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THE ROLE OF BANK INTEREST RATE IN THE COMPETITIVE EMERGING MARKETS TO PROVIDE FINANCIAL AND ECONOMIC STABILITY

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Abstract

Financial and economic stability are two main significant concepts of the countries. Many different actions are taken in order to reach this objective. In this process, interest rate plays a key role because it mainly affects the cost of investments and consumption decisions of the parties. Therefore, the determinants of interest rate should be identified to have more effective financial market. This study aims to determine the influencing factors of bank interest rate in Turkey. Within this framework, seven different independent variables are selected based on literature review. Moreover, quarterly data of these variables for the periods between 2001:01 and 2018:02 is taken into the consideration. Furthermore, multivariate adoptive regression splines (MARS) model is used in the analysis process. The findings show that inflation, foreign debt, budget deficit, current account deficit and high oil price are the main determinants of high interest rate in Turkey. Therefore, it is obvious that Turkish government should take some actions to minimize these macroeconomic problems. In this context, inflation targeting plan should be implemented more effectively with the coordination of the government and central bank. Additionally, budget discipline should be maintained in order to prevent budget deficit. Furthermore, the government should take some measures to reduce the demand for imported goods, so current account deficit can be decreased. With the help of these actions, it can be more possible to decrease interest rate in Turkey. Lower interest rate has an increasing effect on the investment which contributes sustainable financial and economic growth.

Keywords: *Interest Rate; MARS; Turkey; Financial Development; Sustainable Economic Growth*

JEL Codes: *F43, G12, Q01*

FİNANSAL VE EKONOMİK KARARLILIK SAĞLAYABİLMEK İÇİN REKABETÇİ PİYASALARDA BANKA FAİZ ORANININ ROLÜ

Özet

Finansal ve ekonomik istikrar, ülkelerin iki ana önemli kavramıdır. Bu hedefe ulaşmak için hükümetler tarafından birçok farklı eylemde bulunulmuştur. Bu süreçte, faiz oranı kilit bir rol oynamaktadır, çünkü esas olarak yatırımların maliyetini ve tarafların tüketim kararlarını etkilemektedir. Dolayısıyla, faiz oranının belirleyicileri daha etkin bir finansal piyasaya sahip olmak için tanımlanmalıdır. Bu çalışma, Türkiye'deki banka faiz oranını etkileyen faktörleri belirlemeyi

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amaçlamaktadır. Bu çerçevede, literatür taramasına dayanarak yedi farklı bağımsız değişken seçilmiştir. Ayrıca, 2001:01 ve 2018:02 dönem aralığı için bu değişkenlerin üç aylık verileri dikkate alınmıştır. Ayrıca, analizde çok değişkenli uyarlanmış regresyon uzanımları (MARS) modeli kullanılmıştır. Bulgular, enflasyonun, dış borcun, bütçe açığının, cari açığın ve yüksek petrol fiyatlarının Türkiye'deki yüksek faiz oranının belirleyicisi olduğunu göstermektedir. Bu nedenle, Türk hükümetinin bu makroekonomik sorunları en aza indirmek için bazı adımlar atması gerektiği açıktır. Bu bağlamda, enflasyon hedefleme planı hükümet ve merkez bankasının koordinasyonunda daha etkin bir şekilde uygulanmalıdır. Ek olarak, bütçe açığını önlemek için bütçe disiplini sürdürülmelidir. Ayrıca, cari işlemler açığının azaltılması gerektiğinden hükümetin ithal mallara olan talebi azaltabilmesi için bazı önlemler alması gerekmektedir. Bu eylemler sayesinde, Türkiye'deki faiz oranını düşürmek daha mümkün olabilecektir. Düşük faiz oranı, sürdürülebilir finansal ve ekonomik büyümeye katkıda bulunan yatırımlar üzerinde artan bir etkiye sahiptir.

