

# A Dynamic Analysis on the Validity of the Phillips Curve for Turkey

## Abstract

The connection between inflation and unemployment is one of the most discussed issues of macroeconomy. This study investigates the Phillips curve, which expresses the trade-off between inflation and unemployment, using Bound test approach, ARDL method and Kalman Filter for the period between 1996 and 2016 for Turkish economy. In the empirical analysis, co-integration relationship between inflation and unemployment has been determined by Bound test. ARDL model results suggest that unemployment rate is statistically significant and negatively affects inflation rate in the long run. Although the short-run coefficient obtained from ARDL model is not statistically significant, the trade-off has been stated between inflation and unemployment in the long run. Kalman Filter model is employed in order to analyze dynamic relationship between inflation and unemployment. The results show that the effect of unemployment on inflation has significantly increased after the implementation of inflation targeting regime in 2002.

**Keywords:** *Phillips Curve, Bound Test, ARDL Model, Kalman Filter.*

## Türkiye’de Phillips Eğrisinin Geçerliliği Üzerine Dinamik Bir Analiz

### Öz

Enflasyon ve işsizlik arasındaki bağlantı makroekonominin en çok tartışılan konularından birini oluşturmaktadır. Bu çalışmada, enflasyon ve işsizlik arasında değiş-tokuş (trade-off) ilişkisinin olduğunu ifade eden Phillips eğrisi; Sınır testi yaklaşımı, ARDL metodu ve Kalman Filtresi modeliyle 1996-2016 yılları için incelenmektedir. Ampirik analizde, Sınır testi yaklaşımı ile enflasyon ve işsizlik arasında eşbütünleşme ilişkisinin olduğu belirlenmiştir. ARDL modeli sonuçları, uzun dönemde işsizliğin enflasyon üzerinde istatistiksel olarak anlamlı ve negatif etkisi olduğunu göstermiştir. ARDL modelinden elde edilen kısa dönem katsayısı istatistiksel olarak anlamlı olmamasına karşın, enflasyon ve işsizlik arasındaki değiş-tokuş ilişkisinin uzun dönemde geçerli olduğu sonucuna ulaşılmıştır. Enflasyon ve işsizlik arasındaki dinamik ilişkiyi belirlemek için Kalman Filtresi modeli kullanılmıştır. Kalman Filtresi modeli sonuçları, işsizliğin enflasyon üzerindeki etkisinin enflasyon hedeflemesi rejimi uygulanmasından sonra önemli ölçüde arttığını göstermiştir.

**Anahtar Kelimeler:** *Phillips Eğrisi, Sınır Testi, ARDL Modeli, Kalman Filtresi.*

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## 1. INTRODUCTION

Over the past few decades, policymakers throughout the world have become increasingly aware of social and economic costs of inflation and more concerned with maintaining a stable price level as a goal of economic policy. Indeed, price stability, which central bankers define as low and stable inflation, is increasingly viewed as the most important goal of monetary policy (Mishkin, 2007: 393).

The unemployment rate is a key macroeconomic statistic (Hubbard and O'Brien, 2008: 236) and one of the most closely followed economic statistic because it provides an indication of what is happening in the labor market and how well the economy is utilizing its resources (Mishkin, 2012: 81).

Unemployment and inflation are macroeconomic problems that are most often discussed in the media and during political campaigns. For many members of the general public, the state of the economy is summarized in just two measures: the unemployment rate and the inflation rate (Hubbard and O'Brien, 2008: 236). The effect of monetary policy on inflation and unemployment has been among the main subject of macroeconomics. The connection between these two variables is still discussed since "Phillips Curve" arises in 1958 (Phillips, 1958). Phillips curve is based on the notion that there is a negative relationship between inflation and unemployment. In other words, inflation is high when unemployment is low; unemployment is high when inflation is low.

