yönetim ve ekonomi araştırmaları dergisi
journal of management and economics research
Cilt/Volume: 18 Sayı/Issue: 3 Eylül/September 2020 ss./pp. 116-136
İ. Şıklar, B. Bari, Doi: http://dx.doi.org/10.11611/yead.759465

HOW MUCH UNEMPLOYMENT IS STRUCTURAL IN TURKEY? AN UNOBSERVED COMPONENTS APPROACH

Prof. İlyas ŞIKLAR *

Asst. Prof. Bilgin BARİ *

ABSTRACT

This study aims to determine the course of structural unemployment by decomposing trend and cyclical components of 1987-2019 actual unemployment in Turkey. This decomposition will be carried out in the context of time-varying NAIRU (Non-Accelerating Inflation Rate of Unemployment). It is accepted that structural unemployment is the unemployment that is consistent with the performance of the economy at the potential output level and, therefore, can be proxied by the time-varying NAIRU. The developments in Turkish labor markets during the investigation period emphasize that the importance of structural factors besides the cyclical ones. Therefore, it is crucial to examine how much of the increase in the unemployment rate is structural in the Turkish economy. Structural unemployment rate figures obtained through the state-space model estimated by using reduced form accelerationist Phillips curve indicate the presence of high and increasing structural unemployment problems in Turkey, specifically during the last years. Alternative models like Beveridge curve and Hodrick – Prescott filtering also produce results confirming this determination and reveal that the unemployment gap is almost closing in the country.

Keywords: *Structural Unemployment, Time-varying NAIRU, Kalman Filter, Beveridge Curve.*

JEL Codes: *C32, C63, E24, E31*

TÜRKİYE'DE İŞSİZLİĞİN NE KADARI YAPISAL? GÖZLEMLENEMEYEN BİLEŞENLER YAKLAŞIMI

ÖZET

Bu çalışmada amaç Türkiye'de 1987 – 2019 dönemi işsizliğini trend ve devresel bileşenlerine ayırarak yapısal işsizliğin seyrini inceleyebilmektir. Bu ayrıştırma zamana bağlı olarak değişen NAIRU (enflasyonu hızlandırmayan işsizlik oranı) kavramı bağlamında gerçekleştirilmektedir. Yapısal işsizliğin ekonominin potansiyel üretim düzeyindeki performansı ile uyumlu olan işsizlik oranı olduğu;

* Anadolu University, Faculty of Economy and Administrative Sciences, Department of Economy, Eskişehir-Turkey. e-mail: isiklar@anadolu.edu.tr

* Anadolu University, Faculty of Economy and Administrative Sciences, Department of Economy, Eskişehir-Turkey. e-mail: bbari@anadolu.edu.tr

Makale Geçmişi/Article History

Başvuru Tarihi / Date of Application : 28 Haziran / June 2020
Düzeltme Tarihi / Revision Date : 30 Temmuz / July 2020
Kabul Tarihi / Acceptance Date : 28 Ağustos / August 2020

Araştırma Makalesi/Research Article

bu nedenle zamana bağlı olarak değişen NAIRU ile temsil edilebileceği kabul edilmektedir. Çalışmada, incelenen dönemde Türkiye işgücü piyasasındaki gelişmeler devresel faktörler kadar yapısal faktörlerin de önemli olduğunu vurgulamaktadır. Bu nedenle gerekli iktisat politikaları açısından işsizlik oranındaki artışın ne kadarının yapısal olduğunun incelenmesi önem kazanmaktadır. İndirgenmiş form hızlandırıcı Phillips eğrisi aracılığı ile tahmin edilen durum uzayı modelinden elde edilen yapısal işsizlik değerleri Türkiye'de, özellikle son dönemde, oldukça yüksek bir yapısal işsizlik sorununun varlığına işaret etmektedir. Beveridge eğrisi ve Hodrick – Prescott filtresi yöntemleri de bu tespiti doğrular sonuçlar üretmekte ve işsizlik açığının kapanmaya oldukça yakın olduğunu ortaya koymaktadır.

Anahtar Kelimeler *Yapısal İşsizlik, Zamana bağlı değişen NAIRU, Kalman Filtresi, Beveridge Eğrisi*

JEL Codes: *C32, C63, E24, E31.*

1. INTRODUCTION

The unemployment rate, which fell to 10% during mid-2018 in Turkey, has risen about 14% after one year. Although it has occurred during an economic recession, this increase in the unemployment rate has called forth intensified discussions on whether it is due to cyclical or structural factors. While policies that attempt to reduce cyclical unemployment are mainly demand management policies, fighting against structural unemployment requires more serious reform policies. These reform policies should be considered as long-term policy reforms on a scale ranging from legal regulations on the operating principles of the labor market to the training of the labor force. In order to shed light on these discussions, it has become essential to analyze to what extent structural and cyclical factors are caused by recent high unemployment in Turkey. The aim of this study is to present the light in question to the reader.

The unemployment rate is an important criterion for economic activities in the country. Understanding the movements in this indicator is very useful in evaluating the causes of economic fluctuations and their effects on welfare. On the other hand, unemployment rate changes also make it easier for us to understand the long-term path between economic activity and employment. Unemployment in a country is that a resident of the 15-64 age group does not work in a job for wage and cannot find it despite seeking a job at the current wage level. Because of this definition, unemployment is one of the primary criteria used in evaluating the performance of an economy. The indicator used for unemployment is mostly the unemployment rate and is found by proportioning the number of unemployed fitting the definition above to the number of those who are included in the labor force. Unemployment can occur due to a number of factors and is named depending on these factors. In this context, cyclical, seasonal, frictional, and structural unemployment are mentioned.

Cyclical unemployment occurs as a result of changes in aggregate demand in a business cycle period. If firms are faced with a weakening in demand, they can lay off existing workers and employ fewer new workers. In this case, while cyclical unemployment decreases during the expansion periods of the economy, it increases during the contraction periods. Frictional unemployment refers to short-term fluctuations in the labor market and labor force (in terms of participating and leaving), and it is determined by the effectiveness of the process of matching job seekers with vacancies. Therefore, frictional unemployment is temporary unemployment that covers the job search process. Seasonal unemployment is the unemployment that occurs in the sectors that have seasonal employment opportunities (such as agriculture, tourism), out of these seasons. Structural unemployment, on the other hand, is a more fundamental problem that occurs when features of job seekers and current vacancies do not match or, even if they match, locations are different. This may be due to long-term changes in the economic structure, such as socio-demographic trends, technological developments, and rapid changes in the industrial structure. Since the unemployment rate is measured also by considering seasonal fluctuations and calendar effects, the other three factors (cyclical, frictional, and structural) are the factors that should be decomposed from our perspective. However, it is often difficult to draw precise lines between these categories. For instance, it is claimed that long-lasting cyclical unemployment creates a hysteresis effect, and this contributes to an increase in structural unemployment (Blanchard, 2018). A prolonged period of unemployment makes workers' abilities out of date and reduces their attractiveness for employers; therefore, it may cause a depreciation in human capital by decreasing the bargaining power of the workers (Melolinna - Toth, 2016). In short, it is possible to say that cyclical unemployment may turn into structural unemployment after a while. However, Orlandi (2012) defines structural unemployment as follows: Structural unemployment is the equilibrium (natural) unemployment rate that the economy reaches in the long term if there is no shock. This level is determined by institutional factors and fiscal measures in the economy". In this case, the structural unemployment rate is the unemployment rate, which is compatible with the performance of the economy at the potential output level; in other words, it is the unemployment rate that is independent of the inflation rate. This definition of the structural unemployment phenomenon corresponds to the economists' "natural unemployment rate" or "nonaccelerating inflation rate of unemployment" (NAIRU). Although two concepts are sometimes used in the same sense, they actually have different meanings.