Anahtar Kelimeler: *Faiz Oranı; MARS; Türkiye; Finansal Gelişme; Sürdürülebilir Ekonomik Büyüme*

JEL Sınıflandırması: *F43, G12, Q01*

1. Introduction

Countries mainly aim to reach financial and economic stability. With the help of effective financial market, economy of the country can be stimulated. In other words, companies become willing to make new investment when financial system works effectively in the countries. With respect to this situation, bank interest rate is a very significant concept for the economies of the countries because it affects the cost of the companies. It means that in case of high interest, companies become reluctant to take loans form the banks due to the high cost. This situation negatively influences investment amount in this country. As a result, economic growth decreases because this investment is one of the main components of gross domestic product (GDP) calculation. Therefore, it is obvious that countries prefer to have lower interest rate for this purpose (Tumwine et al., 2018).

On the other side, in some cases, increasing interest rates becomes necessary for the sustainability of the economy although it has a negative effect on investment. For example, if there is high inflation in the economy, interest rates should be gone up to minimize the expenditures and this situation has a decreasing effect on the inflation rates (Entrop et al., 2017). In addition to the inflation problem, high currency exchange rate can cause serious problems for the economies when this country has high foreign debts. In order to reduce currency exchange rate, there should be increase in the interest rates with the aim of attracting the attention of foreign investors. However, high interest negatively influences investments in the country.

As it can be understood that the main purpose of the countries is to decrease the interest rate to increase investment and stimulate the economy whereas sometimes it should be higher to solve some macroeconomic problems. Therefore, it is obvious that identifying the indicators of the interest rate plays a significant role for the economies. With the help of this issue, it can be possible to understand when interest rates increase or decrease. Hence, this situation can be very beneficial for giving strategic and important decisions related to the investment.

This study aims to define the influencing factors of the bank interest rate in Turkey to provide policy recommendations for the sustainable financial and economic growth. For this purpose, seven different independent variables are selected that may have an effect on the interest rate. With respect to the dependent variable, deposit interest rate of the banks is taken into the consideration. In the analysis process, quarterly data of these variables for the periods between 2001:01 and 2018:02 is evaluated by using multivariate adoptive regression splines (MARS) approach. As a result, it can be possible to

understand which conditions cause interest rate to increase or decrease. Thus, important recommendations can be given for the governments and investors for their strategic decisions.

The main novelty of this study is using multivariate adoptive regression splines methodology is the analysis process. The subject of interest rate was evaluated in many different studies in the literature for various purposes. For instance, a lot of studies aimed to define the indicators of the interest rate whereas some of them focused on the influences of the interest rates on some other factors. However, MARS method is firstly used in this study to reach the objective which increases the originality.

There are four different sections in this study. In this introduction section, general information related to the interest rate is given. Moreover, the second section includes literature review. In this section, the studies focused on the determinants of the interest rate are detailed. On the other side, the third section is related to the research and application. Within this framework, firstly, the data and methodology are defined. After that, the analysis results are shared. In the last section, recommendations are given based on these analysis results.

2. Literature Review

There are lots of studies related to the determinants of interest rate in the literature. Some of these studies were depicted below.

Table 1: Studies Related to Interest Rate

Author	Scope	Method	Results
Benjamin and Kochin (1984)	UK	Gibson's paradox	They concluded that no evidence founded between long-term interest rate and price level.
Cebula (1988)	USA	Descriptive statistics	There is significant linkage between budget deficits and interest rates.
Zahid (1988)	USA	Descriptive statistics	It was concluded that there is significant linkage between budget deficits and interest rates.
Angeloni and Prati (1993)	Italy	Descriptive statistics	Foreign exchange has a dominant influence on interest rate variability.
Mehra (1996)	USA	Johansen cointegration analysis	Inflation rate has an influence on the interest rates.
Berument (1999)	UK	Autoregressive conditional heteroscedasticity model	Expected inflation positively affects interest rates.

