable. In the model, Us (2004) used the real interest rate, nominal exchange rate, and the lagged output gap series to explain the changes in the output gap. The weights for the interest rate and the exchange rate were determined to be 0.53 and 0.47, respectively.

Berument (2007) examined the monetary policy in Türkiye without constructing a monetary conditions index. He employed a VAR model that included variables such as prices, commodity prices, income, a basket of exchange rates, the spread between the interbank interest rate and the depreciation rate (the depreciation of the local currency against foreign currencies), along with monetary aggregates. Income was measured using three different indicators: industrial production, capacity utilisation rate, and the number of housing permits. The study found that the spread has a significant negative impact on income, prices, and commodity prices, and it leads to an appreciation of the local currency based on the impulse responses.

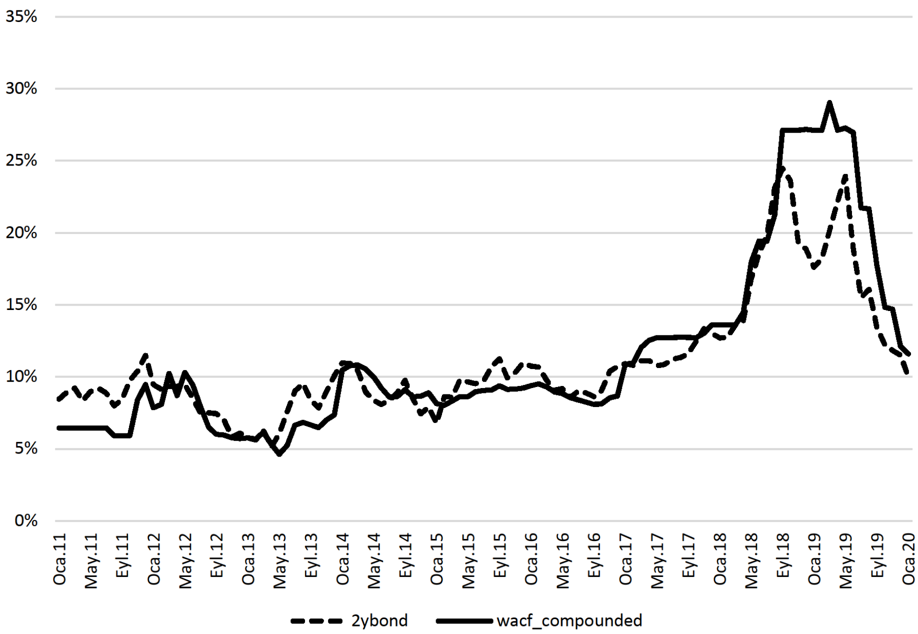
Additionally, the Central Bank of the Republic of Türkiye computes a Financial Conditions Index (FCI), which can be regarded as an enhanced version of the MCI (Kara et al., 2012). This index incorporates financial variables alongside the monetary variables typically used in an MCI. It spans the period from the second quarter of 2005 to the second quarter of 2012. To estimate the weights of the variables, the impulse responses of output growth to a one-unit shock applied to each variable are analysed after constructing a VAR model. The variables considered include the credit-deposit rate spread, credit standards, the change in the credit-to-GDP ratio, real effective exchange rate, stock market index (real, year-on-year percentage change), benchmark rate (ex-ante real, de-trended), and capital inflows.

While various studies examine the roles of different variables in Türkiye's monetary conditions, they omit the fiscal dimension, despite its significant influence on prices (Başçı et al., 2008). Inflation in Türkiye, in particular, is believed to respond sensitively to fiscal policy changes over the long term, while government borrowing instruments have a direct impact on financial markets and the transmission mechanism in the short term. Traditional monetary indicators like interest and exchange rates are commonly used, yet the literature on Türkiye's MCI remains largely outdated and lacks a comprehensive fiscal perspective. Addressing this gap through an updated MCI that integrates modern monetary, financial, and fiscal indicators is essential to accurately reflect Türkiye's current economic conditions.

3. Data and Methodology

In this study, we attempt to develop a monetary conditions index comprising a "new" interest rate variable and the real effective exchange rate for Türkiye. Our interest rate variable is a spread, which is the difference between the weighted average cost of the funding rate of the central bank and the 2-year government bond yield. We selected the 2-year bond as a proxy for inflation expectations because it is the benchmark rate with the highest transaction volume and serves as a key indicator for inflationary expectations, closely monitored by financial institutions, corporations, and investors. Since it is determined in the financial markets, it is more volatile and provides significantly more signals compared to the funding rate (see figure 1).

The spread is in fact an ex-ante real interest rate since we implicitly assume the bond yield as the expected inflation rate. Bond yields are priced according to inflationary expectations and are good proxies for future inflation (Gürkaynak, et al., 2006). If the weighted average funding rate is above this benchmark rate (higher spread), it reflects the degree of monetary tightening of the Central Bank in terms of interest rates. Note that we do not claim that the spread shows the monetary stance of the Bank but mimics its properties.



Sources: TCMB, Istanbul Stock Exchange (ISE)

Figure 1: 2-year government bond yield and weighted average cost of funding

Along with the interest rate, the other component of the MCI is the real exchange rate. We use an exchange rate basket that is the real effective exchange rate (REER). Since the effective exchange rate measures the value of the currency relative to the foreign currencies of all the trading partners, it is the true indicator for the real value of the domestic currency instead of only taking the exchange rate of the Turkish Lira against the US Dollar.