The natural rate concept was first introduced by Phelps (1967) and Friedman (1968) and is based on the notion that there is no adverse relationship between unemployment and inflation in the long run. In the presence of forward-looking economic agents, an unemployment rate lower than the natural rate is not sustainable without increasing inflation. If economic policy attempts to maintain the current unemployment rate lower than the natural rate, inflationary expectations will rise, and workers will demand higher nominal wages. This causes current inflation to rise. On the other hand, present high wages lead to layoffs, and the unemployment rate rises towards the natural rate. Consequently, natural unemployment is defined as the unemployment level that the economy has in the long run in which there are no structural changes, and business cycle fluctuations. Structural changes and institutional features in the labor and commodity markets are the main factors that determine the natural unemployment rate.

The NAIRU concept brought up by Modigliani - Papademos (1975), is related to the equilibrium unemployment theory. Treated as a narrower concept than the natural rate, NAIRU is defined as "unemployment rate that occurs in the medium term, where the realized inflation is at the expected level". NAIRU is also affected by the same structural factors as the natural rate. However, NAIRU is not a static measure and is calculated from the relationship between inflation and unemployment (Phillips curve). Contrary to the natural rate, NAIRU may change depending on the effects of temporary shocks (such as wage and price-setting behavior) in the short term. Therefore, it is accepted that NAIRU fluctuates more than the natural rate (Estrella - Mishkin, 1999; Richardson et al., 2000). It is possible to say that NAIRU will approach the natural rate in the long term when the effects of shocks experienced in the economy die out (Ball - Mankiw, 2002).

Considering above explanations, it is possible to say that structural unemployment and frictional unemployment concepts will be represented by NAIRU or trend in natural rate measures in an economy since both types of unemployment may continue to exist even if the labor market is in equilibrium. The reason for this can be detailed as follows: Structurally unemployed workers may not be included in employment despite the increase in labor demand and upward adjustment in wages. In addition, the frictional unemployment level is largely determined by the efficiency of matching potential workers and employers. In contrast, cyclical unemployment occurs when labor market operates below the capacity due to insufficient demand.

The purpose of this study is to decompose the structural and cyclical components of measured unemployment in Turkey. This decomposition will be carried out in the context of time-varying NAIRU. In the second part, basic developments in Turkish unemployment during the analyzing period are shortly discussed. The third part is fundamentally devoted to methodological issues and empirical literature on the measurement of structural unemployment, while the fourth section deals with data and estimation results. Since it is an unobservable variable, robustness checking for time-varying NAIRU estimates constitutes the fifth section's subject. The last section concludes the study and contains some policy recommendations.

2. LONG TERM TREND OF UNEMPLOYMENT IN TURKEY

The number of unemployed (U) in a country is the difference between the labor force (L) and the employed (E). Since the labor force is equal to the labor force participation rate (l) times the active population (N), unemployment can be stated as:

$$U = l(N) - E \tag{1}$$

Differentiating and reorganizing this equation yields:

$$\Delta\left(\frac{U}{L}\right) = \left(\frac{E}{L}\right)\eta_n + \left(\frac{E}{L}\right)\eta_l - \left(\frac{E}{L}\right)\eta_e \quad (2)$$

Here, while U/L and E/L represent unemployment and employment rates, η_n, η_l and η_e show percentage changes in the active population, labor force participation and employment, respectively. Thus, possible determinants of changes in the unemployment rate are presented in terms of demand for and supply of labor. Results obtained through Equation (2) for annual data of 1987 – 2019 period are presented in Figure 1. According to the figure, fluctuations in the unemployment rate in Turkey during the analyzing period are mainly due to the demand for labor. While in the pre-2000 period, an increase in the working-age population is the most important factor for increasing the unemployment rate, during the post-2000 period labor force participation growth rate is the basic factor that drives unemployment. The change observed, especially in the period after the 2008 global crisis, is remarkable. While the contribution of active population growth to unemployment remained more or less constant after the 2008 period, the contribution of the labor force participation rate in some years (such as 2008, 2012, 2014, and 2019) exceeds that of employment rate. In summary, with the 2000s, contrary to the previous period, the decisive power of factors related to labor supply on the unemployment rate has deepened. For further information on unemployment dynamics in Turkey could be found in some studies. Ayhan (2019) examines the unemployment in the Turkish economy from a different perspective. His research focuses on macroeconomic determinants of unemployment for the period of 2005:M1-2018:11. Uslu (2020) researches unemployment-growth relation and tests Okun's Law for three different periods between 1923-2019.

