DOI 10.2478/sbe-2021-0005

SBE no. 16(1) 2021

MACROECONOMIC DETERMINANTS OF INTEREST RATES IN BRICST, MINT, AND FRAGILE FIVE COUNTRIES: EVIDENCE FROM QUANTILE REGRESSION ANALYSIS

DEPREN Özer

Customer Experience Researches Directorate in Yapı Kredi Bank, Turkey

KARTAL Mustafa Tefvik

Strategic Planning and Investor Relations Directorate in Borsa İstanbul, Turkey

DEPREN Serpil Kiliç

Yıldız Technical University, Department of Statistics, Turkey

Abstract:

As a substantially important indicator for economies, interest rates are influenced by a variety of macroeconomic factors. Considering this fact, the study aims to determine the influential macroeconomic determinants on deposit interest rates in emerging countries by using 12 independent macroeconomic determinants, yearly data between 1980 and 2018, and quantile regression method, which is applied for the first time to analyze interest rates. The empirical results show that influential determinants and their effects on the interest rate are differentiating for countries. The findings reveal that the most important factor in the interest rate is the consumer price index (CPI) in Turkey and Mexico; unemployment in Russia and China; total reserves in Nigeria; GDP in Indonesia; imports of goods and services in Brazil and South Africa. The results of the analysis emphasize the importance of macroeconomic indicators on the interest rates in each quantile. Taking measures by considering the findings of the study, which shows the role and importance of each macroeconomic indicator in quantiles, is essential to promote economic growth via ensuring low-level deposit interest rates and hence providing credit growth in emerging countries.

Key words: *Interest Rate, Macroeconomic Factors, Quantile Regression, BRICST, MINT, Fragile Five*

1. Introduction

Achieving and maintaining financial stability has importance for every country. That is why countries aim to be developed to provide high life quality to citizens. For this aim, the development of countries in both real and financial aspects is significant. In this context, stability in macroeconomic and financial indicators has crucial importance.

Macroeconomic and market (financial) indicators with financial markets and financial institutions have a key role in the development of countries. Although each indicator such as debt, economic growth, foreign exchange rates (FER), foreign trade,

inflation, investments, money supply, reserves, savings, and unemployment has importance from various perspectives, one of the most important indicators is the interest rates because they not only have potential to make effects on these indicators but also they are affected from these variables.

Actions taken in the context of monetary, fiscal, and macroprudential policies affect the interest rate level. Changes and volatility in interest rates deeply fund flows to stock exchanges, credit expansion, and hence economic growth via increasing or decreasing uncertainty (Gözüör et al., 2019). Moreover, interest rates affect the investment, saving, and consumption desire of all economic actors including states, companies, international funds, etc. For these reasons, the level and development trend of the interest rates have substantial importance for the stability, economic growth, and development of countries as well.

Besides the roles mentioned above, interest rates also show the cost/value of money in an economy. In other words, the level of economic activity decreases when interest rates increase in an economy and vice versa. Therefore, the relationship between interest rates and other macroeconomic indicators affects the capacity, the development, and the growing trend of countries. Therefore, each country aims and prefers to have a low-level interest rate (Tumwine et al., 2018).

Although low-level interest rates are desired; however, there may be some cases that require high-level interest rates in an economy. In other words, there should be a higher interest rate in cases, where inflation has a high-level, to keep inflation under control and make it possible to have a decreasing trend (Entrop et al., 2017). Besides inflation, volatile and high-level in FER constitute risks for countries that have high FER denominated foreign debts. Sudden increases/decreases of FER in such countries may result in harmful negative effects on economic actors and may cause a lot of bankruptcies. Increasing interest rates is required and essential in such a case to stabilize FER.

Achieving low-level interest rates is not so easy in the world which has been much more globalizing and countries have been much more interdependent. In such an environment, there are too many factors that should be considered. Therefore, multiple factors must be taken into consideration to manage interest rates effectively. To do so, factors, which have either negative or positive effects on interest rates, should be stated first. After that, countries should try to decrease the negative effects of the effective factors on interest rates.

There has been a high-level or an increasing trend in the interest rates in some emerging countries. In this context, making an analysis upon which factors have effects is necessary. In this study, the determination of influential macroeconomic determinants on deposit interest rate is aimed. Yearly data between 1980 and 2018 with 12 independent macroeconomic determinants are employed for analysis. The examination includes BRICST, MINT, and Fragile Five countries which include emerging countries. In the study, it is expected that analysis results could allow the management of deposit interest rates in selected emerging countries upon how they progress on achieving low-level interest rates by taking into consideration the recent developments in macroeconomic indicators affecting the interest rates.

The main contribution of the study is to define the determinants of deposit interest rates in selected emerging countries by using macroeconomic indicators and focusing on the period between 1980 and 2018 which is the most up-to-date data available on World Bank (WB) and, thereby contributing to the literature in some ways. First, best to authors' knowledge, there has not been a study covering recent periods and examining recent developments on interest rates. Second, this study focuses on BRICST, MINT, and Fragile Five countries in a comparative way. They are totally important emerging economies in the world taking place in the high order of the list. Third, it would be possible to recommend some policy proposals by benefitting from the analysis results based on the findings to prevent the increase in interest rates in the examined emerging countries. Fourth, the quantile regression method, which has a relatively high estimation capability among non-parametric methods, is used in the study for analysis. It is the first time the method used for the analysis of interest rates as far as the authors know. They could be summarized as the main contributions of the study to the literature.