This study covers the period from February 2011 to December 2019. The reason for choosing this time interval is the data availability for the weighted average funding rate. Note that in most of 2011, the one-week repo rate is equal to the weighted average funding rate because the lower and upper bands of the interest rate corridor have not been used at these dates. We also did not prefer to include the date after 2019 because the Pandemic brought out an enormous shock on the macro-variables. Including this period in the model deteriorates the model's accuracy and causes misinterpretations of the coefficients and standard errors. To ensure the robustness of the results, we do not include the years after 2019, aligning with the objective of capturing the underlying relationships between the inflation rate, exchange rate, and interest rate in a more stable and discernible pre-pandemic context.

We construct the MCI as a weighted average of the spread and the change in the REER after determining the variables for the interest rate and exchange rate channels (see equation (1)). Accordingly, our aim is to estimate the W_{spread} and W_{REER} coefficients.

$$MCI = (spread) * W_{spread} + (\Delta REER) * W_{REER} \tag{1}$$

Where spread is the difference between the CBRT rate and the 2-year government bond yield, W_{spread} is the weight of the spread, REER is the real effective exchange rate, and W_{REER} is the weight of the REER. After determining the variables, the next step is to estimate the weights of these variables (W_{spread}, W_{REER}).

In the literature, there are three primary methods for estimating the weights: reduced-form aggregate demand equations, large-scale macro-econometric models, and vector autoregressive (VAR) models (Goodhart and Hofmann, 2001). Large-scale macro models are generally considered superior because they account for nearly all economic dynamics. However, due to limited data availability, applying this method in emerging economies like Türkiye can be challenging. In addition, structural models are exposed to the stage identification problem (Sims, 1980). The reduced-form model involves estimating the Phillips curve and the IS equation. The VAR methodology allows for an analysis of the interdependencies between monetary variables.

Sims (1980) advocates the use of VAR models because complex structural models often impose restrictions without rigorous econometric or statistical justification (such as treating certain variables as exogenous by default), which can result in misleading interpretations of the estimation outcomes. VAR models help avoid such misinterpretations. Moreover, VAR models simplify the analysis of the interrelationships between monetary variables like inflation, interest rates, and exchange rates, as they enable the simultaneous examination of multiple time series (Lütkepohl, 2005). In line with this, many studies employ the VAR methodology to understand the monetary transmission mechanism and construct monetary condition indexes (Berument, 2007; Kara et al., 2012; Juhro and Njindan Iyke, 2019; Memon and Jabeen, 2018; Nucu and Anton, 2019). Due to the mentioned reasons, we followed the VAR methodology in this study.

Using the VAR approach, we developed four equations for estimation, labelled as Equations 2, 3, 4, and 5, following the aggregate demand approach for estimating inflation (Lütkepohl, 2005). There are two primary methods for constructing an MCI using VAR: the aggregate demand approach and the price-based approach. In the aggregate demand approach, the output gap is considered a primary determinant of inflation. In contrast, the price-based approach excludes output from the model, which can lead to misinterpretations by omitting this critical variable in the price equation. Therefore, the aggregate demand approach is well-established in the literature, with notable studies by Freedman (1994), Ericsson et al. (1997), Peng and Leung (2005), and Goodhart and Hoffman (2001) supporting its validity.

$$cur_t = \delta_1 + \Sigma_{h=1}^{n}\theta_{1i}cur_{t-h} + \Sigma_{i=1}^{n}\alpha_{1i}\Delta cpi_{t-i} + \Sigma_{j=1}^{n}\beta_{1j}spread_{t-j} + \Sigma_{k=1}^{n}\gamma_{1k}\Delta reer_{t-k} + u_{1t} \qquad (2)$$

$$\Delta cpi_t = \delta_2 + \Sigma_{h=1}^{n}\theta_{2i}cur_{t-h} + \Sigma_{i=1}^{n}\alpha_{2i}\Delta cpi_{t-i} + \Sigma_{j=1}^{n}\beta_{2j}spread_{t-j} + \Sigma_{k=1}^{n}\gamma_{2k}\Delta reer_{t-k} + u_{2t} \qquad (3)$$

$$spread_t = \delta_3 + \Sigma_{h=1}^{n}\theta_{3i}cur_{t-h} + \Sigma_{i=1}^{n}\alpha_{3i}\Delta cpi_{t-i} + \Sigma_{j=1}^{n}\beta_{3j}spread_{t-j} + \Sigma_{k=1}^{n}\gamma_{3k}\Delta reer_{t-k} + u_{3t} \qquad (4)$$

$$\Delta reer_t = \delta_4 + \Sigma_{h=1}^{n}\theta_{4i}cur_{t-h} + \Sigma_{i=1}^{n}\alpha_{4i}\Delta cpi_{t-i} + \Sigma_{j=1}^{n}\beta_{4j}spread_{t-j} + \Sigma_{k=1}^{n}\gamma_{4k}\Delta reer_{t-k} + u_{4t} \qquad (5)$$

where δ is constant, $\theta, \alpha, \beta, \gamma$ are the coefficients, and u is the error term. The variables are ordered from the least reactive variable to the most reactive variable (Goodhart and Hofmann, 2001). The Cholesky ordering is as follows: CUR, CPI, spread (interest rate channel), and REER (exchange rate channel). The output is placed first because the variable reacts slowly to changes in other variables. Following the same rationale, we positioned the REER at the end of the equation because it responds immediately to changes in other variables. Table 1 provides all the data definitions and sources used in these equations.

