DETERMINING INFLUENCING FACTORS OF UNEMPLOYMENT IN TURKEY WITH MARS METHOD

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Abstract

Higher unemployment rate is the problem of most of the countries in the world. Because of this situation, these countries try to make many actions in order to decrease unemployment rate. However, to make such a recommendation, first of all, the reasons of the unemployment should be analyzed. Within this framework, the aim of this study is to identify the factors which influence unemployment in Turkey. For this purpose, quarterly data for the periods between 2003 and 2016 is evaluated with MARS method. It is concluded that economic growth negatively affects unemployment in Turkey. Another result of this study is that higher inflation rates negatively affect unemployment rate. The last conclusion of this analysis is that interest rate has a positive influence on the unemployment rate. While considering these results, it is recommended that economic performance of the country should be improved and interest rates should be declined to decrease unemployment rate in Turkey. Another recommendation is that implementations, which are aimed to decrease inflation rate, should be controlled carefully because any implementation which aims to decrease inflation rate causes unemployment rate to increase.

Keywords: *Unemployment, MARS Method, Turkey*

JEL Codes: *F31, G21, G32,*

1. Introduction

Unemployment refers to the difference between the level of labor force and employment level. In other words, it explains the situation that the supply of the labor is higher than the demand of the labor. Owing to this aspect, many people in the country cannot find a job although they want to work. Therefore, it can be said that unemployment is one of the most important problems in the economy. Because of this condition, all governments try to implement a policy to decrease unemployment rate (Kingdon and Knight, 2007: 198).

There are different types of unemployment. Structural unemployment is occurred due to the structural problems in the economy. Moreover, frictional unemployment shows condition that people become unemployed for a temporary period because they change their jobs. Additionally, cyclical unemployment is another type of unemployment that which happens when there are downturns in the economy. Furthermore, technological unemployment occurs when there is a decrease in labor demand mainly because of technological improvement in the country.

It is accepted that unemployment leads to many different problems for the countries which may be social or economical. First of all, when there are many people who do not have a job, it increases social chaos in the country. In addition to this problem, due to the people who do not have permanent income, there will be decrease in the demand of the goods in this country. Owing to the decline in production and investment levels, this situation reduces economic growth.

There may be many different reasons of unemployment. For example, if there is an economic recession in the country, many companies will go bankruptcy and lay off lots of employees. Parallel to this aspect, it can be said that anything which affects economic growth negatively such as volatility in exchange rate or higher interest rate, will also

have an increasing influence on unemployment rate. Additionally, in case of high uncertainty, companies will be reluctant to make investment. In this condition, they prefer to employ less people.

Turkey is also a country which suffers from unemployment problem. For instance, in 2001, there was a damaging economic crisis which caused many companies to go bankruptcy. According to World Bank data, in this period, unemployment rate in Turkey exceeded 10%. After 2008 mortgage crisis, there was a decrease in the production and investment levels, so this ratio increased to 12%. At the end of 2016, unemployment rate in Turkey was 10.32%. Turkish government tries to take some actions in order to decrease this unemployment rate (World Bank Dataset).

It can be said that decreasing unemployment rate is the focus of many different countries. In order to minimize unemployment, first of all, the factors that cause this problem should be analyzed. The main purpose of this study is to define the indicators of unemployment in Turkey. To achieve this objective, quarterly data of the variables between 2003 and 2016 is evaluated with MARS method. As a result, it will be possible to make some recommendation to minimize this problem in Turkey.

2. Literature Review

Unemployment is a very popular subject which attracted the attention of many researchers in the literature. Table 1 gives information about some of these studies.

Table 1

Featured Studies related to Unemployment

Authors	Scope	Method	Result
Yashiv (2000)	Israel	Simulation Analysis	Interest rate and economic growth play an important role in the unemployment.
Naudé and Serumaga-Zake (2001)	South Africa	Regression	Education level and gender are important determinants of unemployment.
Ollikainen (2003)	Finland	Duration Analysis	Education is a factor that reduces the duration of unemployment.
Zagler (2003)	France, Germany, Italy, and the UK	VECM	Economic growth negatively affects unemployment rate.
Valadkhani (2003)	Iran	Regression	Inflation rate influences unemployment rate in Iran.
Tansel and Tasci (2004)	Turkey	Duration Analysis	Education has a negative effect on unemployment.
Kingdon and Knight (2004)	South Africa	Probit Model	Education is an important factor of unemployment.
Tasci and Tansel	Turkey	Descriptive	Higher level of education decreases unemployment rate.