The inflation-unemployment tradeoff is a proposition regarding the effects of monetary policy. It is the argument that changes in monetary policy impose these two variables in adverse aspect (Mankiw, 2000:2). The Philips curve is a main ingredient in macroeconomics, ensuring a constitutive equation that states the inflation rate as a function of the unemployment rate. In addition, it is principal for policymaking as it forms a basic restriction on policy (Palley, 2011: 2). As the discovery of the negative inflation-unemployment relation by Phillips, popularized by Samuelson and Solow, policy-makers assumed that they could exploit the trade-off to reduce unemployment at a small cost of additional inflation (Gordon, 2011:10).

The aim of this study is to analyze the existence of the Phillips curve for Turkish economy. This study differs from the existing literature on Phillips curve for Turkey as it employs Kalman Filter method in order to investigate the dynamic relationship between inflation and unemployment. The study is organized as follows. The second section presents the theoretical background on Phillips curve. Section 3 presents literature review on Phillips curve. The following section provides the methodology and the data for the empirical analysis. The last section concludes.

## 2. THEORETICAL BACKGROUND

The first evidence between price changes and unemployment has been introduced by Irving Fisher (1926). Fisher determined a substantial causal relation from inflation to unemployment rates for U.S. between the period of 1915-1925. Following this study, Jan Timbergen has approached the relationship between inflation and unemployment econometrically for Netherlands for the 1923-1933 period.

The unemployment rate is the percentage of the labor force that is unemployed. The inflation rate is the percentage increase in the price level from one year to the next (Hubbard and O'Brien, 2008: 236-249).

A.W. Philips' article published in 1958 inspired interest considerably, and generated discussions that will survive until today. Philips suggested that there is a nonlinear, stable and reverse relationship between unemployment rate and rate of change of money rates. (Büyükakın, 2008: 136). According to Philips; while unemployment rate is low, rate of change of money rates are high and while unemployment rate is high, it is the total opposite (Phillips, 1958: 290).

Samuelson and Solow translate the original Phillips' diagram demonstrating the rate of change of money wage rates against degree of unemployment into a Modified Phillips Curve. The Modified Phillips Curve shows the varied degrees of unemployment which would be "needed" for each degree of price level change. The modified Phillips curve is shown in Figure 1. The point A, corresponding to price stability, is seen to involve

about 5,5 per cent unemployment; whereas the point B, corresponding to 3 per cent unemployment, is seen to involve a price rise of about 4,5 per cent per annum. This indicates the menu of choice between different degrees of unemployment and price stability in the short run (Samuelson and Solow, 1960: 191-193).

Samuelson and Solow' Phillips curve, offers a selection menu between inflation rate and unemployment rate, became an economic policy of the governments over the years of 1960s. The reason for this, the selections of the governments between inflation and unemployment are legitimated based upon standing the fact that low inflation causes higher unemployment; low unemployment causes higher inflation.

From the last years of 1960, some economists especially Milton Friedman criticized the Phillips curve, and included inflation expectations to the Philips' curve analysis. In Figure 2, Long-Run Phillips curve (LRPC) states that there is no trade-off relationship between inflation and unemployment in the long run and Short-Run Phillips curve

(SRPC) shows that there is a trade-off relationship in the short run. In return, expected inflation rate is different than inflation outturn rate and accordingly unemployment rate is not equal to natural rate of unemployment and states that the original Phillips curve is valid in the short run. The Figure 2 shows that the trade-off relationship between inflation and unemployment is valid in the short run, not in the long run. Accordingly, this study investigates the validity of Phillips curve both for the short and the long run.

### 3. LITERATURE REVIEW

The relationship between inflation and unemployment is central to the conduct of monetary policy (Gordon, 1997: 11). There have been many empirical studies on whether there exists inflation-unemployment trade-off relationship. The results of these empirical studies on Phillips curve are not consistent. This diversity in empirical results may be in charge of by differences in time frame, used technique and financial system. It is presented the studies on Phillips curve in the literature in this section.