Table 1: Variables

Variable	Definition	Source
CUR	Capacity utilisation ratio (seasonally adjusted)	CBRT
ΔCPI	Monthly change in the log of CPI (seasonally adjusted)	TurkStat
spread	Difference between the weighted average funding rate of the CBRT and the 2-year government bond yield	CBRT, Istanbul Stock Exchange
ΔREER	Monthly change in the log of REER	BIS

After calculating the weights of the variables in the MCI through the variance decomposition results of the VAR model, we test Granger causality of MCI to inflation. To examine the Granger causality between this tool and inflation, we set up two equations in a VAR framework (Lütkepohl, 2005). In this approach, MCI Granger causes ΔCPI, if lagged values of MCI are statistically significant beyond the information contained in the lagged values of ΔCPI itself. We also test the response of MCI to shocks coming from ΔCPI, which is reflected in Equation 7.

$$\Delta CPI_t = \alpha_1 + \Sigma_{i=1}^{p}\alpha_{1i}\Delta CPI_{t-i} + \Sigma_{i=1}^{n}\beta_{1i}MCI_{t-i} + \varepsilon_{1t} \qquad (6)$$

$$MCI_t = \alpha_2 + \Sigma_{i=1}^{p}\alpha_{2i}\Delta CPI_{t-i} + \Sigma_{i=1}^{n}\beta_{2i}MCI_{t-i} + \varepsilon_{2t} \qquad (7)$$

4. Empirical Analysis

Before analysing the model, it is essential to check the stationarity of the variables. All variables must be stationary to construct a VAR model. Table 2 shows that all the variables are indeed stationary. CPI, and REER is stationary at the first difference (I(1)). CUR and spread is stationary at the level (I(0)). Note that the CPI and REER variables are in the logarithmic difference form.

Table 2: Unit root test statistics (with constant)

	ADF test		Philips-Perron test	
Variable	**Level**	**Difference**	**Level**	**Difference**
CUR	-2.70*	-13.87***	-2.61*	-13.71***
CPI	1.98	-4.76***	1.97	-7.64***
spread	-3.07**	-10.10***	-3.20**	-10.58***
REER	-0.73	-8.30***	-0.91	-7.94***

Note: Significance levels are indicated as follows: *** for 1%, ** for 5%, and * for 10%.

The optimal number of lags, determined to be 2, is based on the information criteria, the results of which are displayed in Table 3. Subsequently, an autocorrelation test was conducted, as revealed in Table 4, affirming the absence of any serial correlation issues with the selected lag structure of 2. Additionally, the variance inflation factors (VIFs) for the estimated equations, provided in Table A.1 in the Appendix, indicate no multicollinearity concerns, as all VIFs are below the threshold of 10 (Gujarati, 2010, p. 362).

Table 3: Lag order selection criteria

Lag	LR	FPE	AIC	HQ	SC
0	NA	1.54e-11	-13.54	- 13.50	-13.44
1	220.74	2.03e-12	-15.57	-15 36*	15.04*
2	31.17*	1.99e-12*	-15.93*	-15.21	-14.65
3	18.92	2.22e-12	-15.45	- 14.94	-14.13

Note: * shows the lag order selected by the criterion; FPE: Final prediction error; LR: Likelihood-ratio test; AIC: Akaike information criterion; HQ: Hannan-Quinn information criterion; SC: Schwarz information criterion.

Table 4: VAR residual serial correlation LM test results

The null hypothesis: no autocorrelation at lag h				
Lag	LRE stat	Prob.	Rao F-stat	Prob.
1	15.57	0.48	0.98	0.48
2	27.35	0.04	1.75	0.04
3	21.85	0.15	1.38	0.15

Following these tests, the investigation into the direction of causality between the variables is pursued through the examination of the impulse response graphs. First, we will try to investigate the causality between spread and CPI, which is the main aim of this study. As seen in Figure 2, there is a substantial response of CPI to an impulse coming from spread and it is negative. The response peaks at the third month and becomes statistically significant, as the confidence interval excludes the zero lines at the third period.

This result supports our claim about the role of the benchmark bond yield in the monetary conditions. The underlying economic intuition is that increasing the spread means that the CBRT funds the market above the bond yield, which is the tightening of monetary conditions. It may occur due to an increase in the CBRT funding rate or a decrease in the bond yield. After monetary conditions are tightened, market agents expect lower inflation rates in the future and shape their pricing policies considering this situation, as seen in the impulse response of CPI to spread in the figure. That is, spread might affect CPI via the expectations channel.

Moreover, an increase in the spread indicates a higher cost of funding for the Turkish Lira compared to the bond rate, which is anticipated to lead to an appreciation of the currency. As seen in the last row of Figure 2, REER responses to a shock coming from spread in a positive direction (the domestic currency appreciates). Because of the currency appreciation, the cost of imported goods decreases, leading to a decline in the inflation rate (Δ CPI). In this vein, it is claimed that spread might affect CPI by influencing the REER (exchange rate channel). In addition, the spread responds to the movements in the REER, which is seen in the impulse response of the spread to the REER. If REER decreases the domestic currency depreciates, then the spread reacts and goes up to defend the currency and provide the price stability.