Figure 1: Determinants of Unemployment Rate

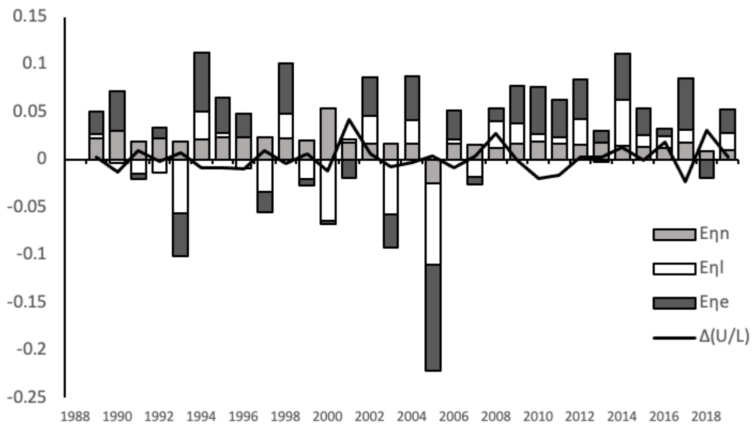


Figure 2: Developments in Labor Supply

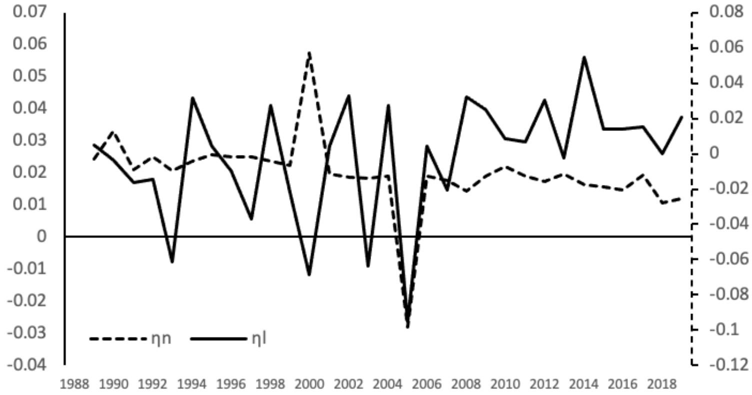
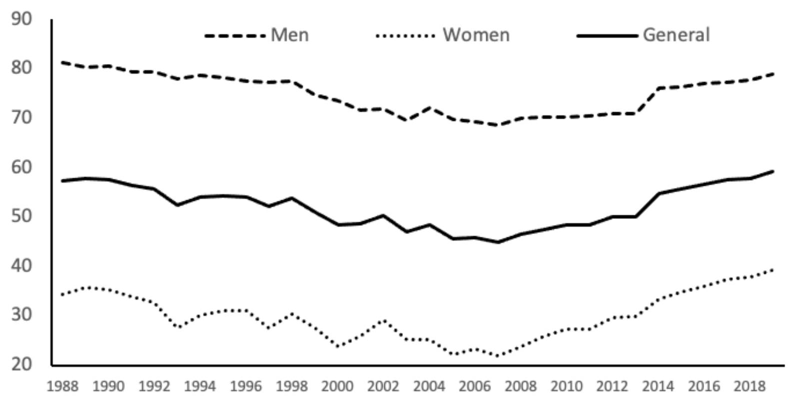


Figure 2 shows other evidence confirming our findings above. During the post-2000 period, while the active population increased almost at a constant rate, the increase in the labor force participation rate was higher than that rate. This is a concrete indication that those who were previously in the active population but who were not in the labor force have joined the labor market. Increasing the participation of women in the labor market is one of the main reasons for this situation. The Figure 3 shows developments in the labor force participation rate on a gender basis[1]. Specifically, after 2007, the participation rate of women increases by almost 80%, while that of men increases only 15%. Therefore, it seems possible to mention the existence of a significant structural change in labor supply, especially in the post-2007 period.

Figure 3: Labor Force Participation Rate by Gender



When this development in labor force participation rate is evaluated together with Figure 4, which summarizes the developments in economic growth rate and employment rate in the same period, it is understood that there are also some problems in the employment creation capacity of the Turkish economy. This situation can be evaluated as a result of economic growth, which followed a fluctuating course during the analyzing period. The vulnerabilities in the economic structure and the uncertainty they create lead to unstable economic growth and an overall downward trend in employment. This

[1] For detailed information on female participation in the labor force, see Aksoy et al. (2019).

situation states that factors that create structural fragility in the economy, as well as cyclical fluctuations, are among the factors behind the increase in the unemployment rate

Figure 4: Economic Growth and Employment

Note: The left axis represents the employment rate, while the right axis shows the economic growth rate.

The above-outlined developments in Turkish labor markets during the investigation period also emphasizes the importance of structural factors besides the cyclical ones. Therefore, it is essential to examine how much of the increase in the unemployment rate is structural in terms of necessary economic policies.

3. MEASUREMENT OF STRUCTURAL UNEMPLOYMENT

Resources not used in the labor market are traditionally assessed as structural unemployment, and in this sense, it reflects the structural characteristics of the economy and the labor market. For example, if the current unemployment is higher than the structural one, the decrease in the unemployment rate through economic growth will not create a wage pressure that will threaten the balanced development of the economy. For this reason, determining the labor market slack is vital as its degree will guide the government's employment policies and anchor in the formation of wages. If the unemployment gap is positive, monetary and fiscal policies (such as high public spending and low-interest rates) can reduce unemployment without creating a significant increase in wages and prices. If the unemployment gap has closed, it is necessary to concentrate on the structure of labor market in order to reduce the unemployment. Therefore, structural unemployment is an important criterion in policy decisions regarding the labor market and the economy in general.

3.1. Measurement Methodology

Structural unemployment is difficult to measure, although it is an important indicator of policy decisions regarding the labor market and the overall economy. First of all, this indicator should be estimated because it has an unobservable characteristic. In addition to the difficulties stemming from estimation, the developments in the world economy in recent years have made this estimation even more complicated.

It is possible to mention three groups of methods in estimating structural unemployment: (1) structural methods, (2) statistical methods, and (3) reduced-form methods. The first group of methods is based on modeling wage and price-setting behavior structurally. In these methods, the equilibrium unemployment rate is generally modeled in the economy. As Pissarides (2000) states, economists working on labor market imperfections related to job search and job creation processes have made a considerable contribution to the improvement of the equilibrium unemployment concept. The equilibrium unemployment rate is similar to the NAIRU concept we mentioned earlier. However, unlike NAIRU, structural unemployment in the equilibrium unemployment model is not affected by short-term changes in prices, wages, and expected inflation. The second group of methods, called statistical methods, is based on the decomposition of structural and cyclical components of the actual unemployment rate by using simple statistical techniques. As remarked by Turner et al. (2001), the assumption behind these methods is that there is no long-term relationship between unemployment and inflation. The reduced form approach that composes the third group of methods is mostly based on the expectations augmented Phillips curve and is associated with the estimation of the NAIRU. This method has been used extensively by various institutions, including international organizations such as OECD and IMF in recent years (Laubach, 2001; Gianella et al. 2008; Guichard - Rusticelli, 2011; IMF, 2013; Ebeke - Everaert, 2014). This technique involves the estimation of the reduced-form Phillips equation that contains the time-varying NAIRU (thus, inflation and unemployment gap are linked together). One of the main advantages of this method is that a detailed econometric forecast eliminates the disadvantages of pure statistical techniques (such as obtaining confidence intervals and eliminating the last observation problem). The third method is preferred in this study since it benefits from economic theory and is based on detailed econometric forecasts.

The usage of a reduced-form model in the estimation of NAIRU as an unobservable variable is accomplished through the use of a multivariate filter (Kuttner, 1994). Through this filter, observable variables are decomposed simultaneously to trend and cyclical components. In a model that uses the actual measured unemployment as an observable variable, NAIRU and unemployment gap values are decomposed in a periodical basis. Although there are a couple of filtering techniques to use for this purpose, the state-space model based on Kalman filtering methodology is the extensively used one recently (Gianella et al., 2018; Durbin – Koopman, 2012).