Author	Scope	Method	Results
Patnaik and Vasudevan (1999)	India	Johansen cointegration analysis	They reached a conclusion that returns on foreign assets play a significant and increasing role in the determination of domestic interest rates.
Berument and Malatyalı (2001)	Turkey	GARCH	Interest rates are positively affected by expected inflation.
Günay (2001)	Turkey	Regression	There is positive relationship between exchange rate risk and interest rate.
Güneş and Tulçal (2002)	Turkey	Regression	Wholesale price index is the most important factor affecting interest rates in Turkey.
Bulut and Canbolat (2003)	Turkey	Regression	They defined that public deficit has an effect on interest rate.
Moschitz (2004)	Euro Area	Regression	The permanent change in reserve supply effect overnight interest rate negatively.
Karaca (2005)	Turkey	Bounding test	There is a relationship between exchange rate volatility and interest rate.
Hol (2006)	Norway, Sweden, Denmark	ARCH	The exchange rate regime, international debt and unemployment are significant in explaining the interest rate.
Masatçı and Darıcı (2006)	Turkey	Johansen cointegration analysis	The government expenditures, and inflation affect interest rates negatively in Turkey.
Muinhos and Nakane (2006)	Brazil	Regression	The inflation risk takes a negative role on interest rate.
Poddar et. al. (2006)	Lebanon	Regression	They determined that global interest rates have a strong effect on interest rates in Lebanon.
Gül et. al. (2007)	Turkey	Granger causality analysis	They defined that there is one-way causality relationship from exchange rates to interest rates.
Sever and Mızrak (2007)	Turkey	Vector auto regressive model	It was determined that exchange rates and inflation are significant determinants of the interest rate.

Author	Scope	Method	Results
Demir and Sever (2008)	Turkey	Johansen cointegration analysis	There is a correlation between interest rate and public domestic borrowing.
Mukhtar and Zakaria (2008)	Pakistan	Regression	The budget deficits do not have significant effect on nominal interest rates.
Doğrul and Soytaş (2010)	Turkey	Toda-Yamamoto causality analysis	They determined that there is no causality relation between interest rates and oil prices.
Durgut (2010)	Turkey	Johansen cointegration analysis	Real money supply, public debt stock, and real exchange rate are the indicators of the interest rate.
Onanuga and Shittu (2010)	Nigeria	Vector error correction model	They determined that real money supply influences treasury bill rates.
Öztürk and Durgut (2011)	Turkey	Johansen cointegration analysis	There is a positive long-run relationship between interest rates and domestic debt stock.
Arora and Tanner (2013)	USA	VAR model and impulse-response analysis	It is stated that oil prices have an influence on real interest rates.
Mercan (2013)	Turkey	Granger causality analysis	Inflation rate affects nominal interest rate positively.
Wang and Chueh (2013)	USA	Threshold model	The oil prices have effects on interest rates.
Aytaç and Sağlam (2014)	Turkey	Vector auto regression model	Inflation rate is the most significant component of the interest rate.
Köse and Terzioğlu (2014)	Turkey	MGARCH	The inflation uncertainty has a reducing impact on interest rate.
Taşbaşı (2014)	Hong Kong	GARCH	There is a strong relationship between exchange rate and interest rate volatilities.
Atgür and Altay (2015)	Turkey	Johansen cointegration analysis	There is a positive relation between inflation and nominal interest rate in the long run.

Author	Scope	Method	Results
Doğan et al. (2015)	Turkey	Johansen cointegration analysis	Inflation rate is the main cause of the interest rates.
Gupta and Goyal (2015)	India	Vector auto regression model	They determined that interest rates move in the same direction with oil prices.
Sotoudeh and Worthington (2015)	Net oil-consuming and oil-producing countries	Hiemstra-Jones cointegration test	There is an interaction between oil prices changes and short-term interest rate in net oil-producing countries.
Tanrıöver and Yamak (2015)	Turkey	Bounding test	They concluded that general price level influences nominal interest rates positively.
Akıncı and Yılmaz (2016)	Turkey	Johansen cointegration analysis	They defined that inflation rate, current account balance, external debt service, money supply, exchange rate and process of economic growth have statistically significant effects on the interest rate.
Ekinci et al (2016)	Turkey	Regression	They stated that increasing exchange rates cause increase in interest rates.
Mucuk et al. (2016)	Turkey	Vector auto regression model	They concluded that there is no long-term relationship between oil prices and interest rate.
Ratti and Vespignani (2016)	USA, Euro Region, China, India, Japan	Granger causality analysis	There is a strong correlation between global oil prices and global interest rates.
Torun and Karanfil (2016)	Turkey	Johansen cointegration analysis	There is a long-term relationship between interest rate with inflation rate, foreign exchange rate and GDP growth.
Tunalı and Erönal (2016)	Turkey	Gregory-Hansen cointegration test	There is a positive relationship between inflation and interest rate in the long run.
Holston et al. (2017)	US	Vector error correction model	There is a relationship between economic growth and interest rate.
Obeng and Sakyi (2017)	Ghana	Vector error correction model	Exchange rate volatility and economic growth affect interest rate.