Figure 1. Phillips Curve

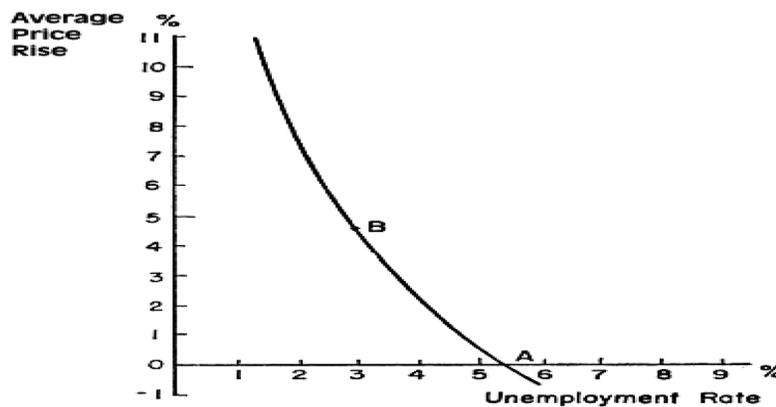
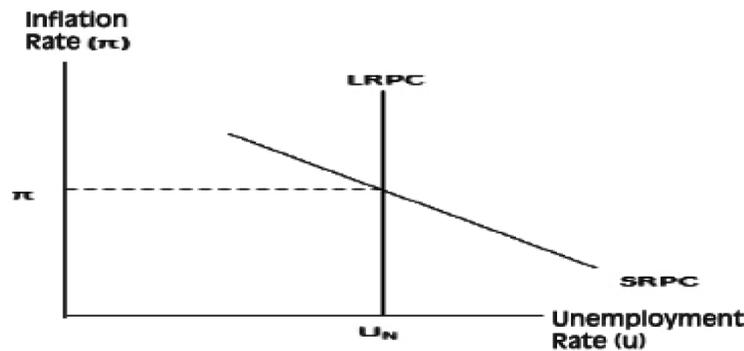


Figure 2. Short Run and Long Run Phillips Curve



Bhattacharai (2004) analyze the trade-off relationship between unemployment and inflation in OECD countries by using panel data analysis for the period of 1970:4-2002:1. The empirical results indicate that Phillips curve is empirically significant for Great Britain, Italy, Norway, Netherlands, New Zealand and US as well as for other countries. The author state that most of the variation in the country specific differences in unemployment rates can be explain by country specific supply side, technological factors, frictional unemployment and insider-outsider theory.

Furuoka (2007) examines the validity the Phillips curve in Malaysia, employing VECM for the period from 1973 to 2004. The results reveal that there is a long-run trade-relationship between inflation rate and unemployment rate and unemployment rate does 'Granger cause' inflation rate in the short-run.

Gaiotti (2008) uses data from the Bank of Italy's annual Survey of Investment in Manufacturing (SIM) and employs sub-Chow test to analyze whether the globalization changes the slope of Phillips curve<sup>1</sup>. The study covers the period 1988–2005 and includes about 2.000 Italian firms. The results suggest that the flattening of the Phillips curve is not rooted in the different behavior of individual firms exposed to competition, but rather in a more moderate dynamic of inflation expectations. Namely, the results do not support the view that flattening of the Phillips curve is for globalization<sup>2</sup>. Zaniboni (2008) is the study to investigate

1 A flatter Phillips curve means that inflation is less responsive to unemployment gap. There is a positive and negative effect for economy due to declining slope of the Phillips curve. On the positive side, it implies that an overheating economy will tend to generate in smaller increase in inflation. On the negative side, it implies that a given increase in inflation will be more costly to put out of the system (Mishkin, 2007: 322).

2 Foreign competition has reduced the pricing power of domestic corporations, limiting their ability to raise prices; the prices of items produced at home are increasingly determined by foreign demand and supply factors, rather than domestic ones. On the labour market, the threat of outsourcing to cheaper labour countries disciplines wages, keeping them low and less responsive to increases in demand. This implies that a flatter Phillips curve is a structural feature of advanced economies; if true, this would have far-reaching implications for the conduct

the effect of globalization on Philips curve in US. He find that globalization increase the volatility of shocks to the Phillips curve, but not a large extent. Besides, increased openness only slightly decreases the slope of Phillips curve, domestic factor are the main determinants of inflation.