The study includes 5 sections. After providing general information about the initiative of the study in the introduction part, Section 2 introduces the conceptual framework including types of interest rates and the development of deposit interest rates in the selected emerging countries. Section 3 includes the scope, determinants that are used in the analysis selected by benefitting from the current literature, details of the determinants, data, and methodology applied in the study. Section 4 presents the empirical results, the discussion on findings, and the policy recommendations which are developed based on the findings. Section 5 concludes the results.

2. Conceptual Framework

Interest rates show mainly the value cost of the money. In other words, interest rates can be described as the price of the money loaned or the cost of the money borrowed. Therefore, they have a critical function in economies, especially in the financial intermediary activities.

There are a variety of interest rates types in economies depending on the infrastructure of financial systems. Some of the main interest rate types can be summarized as central bank rates (policy rate, marginal funding rate, and late-liquidity window rate), money market rate, Treasury bond rate, deposit rate, and lending (credit) rate (Dinçer et al., 2019; Kartal, 2019; Salim, 2019; Kartal, 2020). Each of these has different functions in economies. For example, the Treasury bond interest rate has a key role in terms of borrowing of Treasures of countries while money market interest rate has a function in the buying/selling of money between banks in the interbank market. On the other hand, central bank policy rates are important to create a level to determine the price level of money in economies. However, interest rates in the market could be different from what central banks announced. Hence, another grouping of interest rates has occurred which are either benchmark interest rate or market interest rates.

Also, the level of borrowing (deposit) and lending (credit) interest rates are significant in countries that have a bank-based financial system and banks provide much of the funding by using deposits as the main funding source (Kartal et al., 2018). In this

structure, the deposit interest rate is quite critical for the intermediary functions of the banks. That is why banks provide credits from the sources either deposit or equity. Taking into consideration that the equity volume of banks is quite smaller than deposit volume, then the importance of deposit could be understood better. In other words, deposits are the main source of credits.

Mainly, developed countries enjoy low-level interest rates. However, the condition is quite different for emerging countries. There has been a high-level and increasing trend in interest rates in some emerging countries in recent times. Figure 1 presents the development trends of nominal deposit interest rates in emerging countries.

Figure 1. The Development of Nominal Deposit Interest Rates (%) in Selected Emerging Countries between 2004 and 2018 (among announced 103 countries).

Source: WB Open Data Database, 2019.

As can be seen in Figure 1, Turkey has the highest interest rate among countries between 2004 and 2018. After Turkey, Brazil is the second and Nigeria is the third country that has high-level interest rates in some periods generally whereas Russia and Indonesia are the other countries that have high-level interest rates in different periods. Also, all emerging countries, taking place in Figure 1, have higher interest rates than developed countries. Emerging countries generally have a high-level interest rate among 103 countries, of which deposit interest rate figures are published for the 2018 end.

Besides nominal deposit interest rates, it is necessary to mention about real deposit interest rates. Figure 2 includes the development trends of real deposit interest rates in emerging countries.

Figure 2. The Development of Real Deposit Interest Rates (%) in Selected Emerging Countries between 2004 and 2018 (among announced 103 countries).

Source: WB Open Data Database, 2019.

As can be seen in Figure 2, Turkey has the highest real interest rate with 6% which was 3.7% in 2017. Also, there is an increase in South Africa, Indonesia, and Russia from 2017 to 2018. On the other hand, Nigeria, Mexico, and China have negative real interest rates in both 2017 and 2018. Consequently, 5 of the emerging countries have high-level real deposit interest rates, and 3 of the emerging countries have negative real deposit interest rates as well.

Both nominal and real interest rates are important for economic actors. However, nominal interest rates are important for especially foreign investors because of reflecting the possible gain level in an economy which is also related to the riskiness of a country. Also, the level of the nominal interest rate is much related to the investment preferences of foreign investors. Foreign investors hesitate to make investments (both direct and portfolio) to countries in case of high country risks which is closely related to interest rates. By considering this fact, the nominal interest rate is selected as a dependent variable in the study.

On the other hand, a variety of factors, especially macroeconomic factors, are important for interest rates (Özdemir & Cüneyt, 2012). Besides, there is an interaction from interest rates to other macro indicators and from macro indicators to interest rates as well. For example, deposit interest rates increase when inflation increases. Credit interest rates increase when deposit interest rates increase in turn. However, the relationship may be different between interest rates and other macro indicators. Hence, examining the effect of the selected macroeconomic indicators on the nominal deposit rates in Turkey is purposed. Also, the determinants of the interest rates should be determined to develop policies because of the importance of banks' funding cycle.

3. Scope, Determinants, Data, And Methodology

3.1. Scope

In this study, it is aimed to examine the deposit interest rates in BRICST, MINT, and Fragile Five countries. This country groups include countries as follows:

- BRICST: Brazil, Russia, India, China, South Africa, Turkey.
- MINT: Mexico, Indonesia, Nigeria, Turkey.
- Fragile five: Brazil, India, Indonesia, South Africa, Turkey.