The CPI exhibited a clear and significant negative response to shocks from the REER. When the domestic currency depreciates (or appreciates), the prices of imported goods become more expensive (or cheaper), which in turn affects the average price level of the consumer basket. This phenomenon is particularly relevant for Türkiye because of the substantial exchange rate pass-through effect observed (Karaoğlu and Demirel, 2021; Mihaljek and Klau, 2008).

The immediate reaction of the CPI to shifts in the REER can be attributed to Türkiye's high dependency on energy imports, with energy prices adjusting rapidly in the market. Because Türkiye purchases energy using foreign currencies, any changes in exchange rates have an instantaneous effect on the cost of energy products, including natural gas, gasoline, and electricity. Furthermore, these energy products constitute a significant portion of the consumer price index basket, ensuring that fluctuations in exchange rates directly impact the overall price level.

Moreover, the persistence in prices can be seen from the figure of the response of CPI to a shock coming from itself. It is a pervasive phenomenon in the countries having a chronic inflation problem like Türkiye (Karaoğlu and Demirel, 2021). Today's inflation is one of the best predictors for future inflation for the country. Çebi (2012) claims that past price movements and related inflationary expectations are the key factors determining the current inflation rate in the country, which is named as backward-looking behaviour.

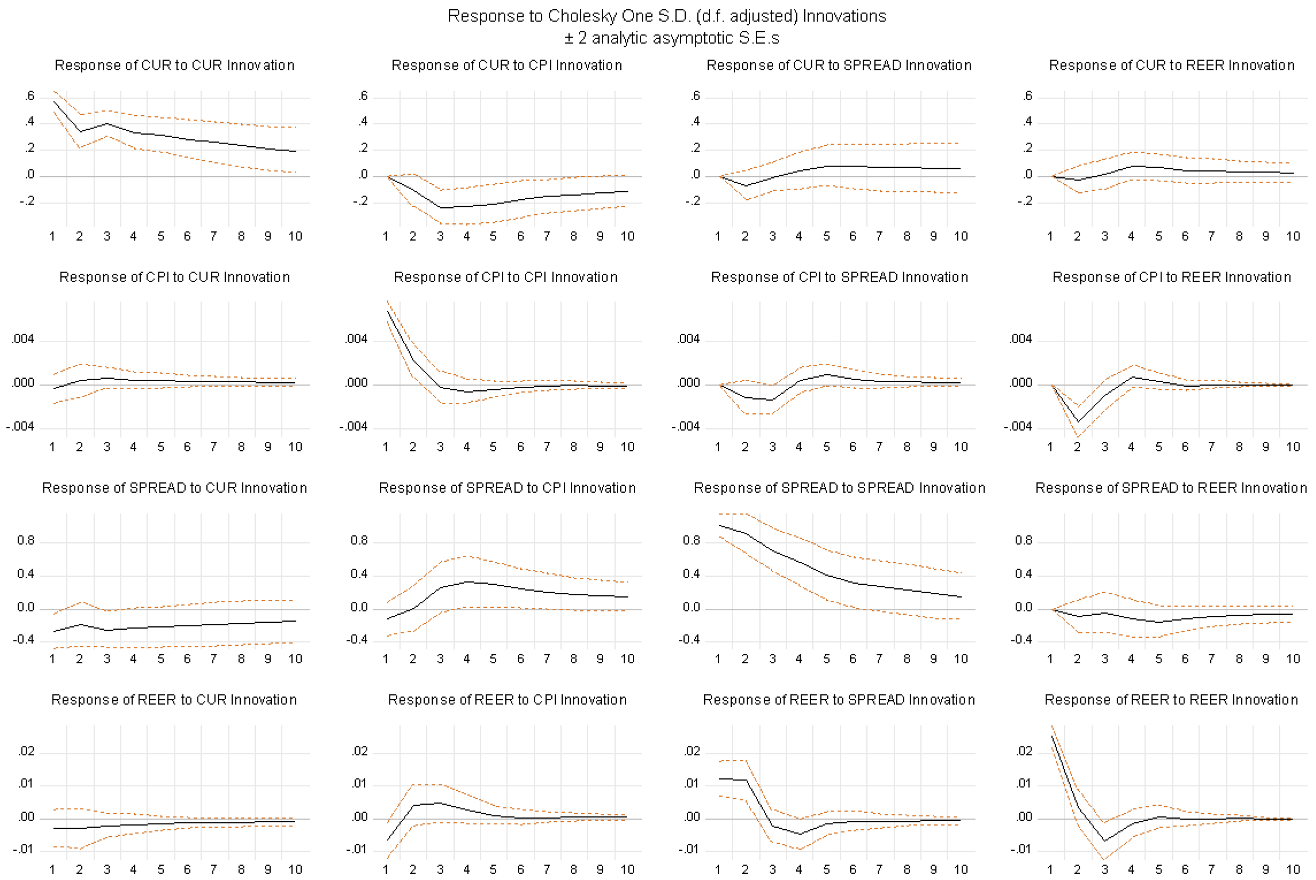


Figure 2: Impulse response graphs

On the other hand, we could not find any significant evidence that the output is an important determinant of inflation rates in Türkiye since the confidence interval for the impulse response of CPI to CUR includes the zero line. Our result is consistent with the findings of other studies on Türkiye by Brooks (2007), Eroglu (2018) and Karaoğlu and Demirel (2021). A potential explanation for this phenomenon lies in the inflationary characteristics of Türkiye's economy. D'Amato and Garegnani (2009) argue that when trend inflation rises, the connection between the output gap and inflation tends to diminish, indicating that traditional economic relationships may not hold in such an environment. This argument is also verified by another model with industrial production (see Figure 3).