Bentolilo (2008) examines the effect on the immigration on the scope of the Phillips curve in Spain over the period 1982:1-2006:3. The estimation results reveal that while the fall in the average unemployment rate over the last 8 years caused the inflation rate to increase by 2.5 percentage points per year, the surge in immigration account for an offsetting 2.2 percentage-point drop in the inflation rate per year. According to New Keynesian Phillips Curve (NKPC) model, the reduction of the Phillips Curve' slope is due to the reduction in the bargaining power of workers induced by immigration.

Chicheke (2009) conclude that there is a positive long-run relationship between inflation and unemployment and causal relation from inflation to unemployment only in the long-run, employing vector error correction (VEC) model for the period 1980-2008. The results suggest that Phillips curve does not exist in South Africa.

Topçu (2010) analyze the relationship between unemployment and inflation of G8 countries with Granger causality test for the period of 1993:1-2005:4. The study reveals that there is a two-way causality in G8 countries and unemployment causes inflation or vice versa. Altay et al (2011) is another study that examines the relationship between inflation and unemployment in G8 countries. Pedroni (1999, 2004) cointegration test results suggest that there is a cointegration relationship between the two variables and Granger causality test results indicate that the direction of the causality is from inflation to unemployment in the short run and is from unemployment to inflation in the long run.

Blanchflower et al (2014) obtain from a different approach. They use of a large European survey data, covering the period 1975 to 2013, to estimate happiness equation in which individual subjecti-

of monetary policy (Gaiotti, 2008: 3).

ve measure of life satisfaction is regressed against unemployment rate and inflation rate. They estimate the unemployment/inflation trade-off as approximately 5.6 that means one percentage point increase in unemployment rate lower well-being nearly six times more than an equivalent rise in inflation. They reach the same results with the study of Shiller (1997), that is, unemployment hurts more than inflation.

The studies that investigate the relationship between inflation and unemployment in Turkey are as Uysal and Erdoğan (2003), Kuştepelı (2005), Önder (2006), Hepsağ (2009), Arabacı and Eryiğit (2012), Bayrak and Kanca (2013), Gül et al (2014), Güven and Ayvaz (2016), Tabar and Çetin (2016), Petek and Aysu (2017).

Uysal and Erdoğan (2003) investigated the relationship between inflation and unemployment covering the 1980-2002 period by using regression analyses. The results of the analysis reveal that there is a positive relationship between inflation and unemployment for the period 1980-1990 and there is a negative relationship between the two variables for 1991-2002.

Kuştepelı (2005) analyzes the relationship between inflation and unemployment, employing OLS approach. The annual data covers the period 1980-2001 and semiannual data represents by 1988:2-2003:1. According to the study, although the semiannual data has a better fit in all specification compared to the annual data, the results indicate no evidence of a Phillips curve in Turkey. The study reveals that inflation expectations are found to be significant for inflation rather than unemployment rate in the current period.

Önder (2006) uses output gap instead of unemployment and employs multiple structural break models and Markov-Switching models for the period 1987:1-2004:7. Empirical results show that Turkish Phillips curve is not stable and linear. According to the study, there is evidence on structural change in the Turkish Phillips curve in the end of 2001. Except for the period of 1994 and 2004, including two economic crises in Turkey, the results support for the existence of Phillips curve. In addition, the study reveals that there is no evidence on the asymmetry of the Turkish Phillips curve.

Hepsağ (2009) concludes that there is a trade-off relationship between inflation rate and unemployment rate only in the long run, employing bound test and ARDL model for the 2001:Q1-2007:Q3 period. On the contrary, in the study by Bayrak and Kanca (2013), employing Engle-Granger cointegration test with data from 1970-2010, results indicate that the trade-off relationship has been determined between inflation rate and unemployment rate in short run but the analysis of Phillips Curve is not valid for long run. The estimates suggest that 1 per cent increase in inflation rate lead to 0.14 per cent decrease in unemployment rate.