All these countries can be summarized as Brazil (BRA), China (CHN), India, Indonesia (IDN), Mexico (MEX), Nigeria (NGA), Russian Federation (RUS), South Africa (ZAF), and Turkey (TUR), totally counting 9 countries. It was aimed to examine 9 countries covering fully BRICST, MINT, and Fragile Five countries. India is excluded and the other 8 countries are included in the analysis because interest rate data of India could not be reached.

3.2. Determinants of the Interest Rate

Some of the studies in the literature use deposit interest rates as the dependent variable whereas some of the others use credit interest rates. Also, different types of interest rates like Treasury bonds/bills, policy rates are used in studies. In this study, the deposit interest rate is used as dependent determinants for the analysis because we would like to examine interest rates in terms of source cost of countries. Also, various independent factors have been examined in terms of their effects on these interest rates types.

Researchers work on interest rates very often and have tried to determine the effects of various determinants such as debt, foreign trade (exports, imports), gross domestic product (GDP) growth, inflation (consumer prices index, producer prices index), investment, money supply, reserves, savings, and unemployment on interest rate using different techniques such as ARCH, GARCH, causality analysis (Granger, Toda-Yamamoto), co-integration test (Gregory-Hansen, Hiemstra-Jones, Johansen), generalized method of moments, multivariate adaptive regression splines, MGARCH, regression (logit, panel, OLS), vector autoregressive model, vector error correction model, etc.

The relationship between types of debt and interest rates is examined in some studies. International debt is important in explaining interest rates in Norway, Sweden and Denmark (Hol, 2006), and public debt has the role in interest rates changes in Uganda (Tumwine et al., 2018) while foreign debt is important in terms of interest rates changes in Turkey (Dinçer et al., 2019). As a whole, it is defined that there is a strong relationship between debt and interest rates.

Some studies focus on the relationship between economic growth and interest rates. It is determined that economic growth is related to the interest rate in the United States of America (USA) (Holston et al., 2017). On the other hand, Shaukat et al. (2019) examine selected 38 countries and conclude that there is a multi-fold inverse relation between economic growth and real interest rate.

There are also studies in the literature examining the relationship between inflation and interest rates. Generally, researchers find that there is a positive relationship. For example, Mehra studies the USA and defines that inflation influences interest rates (Mehra, 1996). Similarly, it is defined that expected inflation increases the interest rate in Turkey (Berument & Malatyali, 2001), inflation uncertainties increase interest rate spreads in the United Kingdom (Berument et al., 2004), and inflation influences the deposit interest rates (Dinçer et al., 2019), and credit interest rates (Kartal, 2019) in Turkey.

The money supply is another factor in which its effects on interest rates is researched. It is determined by the researchers that the money supply affects interest rates. Real money supply influences Treasury bill rates in Nigeria (Onanuga & Shittu, 2010) and money supply (M2 volume) has a negative effect on credit interest rates in Turkey (Kartal, 2019).

Reserves and unemployment are also some of the other variables that are examined. Hol (2006) examines the relationship between unemployment and interest rate in Norway, Sweden, and Denmark and defines that unemployment is significant in explaining interest rates. Also, Kartal (2019) examines the relationship between reserves and interest rates in Turkey and determined that central banks' reserves affect credit interest rates.

Besides, some studies in the literature search the relationship between interest rates and other determinants. Studies are examining the effects of FER on interest rates. FER has a dominant influence on interest rate variability in Italy (Angeloni & Prati, 1993). Also, the exchange rate regime is significant in explaining interest rates in Norway, Sweden, and Denmark (Hol, 2006). Also, the volatility of FER affects the interest rate in India (Paramati & Gupta, 2013). Similarly, USD/TL FER has an effect on credit interest rates in Turkey (Kartal, 2019). Besides these studies, Dinçer et al. (2019) study Turkey in terms of the effect of the current account balance on interest rates and stated that current account deficit affects deposit interest rates.

Another group of studies focuses on the relationship between budget deficit and interest rates. Studies define that there is a positive relationship generally. There is a significant linkage between budget deficits and interest rates in the USA (Cebula, 1988; Cebula & Foley, 2019). Also, the budget deficit has a statistically important effect on nominal interest rates in Pakistan (Mukhtar & Zakaria, 2008). Similarly, the budget deficit influences deposit interest rates in Turkey (Dinçer et al., 2019).

When evaluating the studies in the literature, it can be summarized that the effects of various independent determinants on interest rates could be either positive or negative depending on the period, countries, and methods used. On the other hand, determinants of interest rate are studied frequently by different researches because of its importance. Therefore, interest rates will be the subject of new studies in the coming period because they will have still important for countries.

Since emerging countries have been faced with the increasing and high-level interest rate problem recently, there is a need to examine emerging countries covering the recent periods. Also, it is important to include comprehensive countries and cover more recent periods. Also, taking new peer groups of countries like BRICST, MINT, and Fragile Five countries into consideration is essential for new studies. In this context, it is thought

that a new study, which covers the most recent accessible data and focuses on the new country peers including emerging countries, would be beneficial. By using macroeconomic determinants, which may have an influence on interest rates, with the data including the most recent periods and applying a new method like quantile regression in terms of analysis of interest rates has the potential to contribute to the literature.

The dependent variable is the nominal deposit interest rates. Independent variables, which are used in the analysis to determine influential factors on the interest rates in selected emerging countries, are selected by benefitting from the literature taking place above and summarized in Table 1.