The general form of the linear state-space model has few components: unobservable states, observable data, shocks, and system matrices. In contrast, the model can often be written as a two-equation system. The first is a measurement equation (also known as signal or observation equation):

$$y_t = \Theta_t \beta_t + \Lambda_t X_t + \xi_t \qquad (3)$$

Here, y_t *is a* (n x 1) scale observable variables vector, Θ_t is a (n x m) scale matrix, X_t is a (n x k) scale exogenous variables matrix, β_t is a (m x 1) scale unobservable state variables vector, Λ_t is a (k x n) scale parameters matrix and ξ_t error terms vector. Error terms have traditional characters like that $E(\xi_t) = 0$ and $Var(\xi_t) = \Omega_t$ where Ω_t is a (n x n) scale known matrix.

According to so-called transition (or also known as a state) equation, unobservable state variables (β_t) are generated by a first-order Markov process:

$$\beta_t = \varphi_t + \Psi_t \beta_{t-1} + \Phi_t \zeta_t \quad (4)$$

Here, Ψ_t is a (m x m) scale matrix, φ_t is a (m x 1) scale vector, Φ_t is a (m x g) scale matrix and ζ_t is a (g x 1) scale serially uncorrelated error term vector. For error terms, traditional assumptions that $E(\zeta_t) = 0$ and $Var(\zeta_t) = \Xi_t$ hold where Ξ_t is a (g x g) scale known matrix.

Error terms in equations (3) and (4) may be simultaneously correlated. This means:

$$E(\xi_t, \zeta_t') = \Upsilon_t = var\begin{bmatrix} \xi_t \\ \zeta_t \end{bmatrix} = \begin{bmatrix} \Omega_t & \Sigma_t \\ \Sigma_t' & \Xi_t \end{bmatrix} \quad (5)$$

As long as it is accepted that $\Sigma_t = 0$ in this representation, Θ_t, Ω_t, Ψ_t, Φ_t, Ξ_t ve Σ_t indicate system matrices whose elements are constant consisting such as 1 and 0. Residuals in the signal equation (3) above (ξ_t) represent the measurement error. If this is the case, the state-space model is the system modeling based on the measurement errors. The state equation, hereunder, defines the signal (β_t), which is unobservable and measurable with an error. Therefore, the proportion of $Var(\zeta_t) = \sigma_\zeta^2$ to $Var(\xi_t) = \sigma_\xi^2$ is critical in state-space models. This ratio, called as signal-to-noise, is calculated as $q = \frac{\sigma_\zeta^2}{\sigma_\xi^2}$.

Representing a dynamic system in a state-space form generates two main benefits, as stated by Rummel (2015): (1) A state-space form makes possible to include unobservable variables to an observable model and to estimate them through with this model. (2) State-space models are the proper models for an analysis by the Kalman filtering technique. Developed by Kalman (1960) and Kalman-Bucy (1961), the Kalman filter is an algorithm that creates forecasts with a minimum mean square error in a state-space model. In other words, the method is a sequential estimation technique that updates the mean and variance of the situation for a period ahead each time new information is obtained. Since state-space models in which time-varying parameters, measurement errors and missing observations are simply handled present a general formulation of linear models, Kalman filtering methodology that makes possible to estimate these type of models is a handy tool. By using this filter, the logarithmic likelihood function of the state-space model can be estimated and, thus, parameters of the model are easily estimated through maximum likelihood methods. On the other hand, the extension of the model with exogenous variables and exogenous shocks should be stated as another advantage of Kalman filtering (Darvas-Simon, 2015; Borio et al. 2014; Melolinna - Toth, 2016). For example, Alichi (2015) and Alichi et al. (2017) shows that the use of additional exogenous variables contributes to reducing the sensitivity of the model. For a systematic review of the literature related to the summary results of the studies carried out on this subject, Richardson et al. (2019) and Fronckova et al. (2019) can be suggested.

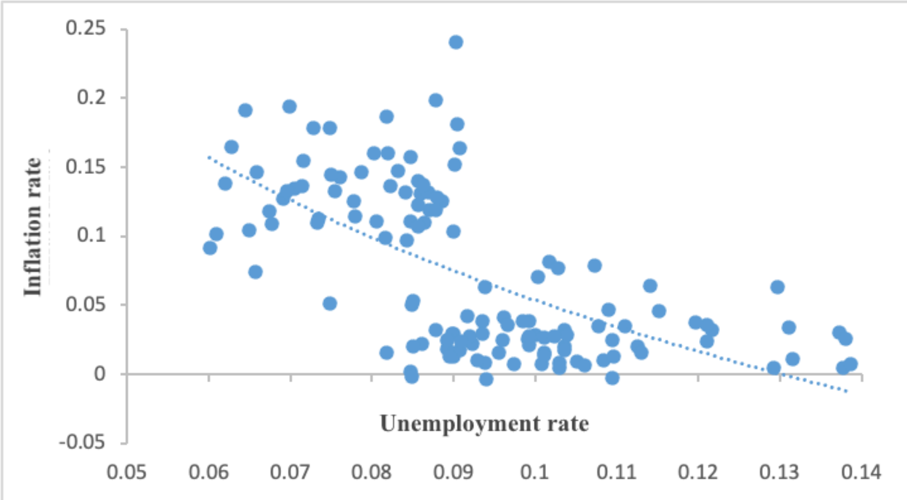
Recent studies on the structural unemployment and Beveridge curve in the Turkish economy is limited. Us (2014) estimates NAIRU and a time-varying Phillips curve for the Turkish economy by system approach for 2000Q1-2013Q3. The forecast results show that the NAIRU series follows a more fluctuating course, but acting in line with the actual unemployment level. The estimated NAIRU series reacts more strongly than the actual unemployment during crisis times. On the other hand, the time-varying coefficients show a stable but weak relationship between unemployment and inflation. Uslu et al. (2019) investigate the validity of the Beveridge curve for 2005:Q1-2017:Q4 in the Turkish economy. They use the Bound test, ARDL model, and asymmetric causality test. Their results show that the vacancy rate negatively affects the unemployment rate in the long-run, and there is no statistically significant relationship between the series in the short-run. Also, there is unidirectional causality from positive (negative) vacancy shocks to negative (positive) unemployment shocks. Kayacan and Birecikli (2020) estimate the Phillips curve using unobservable component models for the period of1998:Q1-2016:Q2. In their model, unobservable components are output gap and natural unemployment. They also employ state-space models and Kalman filters. They find that the Phillips curve is not valid for Turkey. Ozer (2020) estimates the Phillips curve by using the Fourier approach over the period 2006-2017. Their results state that the Phillips curve is valid in Turkey.