Empirical results by Arabacı and Eryiğit (2012), using threshold regression including 1991:Q1-2010:Q4 periods, suggest that Turkish Phillips curve has a convex shape and the threshold regression model is an appropriate modeling tool for the Turkish short run Phillips curve. The study presents a stable nonlinear relationship between the real economic activity and inflation in Turkish economy.

Tabar and Çetin (2016) show that there is no cointegration relationship between inflation and unemployment according to the result of Gregory and Hansen (1996) cointegration tests and Maki (2012) cointegration test for the period of 2003-2016. The authors state that Phillips curve is not valid both in short and long run.

Gül et al (2014) find that there is a one-sided causal relation from inflation rate to unemployment rate in long run by using panel cointegration and causality analysis for the period 1996-2012. However, empirical studies by Güven and Ayvaz (2016) show contrasting result. Using cointegration analysis and VAR model, they determine that there is long-term relationship between inflation rate and unemployment rate and the existence of one causality relation from unemployment rate to inflation rate. Petek and Aysu (2017) conclude that there is not causal relation from inflation rate to unemployment rate and from unemployment rate to inflation rate covering the period 1980-20015 by using VAR model.

The empirical studies on inflation-unemployment trade-off relationship for Turkish economy are scant and contradicting. However, during the last decade, the empirical work on Phillips curve in

Turkey has gained interest. This paper differs from the existing literature on Phillips curve in Turkey, by applying Kalman filter method to analyze inflation and unemployment dynamic relationship.

#### 4. DATA AND METHODOLOGY

This paper examines the evaluation of the Phillips curve for the Turkish economy. For that purpose, we investigate the relationship between inflation and unemployment. We use annually data which are obtained from Turkish Statistical Institute for the period of 1996-2016. Annual variation of Consumer Price Index (P) with 1994 base year is used as the indication of inflation. Inflation (P) and unemployment rate (UN) measured in natural logarithms and were represented as LP and LUN respectively.

In the empirical analysis, it was primarily analyzed stationary properties of the series by using ADF (Augmented Dickey-Fuller), PP (Phillips Perron) and Ng-Peron test. After stationary test, co-integration relationship between inflation and unemployment was investigated with Bound Test developed by Pesaran et al. (2001).

After determining co-integration relationship between LP and LUN, the short and long term static relationships were analyzed by employing ARDL (Autoregressive Distribution Lag) model<sup>3</sup>. Lastly, we investigated the dynamic analyze for Phillips curve by employing the Kalman Filter model.

##### 4.1. Unit Root Test

We firstly analyzed stationary properties of the LP and LUN by using ADF, PP and Ng-Peron test in the empirical analysis. The results of unit root tests are presented in Table 2.

**Table 2.** Unit Root Test Results

<b>ADF Test Results</b>				
LP	-1.12	$\Delta$ LP	-3.34	
LUN	-1.85	$\Delta$ LUN	-3.40	
<b>PP Test Results</b>				
LP	-1.37	$\Delta$ LP	-3.34	
LUN	-1.70	$\Delta$ LUN	-4.02	
ADF and PP Critical Values (Level): %5=-3.66 %10= -3.27				
ADF and PP Critical Values (First Differenced): %5= -3.03 %10= -2.65				
<b>Ng-Peron Test Results</b>				
	<b>MZa</b>	<b>MZt</b>	<b>MSB</b>	<b>MPT</b>
LP	-7.42	-1.88	0.25	12.35
LUN	-4.78	-1.48	0.31	18.64
Ng-Peron critical values for MZa, MZt, MSB and MPT respectively; %5 significance level -17.30, -2.91, 0.17, 5.48; %10 significance level -14.20, -2.62, 0.18, 6,67.				
$\Delta$ LP	-9.02	-2.08	0.22	2.87
$\Delta$ LUN	-15.90	-2.82	0.18	1.55
Ng-Peron critical values for MZa, MZt, MSB and MPT respectively; %5 significance level -8.10, -1.98, 0.23 and 3.17; %10 significance level-5.70,-1.62, 0.27, 4.45.				