Author	Scope	Method	Results
Jammazi et al. (2017)	US	Granger causality analysis	Stock return is the main driving force of the interest rate.
Entrop et al. (2017)	US	Regression	The size of the banks is directly related to the interest rate.
Tumwine et al. (2018)	Uganda	Regression	Public debt is the significant factor of the interest rate.

Table 1 shows that there are many different researches regarding the determinants of the interest rate. Most of these studies aimed to analyze the relationship between interest rate and inflation rate. For example, Tunalı and Erönal (2016) examined this situation for Turkey. In this study, Gregory-Hansen cointegration test is taken into the consideration. It is defined that there is a positive relationship between inflation and interest rate in the long run. Torun and Karanfil (2016), Akıncı and Yılmaz (2016), Tanrıöver and Yamak (2015), Doğan et al. (2015), Atgür and Altay (2015), Köse and Terzioğlu (2014), Aytaç and Sağlam (2014) and Mercan (2013) used different methodology in their studies and reached the same conclusion. Similarly, Sever and Mızrak (2007), Muinhos and Nakane (2006), Masatçı and Darıcı (2006), Güneş and Tulçal (2002), Berument and Malatyalı (2001), Berument (1999) and Mehra (1996) also identified that expected inflation positively affects interest rates. In spite of these studies, Benjamin and Kochin (1984) determined that no evidence founded between long-term interest rate and price level.

Moreover, oil price is also another variable that can influence interest rate according to the many researchers. For instance, Ratti and Vespignani (2016) made an analysis in order to understand the indicators of the interest rate. They made a very detailed anaylsis by considering USA, Euro Region, China, India and Japan. As a result of Granger causality analysis, it is identified that there is a strong correlation between oil prices and interest rates. Sotoudeh and Worthington (2015), Gupta and Goyal (2015), Wang and Chueh (2013) and Arora and Tanner (2013) also underlined that interest rates move in the same direction with oil prices. Despite these studies, Doğrul and Soytaş (2010) and Mucuk et al. (2016) determined that there is no causality relation between interest rates and oil prices.

On the other side, the effects of currency exchange rates on the interest rates were also underlined in some studies. Within this context, Obeng and Sakyi (2017) focused on this situation for Ghana. In order to achieve this objective, vector error correction model was taken into the consideration. It is concluded that exchange rate volatility has a strong influence on the interest rates. Additionally, this conclusion was also emphasized with different metdology (Torun and Karanfil, 2016; Ekinci et al, 2016; Akıncı and Yılmaz, 2016; Taşbaşı, 2014; Durgut, 2010; Sever and Mızrak, 2007). Furthermore, Gül et al. (2007), Hol (2006), Karaca (2005), Günay (2001) and Angeloni and Prati (1993) defined that there is one-way causality relationship from exchange rates to interest rates.

Furthermore, macroeconomic factors of the countries can also affect the interest rates according to the many researchers. For instance, public debt was defined as the main indicator of the interest rate in some studies (Tumwine et al., 2018; Akıncı and Yılmaz, 2016; Öztürk and Durgut, 2011; Durgut, 2010; Demir and Sever, 2008; Hol, 2006). Similarly, budget deficit was also underlined by Cebula (1988), Zahid (1988), Mukhtar and Zakaria (2008). In addition to these factors, Obeng and Sakyi (2017), Holston et al. (2017), Torun and Karanfil (2016) stated that there is a relationship between economic growth and interest rate. Additionally, unemployment (Hol, 2006), current account balance (Akıncı and Yılmaz, 2016), money supply (Moschitz, 2004; Onanuga and Shittu, 2010), government expenditure (Masatçı and Darıcı, 2006), global interest rates (Poddar et al., 2006), stock return

(Jammazi et al., 2017) and the size of the banks (Entrop et al., 2017) are also accepted as the main factors of the interest rates.