Table 1. Determinants of Interest Rates

Variables	Symbol	Description	Expected Effects
GDP	GDP	Gross Domestic Product	+, -
GDP per Capita	GDPPC	GDP per Capita	+, -
Imports	IGS	Imports of Goods and Services (% of GDP)	-
Exports	EGS	Exports of Goods and Services (% of GDP)	-
Inflation	CPI	Consumer prices index (Annual %)	+
Investment	FDI	Net inflow amount of Foreign Direct Investments (FDI) (Billion USA Dollar)	-
Money Supply	BM_AG	Annual growth of Broad Money	+, -
Money Supply in GDP	BM_GDP	Broad Money (% of GDP)	+, -
Reserves	RSRVS	Total reserves (% of total external debt)	-
Savings	SVNGS	Gross savings (% of GDP)	+, -
Short Term Debt	DBT	Short term debt (% of total reserves)	+
Unemployment	UNEMP	Unemployment rate in total labor force (%)	+

Positive (+) relationship means that interest rates increase when independent variables increase.

Negative (-) relationship means that interest rates decrease when independent variables increase.

3.3. Data Source

The yearly data between 1980 and 2018 is used in the study by considering data availability. Data for the dependent and independent determinants are gathered from WB Open Data Database (2019) to analyze the influential macroeconomic determinants on the interest rate. However, interest rate data of India could not be reached. For this reason, although it was desired to be included, the analysis includes a total of 8 countries excluding India.

3.4. Methodology

A constructed model is used in the analysis process. Figure 3 includes the details of the methodology.

Figure 3. The Methodology.

Source: Authors' construction.

The first step of the methodology is to examine the descriptive statistics of dependent and independent variables. The second step is to check if there are any missing values in the dataset. If there are missing values in the dataset, values are estimated using 10-fold cross-validation based random forest algorithm. Then estimation accuracy is calculated, which is R^2 . If R^2 is lower than 0.80, cross-validation and random forest algorithm parameters are updated to increase the estimation accuracy. If it is greater than 0.80, continue to Feature Selection step, which is the third step. In this step, highly correlated independent variables are determined and excluded from the analysis. Finally, quantile regression is performed and checked if there are any significant independent variables. If there are statistically significant variables, the results are interpreted. If not, the quantile regression parameters are updated and re-run the model.

The quantile regression method is preferred to be used in this study because the method has never been used to analyze the interest rate. Furthermore, this method allows researchers to figure out the most important factors on the target variable in different quantiles of the target variable, which is the most distinctive feature that distinguishes this method from others.

4. Empirical Results

4.1. Descriptive Statistics

The first step of the methodology is to give descriptive statistics of the variables to understand the basic characteristics of the dataset. Table 2 presents the descriptive statistics for determinants.

Table 2. Descriptive Statistics

Variables	BRA	CHN	IDN	MEX	NGA	RUS	TUR	ZAF
IR	744,7715 (1938,77)	4.89 (3.07)	12.94 (7.5)	19.45 (22.94)	9.63 (4.84)	7.03 (3.86)	42.31 (23.82)	10.43 (4.13)
BM_GDP	54,35173 (28,67)	122.61 (53.94)	44.64 (6.59)	27.98 (5.34)	16.05 (5.56)	42.63 (13.21)	37.45 (10.98)	60.20 (10.47)
BM_AG	353,5481 (765,64)	20.58 (8.42)	17.61 (11.77)	28.98 (30.31)	25.96 (20.4)	23.24 (12.12)	50.53 (35.54)	13.52 (6.25)
EGS	11,09805 (2,53)	19.53 (7.91)	28.82 (7.02)	22.81 (8.2)	19.17 (7.84)	31.43 (5.35)	19.64 (4.7)	27.76 (3.73)
FDI	28653,19 (32389,82)	86276.72 (95002.26)	7597.57 (8920.77)	15153.44 (13168.54)	2197.75 (2512.55)	26384.70 (23394.44)	5886.92 (7241.18)	2097.85 (2835,50)
GDP	990012,4 (769880,48)	3217834.87 (4079324.77)	445903.07 (339511.61)	616194.73 (408141.69)	149727.77 (160270.59)	1125842.15 (703608.76)	389461.22 (317171.13)	187707,11 (111739,91)
GDPPC	5374,614 (3577,94)	2405.13 (2946.21)	1861.64 (1251.59)	5913.12 (3131.14)	1100.45 (865.47)	7792.75 (4892.78)	5584.33 (3925.3)	4122,11 (1720,8)
SVNGS	17,24679 (4,24)	42.03 (5.69)	26.90 (4.56)	22.49 (2.48)	41.66 (16.44)	27.74 (3.93)	24.08 (4.62)	18,65 (4,39)
IGS	10,5653 (2,65)	17.43 (6.04)	25.90 (4.56)	23.20 (9.35)	14.07 (5.6)	21.98 (1.77)	22.64 (4.91)	25,31 (4,91)
INF	303,8244 (666,22)	5.47 (5.89)	9.46 (10.09)	24.94 (31.99)	18.42 (15.76)	15.09 (16.92)	38.96 (29.69)	9,10 (4,55)
DBT	92,92073 (95,92)	23.63 (12.19)	76.80 (52.25)	151.95 (245.54)	82.84 (106.69)	31.22 (33.26)	110.07 (45.64)	113,06 (91,94)
RSRVS	34,56861 (28,75)	187.93 (128.95)	27.08 (11.98)	24.52 (17.21)	105.30 (129.53)	66.69 (35.4)	20.70 (7.69)	32,10 (10,74)
UNEMP	744,7715 (1938,77)	3.92 (0.78)	5.18 (1.6)	3.98 (1.03)	4.14 (0.77)	7.60 (2.53)	9.15 (1.55)	27,91 (10,43)

(): standard deviation

Source: WB Open Data Database, 2019.

