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The impact of interest rate corridor on monetary policy efficiency: VEC Granger causality evidence from the central bank of the Republic of Turkey

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ABSTRACT

This paper aimed to analyze the impacts of interest rate corridor policy on monetary efficiency in Turkey, applying the Error Correction Model and VEC Granger causality. The data set consisted of 108 observations for each time series from May 2010 to December 2019. The Granger causality test results indicated a significant impact of the borrowing rate on the inflation rate. Response function revealed that a change in the borrowing interest rate affected the opposite way in the inflation rate with a 3-month lag. An increase in the lending rate caused an increase in the BIST 100 index value. It is concluded that the interest rate corridor implementation successfully increased the flexibility and effectiveness of the monetary policy in Turkey.

1. Introduction

Throughout history, those who set the rules of the international financial system have also been the owners of economic and political power. Serin et al. (2020) tried to answer the basic questions that will shed light on the dynamics of the global financial system. After the latest global financial crisis, the central banks of advanced countries started to apply expansionary monetary policies by stimulating quantitative easing and zero interest rate policies. Thus, changing global risk perception led to a shift in global excess liquidity from advanced countries to emerging countries. In this context, The Turkish economy has faced macroeconomic stabilities such as excessive credit growth, exchange rate appreciations, volatility capital flows, and external imbalances. Hence, the CBRT has been started to apply mixed policies such as the interest rate corridor, liquidity policy, and required reserves to cope with the adverse conclusion of global excess liquidity since May 2010. Thus, the CBRT gained a more flexible structure by diversifying its monetary policy tools. It gained the ability to influence the credit and exchange rate channels separately.

Recently a lot of academicians such as Alper et al. (2019), Ambler and Rumler (2019), Bayır and Abdioğlu (2020), Bech and Monnet (2013), Binici et al. (2016), Kara (2015), and Berentsen and Monnet (2008) have analyzed the effects of interest corridor policy on financial variables. Taylor (1995) defined the monetary transmission mechanism as the transfer of monetary policy decisions on inflation and real income and classified monetary transmission mechanisms channels into four main groups: exchange rate, credit, asset price, and interest channels and added risk-taking, balance sheet, expectations, and bank credit channels in his classification in addition to that Miskin's types. Bofinger and Wollmershäuser (2001) investigated the monetary transmission mechanism into three categories: Expectations, interest, and quantity theory channels. Whitesell (2006) argued that the interest rate corridor was not effective in controlling the volatility of overnight interest rates. Cambazoğlu and Karaalp (2012) analyzed the effect of the exchange rate channel on prices and total output by establishing a VAR model. Haznedaroğlu (2014) explored the interest rate corridor tool using data set including loans, producer price index, one-week repo auction interest rate, and industrial production index. The single equation cointegration analysis method was used. Haznedaroğlu (2014) found that the interest rate corridor positively affected financial

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stability and analyzed the effects of the interest rate decisions of the CBRT on inflation. This study found that a long-term inverse relationship between inflation and interest rates. Tetik and Ceylan (2015) investigated the effect of the interest rate corridor policy tool on exchange rates and stocks. This study employed the VAR model. Results indicated that the exchange rate reacted negatively in the first period but positively in the second period. Kara (2015) examined the interaction of liquidity and short-term interest rate policy within the broad interest rate corridor system framework.

Binici et al. (2016) found that a rise in interest rates in the long–run affected the interbank interest rates and central banks can control capital movements and exchange rate volatility through credit channels and exchange rates. Lee (2016) analyzed the interest rate corridor policy by comparing UK and Eurozone data. Two main findings are highlighted in the study. Lee (2016) found that flexibility of banks' decisions small range would decline the volatility in overnight interest rates. Teber (2018) examined the effect of the interest rate corridor policy by comparing UK and Eurozone data. Two main findings are highlighted in the study. Lee (2016) found that flexibility of banks' decisions small range would decline the volatility in overnight interest rates. Teber (2018) examined the effect of the interest rate corridor instrument on loan and deposit rates between 2014-2017. It was concluded that with an increase in the lower band interest rate by 1 unit, the deposit interest rates would rise by approximately 1.6 units; that is, a change in the lower band interest rate affects the deposit interest rates in the same direction. Arıkan et al. (2018) analyzed the effect of the interest rate corridor on the Turkish economy using the VAR analysis model. Öztürk et al. (2021) examined the impacts of Covid 19 on Turkish monetary policy.