According to the results of the literature review, it is defined that the determinants of the interest rate were the main cause of many different researchers. Furthermore, it is also identified that various methodologies were used in these studies, such as regression, vector error correction model, vector autoregressive model, Johansen cointegration analysis. This situation indicates that a new method should be used in order to identify the determinants of the interest rate. With the help of this issue, it can be possible to contribute to the literature.

3. Research and Application

3.1. Data

In this study, quarterly data for the periods between 2001:01 and 2018:02 is evaluated. Turkey suffered from a significant banking crisis in 2000. Because of this situation, the data in the analysis was started with this period.

3.2. MARS Model

"Multivariate Adaptive Regression Splines" is represented by the word MARS. This model was developed by Friedman (1991) with the aim of analyzing the relationship between the variables. The main difference of MARS approach in comparison with other methods is that there is not a direct regression line. By using smoothing splines, it can be more possible to reach more effective results. In addition to this condition, high number of independent variables can be considered with MARS method because there is not a multicollinearity problem in this model. Furthermore, instead of having only one coefficient, there can be different coefficients for an independent variable according to the different conditions. There are mainly two different stages in the analysis of MARS model. Firstly, all possible functions are created with different combinations of the independent variables used in the model. With the help of this process, the most complex model can be obtained which includes maximum amount of the basis functions. After that, some basis functions are eliminated from this most complex model because these functions decrease the significance value. As a result, the best model can be selected by the system. The details of this model are given on the equation (1).

$$Y = B_0 + \sum_{n=1}^{K} a_n B_n(X_t) + \varepsilon \quad (1)$$

In equation (1), "Y" represents the dependent variable whereas independent variables are shown as X. On the other side, B_0 demonstrates the constant term and $B_n(X_t)$ describes basis function. Therefore, a_n represents the coefficient of n. basis function. MARS is a very new model in the literature. Hence, there are limited studies regarding social sciences. Dinçer et al. (2018a,b), Oktar and Yüksel (2016), Yüksel et al. (2016), Zengin et al. (2018) and Kartal et al. (2018) are some example studies in the literature in which MARS method was used in some different subjects, such as identifying the determinants of current account deficit, nonperforming loans, central bank reserves, financial crisis, currency exchange rates and migration.

3.3. Variables Used in the Study

This study aims to analyze the determinants of the interest rate. With respect to the dependent variable, deposit interest rates of the banks are taken into the consideration. As a result of literature review, eight different independent variables are selected. The details of these variables are given on Table 2.

Table 2: List of Independent Variables Used in this Study

Independent Variables	References
Inflation Rate	Tunalı and Erönal (2016), Torun and Karanfil (2016), Akıncı and Yılmaz (2016), Tanrıöver and Yamak (2015), Doğan et al. (2015), Atgür and Altay (2015), Köse and Terzioğlu (2014), Aytaç and Sağlam (2014), Mercan (2013), Sever and Mızrak (2007), Muinhos and Nakane (2006), Masatçı and Darıcı (2006), Güneş and Tulçal (2002), Berument and Malatyalı (2001), Berument (1999), Mehra (1996), Benjamin and Kochin (1984)
Oil Price	Ratti and Vespignani (2016), Sotoudeh and Worthington (2015), Gupta and Goyal (2015), Wang and Chueh (2013), Arora and Tanner (2013), Doğrul and Soytaş (2010), Mucuk et al. (2016)
Currency Exchange Rates	Obeng and Sakyi (2017), Torun and Karanfil (2016) Ekinci et al (2016), Akıncı and Yılmaz (2016), Taşbaşı (2014), Durgut (2010), Sever and Mızrak (2007), Gül et al. (2007), Hol (2006), Karaca (2005), Günay (2001), Angeloni and Prati (1993)
Public Debt	Tumwine et al. (2018), Akıncı and Yılmaz (2016), Öztürk and Durgut (2011), Durgut (2010), Demir and Sever (2008), Hol (2006)
Budget Deficit	Cebula (1988), Zahid (1988), Mukhtar and Zakaria (2008), Akgay et al. (2018)
Economic Growth	Obeng and Sakyi (2017), Holston et al. (2017), Torun and Karanfil (2016), Ersoy (2011), Ersin (2018)
Unemployment Rate	Hol (2006), Taylor and Wieland (2016), Shapiro (2018), Mitchell and Pearce (2017), Ersin and Ergeç (2018)
Current Account Deficit	Akıncı and Yılmaz (2016), Jammazi et al. (2017), Akgay et al. (2018),