4.2. Missing Values

The second step of the analysis is to check whether there are missing values in the dataset. In Table 3, the missing value percentage is given for each variable within each country dataset.

Table 2. Missing Value Percentage of the Independent Variables for Each Country

Independent Variables	TUR	NGA	MEX	CHN	BRA	ZAF
Total Reserves (Includes Gold, Current US\$)	-	-	-	-	-	40%
Short-Term Debt (% of Total Reserves)	-	-	-	-	-	40%
Unemployment	26%	43%	33%	28%	28%	33%

According to Table 3, 30% of unemployment ratio statistics are generally missing for each country. Furthermore, 40% of the Total Reserves and % of Short-Term Debts in Total Reserves are also missing in South Africa Dataset. Thus, repeated-cross validation

based Random Forest algorithm was applied to impute missing values. 10-fold with the 5-repeat method was used for the imputation process to avoid overfitting or underfitting problems. Imputation model accuracy statistics of each model are given in Table 4. In this process, all independent variables were used to estimate the missing values of the variables.

Table 3. R² Statistics of Repeated-Cross Validation based Random Forest Algorithm for Missing Values

Independent Variables	TUR	NGA	MEX	CHN	BRA	ZAF
Total Reserves (Includes Gold, Current US\$)	-	-	-	-	-	92.8%
Short-Term Debt (% of Total Reserves)	-	-	-	-	-	82.2%
Unemployment	91.1%	89.8%	87.0%	99.2%	90.8%	94.5%

Imputation process accuracy statistics are generally higher than 80%, which is high enough to use the missing value imputation method.

4.3. Influential Determinants on the Interest Rates

After the imputation step, highly correlated variables and variables had a significant impact on interest rate were determined with the feature selection algorithm. In this step, 10-fold with 5-repeat cross-validation and Random Forest algorithm was used. The feature selection algorithm was used for each country to identify the most important factors affecting the interest rate. Table 5 shows the most important factors that had a statistically significant effect on the interest rate for each country.

Table 4. The most important factors determined using Feature Selection by Random Forest Algorithm

Independent Variables	TUR	RUS	NGA	MEX	IDN	CHN	BRA	ZAF
BM_AG	●	○	○	●	○	●	●	○
GDP	●	○	○	○	●	○	○	○
GDPPC	○	○	●	●	○	○	○	○
CPI	●	●	○	●	○	●	●	○
RSRVS	○	●	●	●	○	○	○	●
UNEMP	○	●	○	○	○	●	●	○
SVNGS	○	●	○	○	●	●	●	○
DBT	○	○	●	●	●	○	○	●
FDI	○	○	●	○	○	○	○	○
BM_GDP	○	○	○	○	●	○	○	●

Independent Variables	TUR	RUS	NGA	MEX	IDN	CHN	BRA	ZAF
IGS	○	○	○	○	○	●	●	●

●: Included in the quantile regression model

○: Not included in the quantile regression model

Phillips-Perron Stationary test was performed for the factors that had a significant effect on the interest rate after the feature selection process. It was seen that all factors in each country were not stationary. Thus, first-order differences of variables were used in all models to avoid the non-stationary problem. All factors in each country were stationary after the first order difference was used.

4.4. Quantile Regression Results

The final step of this research was to apply the quantile regression model for each country using independent variables determined with the feature selection step. Quantile regression models were run with $\tau=0.25$, 0.50 , and 0.75 for each country. Thus, each factor could be compared to a different level of interest rates.