<sup>3</sup> Hepsağ (2009), as explained in Section 2, employs Bound test approach and ARDL model to test the validity of the Phillips curve in Turkey. The Bound test results reveal that there is a long-run relationship between inflation and unemployment while ARDL model result suggest that Phillips curve is empirically significant only in the long-run.

For ADF and PP tests, the null hypothesis suggests that the series are not stationary. Table 2 shows that the estimated t statistics for the LP and LUN are less than the critical values in their level form which means null hypothesis cannot be rejected for ADF and PP tests.

For Ng-Peron test, according to MZa and MZt tests the null hypothesis suggest that the series include unit root and according to MSB and MPT tests the null hypothesis indicates that the series are stationary. For Ng-Peron test, the estimated t statistics for LP and LUN are less according to MZa and MZt tests and greater than the critical values according to MSB and MPT tests. For the first difference of the series, the estimated t statistics for LP and LUN are greater according to MZa and MZt tests and less according to MSB and MPT tests. In sum, the series are integrated of order I(1) considering ADF, PP and Ng-Perron tests.

### 4.2. Bound Test Co-Integration Approach

Following specifying stationary properties of the series, the existence of co-integration relationship between inflation and unemployment was investigated employing Bound Test improved by Pesaran et al. (2001). For the Bound test analysis, Unrestricted Error Correction model (UECM) specification for our study is shown in equation 1.

$$\Delta LP_t = a_0 + a_{1t} + \sum_{i=1}^p a_{2i} \Delta LP_{t-i} + \sum_{i=0}^p a_{3i} \Delta LUN_{t-i} + a_4 LP_{t-1} + a_5 LUN_{t-1} + u_t \tag{1}$$

Where, LP is log of inflation, LUN log of unemployment. In UECM model in equation (1), “m” symbolizes number of lags and “t” symbolizes trend variables. The null hypothesis for F test is constituted as  $H_0: \alpha_4 = \alpha_5 = 0$  which means there is no co-integration relationship between the series

and estimated F statistics is compared with table bottom and upper critical levels in Pesaran et al. (2001). If the estimated F statistic is lower than the bottom bound of critical values, the null hypothesis cannot be rejected. If the estimated F statistic is higher than the upper critical level, there is a co-integration relationship between the series (Ertuğrul and Kenar, 2013:87; Karagöl et al., 2007: 76). The bound test results are presented in Table 3.

According to the bound test results, the null hypothesis is rejected in that F statistics is higher than the upper bound of critical values. Accordingly, we detected the existence of long run co-integration relationship between inflation and unemployment.

### 4.3. ARDL Model

After we have found co-integration relationship between the variables, the short and long run static relationships between inflation and unemployment were analyzed by employing ARDL (Autoregressive Distribution Lag) model. ARDL model specifications for our study are presented in equation (2) and (3) below.

$$LP_t = a_0 + \sum_{i=1}^m a_{1i} LP_{t-i} + \sum_{i=0}^n a_{2i} LUN_{t-i} + u_t \tag{2}$$

$$\Delta LP_t = a_0 + a_1 ECM_{t-1} + \sum_{i=1}^m a_{2i} \Delta LP_{t-i} + \sum_{i=0}^n a_{3i} \Delta LUN_{t-i} + u_t \tag{3}$$

The error correction term which is ECM(-1) is the one period lagged value of the error terms derived from the equilibrium relationship. It shows to the extent of the eliminated rate of the short-run disequilibrium in the long run (Karagöl et al., 2007: 78; Gençosmanoğlu ve Ertuğrul, 2015: 291). The calculated short and long-run coefficients by employing ARDL (1,2) model is presented in Table 4.