(2005)		Statistic	
Chang (2005)	Taiwan	VAR	Economic growth is important determinant of unemployment, but FDI has no impact.
Tasci and Ozdemir (2006)	Turkey	Probit Model	The level of education has an important effect on unemployment.
Frenkel and Ros (2006)	4 Latin American Countries	Regression	Volatility of real exchange rate increases unemployment.
Baccaro and Rei (2007)	OECD Countries	Regression	Higher interest rate is a factor that increases unemployment.
Sahin and Kızılırmak (2007)	Turkey	Descriptive Statistic	Age, sex and marital status play an important role on unemployment.
Filiztekin (2009)	Turkey	Regression	Human capital is the main source of unemployment level.
Aydıner Avşar and Onaran (2010)	Turkey	Regression	Higher economic growth reduces unemployment rate.
Eita and Ashipala (2010)	Namibia	Regression	The level of investment negatively influences unemployment rate.
Nunez and Livanos (2010)	15 EU countries	Survey	Education level is an effective tool to reduce unemployment.
Tunah (2010)	Turkey	Granger Causality Analysis	Economic growth and inflation rate have a significant effect on unemployment.
Doğrul and Soytas (2010)	Emerging Markets	VAR	Oil price and interest rate affect unemployment level.
Kyei and Gyekye (2011)	South Africa	Regression	Economic growth has no impact on unemployment rate.
Tirkayi and Özkan (2011)	Turkey	VAR	Economic growth is an important factor of unemployment.
Yerdelen (2011)	EU	Regression	Economic growth plays a major role in order to decrease unemployment.
Kreishan (2011)	Jordan	Regression	There is not a relationship between inflation rate and

			unemployment.
Maqbool et. al. (2013)	Pakistan	ARDL	Economic growth, the number of population, inflation and FDI are significant determinants of unemployment.
Altuntepe and Güner (2013)	Turkey	Regression	Economic growth has an important influence on employment level.
Turco and Maggioni (2013)	Turkey	Regression	High export amount decreases unemployment rate in a country.
Chowdhury and Hossain (2014)	Bangladesh	Regression	Inflation rate has a positive impact on unemployment whereas economic growth negatively influences it.
Şentürk and Akbaş (2014)	Turkey	Toda Yamamoto Causality Analysis	Economic growth is a factor that reduces unemployment rate in Turkey.
Shahid (2014)	Pakistan	ARDL	There is not a significant relationship between unemployment and inflation rate.
Arslan and Zaman (2014)	Pakistan	Regression	FDI and economic growth have a negative influence on unemployment.
Altunöz (2015)	Turkey	Granger Causality Analysis	Inflation rate does not affect unemployment rate.
Alhdiy et. al. (2015)	Egypt	Granger Causality Analysis	GDP growth does not affect unemployment.
Bakhshi and Ebrahimi (2016)	Iran	ARDL	Exchange rate is an important issue which influences unemployment.
Ogbeide et. al. (2016)	Nigeria	Regression	FDI, economic growth and exchange rate affect unemployment.
Ibragimov and Ibragimov (2016)	CIS Countries	Regression	Economic growth decreases unemployment rate.
Wang (2016)	China	Regression	Export has a positive influence on employment.
Irpan et. al. (2016)	Malaysia	Regression	Economic growth is a significant factor to reduce unemployment.
Ayşe (2016)	Turkey	Hatemi-J Causality	Economic growth has no influence on unemployment.

		Analysis	
Saraç and Yildirim (2016)	Turkey	Markov Change Technique	Inflation rate does not have any effect on unemployment.
Bayrak and Tatli (2016)	Turkey	ARDL	Higher education level decreases unemployment rate.
Mucuk et. al. (2017)	Turkey	VECM	Economic growth is inversely related with unemployment rate.