Inflation rate refers to the increase in the price levels of the goods and services. Hence, when there is high inflation, interest rate should be increased in order to decrease the price levels (Torun and Karanfil, 2016; Tanrıöver and Yamak, 2015). Also, high oil prices have an increasing effect on the import for the countries that are dependent to the oil. Since this situation negtively affects current account balance, interest rates should be increased to attract the attention of foreign investors so that this problem can be solved (Wang and Chueh, 2013; Arora and Tanner, 2013). Additionally, volatility in currency exchange rates causes some financial problems for the companies which have foreign debts. Due to this issue, interest rates should be higher for the foreign investors to enter in the country so that this volatility can be decreased (Obeng and Sakyi, 2017).

When countries have public debt, they prefer to increase interest rate to reach money. Hence, this debt can be paid much easily (Tumwine et al., 2018). This situation is similar for the budget deficit and current account deficit problems (Mukhtar and Zakaria, 2008; Jammazi et al., 2017). On the other side, high interest rates have a negative effect on the investments in the country. Because of this

condition, countries prefer lower interest rates if there is not a macroeconomic problem, such as low economic growth and high unemployment rates (Taylor and Wieland, 2016; Holston et al., 2017).

3.4. Results and Findings

In the analysis process, the system firstly generated 19 different models. The details of these models are given on Table 3.

Table 3: 19 Different Models Generated by the System

Basis Functions	Total Variables	GCV	GCV R2
24	7	64.85	0.828
23	7	31.45	0.916
22	7	19.66	0.948
21	6	14.23	0.962
20	6	11.15	0.970
19	6	8.48	0.977
18	6	7.40	0.980
17	6	6.22	0.983
16	6	5.93	0.984
15*	6	5.75	0.985
14	6	6.46	0.983
13	6	6.79	0.982
12	6	8.72	0.977
11	6	10.41	0.972
10	6	12.36	0.967
9	6	14.20	0.962
8	6	15.54	0.959
7	6	14.76	0.961
6	6	15.61	0.959

Table 3 shows that the system generated different models until reaching the most complex model which includes 24 different basis functions and 7 different variables. After that, some basis functions, which are unnecessary, are eliminated from the most complex model. This process continues until the best model is reached. In this analysis, the best model, which is represented by (*), has 15 different

basis functions and 6 different variables. It can also be seen from Table 3 that the best model has the lowest GCV and highest GCV R^2. The details of the 15 different basis functions (BF) in the best model are demonstrated on Table 4.

Table 4: 15 Basis Functions of the Best Model

Basis Functions	Details	Coefficient	P Values
BF2	max(0, 35.631 – INFLATION)	- 1.215	0.000
BF4	max(0, 7.000 - UNEMPLOYMENT)	+ 22.125	0.000
BF5	max(0, OILPRICE - 45.953)	- 0.635	0.000
BF6	max(0, 45.953 – OILPRICE)	+ 0.450	0.000
BF8	max(0, 21.805 - FOREIGNDEBT) * BF5	+ 0.081	0.000
BF9	max(0, UNEMPLOYMENT - 7.800) * BF6	+ 0.455	0.000
BF10	max(0, 7.800 - UNEMPLOYMENT) * BF6	+ 0.644	0.000
BF11	max(0, BUDGETDEFICIT - 8.600) * BF2	+ 0.325	0.000
BF12	max(0, 8.600 - BUDGETDEFICIT) * BF2	+ 0.072	0.000
BF14	max(0, - 7.179 – CURRENT ACCOUNT BALANCE) * BF2	+ 0.070	0.000
BF16	max(0, 11.400 - BUDGETDEFICIT) * BF6	+ 0.111	0.000
BF18	max(0, 32.007 – FOREIGNDEBT)	+ 0.414	0.000
BF19	max(0, OILPRICE - 96.673)	+ 0.670	0.000
BF20	max(0, 96.673 - OILPRICE)	-	0.000
BF22	max(0, 8.600 - BUDGETDEFICIT) * BF20	- 0.070	0.000
BF23	max(0, CURRENT ACCOUNT BALANCE + 0.759) * BF20	- 0.072	0.000
Prob (F test): 0.000 Adj R2: 0.996			