2. Methodology and data set

This study used the econometrics methodology of cointegration, Granger causality tests, and vector error correction mechanism (ECM). The Augmented Dickey-Fuller (ADF) test was carried out on the data. Table 2 indicated that the first difference in the results of the ADF unit root test. Besides that, Phillips Perron (PP) unit root test was used. VAR Analysis was used in the study to capture the relationship between multiple quantities as they change over time. The Johansen cointegration test was used to check the long-term relationship between series. After the stationarity of the series was determined Granger causality test was applied in each set of the variables. Whitesell (2006), Haznedaroğlu (2014), and Tetik and Ceylan (2015) explored the relationships between several variables over time for Turkey. Therefore, it VAR method is used to investigate the interest rate corridor policy's effectiveness. This study used the econometrics methodology of cointegration, Granger causality tests, and vector error correction mechanism (ECM).

The Augmented Dickey-Fuller (ADF) test was carried out on the data. Table 2 indicated that the first difference in the results of the ADF unit root test. Besides that, Phillips Perron (PP) unit root test was used. VAR Analysis was used in the study to capture the relationship between multiple quantities as they change over time. The Johansen cointegration test was used to check the long-term relationship between series. After the stationarity of the series was determined Granger causality test was applied in each set of the variables.

To eliminate the autocorrelation problem, the ADF unit root test is shown by Eq. 1:

$$\Delta Yt=\beta 0+\gamma . Yt\text{-}1+\sum pi=2\ \varphi i\Delta Yt\text{-}i+1+et. \quad (1)$$

PP unit root test Eqs. 2 and 3, which are all components of the ADF test, and these equations:

$$Yt=\alpha 0+\alpha 1+Yt\text{-}1+\mu t \quad (2)$$
$$Yt=\alpha 0+\alpha 1. Yt\text{-}1+a2. (T\text{-}T/2)+t. \quad (3)$$

where, α and t show trend variables, penalties, and error terms. Johansen cointegration test equations are useful for the following Eqs. 4 and 5. M error term is a good payback.

$$Y_t = \alpha_{20} + \sum_{i=1}^{p} \alpha_{11i}\ Y_{t-1} + \sum_{i=1}^{p} \alpha_{12i}\, X_{t-1} + \mu_{1t} \quad (4)$$
$$Y_t = \alpha_{20} + \sum_{i=1}^{p} \alpha_{21i}\ X_{t-1} + \sum_{i=1}^{p} \alpha_{22i}\, Y_{t-1} + \mu_{2t}. \quad (5)$$

The Granger causality test is applied by the following equations (Takım, 2010).

$$Y_t = \sum_{i=1}^{m} \alpha Y_{t-i} + \sum_{j-1}^{m} B_j\, X_{t-j} + \mu_{1t} \quad (6)$$
$$Y_t = \sum_{i=1}^{m} \lambda_i\, X_{t-i} + \sum_{j-1}^{m} \delta_j\, Y_{t-j} + \mu_{2t}\ . \quad (7)$$

In the study, the borrowing interest rate, the lower band of the interest corridor, was chosen as a dependent variable. We used logarithms of all series in the analysis. The model equation was shown below,

$$lalt_c = \alpha_1 + \alpha_2 lkg_t + \alpha_3 lrek_t + \alpha_4 lm3_t + \alpha_5 lbist_t + \alpha_6 linf_t + \alpha_7 lust_t + \mu_t. \quad (8)$$

The data set was included monthly 108 observations for each time series from May 2010 to December 2019. The monthly Consumer Price Index of Turkey (CPI), broad money supply (M3), borrowing interest rate (BR), interest rate, lending interest rate (LR), and real effective exchange rate (RER) were obtained from the CBRT, Electronic Data Delivery System. The M3 is the broadest measure of the money supply, which helps policymakers to better understanding potential inflationary tendencies. Corridor width was calculated by ourselves. All variables were altered into natural logarithms to stabilize the variability in the data. Table 1 shows variable definitions and data sources.

3. Empirical findings

The results of the Augmented Dickey-Fuller unit root test were shown in Table 2.

Table 1: Variable definitions and data sources

Variables	Definitions	Data Source
Borrowing Interest Rate (BR)	Interest corridor overnight borrowing interest rate	CBRT
Corridor's width (W)	The width of the interest corridor between the lower and upper band	Our calculations
Real Effective Exchange Rate (RER)	Real effective exchange rate based on spreads (2003=100)	CBRT
M3 Money Supply (M3)	The largest money supply and provision items monthly average	CBRT
BIST 100 Index XU (BIST)	Monthly average of BIST 100 index closing values	www.investing.com
Inflation (CPI)	CPI (%)	CBRT
Lending Interest Rate (LR)	Interest corridor upper band, overnight lending interest rate	CBRT