Another significant finding is the negative response of the capacity utilisation rate to inflationary pressures (see Figure 2). In an inflationary environment, the rise in prices often leads to heightened uncertainty among businesses and consumers. This uncertainty arises because businesses may delay or scale back production due to unpredictable costs and deteriorating demand conditions. As a result, companies may struggle to maintain optimal production levels, leading to the underutilisation of available resources.

As Figure 3 indicates, after replacing the capacity utilisation rate with industrial production (IND), the impulse responses of spread and REER remain significant, and the coefficients are still consistent with those in the base model. Furthermore, the causal relationship between spread and REER remains unchanged. The inclusion of this important macroeconomic variable does not alter our results, demonstrating the robustness of our findings. We also constructed the same model for different time periods, from January 2015 to December 2019, and the results remain consistent and significant (see Figure A.1 in the Appendix).

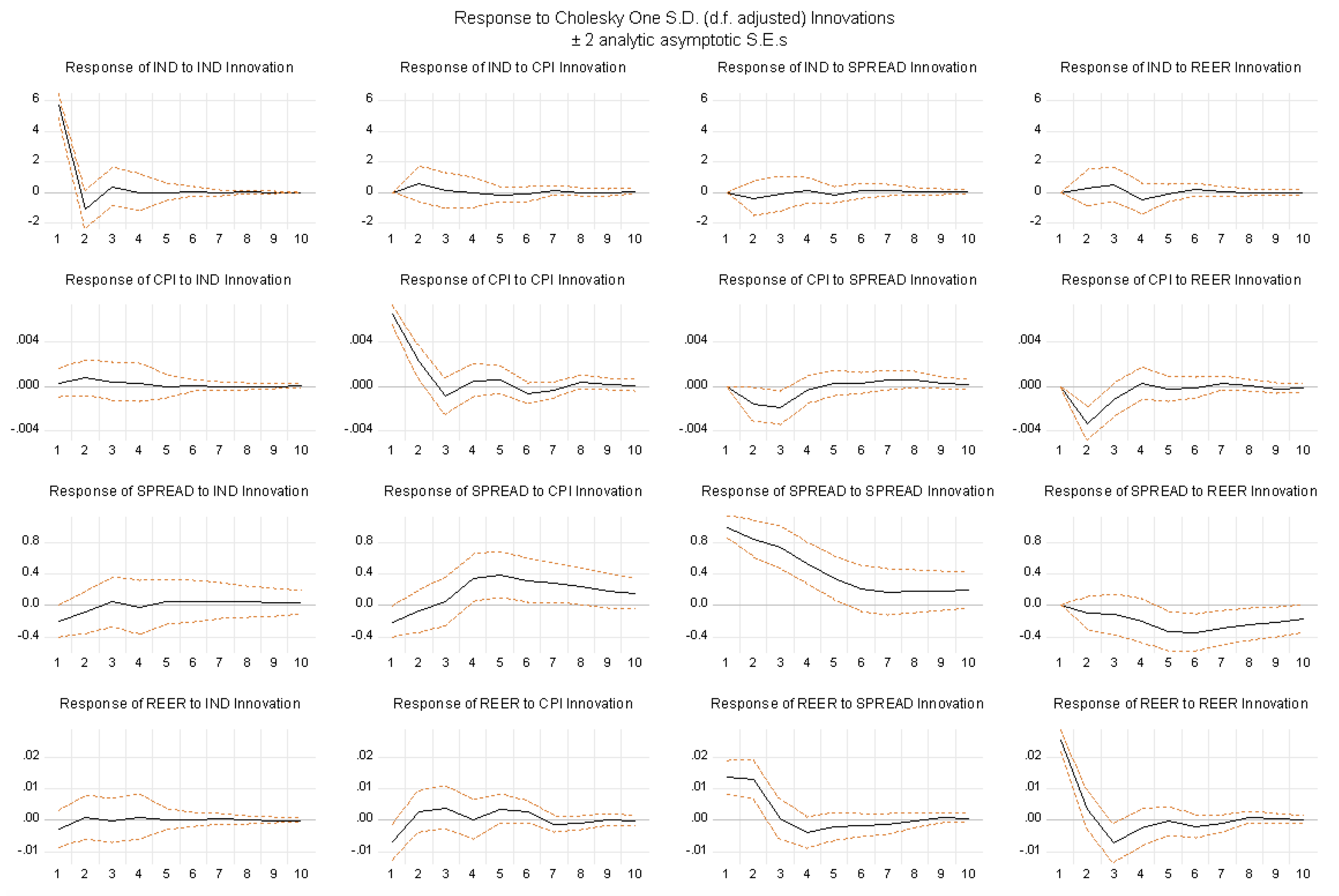


Figure 3: Impulse response graphs (industrial production)

Additionally, the impact of the weighted average cost of funding (WACF) on inflation is examined to reveal the potency of our newly invented variable-spread. The Cholesky order of the variables is as follows: CUR, CPI, WACF and REER. As shown in Figure 4, the response of the CPI to a shock from the funding rate is not significant across all time horizons, and the coefficient sign does not align with established economic theories and empirical findings. This is why we chose to use the spread variable instead of the funding rate directly. We argue that for market agents, the relative level of the funding rate is more important than the level itself. Our results indicate the importance of the interaction of the CBRT rate with the bond yield.