Table 1 shows that most of the studies tried to examine the relationship between unemployment and economic growth. For example, Zagler (2003) conducted a study to analyze this relationship in France, Germany, Italy, and the UK by using VECM. Thus, it was concluded that economic growth plays a major role to decrease unemployment. Additionally, Yashiv (2000), Chang (2005), Tunah (2010), Aydıner-Avşar and Onaran (2010), Yerdelen (2011), Maqbool et. al. (2013), Altuntepe and Güner (2013), Arslan and Zaman (2014), Chowdhury and Hossain (2014), Ogbeide et. al. (2016), Ibragimov and Ibragimov (2016), Irpan et. al. (2016) also found similar results by using different methodology.

In spite of these studies, there are some other studies which underlined the opposite results. For instance, Kyei and Gyekye (2011) identified that economic growth is not an important determinant of unemployment in South Africa with the help of regression analysis. Also, Alhdiy et. al. (2015) achieved similar results with different methods. Additionally, Ayşe (2016) and Mucuk et. al. (2017) tried to determine the relationship between these variables in Turkey. They concluded that economic growth has no influence on unemployment.

Moreover, it can be understood from table 1 that inflation rate is also another indicator of unemployment. Valadkhani (2003) tried to define the determinants of unemployment in Iran by using regression analysis and identified that inflation rate influences unemployment rate. Kreishan (2011) and Chowdhury and Hossain (2014) reached similar results by using the same method. Tunah (2010), Maqbool et. al. (2013), Shahid (2014), Altunöz (2015) and Saraç and Yildirim (2016) emphasized the same issues with the help of different methods. On the other side, some other studies concluded that interest rate affects unemployment rate (Yashiv, 2000: 1297), (Baccaro and Rei, 2007: 527), (Doğrul and Soytas, 2010: 1523).

In addition to these studies, some studies were conducted to evaluate the relationship between exchange rate volatility and unemployment. For instance, Bakhshi and Ebrahimi (2016) made a study to analyze this relationship in Iran by using ARDL. It was concluded that exchange rate volatility affects unemployment rate. Also, Chowdhury and Hossain (2014), Frenkel and Ros (2006) and Ogbeide et. al. (2016) underlined the same conclusion by using regression analysis. On the other hand, Tunah (2010) underlined that exchange rate volatility does not influence unemployment.

Another important indicator of unemployment is foreign direct investment. Ogbeide et. al. (2016) identified that foreign direct investment has a negative effect on unemployment in Nigeria by using regression analysis. However, Chang (2005) found that foreign direct investment has no impact on unemployment in Taiwan by using a different method. In addition to foreign direct investment, Wang (2016), Turco and Maggioni (2013) and Ogbeide et. al. (2016) emphasized the importance of international trade on unemployment.

Besides macroeconomic determinants of unemployment, there are some other studies that focus on the level of education to explain unemployment. For example, Bayrak and Tatli (2016) tried to understand the influencing factors of unemployment in Turkey by using ARDL analysis. They concluded that higher education level decreases unemployment rate. Naudé and Serumaga-Zake (2001), Ollikainen (2003), Kingdon and Knight (2004), Tansel and

Tasci (2004), Tasci and Tansel (2005), Tasci and Ozdemir (2006), Filiztekin (2009), Kyei and Gyekye (2011) and Nunez and Livanos (2010) reached this result by using different methods. While taking into the consideration of table 1, it was understood that there is a need for a new study that analyzes influencing factors of unemployment by using a new and original method.

3. An Application for Turkey

3.1. Data and Variables

In the analysis process, the data for the periods between 2003:1 and 2016:4 is taken into the consideration. This data is provided from the websites of Turkish Statistical Institution and OECD. Unemployment rate is the dependent variable whereas 5 different independent variables are also considered in the analysis. The details of them are shown on table 2.