Table 6. Quantile Regression Results for Each Country

Variables	τ	TUR	RUS	NGA	MEX	IDN	CHN	BRA	ZAF
CPI	0.25	0.2213	0.0436	-	0.4338	-	0.1342	2,9785	-
	0.50	0.3423	0.0672	-	0.3965	-	0.1152	2,8762	-
	0.75	0.2319	0.0992	-	0.3277	-	0.1161	2,7406	-
BM_AG	0.25	0.2155	-	-	0.1992	-	-	-0.7075	-
	0.50	0.2191	-	-	0.1387	-	-	-0.6695	-
	0.75	0.3025	-	-	0.0639	-	-	-0.6470	-
GDP	0.25	1.56×10^{-6}	-	-	-	-8.98×10^{-6}	4.01×10^{-7}	-	-
	0.50	4.48×10^{-6}	-	-	-	-3.96×10^{-6}	5.49×10^{-6}	-	-
	0.75	1.64×10^{-6}	-	-	-	-1.43×10^{-6}	1.23×10^{-7}	-	-
UNEMP	0.25	-	0.1740	-	-	-	-0.4801	56,0388	-
	0.50	-	0.3877	-	-	-	-0.3038	11,1161	-
	0.75	-	0.1683	-	-	-	-0.3780	48,6507	-
SVNGS	0.25	-	-0.3919	-	-	-0.4918	-0.0299	55,8272	-
	0.50	-	-0.2419	-	-	-0.1596	-0.0750	10,9150	-
	0.75	-	-0.1903	-	-	-0.8123	-0.0574	86,5861	-
RSRVS	0.25	-	0.0398	-0.0019	0.2066	-	-	-	-0.1319
	0.50	-	0.0196	-0.0040	0.0147	-	-	-	-0.1388
	0.75	-	0.0414	-0.0026	0.0359	-	-	-	-0.2035
DBT	0.25	-	-	0.0018	-0.0008	-0.1349	-	-	0.0065
	0.50	-	-	-0.0017	-0.0001	-0.1597	-	-	0.0005
	0.75	-	-	0.0088	-0.0042	-0.0663	-	-	0.0002
GDPPC	0.25	-	-	0.0005	-0.0001	-	-	-	-
	0.50	-	-	0.0003	-0.0001	-	-	-	-
	0.75	-	-	0.0013	-0.0029	-	-	-	-
FDI	0.25	-	-	-0.0002	-	-	-	-	-
	0.50	-	-	-0.0004	-	-	-	-	-
	0.75	-	-	-0.0002	-	-	-	-	-
BM_GDP	0.25	-	-	-	-	0.7254	-	-	0.4476
	0.50	-	-	-	-	0.8297	-	-	0.4301
	0.75	-	-	-	-	0.2441	-	-	0.4464
IGS	0.25	-	-	-	-	-	0.1783	-22,1100	0.1122
	0.50	-	-	-	-	-	0.0617	-3,3621	0.1164
	0.75	-	-	-	-	-	0.0204	-47,4257	0.2608

4.5. Discussion on the Findings and Policy Proposals

Based on each influential factor, CPI has a positive effect on the deposit interest rate. This is consistent with the literature (Mehra, 1996; Berument & Malatyali, 2001; Dincer et al., 2019; Kartal, 2019). The impact of inflation in the lower quartile of the interest

rate was relatively lower than the other quartiles in Russia. The impact of inflation on the interest rate was almost the same for all the quartiles in China and Brazil.

Broad Money (Annual Growth) is another factor affecting the interest rate positively in Turkey and Mexico. However, its effect on the interest rate was negative in Brazil. The impact of Broad Money (Annual Growth) in the lower quartile of the interest rate was relatively lower than the other quartiles in Turkey. This impact was almost stable for all the quartiles in Brasil. The result for Brazil is consistent with the literature (Kartal, 2019) while they are inconsistent with the literature but consistent with the expected results for Turkey and Mexico.

GDP has been determined as a significant factor affecting the interest rate in Turkey, Indonesia, and China. Beta coefficients were very close to the zero for each tau values in all countries. However, GDP had a significantly negative effect on the interest rate in Indonesia while its effect was positive in Turkey and China. The results for Turkey and China (Holston et al., 2017), and Indonesia (Shaukat et al., 2019) are consistent with the literature.

It has been revealed that the effect of unemployment on interest rates varies according to the interest rate level in Russia, Turkey, and China. Gross savings has also a significant negative effect on the interest rate in Russia, Indonesia, and China while it has a significant positive effect on interest rate in Brasil. In Russia, the effect of Gross savings declines if the interest rate increases. Imports of goods and services have a significant effect on the interest rate in China, Brazil, and South Africa. Also, its effect in Brazil is relatively higher than the others, which is important for that country. The results for unemployment, gross savings, and Imports of goods and services are consistent with the expected results.

As can be seen from the above, determinants and their effects on the deposit interest rate are differentiating for each country. They can be summarized as follows:

- Consumer prices index, annual growth of broad money, and annual growth of GDP affect the deposit interest rate in Turkey.
- Consumer prices index, total reserves, unemployment rate, and gross savings are important in terms of their effect on the deposit interest rate in Russia.
- Total reserves, short term debt, GDP per capita, and new inflow amount of FDI are influential on the deposit interest rate in Nigeria.
- Consumer prices index, annual growth of broad money, total reserves, short term debt, GDP per capita are the determinants of the deposit interest rate in Mexico.
- Annual growth of GDP, gross savings, short term debt, and broad money (% of GDP) are important in terms of determination of the deposit interest rates in Indonesia.
- Consumer prices index, annual growth of GDP, unemployment rate, gross savings, and imports of goods and services (% of GDP) are influential on the deposit interest rate in China.
- Consumer prices index, annual growth of broad money, unemployment rate, gross savings, imports of goods, and services (% of GDP) affect the deposit interest rate in Brazil.
- Total reserves, short term debt, broad money (% of GDP), imports of goods and services (% of GDP) are the determinants of deposit interest rate in South Africa.

When examining analysis results based on each influential determinant, the consumer price index is influential in Turkey, Russia, Mexico, China, and Brazil. Unemployment is important for Russia, China, and Brazil. Savings is important in Russia, Indonesia, China, and Brazil. Reserves are important in Russia, Nigeria, Mexico, and South Africa. Debt is important in Nigeria, Mexico, Indonesia, and South Africa. GDP per capita is important in Nigeria and Mexico while FDI is important in only Nigeria. Broad money (% of GDP) is important in Indonesia and South Africa whereas imports of goods and services have an effect in China, Brazil, and South Africa.