**Table 3.** Bound Test Results

K	F statistics	Critical Values at %5 Significance Level	
		Bottom Bound	Upper Bound
1	6.74	3.15	4.11

K is the number of independent variable in equation (1). Critical values are get from Table CI(i) at Pesaran et al. (2001: 300).

**Table 4.** ARDL (1,2) Model Long And Short-Run Parameter Estimations

Variables	Coefficient	T statistics
LP(-1)	0.661269	6.844601
LUN	-0.464642	-1.054116
LUN(-1)	-0.299184	-0.546799
LUN(-2)	-0.899850	-1.763506
C	4.587953	3.337112
<b>Diagnostic Checks</b>		
X <sup>2</sup> BG	0.030274 [0.9703]	
X <sup>2</sup> NORM	0.467362 [0.791674]	
X <sup>2</sup> WHITE	0.237255 [0.6328]	
X <sup>2</sup> RAMSEY	2.247291 [0.1399]	
<b>Estimated Long-run Coefficients Using ARDL(1,2) Model</b>		
LUN	-4.910625	-5.949564
C	13.542138	7.291631
<b>Short-run parameters and error correction coefficient from the ARDL(1,2) model</b>		
D (LUN)	-0.464602	-1.298601
D(LUN(-1))	0.899850	1.972156
ECM (-1)	-0.338791	-4.808510

According to the diagnostic checks in the ARDL (1,2) model, there are no serial correlation, heteroscedasticity and misspecification problems. The long-run coefficient, which is estimated as -4.91 obtained from ARDL (1,2) model, indicates that there has been a negative and statistically significant relationship between inflation and unemployment. The long-run coefficient suggests that 1 percent increase in unemployment rate will lead ceteris paribus to 4.91 per cent decrease in inflation rate. The estimated coefficient of the short-run relationship shows that there is not statistically significant relation between the series. The error correction term, ECM(-1), is estimated as -0.33 which means that 33 % of disequilibrium from the previous year's shock is resolved in the current year. In conclusion, according to the results of the ARDL (1,2) model, there is a trade-off relationship between inflation and unemployment in the long run. In other words, unemployment is significant and negative affects inflation in the long run.

#### 4.4. Dynamic Approach

We investigate dynamic relationship between inflation and unemployment by employing Kalman

filter approach<sup>4</sup>. For this study, the Kalman filter model is presented in equations 4 and 5 below.

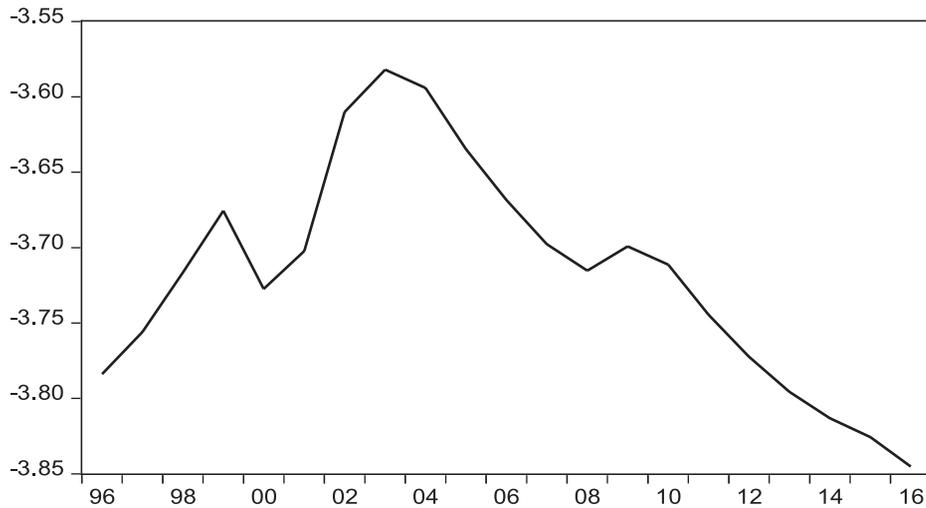
$$LP_t = \alpha_0 + \alpha_{1,t} LUN + \varepsilon_t \quad (4)$$