Table 2

Details of Independent Variables

Variable	References
Interest Rate	Yashiv (2000), Baccaro and Rei (2007), Doğrul and Soytas (2010)
Inflation Rate	Valadkhani (2003), Kreishan (2011), Maqbool et. al. (2013), Chowdhury and Hossain (2014), Shahid (2014), Altunöz (2015), Saraç and Yildirim (2016)
Economic Growth	Yashiv (2000), Zagler (2003), Chang (2005), Aydıner Avşar and Onaran (2010), Kyei and Gyekye (2011), Yerdelen (2011), Maqbool et. al. (2013)
Current Account Deficit	Turco and Maggioni (2013), Wang (2016)
Exchange Rate Volatility	Frenkel and Ros (2006), Bakhshi and Ebrahimi (2016), Ogbeide et. al. (2016)

3.2. MARS Model

Multivariate Adaptive Regression Splines (MARS) was created by Jerome Friedman in 1991. The aim of this method is to investigate the impacts of independent variables on dependent variable. There are many advantages of this method. For example, there is no multicollinearity problem in MARS method, so it can be possible to use many different independent variables in the analysis. Furthermore, although independent variables take only one method in other analysis, they may take different values for different conditions in MARS method. Due to this aspect, it is very helpful to reach more accurate results (Friedman, 1991). The details of this method are given below.

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

Y refers to the dependent variable and X explains independent variables in the equation. Additionally, B_0 is the constant term and ε shows error term. It can be understood that the number of total basis functions are K. The analysis process in MARS method is occurred in two different stages. Firstly, all possible basis functions are created. In the second stage, the basis functions, which affect the model negatively, are eliminated from the model by the system (Friedman, 1991: 60), (Dinçer et. al., 2017   261).

3.3. Analysis Results

In the first step of the analysis, unit root tests are performed to see whether the independent variables are stationary or not. For this purpose, Augmented Dickey Fuller (ADF) and Phillips Peron (PP) unit root tests are considered and the details are shown in table 3.

Table 3

Unit Root Test Results

Variable	Augmented Dickey Fuller (ADF) Test		Phillips Peron (PP)Test	
	Level Value (Probability)	First Difference Value (Probability)	Level Value (Probability)	First Difference Value (Probability)
Real Interest Rate	0.0361	-	0.0446	-
Inflation	0.0000	-	0.0000	-
Economic Growth	0.0000	-	0.0000	-
Current Account Deficit	0.1807	0.0000	0.3289	0.0000
USD/TL Currency Exchange Rate	0.9822	0.0000	0.9995	0.0000

Table 3 shows that 3 independent variables (real interest rate, inflation and economic growth) are stationary on their level values because their probability values are less than 0.05. Nonetheless, two independent variables (current account deficit and USD/TL currency ex-change rate) are not stationary. Hence, the first differences of them are used in the analysis. After stationary analysis, MARS method is used to identify the influencing factors of unemployment in Turkey. MARS method provided us 8 different models which are detailed on table 4.

Table 4

All Models in the Analysis

Total Basis Functions	Total Variables	GCV	GCV R2
10	5	1.436	0.036
9	5	1.239	0.168
8	4	1.128	0.243
7	4	1.037	0.303
6	4	0.993	0.333
**5	3	0.984	0.339

4	3	1.181	0.207
3	2	1.320	0.114

Table 4 demonstrates that the model, which is at the top of the table, is named as the most complex model. It has 10 different basis functions and 5 different variables. After that, MARS method eliminated some basis functions from this model and reached to the best model which has 5 different basis functions and 3 different variables. It can also be seen that this model has the lowest GCV and highest GCV R2 values. Table 5 gives information about the details of the best model.

Table 5

The Best Model of the Analysis

Variable	Coefficient	p Value
Constant	6.763	0.00
Basis Function 2	0.417	0.00
Basis Function 7	-3.144	0.00
Basis Function 10	0.532	0.00
Basis Function 11	0.194	0.00
Basis Function 13	3.034	0.00
F Test: 17. 531 [0.000]	GCV: 0.339	
R^2:0.637	Adj R2: 0.600	

Table 5 shows that there are 5 different basis functions in the best model. Also, all of them are statistically significant because p values are less than 0.01. Additionally, F test demonstrates that the model is appropriate as a whole. Table 6 explains the details of these 5 basis functions stated in the model.