Table 2: Augmented dickey-fuller unit root test for all variables

Variables	Original Level		1st difference	
	t–statistics	Probability	t–statistics	Probability
LBR	0.730630	0.9923	-9.712106	0.0000
LW	-1.790144	0.3836	-8.785697	0.0000
LRER	-1.137382	0.6988	-7.818188	0.0000
LM3	1.614558	0.9995	-9.450245	0.0000
LBIST	-1.725045	0.4158	-1.064977	0.0000
LCPI	-1.554950	0.5020	-7.850722	0.0000
LLR	0.838740	0.9943	-4.140755	0.0013

The results of the ADF test indicate that for all the observed variables, the null hypothesis of a unit root is rejected. In other words, the condition of stationarity seems to be satisfied. The PP unit root test was applied by taking the first-order differences of the variables. It was seen that the PP unit root test results supported the ADF unit root test results. Table 3 shows the PP unit root test for all variables. Also, Table 4 shows the VEC error correction test.

Table 3: PP unit root test for all variables

Variable	Original Level		1st difference	
	t–statistics	Probability	t–statistics	Probability
LBR	0.199047	0.9714	-9.900.222	0.0000
LW	-2.076.160	0.2547	-9.720.208	0.0000
LRER	-0.731947	0.8333	-7.539.846	0.0000
LM3	3.545.225	10,000	-9.419.444	0.0000
LBIST	-1.738.622	0.4091	-1.064.898	0.0000
LCPI	-0.827653	0.8069	-8.794.987	0.0000
LLR	0.530290	0.9871	-1.024.456	0.0000

Table 4: VEC error correction test

Error Correction	D (LBR)	D (LW)	D (LRER)	D (LM3)	D (LBIST)	D (LCPI)	D (LLR)
Coefficient	-0.054035	0.002531	-0.002639	0.008777	0.018649	-0.114502	-0.071330
Standard error	(0.01674)	(0.03162)	(0.00404)	(0.00241)	(0.01193)	(0.02209)	(0.03841)
t–statistics	[-3.22844]	[0.08005]	[-0.65264]	[3.63718]	[1.56326]	[-5.18378]	[-1.85730]

In Table 4, VEC error correction test has been applied. The findings obtained from the test explain that imbalances occurring in the short term will stabilize in a long time. Table 5 shows Granger causality tests on all the variables.

Table 5: Granger causality tests on all the variables

Null Hypothesis	Lag	F-statistics	Probability	Decision
LRER is not the Granger cause of LBR	3	6.11329	0.0007	Accepted
LBR is the Granger cause of LRER	3	14.4234	7.E-08	Rejected
LM3 is not the Granger cause of LBR	3	4.32939	0.0065	Accepted
LBR is the Granger cause of LM3	3	11.8113	1.E-06	Rejected
LBIST is not the Granger cause of LBR	3	4.01260	0.0097	Accepted
LBR is the Granger cause of LBIST	3	0.45907	0.7115	Rejected
LCPI is the Granger cause of LBR	3	0.71327	0.5464	Rejected
LBR is the Granger cause of LCPI	3	1.65936	0.1808	Rejected
LLR is not the Granger cause of LRER	3	3.91078	0.0110	Accepted
LRER is not the Granger cause of LLR	3	7.02816	0.0002	Accepted
LLR is the Granger cause of LM3	3	2.60562	0.0561	Rejected
LM3 is not the Granger cause of LLR	3	4.17991	0.0079	Accepted
LLR is the Granger cause of LBIST	3	1.87944	0.1381	Rejected
LBIST is the Granger cause of LLR	3	2.53041	0.0616	Rejected
LLR is not the Granger cause of LCPI	3	4.94272	0.0031	Accepted
LCPI is the Granger cause of LLR	3	0.83107	0.4799	Rejected
LW is not the Granger cause of LRER	3	4.06124	0.0091	Accepted
LRER is not the Granger cause of LW	3	4.47325	0.0055	Accepted
LW is the Granger cause of LM3	3	2.44800	0.0682	Rejected
LM3 is the Granger cause of LW	3	8.73684	3.E-05	Rejected
LW is the Granger cause of LBIST	3	0.81760	0.4872	Rejected
LBIST is the Granger cause of LW	3	1.15362	0.3315	Rejected
LW is not the Granger cause of LCPI	3	5.05213	0.0027	Accepted
LCPI is the Granger cause of LW	3	0.19024	0.9028	Rejected

4. Conclusion and discussion

After the global crisis, implementing the interest rate corridor policy, CBRT aimed to reach lower inflation rates, prevent fluctuations in exchange rates, increase short-term capital inflows, and tighten monetarily. The effect of the interest rate corridor policy on the M3, BIST 100 index, and inflation was analyzed using monthly data for January 2010-December 2018 period in this study. Granger causality tests within the framework of multivariate cointegrated VAR models were applied to estimate causal linkages between selected financial and economic variables.