Unlike previous studies, our study estimates the structural unemployment rate over a more extended period and obtains the Beveridge curve for different sub-periods. Testing the results using different robustness checks also differentiates our study.

3.2. Estimation Model

As seen in Figure 5 below, for the 1987-2019 period that constitutes the analyzed period of this study, there is a visually negative relationship between inflation and unemployment, and this relationship refers to the existence of the Phillips curve at least in the short-run.

Figure 5: Unemployment – Inflation Relationship in Turkey (1987-2019)



Phillips curve, as accepted by Keynesian economists, takes the following form:

$$\pi_t = \alpha - \beta U_t \tag{6}$$

where π_t and U_t represent inflation and unemployment rates, respectively. Phillips curve in this form provides a tradeoff menu for policymakers. To reduce unemployment by increasing output, they can use demand management policies, but this can be achieved only with a cost of higher inflation. Friedman (1968) has criticized this specification of the concept because of ignoring inflationary expectations and proposed the following augmented form, including expectations:

$$\pi_t = -\beta(U_t - U^*) + \pi_t^e \tag{7}$$

The last equation shows that inflation has a negative relation with the deviation of actual unemployment from its natural rate level, and the Phillips curve shifts up or down with changes in expected inflation (π_t^e). According to Friedman, efforts to keep unemployment low at the expense of higher inflation only result in an increase in inflation expectations. For this reason, the economy cannot sustain low unemployment and is left with high inflation. Friedman acknowledges that inflation expectations are formed over time as a result of actual inflation in the past; that is, expectations are adaptively shaped. In the model developed on this subject, it is accepted that $\pi_t^e = \pi_{t+1}$. Thus inflation expectations are determined according to the previous period. In this case, inflation – unemployment relation takes the following form:

$$\Delta\pi_t = -\beta(U_t - U^*) \tag{8}$$

This equation is sometimes called the "*accelerationist Phillips curve*" because it shows that unemployment can only be kept low at the expense of increasing inflation (hence the accelerated price level). When applied to quarterly or monthly data, this approach is empirically defined by assuming that the inflation expectations are the weighted average of past inflation rates. This assumption produces the following inflation equation:

$$\pi_t = \alpha - \beta U_t + \sum_{i=1}^{N} \lambda_i \pi_{t-i} \tag{9}$$

The sum of weights (λ_i) in this equation is restricted to 1. This restriction indicates that inflation – unemployment relation can be expressed in terms of first differences with the following way:

$$\Delta\pi_t = \alpha - \beta U_t + \sum_{i=1}^{N-1} \vartheta_i \Delta\pi_{t-i} \tag{10}$$

This model allows us to obtain the NAIRU concept empirically. Since NAIRU is the unemployment rate that is compatible with a constant inflation rate, it will be obtained as:

$$\alpha - \beta U^* = 0 \Longrightarrow U^* = \frac{\alpha}{\beta} \tag{11}$$

This econometric version of the Phillips curve, in general, produces results appropriate to the data for most countries. In this context, it is possible to find various interpretations of the Phillips curve (see Robert, 1995 and 1997). One of these interpretations is the “triangle” inflation model, and the triangle mentioned refers to three factors that inflation depends on inertia, demand, and supply (Gordon, 1997). The general representation of the triangle Phillips curve model to be used in this study is as follows:

$$\pi_t = \alpha(L)\pi_{t-1} - \beta(L)(U_t - U_t^*) + \delta(L)X_t + \xi_t \tag{12}$$

In this model, inertia is represented by the past values of inflation. While the current and past values of the unemployment gap ($U - U^*$) are used as the proxy for excess demand, X_t represents the supply side factors that create inflationary pressure (like oil prices). This approach is usually preferred in order to the estimated time-varying NAIRU or the potential output. In this study, we will consider NAIRU as an unobservable stochastic process and use Kalman filtering methodology, which enables us to estimate the time-varying NAIRU and the Phillips curve simultaneously. This joint estimation procedure produces NAIRU values that perform best in the Phillips curve. Because of this advantage, a reduced form approach has been extensively used in the empirical economic literature (Greenslade et al., 2003). In order to capture dynamic homogeneity for the model, we treat the Phillips curve in the first difference form (Driver et al., 2003). Therefore, the model used in this study consists of the following two equations:

$$\Delta\pi_t = \alpha(L)\Delta\pi_{t-1} - \beta(L)(U_t - U_t^*) + \delta(L)\Delta X_t + \xi_t \tag{13}$$

$$U_t^* = U_{t-1}^* + \zeta_t \tag{14}$$

In this system of equations, (13) and (14) represent the signal and state equations, respectively. For the error terms (ξ_t and ζ_t) in the above equations system following traditional assumptions do hold:

$$\xi_t \sim N(0, \sigma_\xi^2)$$

$$\zeta_t \sim N\left(0, \sigma_\zeta^2\right)$$

$$Cov(\xi_t, \zeta_t) = 0$$

4. DATA AND ESTIMATION RESULTS

In the estimation of the model presented by equations (13) and (14), we will use the quarterly data for 1987 – 2019 period. While the inflation rate is represented by the percentage change in consumer price index (first differences of log levels), the unemployment rate is included in the model with seasonally and calendar effect adjusted unemployment rate series. These time series are compiled by the Turkish Statistical Institute and were obtained through its database. The percentage change rate in the import price index, which is used to represent supply shocks in the model, was compiled from the database of the Central Bank of the Republic of Turkey for the same period. The results obtained by estimating the above-specified state-space model are given in Table 1.

Table 1: Estimation Results of Phillips Curve Equation

Variable	*Coefficient*	*Standard Deviation*	*z-statistic*	*Probability*
$\Delta\pi_{t-1}$	0,608	0,152	3,993	0,000
$(U_t - U_t^*)$	-0,470	0,242	1,942	0,033
ΔZ_{t-1}	0,266	0,118	2,256	0,024
Final State				
SV1	0,131	0,009*	15,138	0,000
Logarithmic likelihood: -155,626				
(*) indicates Root Mean Squared Error value.				

The point that needs to be emphasized in the table regarding the results of estimation is that the coefficient of the AR (1) process is less than 1 in the final state estimate. This shows that the time-varying NAIRU, as it is expected, follows a stationary process. All coefficients in the Phillips curve equation have statistically significant and expected signs. The coefficient of unemployment gap indicates that a 1% reduction in the unemployment gap results in a 0.47% increase in inflation. The same coefficient was found to be -0.23 for the period 2006-2017 in Ozer(2020). The fact that the coefficient is negative and significant is important for the effectiveness of the estimation results. However, our findings differ from those of Kayacan and Birecikli (2000). The estimated equation confirms the importance of expectation management in reducing inflation while it supports the imported inflation hypothesis in Turkey.