On the other hand, when examining analysis results in terms of country groups, all determinants have an effect among BRICST countries except for GDP per capita and FDI. Besides, unemployment and imports of goods and services do not have an effect in MINT countries. Moreover, GDP per capita and FDI do not have an effect in Fragile Five countries.

In the light of the analysis results, it is important to develop policies to prevent from increasing the interest rate, keep the interest rate under control, and provide decreasing the interest rate in the analyzed emerging countries. In this context, the authorities in the countries should;

- Position the interest rate as a macro-prudential concern if currently it has not been done yet.
- Take into consideration the negative effects of the macroeconomic determinants on the interest rate.
- Focus on the most important and influential macroeconomic determinants on the interest rate primarily, and after that they should deal with other less important determinants respectively.
- Issue new regulations to make their financial markets much more competitive. Hence, it is possible to increase efficiency and make the occurrence of the interest rate fair.
- Provide the harmonization between fiscal and monetary policies to prevent the occurrence of negative developments which cause an increase in the interest rate.

Also, as an important point to be stated that necessary precautions should be taken on time without causing any delays so that they could make a positive effect. Otherwise, no precautions would have the opportunity to make provide decreasing the interest rate. Also, the effects of changes in each macroeconomic determinant on deposit interest rates should be analyzed continuously.

5. Conclusion

No doubt achieving stability in macroeconomic indicators is important for countries since stability is an indicator of sustainability in the economic area. Although it is possible to mention a variety of indicators, one of the most important of them is the interest rates. While the level of interest rates can be evaluated as a reflection of financial stability on one side, changes in interest rates make either a positive or a negative effect on economic actors on the other side. Also, it is known commonly that interest rates are important for the development of real sectors and financial markets via affecting investment decisions of economic actors by determining the cost of money.

Besides being one of the main macroeconomic indicators, interest rates are also important for emerging countries because these countries have bank-based financial systems, and funding for economic activities is provided by banks via credit channels in which interest rates have a key role. Also, the level of interest rates in the countries makes effects on international investors which may result in an increase or a decrease in portfolio investments and FDI. Therefore, keeping interest rates under control and having low-level interest rates is crucial for countries to reach low-cost finance sources and hence sustain to finance their economic development and increase the welfare of their citizens. In this context, the main requirement is to determine influential macroeconomic determinants on interest rates in emerging countries and then develop policies by taking into consideration this determination.

In this study, it is aimed to determine influential macroeconomic determinants on deposit interest rates in the selected emerging countries by focusing on the most recent periods accessible by considering that there is an increasing trend in the interest rates in some emerging countries. In this context, BRICST, MINT, and Fragile Five countries have been selected as target population to examine because these groups include most of the important emerging countries which include Brazil, China, India, Indonesia, Mexico, Nigeria, Russian Federation, South Africa, and Turkey. Although 9 emerging countries have been selected to be included in the analysis, the analysis has been completed with 8 countries because interest rate data of India could not be obtained. In the context of the analysis, 12 independent determinants have been selected by searching the literature. Moreover, the yearly data for 1980 and 2018 has been gathered from the source of the World Bank and analyzed with the quantile regression method. This method is used the first time to analyze interest rates as far as known by the authors. Also, in the study, it is dependent on the current studies in the literature to form a contextual background and find and select independent determinants.

In summary, the factors affecting the interest rate differentiated from country to country. Also, analysis results prove that some determinants have a negative effect on interest rates in some emerging countries while they do not have an effect on the other emerging countries. To prevent interest rates from increasing in these countries, and also decrease interest rates from the current level, the negative effects of determinants defined in the analysis should be reduced. Emerging countries can understand when interest rates change, which factors make a contribution to change, how they take effect on the interest rate, and which of them has positive effects while the others have negative effects by considering the results of the study. Hence, regulatory authorities could develop policies regarding these indicators to have low-level deposit interest rates. In this context, some policy proposals have been recommended in the study. It is also possible to develop many more policies by authorities taking their national conditions into consideration.

It is possible to express that new researches, focusing on why defined determinants have an effect on the interest rate, could be applied and such studies could be beneficial to extend the literature on interest rates. Also, as an important point, it must be stated that new precautions should be applied in time by regulatory authorities in order to keep interest rates under control. As it is known, unfortunately, regulatory authorities may be late in taking actions in time. By achieving to keep interest rates under control,

emerging countries could benefit from the low-level and hence they provide sustainable support for economic growth.

In the study, some selected emerging countries have been examined since they have been faced with an increasing interest rate trend. Also, new studies consisting of a different bundle of countries and including many more countries could be made. Also, new variables could be added into the analysis, and different and new statistical and econometric methods such as wavelet coherence approach could be used in new studies.