Table 4 shows probability of F test is 0.000. Because this value is lower than 0.05, it gives information that the model is statistically significant. Additionally, all probability values for the variables are also lower than 0.05. It means that all these basis factions are significant as well. It is also identified that 6 different variables have an effect on the interest rates in Turkey. First of all, inflation rate influences interest rate in Turkey. The details of the basis functions include inflation rate are given on Table 5.

Table 5: Basis Functions of Inflation Rate

Basis Functions	Details	Coefficient
BF2	max(0, 35.631 – INFLATION)	- 1.215

Table 5 indicates that the variable of inflation rate is only stated in basis function 2. It has negative value in the equation and the coefficient of this equation is also negative (-1.215). By considering these two different factors, it is concluded that inflation rate has a positive influence on the interest rates of Turkey. It means that Turkey increases interest rates mainly because of the controlling high inflation problem. This situation was also underlined in many different studies (Muinhos and Nakan, 2006; Masatçı and Darıcı, 2006). Another independent variable that affects interest rate is unemployment rate. The basis functions of this variable are detailed on Table 6.

Table 6: Basis Functions of Unemployment Rate

Basis Functions	Details	Coefficient
BF4	max(0, 7.000 - UNEMPLOYMENT)	+ 22.125
BF9	max(0, UNEMPLOYMENT - 7.800) * BF6	+ 0.455
BF10	max(0, 7.800 - UNEMPLOYMENT) * BF6	+ 0.644

Table 6 demonstrates that unemployment rate takes place in three different basis functions (BF4, BF9, BF10). The coefficients of all these basis functions are positive. Different coefficients show that the effect of unemployment on the interest rate changes according to the conditions. In this analysis, unemployment problem has an increasing effect on the interest rates. However, the power of this positive effect decreases when unemployment rate exceeds 7.8%. Taylor and Wieland (2016) and Shapiro (2018) also identified this situation in their studies. Moreover, oil price is another variable which affects interest rates in Turkey. Table 7 gives information about the basis functions of this variable.

Table 7: Basis Functions of Oil Prices

Basis Functions	Details	Coefficient
BF5	max(0, OILPRICE - 45.953)	- 0.635
BF6	max(0, 45.953 – OILPRICE)	+ 0.450
BF19	max(0, OILPRICE - 96.673)	+ 0.670
BF20	max(0, 96.673 - OILPRICE)	-

Table 7 shows that four different basis functions (BF5, BF6, BF19, BF20) include the variable of oil prices. BF6 demonstrates that the effect of oil price on the interest rate is positive (0.450) when this variable takes value lower than 45.953. On the other side, BF5 gives information that this effect becomes negative when oil price is between 45.953 and 96.673. However, according to BF19, the effect of oil price is again positive because of the positive coefficient (0.670). It is determined that oil

price has an increasing effect on the interest rates in Turkey. Because Turkey is the country that is dependent on the oil import, any increase in the oil prices leads to higher import which has a negative effect on the current account balance. Therefore, interest rates are increased to solve this problem. This result is similar to the many studies in the literature, such as Gupta and Goyal (2015) and Wang and Chueh (2013). Table 8 explains the basis functions related to the foreign debt.

Table 8: Basis Functions of Foreign Debt

Basis Functions	Details	Coefficient
BF8	max(0, 21.805 - FOREIGNDEBT) * BF5	+ 0.081
BF18	max(0, 32.007 – FOREIGNDEBT)	+ 0.414

Table 8 explains that both coefficients of two different basis functions (BF8, BF18) are positive (0.081 and 0.414). This situation gives information that there is a positive relationship between foreign debt and interest rates in Turkey. When Turkey has higher foreign debt, it needs foreign currency in the country. Therefore, by increasing interest rates, it aims to attract the attention of the foreign investors. Tumwine et al. (2018) also underlined this aspect in thier study. Moreover, Table 9 includes the basis functions of budget deficit.