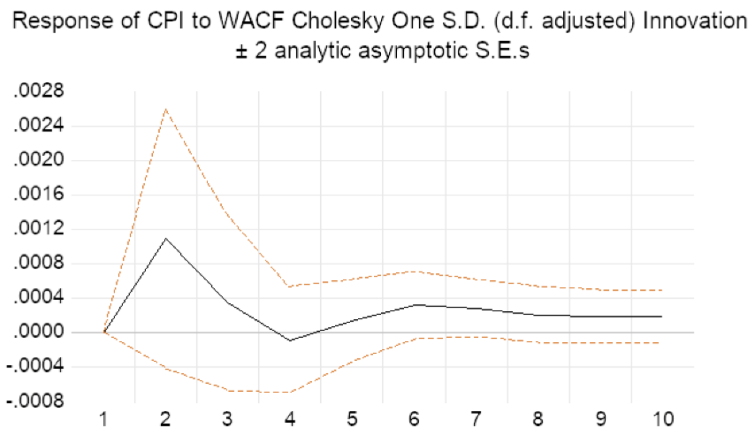


Figure 4: Response of CPI to the weighted average cost of funding

One of the primary implications is that prices in Türkiye exhibit considerable stickiness, which means they do not quickly adjust to changes in the economy. Inflation is largely self-sustaining, driven in part by its own previous values. Additionally, there is a clear pass-through effect from exchange rate fluctuations to prices. However, these exchange rate movements are often triggered by changes in the CBRT funding rate, indicating that inflation is considerably sensitive to interest rate adjustments.

$$interestrate \rightarrow exchangerate \rightarrow inflation$$

The interconnected nature of the inflation dynamics in Türkiye necessitates a simultaneous equation methodology. A single-equation model, such as ordinary least squares (OLS) or auto regressive distributed lag (ARDL), would be insufficient to capture the complexity of these relationships. These models estimate the coefficient of the interest rate by directly regressing it on inflation, which fails to account for the broader interplay between inflation, exchange rates, and interest rates in the Turkish economy. As a result, they may not accurately capture the impact of interest rate changes on inflation.

4.1. Construction of Türkiye's MCI

Based on the variance decomposition results in Table 6, we constructed Türkiye's MCI as a weighted average of the spread and REER. The first column shows the resistance in the inflation since 72.7 percent of the movements in CPI is explained by CPI itself. This is the expected result given that Türkiye has a chronic inflation problem and inflation persistency. The remaining 27.3% of the movements in CPI are explained by other variables: CUR, spread and REER. Spread explains 7.1% of the movements in CPI while it is 19.7% for REER. Since the total effect of spread and REER is 26.8 percent, we calculate the weight of spread as 0.264 (7.1%/26.8%) and REER as 0.736 (19.7%/26.8%) in Türkiye's MCI. Because Türkiye's economy is highly dependent on foreign goods and services, the exchange rate pass-through effect dominates the interest rate effect.

Upon calculating the MCI with weights derived from the variance decomposition results, an examination of its association with the inflation rate is conducted. Figure 5 visually elucidates the interplay between the Turkey's MCI and inflation, revealing a discernible negative relationship during the study period. To explore this relationship, we can look at the contemporaneous impact of the MCI on inflation during the third quarter of 2018. This specific instance was instigated by an exchange rate shock occurring in August 2018, where the Turkish lira underwent a rapid depreciation of 25% within two months due to considerably relaxed monetary conditions. This resulted in remarkable inflationary pressure. Subsequently, the CBRT responded decisively by implementing a substantial 475 basis points increase in the cost of funding in a singular instance. This proactive action led to an appreciation of the Turkish lira and, correspondingly, a reduction in inflationary pressures. The outlined sequence of events underscores the intricate

Table 5: Variance decomposition of CPI (in percent terms)

Period	CPI	spread	REER
[1,]	99,83	0,00	0,00
[2,]	78,82	2,63	18,40
[3,]	74,20	6,43	19,24
[4,]	73,41	6,36	19,79
[5,]	72,93	6,88	19,74
[6,]	72,79	7,00	19,73
[7,]	72,75	7,04	19,71
[8,]	72,71	7,09	19,70
[9,]	72,70	7,10	19,70
[10,]	72,69	7,11	19,70

dynamics between the MCI, exchange rate fluctuations, and inflation within the examined period. For the exchange rate shock and the reaction of the weighted average cost of funding, see also Figure 2.