The smoothed time-varying NAIRU values produced by the final state equation, together with ±2 RMSE bands, are presented in Figure 6. Figure 7 depicts the actual unemployment rates and the estimated time-varying NAIRU values. The most striking point in the time-varying NAIRU estimates is that the structural unemployment displayed a downward trend until the beginning of the 2000s, but this trend has been reversed since then. The general trend in the post-2000 period is the increase in structural unemployment, except for the decrease in the 2009 - 2012 period. It should be noted that this trend has accelerated in the period after 2013.

Figure 6: Time-Varying NAIRU in Turkey

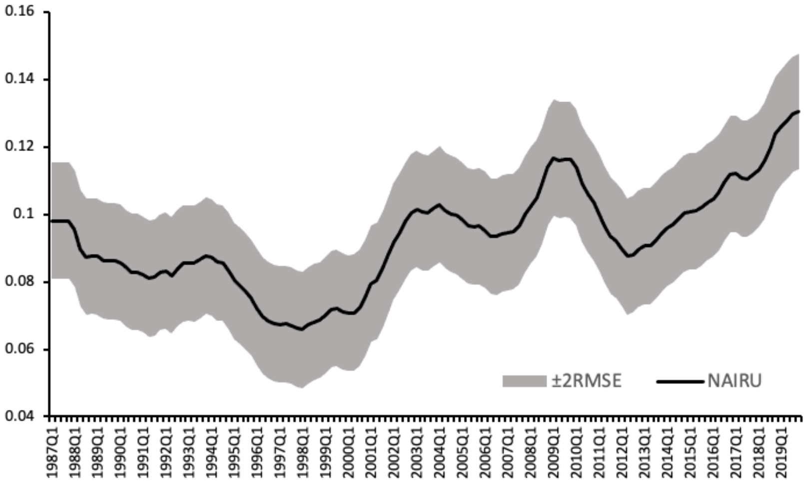


Figure 7: Actual Unemployment Rate and Time-Varying NAIRU

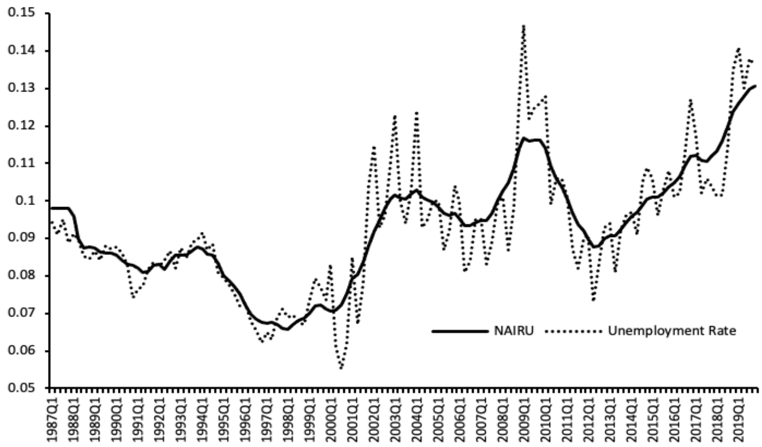


Figure 8: Path of Unemployment Gap in Turkey

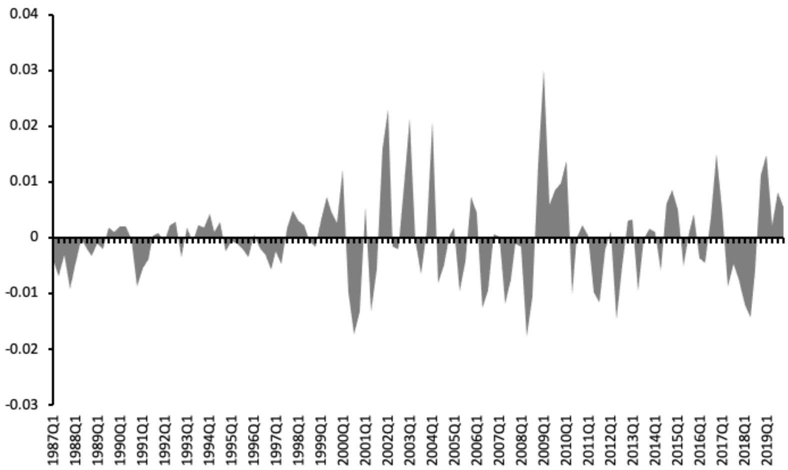


Table 2: Components of Quarterly Unemployment Rates in 2019

Observation	*Actual Unemployment Rate*	*Seasonal Component*	*Cyclical Component*	*Structural Component*
2019 Q1	0.1433	0.0023	0.0150	0.1260
2019 Q2	0.1372	0.0072	0.0022	0.1278
2019 Q3	0.1380	0.0000	0.0082	0.1298
2019 Q4	0.1410	0.0049	0.0055	0.1305

Estimates show that the structural unemployment rate has reached a quite high level in Turkey with a serious increasing trend recently. When we consider the forecasted figures for structural unemployment, we also conclude that the latest level of structural unemployment is very close to the actual unemployment rate. As an example, Table 2 gives the values of the actual unemployment rate decomposed into components for 2019. Unemployment gap figures shown in Figure 8 also confirms this conclusion. It is clearly observed from the figure that the unemployment gap due to cyclical unemployment has recently come to close and the actual unemployment has approached almost the equilibrium unemployment value. In other words, the recent high unemployment seems to reflect the equilibrium trend in the Turkish labor market. According to this result, the unemployment rate cannot decrease significantly without increasing inflationary pressures with an increased output in potential level.

5. ROBUSTNESS CHECK

Results indicating an unexpectedly high level of structural unemployment and almost closed unemployment gap are in need for verification. Therefore, it would be realistic to eliminate the question marks caused by these results by using some methods. For this purpose, we will test the consistency of our results using two methods. While the first of these methods is the Beveridge curve analysis that will enable us to question the recent increase in structural unemployment, the other is the Hodrick – Prescott filtering technique that will enable us to predict the unobservable long-term trend.

The Beveridge curve defines the inverse relationship between vacancies and unemployment. During the expansion periods of the economy, while the ratio of vacant jobs declines, the unemployment rate will be low. Therefore, while movements along the Beveridge curve show the effect of cyclical factors, shifts in the curve will reflect structural changes in the labor market. In other words, the movements observed along the Beveridge curve are considered to be the reflection of the cyclical movements observed in labor demand. In contrast, the upward or downward shift of the curve as a whole is more complicated in terms of interpretation. Shifting of the Beveridge curve generally accepted as the indication of a change in structural unemployment. For instance, an upward shift in the Beveridge curve indicates a reduction in matching efficiency and augmentation in structural unemployment. The factors behind the decline in matching efficiency include changes in institutional settings (Blanchard - Diamond, 1989; Klinger - Weber, 2016), un-matching the requirements of current jobs and abilities of unemployed people (Böheim, 2017) or locational difference between existing jobs and unemployed people (Wall - Zoega, 2002). Especially after the 2008/2009 recession in the world economy, an upward shift occurred in the Beveridge curve in many countries (Bonthuis et al., 2013) and many studies focused on the causes of this shift. For example, Barnichon - Figura (2010), Bouvet (2012) and Klinger - Weber (2016) develop decomposition methods for the Beveridge curve, allowing us to understand the unemployment dynamics and the factors behind them better.