Table 9: Basis Functions of Budget Deficit

Basis Functions	Details	Coefficient
BF11	max(0, BUDGETDEFICIT - 8.600) * BF2	+ 0.325
BF12	max(0, 8.600 - BUDGETDEFICIT) * BF2	+ 0.072
BF16	max(0, 11.400 - BUDGETDEFICIT) * BF6	+ 0.111
BF22	max(0, 8.600 - BUDGETDEFICIT) * BF20	- 0.070

Table 9 gives information that four different basis functions (BF11, BF12, BF16, BF22) are related to the budget deficit. The coefficient of three basis functions are positive whereas BF22 has negative coefficients. As a result, it is determined that there is a positive relationship between budget deficit and interest rates. When Turkey has a budget deficit, it increases the interest rate in order to borrow money easily so that this problem can be solved. Current account deficit is the last important determinant of the interest rate in Turkey. The influence of the budget deficit on the interest rates was also defined by Mukhtar and Zakaria (2008) and Akgay et al. (2018). Related basis functions of this variables are demonstrated on Table 10.

Table 10: Basis Functions of Current Account Deficit

Basis Functions	Details	Coefficient
BF14	max(0, - 7.179 – CURRENT ACCOUNT BALANCE) * BF2	+ 0.070
BF23	max(0, CURRENT ACCOUNT BALANCE + 0.759) * BF20	- 0.072

Table 10 demonstrates that when current account balance has negative value in the equation (BF14), it takes positive coefficient (0.070). The negative value of current account balance is named as the current account deficit. Thus, it is defined that when there is current account deficit, interest rate increases. It means that the country increases interest rate to attract the attention of foreign investors. With the help of this aspect, the amount of the foreign currencies goes up in the country which contributes to the solving of the current account deficit problem. Jammazi et al. (2017) and Akgay et al. (2018) also identified that current account deficit is the main cause of interest rate increase.

4. Conclusions

Identifying the determinants of the interest rate is crucial for the financial and economic stability. The main reason is that it is the main cost for the companies to make investment. Because of this issue, countries aim to decrease interest rate so that investment amount can be increased. This situation contributes the economic growth of the country. Owing to this aspect, countries should define which factors cause high interest amount. With the help of this analysis, it can be possible to take actions to decrease interest rate to reach sustainable economic development.

In this study, it is aimed to identify the influencing factors of the bank interest rate in Turkey to provide recommendations for improving economy and financial market. Within this framework, seven different independent variables are identified by analyzing similar studies in the literature. For this purpose, quarterly data of these variables for the periods between 2001:01 and 2018:02 is taken into the consideration. On the other side, multivariate adoptive regression splines (MARS) model is used in the analysis process.

It is determined that 6 different variables have an effect on the interest rates in Turkey. First of all, interest rate increases mainly because of the controlling high inflation problem. In addition, unemployment rate is another reason of high interest rate. Moreover, it is also determined that oil price has an increasing effect on the interest rates in Turkey. Oil price increase leads to higher import for Turkey because it is an oil dependent country. Because this situation causes problems in current account balance, interest rate increases to minimize this problem.

On the other side, it is also concluded that there is a positive relationship between foreign debt and interest rates in Turkey. There is a need for foreign currency when the country has higher foreign debt. In order to reach this objective, interest rate should be gone up. In addition to them, budget deficit causes interest to be higher. The country needs to borrow some money in case of budget deficit and this purpose can be achieved much easily by increasing interest rates. Finally, when there is current account deficit in the country, interest rate is increased to attract the attention of foreign investors.

By considering these results, it is understood that some macroeconomic problems cause interest rates to be higher. Therefore, Turkey should take some actions to minimize these problems so that economy and financial market can be improved. For instance, budget discipline should be maintained in order to prevent budget deficit. Additionally, inflation targeting plan should be implemented more

effectively with the coordination of the government and central bank. Within this context, unnecessary consumption should be minimized to solve these problems.

This study aims to contribute to the literature by evaluating an important topic for Turkey. However, in the future studies, another analysis can be performed by focusing on higher number of countries. For example, evaluation emerging economies for this subject can give more beneficial results. In addition to this aspect, different methodologies can also be considered in the new studies, such as interval type-2 fuzzy sets.

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