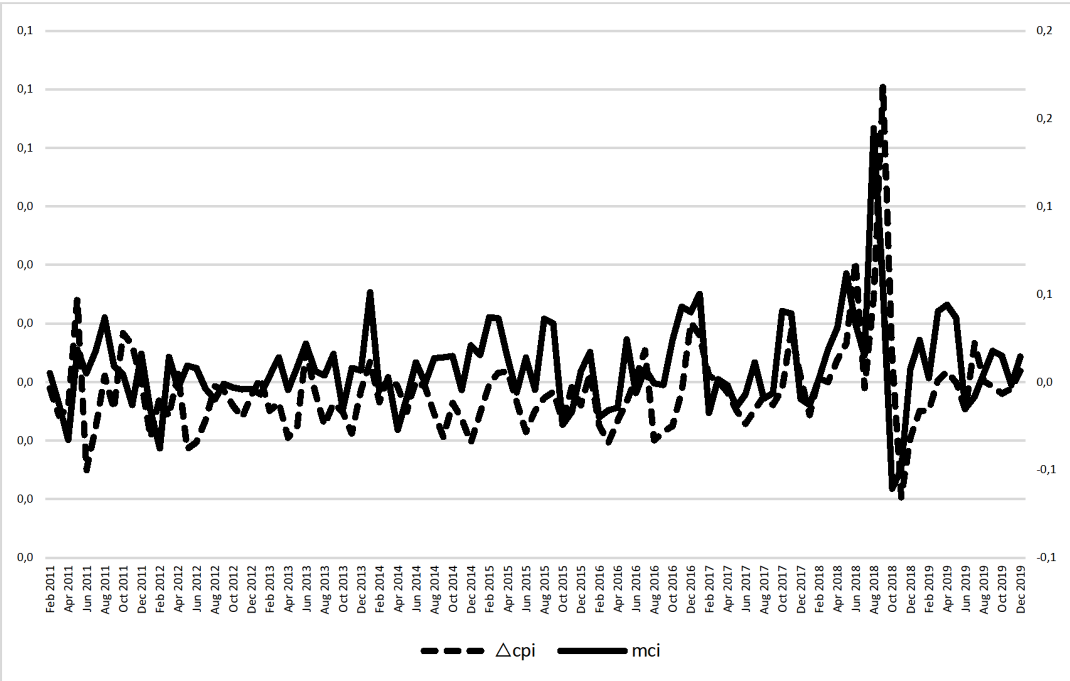


Figure 5: Relationship between the MCI and inflation

Moreover, to understand the potency of our newly invented monetary conditions index is, we test the causality between the MCI and ΔCPI, following the Granger causality methodology. The null hypothesis that "MCI does not Granger Cause ΔCPI" is rejected at the 1% significance level (see Table 7). Therefore, we can infer that MCI significantly affects price movements. Furthermore, the null hypothesis that "ΔCPI does not Granger Cause MCI" is rejected at the 10% significance level, which indicates the responsiveness of MCI to prices. The response mainly comes from the central bank through the funding rate. As the inflation rate increases, the central bank reacts by increasing its policy rate to curb inflationary expectations. When we compare the two impacts, the causality running from the MCI to the price movements is more obvious than the other direction. It reflects the strong impact of monetary policy on inflation but the weak response of monetary policy to an inflationary pressure.

Having established the causality running from the MCI to price movements, it is assertable that bond rates exert an indirect influence on price fluctuations within the context of Türkiye. This inference is drawn from the intrinsic

Table 6: Granger causality between MCI and CPI

Sample: 2011M02 2019M12			
Lags: 2			
Null Hypothesis:	Obs	Chi-sq	Prob.
ΔCPI does not Granger Cause MCI	105	4.97	0.08
MCI does not Granger Cause ΔCPI		33.30	0.00

**Denotes the rejection of the hypothesis at the 5% level.

***Denotes the rejection of the hypothesis at the 1% level.

inclusion of the bond yield indicator within the MCI framework. To exemplify, a decrease in the benchmark bond yield while the policy rate is constant corresponds to a concomitant increase in the MCI, indicative of a tightening of monetary conditions. Consequently, this tightening, which implicitly occurs by a decrease in the bond yield, results in lower inflationary pressures. If market participants expect lower inflation in the future, their increased demand for bonds drives yields down. If the CBRT holds the funding rate unchanged, resisting market expectations, it signals a tight monetary stance.

Through this mechanism, a discernible linkage emerges between monetary conditions and inflation, particularly in relation to government borrowing dynamics. With an increase in the demand for borrowing, the supply of loanable funds in the market increases, consequently pushing bond yields upward. This implies the perception of a relatively lower funding rate for the central bank, thereby leading market agents to interpret this scenario as indicative of monetary easing. The outcome of such an environment is an inflationary pressure. Accordingly, to mitigate inflationary expectations, it becomes imperative for the central bank to exhibit a proactive stance by elevating its funding rate, taking into account market interest rates.

5. Concluding Remarks

As financial markets become more complex and deeply integrated into the economy, central banks are required to watch out for newly invented indicators in addition to the traditional ones while implementing their policies. In this vein, we invented a new monetary conditions index for Türkiye using a different interest rate variable named spread, which is the difference between the weighted average cost of funding and the 2-year government bond yield. Alongside the spread, we included the real effective exchange rate in our index to consider the pass-through effect in the monetary conditions.

It is found that our monetary conditions index Granger causes price changes and has a remarkable effect on inflation. Accordingly, we assert that the yields of government borrowing instruments might significantly affect price movements. The market interest rates may indirectly affect the monetary stance and alter the impact of the policy rate. Evaluating the policy rate alone does not give a clear sense about the position of monetary authority and a benchmark rate is necessary to assess whether the policy rate is tight or loose. In this respect, other interest rates, interbank, deposit or credit rates-might be employed as benchmark rates to measure the tightness of the policy rate, which presents an intriguing area for further research. Since we emphasise the role of fiscal factors on the monetary stance, this aspect remains beyond the scope of our study.