This study revealed that when the central bank responded by increasing the borrowing interest rate during periods of high inflation, inflation reacted and decreased after three months. An increase in the lending (upper band) interest rate caused an increase in the value of the BIST 100 index. An increase in the lending rate shrank the M3 money supply. If uncertainty prevailed in the general situation of the economy, the interest rate corridor instrument might create a partial uncertainty in the market regarding interest rates. An interest rate corridor was a functional tool to control capital inflows. It affected the exchange rate channel and the credit channel separately when the country's economy is stable and national and global uncertainties are less. As a result of the analysis, it was concluded that using the interest rate corridor simultaneously with other monetary policy tools has increased its effectiveness on financial stability. These findings supported related academic literature. It was observed that the interest rate corridor monetary policy worked effectively in line with the CBRT's targets.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

Alper K, Altunok F, Taniu C, and Ongena S (2019). The effect of unconventional monetary policy on cross-border bank loans. SFI Research Paper, University of Zurich, Zürich, Switzerland: 19-38. https://doi.org/10.2139/ssrn.3421459

Ambler S and Rumler F (2019). The effectiveness of unconventional monetary policy announcements in the euro area: An event and econometric study. Journal of International Money and Finance, 94: 48-61. https://doi.org/10.1016/j.jimonfin.2019.02.007

Arıkan C, Görgün S, and Yalçın Y (2018). The position of interest rate corridor on monetary transmission mechanism. Maliye Dergisi [Finance Magazine], 174: 1-25

Bayir M and Abdioğlu N (2020). The effect of interest rate corridor on Turkish financial markets. Journal of the Human and Social Science Researches, 9(5): 3244-3263. https://doi.org/10.15869/itobiad.747107

Bech M and Monnet C (2013). The impact of unconventional monetary policies on the overnight interbank market. In the Reserve Bank of Australia Conference, Sydney, Australia.

Berentsen A and Monnet C (2008). Monetary policy in a channel system. Journal of Monetary Economics, 55(6): 1067-1080. https://doi.org/10.21799/frbp.wp.2008.07

Binici M, Kara H, and Özlü P (2016). Unconventional interest rate corridor and the monetary transmission: Evidence from Turkey. Working Paper NO: 16/08, Central Bank of the Republic of Turkey, Ankara, Turkey.

Bofinger P and Wollmershäuser T (2001). Managed floating: Understanding the new international monetary order. Wuerzburg Economic Working Paper No. 30. https://doi.org/10.2139/ssrn.273998

Cambazoğlu B and Karaalp HS (2012). Parasal aktarım mekanizması döviz kuru kanalı: Türkiye örneği. Yönetim ve Ekonomi, 19: 53-66.

Haznedaroğlu AB (2014). Financed stability: Administered interest rate corridor towards an analysis on financial stability in Turkey (2006-2013). Unpublished Ph.D. Dissertation, Maltepe University, Istanbul, Turkey.

Kara AH (2015). Interest rate corridor and the monetary policy stance [Faiz Koridoru ve Para Politikasi Durusu]. CBT Research Notes in Economics No.1513, Central Bank of the Republic of Turkey, Ankara, Turkey.

Lee J (2016). Corridor system and interest rates: Volatility and asymmetry. Journal of Money, Credit and Banking, 48(8): 1815-1838. https://doi.org/10.1111/jmcb.12364

Öztürk O, Gerlikhan S, Kanuşağı İ, Özcan C, & Serin ZV (2021). A system dynamic approach for determination of optimal monetary policy during the Covid-19 economic crisis: A case of Turkey. Finansal Araştırmalar ve Çalışmalar Dergisi, 13(24): 223-244. https://doi.org/10.14784/marufacd.879264

Serin ZV, Öztürk O, Kanuşağı I, and Ozcan C (2020). Is the USA political and economic strength arising from dollars sustainable? Journal of Institute of Economic Development and Social Researches, 6(22): 114-128.

Takim A (2010). The relationship between GDP and exports in Turkey: Granger causality test. Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 4(2): 1-16.

Taylor JB (1995). The monetary transmission mechanism: An empirical framework. Journal of Economic Perspectives, 9(4): 11-26. https://doi.org/10.1257/jep.9.4.11

Teber H (2018). Unconventional monetary policy tools and Turkey. Master Thesis, Çukurova University, Adana, Turkey.

Tetik M and Ceylan R (2015). Analysis of the effect of interest rate corridor strategy on common stock and exchange rate. Business and Economics Research Journal, 6(4): 55-69.

Whitesell W (2006). Interest rate corridors and reserves. Journal of Monetary Economics, 53(6): 1177-1195. https://doi.org/10.1016/j.jmoneco.2005.03.013