Figure 9: Beveridge Curve in Turkey (1987-2019)

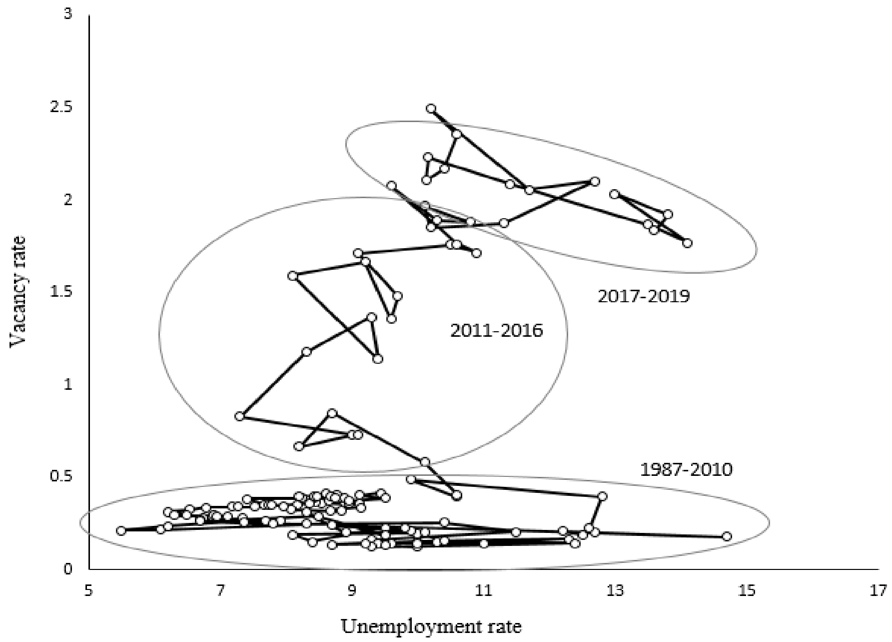


Figure 9 shows the Beveridge curve drawn by using the quarterly data for the 1987 – 2019 period in Turkey. It is possible to say that the Beveridge curve remained stable during the 1987-2010 period, where unemployment was mostly affected by cyclical factors. Whereas, it is seen that the curve shifted upwards in the 2011-2016 period and gained stability in this new location during the subsequent period. The curves obtained for the post-2010 period support the negative relationship that Uslu et al. (2019) found for 2005-2017. In other words, the structural unemployment rate has increased, and this increase has gained a permanent feature. This confirms the results obtained for the structural unemployment rate, which we represent with the time-varying NAIRU.

The second type of robustness check, will be realized through the Hodrick - Prescott filtering technique, which is used extensively in potential output and output gap estimates. This method, which is a purely statistical process and criticized for its high weight for the latest observations, is based on the decomposition of trend and cyclical components in time series (Hodrick - Prescott, 1997). The only parameter required to apply the optimal filter is the appropriate smoothing constant (λ). Hodrick - Prescott filter can be formulated with the following equation:

$$Min\left\{\sum_{t=1}^{T}(U_t - U_t^*)^2 + \lambda\sum_{t=2}^{T-1}[(U_{t+1}^* - U_t^*) - (U_t^* - U_{t-1}^*)]\right\}$$

In this formulation, as before, U represents seasonally adjusted actual unemployment rate, U^* shows the trend component of the unemployment rate, and λ is the smoothing parameter. If $\lambda = 0$, NAIRU equals the actual unemployment rate; if $\lambda \rightarrow \infty$, the trend is determined as a straight line. The recommended optimal λ value for quarterly data is 1600 (Gerlach - Yiu, 2004). In the light of these explanations, NAIRU values obtained with Hodrick - Prescott filter are given in Figure 10 together with the estimates obtained with Kalman Filter, and unemployment gap values obtained by using these forecasts are given in Figure 11.

Figure 10: NAIRU Estimates Obtained by Using Hodrick – Prescott Filter

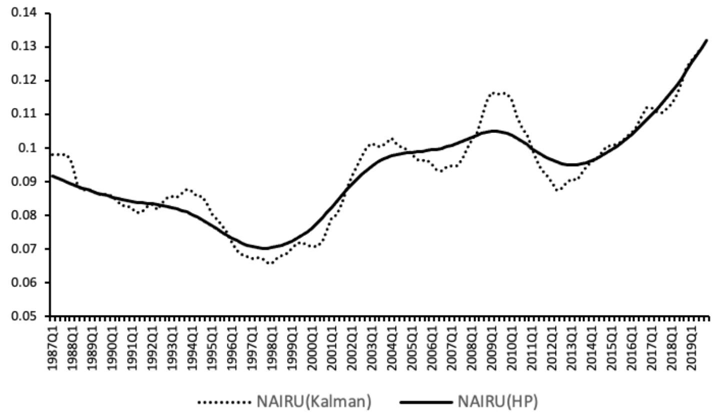
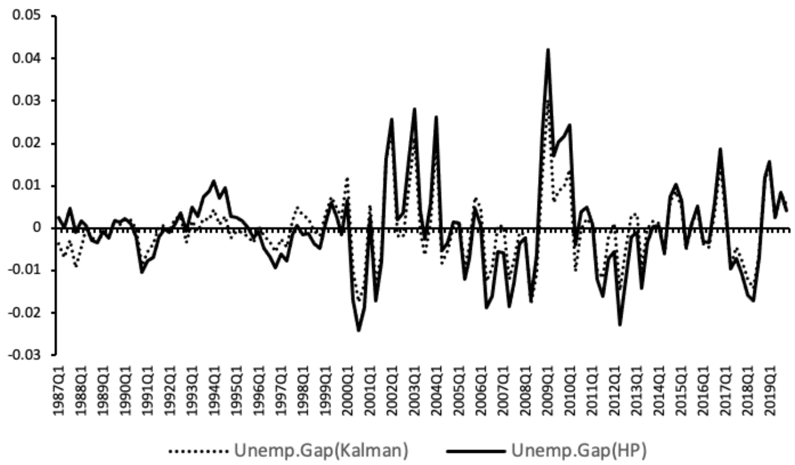


Figure 11: Unemployment Gap Estimates



NAIRU and unemployment gap values obtained with the Hodrick - Prescott filter largely coincide with the values obtained with the Kalman filter. Especially the fact that both methods produce very close values after 2011 verifies the break-in structural unemployment and confirms the shift in the Beveridge curve. Robustness check methods used in this study confirm the results obtained by the estimation of the state-space model: There was a stable structural unemployment rate in the 1987 – 2010 period in Turkey. However, in 2011, structural unemployment started to increase and has stabilized around 13% recently.