6. References

- Angeloni, I., Prati, A., (1993), *Liquidity effects and the determinants of short-term interest rates in Italy (1991-92)* (No. 788), CEPR Discussion Papers.
- Berument, H., (1999), *The impact of inflation uncertainty on interest rates in the UK*, Scottish Journal of Political Economy, Vol. 46, no. 2, pp. 207-218.
- Berument, H., Kılınç, Z., Özlale, Ü., (2004), *The effects of different inflation risk premiums on interest rate spreads*, Physica A: Statistical Mechanics and Its Applications, no. 333, pp. 317-324.
- Berument, H., Malatyalı, K., (2001), *Determinants of interest rates in Turkey*, Russian & East European Finance and Trade, Vol. 37, no. 1, pp. 5-16.
- Cebula, R. J., (1988), *Federal government budget deficits and interest rates: An Empirical analysis for the United States, 1955-1984*, Public Finance, Vol. 43, no. 3, pp. 337-348.
- Cebula, R. J., Foley, M., (2019), *An empirical analysis for the US of the effects of government budget deficits on the ex-ante real interest rate yields on thirty-year and twenty-year treasury bonds*, International Economics, Vol. 72, no. 2, pp. 231-252.
- Desroches, B., Francis, M., (2006), *Global Savings, investment, and world real interest rates*, Bank of Canada Review, (winter), pp. 3-17.
- Dinçer, H., Yüksel, S., Kartal, M. T., (2019), *The role of bank interest rate in the competitive emerging markets to provide financial and economic stability*, Journal of Economics Business and Finance Research, Vol. 1, no. 2, pp. 103-120.
- Entrop, O., Von La Hausse, L., Wilkens, M., (2017), *Looking beyond banks' average interest rate risk: Determinants of high exposures*, The Quarterly Review of Economics and Finance, no. 63, pp. 204-218.
- Gözüör, G., Demir, E., Belás, J., Yeşilyurt, S., (2019), *Does economic uncertainty affect domestic credits? An empirical investigation*, Journal of International Financial Markets, Institutions and Money, no. 63, 101147.
- Gupta, P., Goyal, A., (2015), *Impact of oil price fluctuations on Indian economy*, OPEC Energy Review, pp. 141-162.
- Hol, S., (2006), *Determinants of long-term interest rates in the Scandinavian Countries*. Discussion Papers No. 469, Statistics Norway, Research Department.
- Holston, K., Laubach, T., Williams, J. C., (2017), *Measuring the natural rate of interest: International trends and determinants*, Journal of International Economics, no. 108, pp. 59-75.
- Kartal, M. T., (2019), *Türkiye'de kredi faizlerini etkileyen faktörlerin belirlenmesi: MARS yöntemiyle bir analiz*, Bankacılar Dergisi, no. 108, pp. 24-41.
- Kartal, M. T., (2020), *Determining affecting macroeconomic indicators on interest rates in emerging countries: A comparative examination upon China, Brazil, and Turkey with multivariate adaptive regression splines (MARS)*, Journal of Empirical Economics and Social Sciences, Vol. 2, no. 1, pp. 23-41.
- Kartal, M. T., İbiş, C., Çatıkkaş, Ö., (2018), *Adequacy of audit committees: A study of deposit banks in Turkey*, Borsa İstanbul Review, Vol. 18, no. 2, pp. 150-165.

- Knot, K., (1995), *On the determination of real interest rates in Europe*, Empirical Economics, Vol. 20, no. 3, pp. 479-500.
- Mehra, Y. P., (1996), *Monetary policy and long-term interest rates*, Federal Reserve Bank Richmond Economic Quarterly, Vol. 82, no. 3, pp. 27-49.
- Mitchell, K., Pearce, D. K., (2017), *Direct evidence on sticky information from the revision behavior of professional forecasters*, Southern Economic Journal, Vol. 84, no. 2, pp. 637-653.
- Mukhtar, T., Zakaria, M., (2008), *Budget deficits and interest rates: An empirical analysis for Pakistan*, Journal of Economic Cooperation, Vol. 29, no. 2, pp. 1-14.
- Onanuga, A. T., Shittu, A. M., (2010), *Determinants of interest rates in Nigeria: An error correction model*, Journal of Economics and International Finance, Vol. 2, no. 11, pp. 261-271.
- Özdemir, N., Cüneyt, A., (2012), *Determinants of interest rate pass-through for emerging market economies: The role of financial market structure*, International Advances in Economic Research, Vol. 18, no. 4, pp. 397-407.
- Paramati, S. R., Gupta, R., (2013), *An empirical relationship between exchange rates, interest rates and stock returns*, European Journal of Economics, Finance and Administrative Sciences, no. 56, pp. 168-181.
- Salim, A., (2019), *Macroeconomic determinants of interest rate volatility in Indonesia: A structural VAR analysis*, International Journal of Applied Economics, Finance and Accounting, Vol. 5, no. 2, pp. 101-108.
- Shapiro, A. F., (2018), *Labor force participation, interest rate shocks, and unemployment dynamics in emerging economies*, Journal of Development Economics, no. 133, pp. 346-374.
- Shaukat, B., Zhu, Q., Khan, M. I., (2019), *Real interest rate and economic growth: A statistical exploration for transitory economies*, Physica A: Statistical Mechanics and Its Applications, no. 534, pp. 1-22.
- Taylor, J. B., Wieland, V., (2016), *Finding the equilibrium real interest rate in a fog of policy deviations*, Business Economics, Vol. 51, no. 3, pp. 147-154.
- Tumwine, S., Sejjaaka, S., Bbaale, E., Kamukama, N., (2018), *Determinants of interest rate in emerging markets: A study of banking financial institutions in Uganda*, World Journal of Entrepreneurship, Management and Sustainable Development, Vol. 14, no. 3, pp. 267-290.
- WB, (2019), Open Data, available online at <https://data.worldbank.org/indicator>, 09.12.2019.