$$\alpha_{1,t} = \alpha_{1,t-1} + v_{1,t} \quad (5)$$

Where in our case  $\varepsilon_t$  and  $v_{1,t}$  are vectors of mean zero, Gaussian disturbances. The Kalman filter recursively estimates the parameters by updating the estimation with every additional observation (Atilgan et al, 2016: 4). The  $\alpha_{1,t}$  coefficient in equation (4) indicates unemployment elasticity of inflation, which indicates percentage change in inflation in response to a one percentage change in unemployment. The time-varying parameter (TVP) estimates for unemployment elasticity of inflation employing Kalman Filter approach in 1996-2016 period are shown in Figure 3.

<sup>4</sup> Ertuğrul and Kenar (2013), Atilgan et al (2016), Karahan and Uslu (2016) are the studies that employ Kalman Filter method for Turkish economy to investigate the relationship between external debt and GDP; health expenditure and economic growth; credit volume and current account deficit, respectively.

**Figure 3.** Time-Varying Parameter (TVP) Estimates Result  
SV1F



According to TVP results show that unemployment has a negative and increasing effect on inflation. The effect of unemployment on inflation generally decreased between 1996 and 2003 and commences to increase after 2002 which Turkey has implemented implicit inflation targeting regime. This effect decreased during the period of global financial crisis, 2008-2009, and then increase until this time.

## 5. CONCLUSION

Inflation and unemployment are the main macroeconomic problems. The relationship between inflation and unemployment is one of the most debated arguments in empirical and theoretical literature. Though both rates of inflation and unemployment are aimed at low levels by monetary and fiscal policies, Phillips (1958) has revealed that the two variables do not move towards at the same aspect. This study analyzed the effectiveness of Phillips curve, which reflect a negative relationship between inflation and unemployment, for Turkey from 1996 to 2016.

In empirical analysis, we firstly determined LP and LUN are I(1) according to unit root tests. Then, Bound test results disclose that a statistically significant long-run cointegrating relationship exists between inflation and unemployment. Following determining co-integration relationship, the short and long term static relationship between inflation and unemployment were analyzed by employing ARDL model. ARDL model results suggest that

there is a negative and statistically significant relationship between inflation and unemployment in the long-run. According to the long-run coefficient of ARDL model, unemployment has significant effect on inflation rate in the long-run. Although unemployment has negative effect on inflation in the short-run, the short-run coefficient is not statistically significant and this indicates Phillips curve is not valid in the short-run. In sum, ARDL model result show that there is a trade-off relationship between inflation and unemployment only in the long run.

Unlike other studies in the literature on Turkish Phillips curve, this paper provides time-varying evidence on empirical significance of Phillips curve with Kalman Filter method. Kalman Filter estimate results show that unemployment has a negative effect on inflation and the effect of unemployment on inflation has increased after 2003. In other words, unemployment elasticity of inflation increased between 2003 and 2016 except for in financial global crisis period including 2008 and 2009. As a result, the trade-off relationship between inflation and unemployment is valid in the long run and after Turkey implemented the price stability policy in 2002, performance of efficient of unemployment on inflation has significantly increased. Empirical results of this paper imply that Turkish Phillips curve has a convex shape and the slope of the Phillips curve is steeper than after the period of 2009.

In this respect, strength and aspect of the effect of unemployment on inflation can be used as a tool

to ensure price stability in the long-run for Turkish economy. Assessing empirical results of this paper, monetary policy aimed at cutting down on inflation should take into consideration the trade-off relationship between inflation and unemployment in conducting policy. However, it is significant to constitute policies to prevent to increase unemployment unrestrainedly for lowering inflation and to not lead to economic stagnation.

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