Our results further indicate that the spread responds to exchange rate movements and price changes, which is a reaction of the central bank to defend the currency and curb inflationary expectations. Also, the exchange rate movements significantly reacted to changes in the spread so that the inflation is significantly responsive to the movements in the spread. Based on these findings, as a policy implication, we suggest that the central bank policymakers monitor monetary conditions indexes, including several financial indicators, closely conducting monetary policy. Additionally, when designing fiscal policies, the impact of borrowing instruments on monetary conditions and prices should not be disregarded. The treasury department should be aware of its borrowing channel affecting the monetary stance in the economy.

Peer-review: Externally peer-reviewed.
Conflict of Interest: The author have no conflict of interest to declare.
Grant Support: The author declare that this study has received no financial support.

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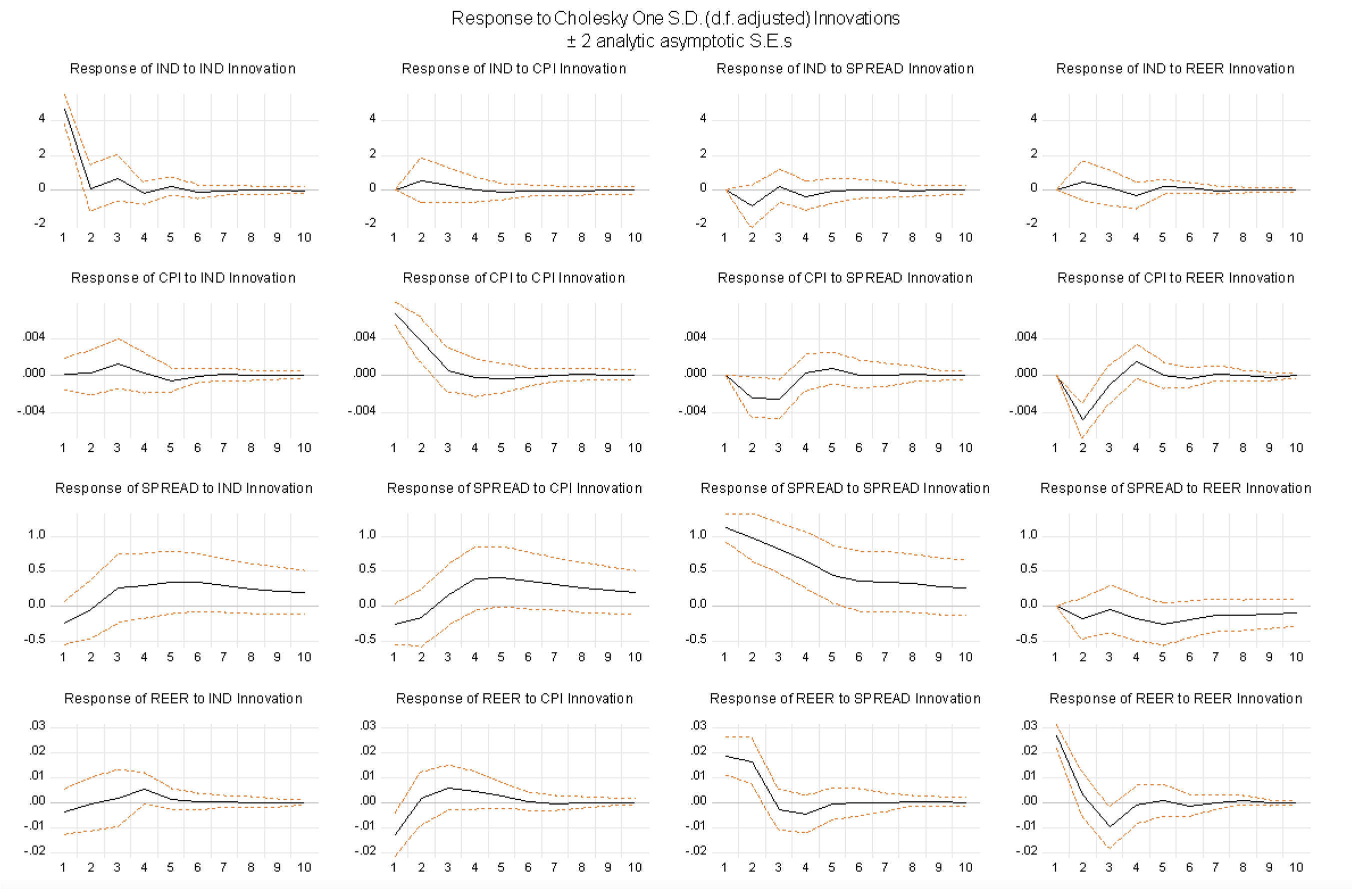
Atıf Biçimi / How cite this article

Kaptan, S. (2024). Roles of the government bond yield and the exchange rate in the monetary conditions of Türkiye. *Maliye Çalışmaları Dergisi-Journal of Public Finance Studies,* 2024; 72, 50–63. https://doi.org/10.26650/mcd2024-1555315

Appendix



Appendix **1**: Impulse response graphs (period from 2015-Jan to 2019-Dec)

Appendix **2**: Granger causality between MCI and CPI

	Dependent Variable			
	CUR	**ΔCPI**	**spread**	**ΔREER**
CUR	-	1.36	1.01	1.46
ΔCPI	8.25	-	6.10	2.00
spread	1.79	1.80	-	2.43
ΔREER	6.54	1.48	6.11	-