Table 6

The Basis Functions in the Best Model

Basis Functions	Details	Coefficient
Basis Function 2	max (0, 0.200 - Economic Growth)	0.417
Basis Function 7	max (0, Interest Rate – 7.970)	-3.143
Basis Function 10	max (0, 10.338 – Inflation Rate)	0.532

Basis Function 11	max (0, Interest Rate – 16.680)	0.194
Basis Function 13	max (0, Interest Rate – 7.130)	3.034

Table 6 shows that economic growth is a significant variable that affects unemployment rate in Turkey. It is stated in basis function 2 as "0.200 - Economic Growth" and the coefficient is 0.417. It can be said that there is a negative relationship between these variables in Turkey. This explains that when there is an economic recession in Turkey, it will be an important indicator of high unemployment rates. Therefore, economic performance of the country should be improved to decrease unemployment rate. Zagler (2003), Yashiv (2000), Chang (2005), Chowdhury and Hossain (2014) and Ogbeide et. al. (2016) also reached this result in the literature.

In addition to the economic growth, inflation rate is another variable that influences unemployment rate in Turkey. In basis function 10, this variable is stated as "10.338 – Inflation Rate" and the coefficient is positive (0.532). This result gives information that when inflation rate is more than 10.338, it does not affect unemployment rate in Turkey. Moreover, when it is less than 10.338, there is a negative relationship between inflation rate and unemployment rate. The main reason is that any implementation which aims to decrease inflation rate causes unemployment rate to increase. This result was also emphasized in many studies in the literature (Kreishan, 2011: 228), (Chowdhury and Hossain, 2014: 16).

Furthermore, it is also identified that interest rate affects unemployment rate in Turkey significantly. This variable is stated in basis function 7, 11 and 13. Additionally, the coefficients of these variables are "-3.143", "0.194" and "3.034". While considering the total of these three coefficients, it can be understood that interest rate positively affects unemployment rates. This means that when interest rate is high, there will be decrease in the investment levels. This situation also leads to decline in the profitability of the companies. Because of this aspect, these companies will prefer to fire employees. As a result, the model related to the unemployment level in Turkey is the following.

Y = 6.763 + 0.417 * BF2 - 3.143 * BF7 + 0.532 * BF10 + 0.194 * BF11 + 3.034 * BF13

4. Conclusion

In this study, it is aimed to determine the macroeconomic indicators of unemployment rate in Turkey. For this purpose, quarterly data for the periods between 2003 and 2016 is taken into the consideration. By analyzing similar studies in the literature, 5 different macroeconomic variables are selected that may affect unemployment rate. Additionally, Multivariate Adaptive Regression Splines (MARS) method is used to achieve this objective.

In the analysis process, firstly, unit root tests are performed to understand whether independent variables are stationary or not. It is defined that 3 independent variables (real interest rate, inflation and economic growth) are stationary on their level values whereas two independent variables (current account deficit and USD/TL currency exchange rate) are not stationary. Hence, the first differences of these two variables are used in the analysis.

After stationary analysis, MARS method is used to identify influencing factors of unemployment rate in Turkey. It is concluded that economic growth affects unemployment negatively in Turkey. This shows that economic performance of the country should be improved to decrease unemployment rate. Furthermore, interest rate positively influences unemployment rates. In other words, in case of high interest rates, investment levels are decreased which causes higher unemployment rate.

In addition to economic growth and interest rate, inflation rate is also an independent variable which affects unemployment rate in Turkey. It is understood that when inflation rate is more than 10.338, it does not affect unemployment rate in Turkey. However, there is a negative relationship between inflation rate and unemployment rate when it is less than 10.338. The main reason is that any implementation which aims to decrease inflation rate causes unemployment rate to increase.

While considering these results, it can be said that economic performance of the country should be improved and interest rates should be reduced to decrease unemployment rate in Turkey. Additionally, it is also recommended that implementations aimed to decrease inflation rate, should be controlled carefully. By analyzing a very important subject, this study aims to make a significant contribution to the literature. Nevertheless, a new study, which focuses on many different countries for this issue, will also be beneficial.

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