6. CONCLUSION

The principal aim of this study is to determine the path of structural unemployment in Turkey by decomposing trend and cyclical components of the seasonally adjusted the actual unemployment rate. The rationale behind the study is that struggling against structural unemployment requires some long-term reform policies, while cyclical unemployment can be reduced through demand management policies in the short-run. If we can determine how much of the current unemployment is structural, we can guide policymakers in tackling unemployment. In our study, the structural unemployment rate is considered as the unemployment rate that is compatible with the economic performance at the potential output level. Since this value means the unemployment rate independent of inflation, the nonaccelerating inflation rate of unemployment (NAIRU) becomes the appropriate criterion for this purpose. Since the NAIRU concept is derived from the Phillips curve, it changes depending on the effects of transitory shocks in the short-run. Therefore, it needs to be addressed in a context that varies over time. This measure is called as time-varying NAIRU.

Analyzing the course of the actual unemployment rate during the full period (1987 – 2019) that this study is interested in indicates that the change in the composition of labor supply during the last 15 years represents the most important structural change in Turkish labor markets. Increasing participation of women in the labor market since these years is one of the main reasons for this transformation. Other factors affecting this change include increased migration, informal employment, and the deterioration in the quality of education. This situation becomes more evident, especially after the 2008/2009 global recession. While the fluctuated economic growth rate throughout the analyzing period caused problems on the employment generation capacity of the economy, the structural fragility in the economy and the uncertainty that comes with it are determined as the factors behind the increase in unemployment.

Although it is an essential indicator for policy decisions regarding the labor market and the overall economy, structural unemployment is an unobservable variable and, therefore, it should be estimated. Despite the existence of a number of methods that can be used for this purpose, the generally preferred method is to estimate the reduced form equation by means of a multivariate filter. In this study, using the state-space model based on the Kalman filter, the seasonally adjusted actual unemployment rate is decomposed into the trend and cyclical components in order to obtain time-varying NAIRU and unemployment gap values. Structural unemployment rate figures obtained through the state-space model estimated by using reduced form accelerationist Phillips curve indicate the presence of a high and increasing structural unemployment problem in Turkey for the 1987 – 2019 period. Estimation results point out that structural unemployment in the country tended to increase in the post-2011 period and started to be close to the actual unemployment rate.

Estimating the level of structural unemployment exceeding expectations required a robustness check. The Beveridge curve, drawn for this purpose, shows that 1987 - 2010 unemployment rate fluctuations are mostly caused by cyclical unemployment and reveals an apparent upward shift in the relationship between vacancy rate and the unemployment rate in the 2011-2016 period. This confirms a significant increase in structural unemployment in Turkey during the mentioned period. On the other hand, as an alternative estimation method, NAIRU values obtained with Hodrick - Prescott filter produced results that substantially coincided with NAIRU values obtained with Kalman filter. The typical result of all three techniques is that the unemployment gap resulting from cyclical unemployment is close to approaching zero, and the actual unemployment rate is close to its equilibrium value. According to this result, the unemployment rate cannot decrease significantly without increasing inflationary pressures with an increasing output at the potential level.

REFERENCES

Aksoy, N., Felek, S., Yayla, N. and Cevis, İ. (2019) "The women employment in Turkey and factors effecting", Journal of Management and Economic Research, 17:146-163.

Alichi, A. (2015) "A new methodology for estimating the output gap in the United States", IMF, WP/15/144.

Alichi, A., Bizimana, O., Laxton, D., Tanyeri, K., Wang, H., Yao, J. and Zhang, F. (2017) "Multivariate filter estimation of potential output for the United States", IMF, WP/17/106.

Ayhan, F. (2019) "An application for the variables determining unemployment in Turkish economy", International Journal of Economic and Administrative Studies, 2019 (25):235-252.

Ball, L. and Mankiw, G. (2002) "The NAIRU in theory and practice", Journal of Economic Perspectives, 16(4): 115-136.

Barnichon, R. and Figura, A. (2010) "What drives movements in the unemployment rate? Decomposition of the Beveridge curve", Federal Reserve Board, Discussion Paper 2010-48.

Blanchard, O and Diamond, P. (1989) "The Beveridge curve", Brookings Papers on Economic Activity. 1(3): 1-76.

Blanchard, O. (2018) "Should we reject the natural rate hypothesis?", Journal of Economic Perspectives, 32(1): 97-120.

Bonthuis, B., Jarvis, B. and Vanhasa, J. (2013) "What's going on behind the Euro area Beveridge curve(s)?",European Central Bank, WP-1586.

Borio, C., Disyatat, P. and Juselius, M. (2014) "A parsimonious approach to incorporating economic information in measures of potential output", BIS, WP44.

Bouvet, F. (2012) "The Beveridge curve in Europe: New evidence using national and regional data", Applied Economics, 44(27): 3585-3604.

Böheim, R. (2017) "The labor market in Austria: 2000-2016", IZA World of Labor, 408(12): 1-10.

Darvas, Z. and Simon, A. (2015) "Filling the gap: Open economy considerations for more reliable potential output estimates", Bruegel Working Paper Series, 2015/11.

Driver, R., Greenslade, J. and Pierse, R. (2003) "The role of expectations in estimates of the NAIRU in the United States and the United Kingdom", Bank of England, WP180.

Durbin J. and Koopman, J. (2012) "Time series analysis by state space methods", Oxford University Press, London.

Ebeke, C. and Everaert. G. (2014) "Unemployment and structural unemployment in the Baltics", IMF, WP/14/153.

Estrella, A. and Mishkin, F. (1999) "Rethinking the role of NAIRU in monetary policy: Implications of model formulation and uncertainty", In Monetary Policy Rules, NBER, New York: 405-436.

Friedman, M. (1968) "The role of monetary policy", American Economic Review, 58(1): 1-17.

Fronckova, K., Prazak, P. and Soukal, I. (2019) "Review of Kalman filter employment in the NAIRU estimation", Systems, 7(1): 1-19.

Gerlach, S. and Yiu, S. (2004) "Estimating output gaps in Asia: A cross-country study", Journal of Japanese and International Economies, 8(1): 115-136.

Gianella, C., Koske, I., Rusticelli, E. and Chatal, O. (2008) "What drives the NAIRU? Evidence from a panel of OECD countries", OECD, WP649.

Gordon, R. (1997) "The time-varying NAIRU and its implications for economic policy. Journal of Economic Perspectives", 11(1): 11-32.

Greenslade, J., Pierse, R. and Saleheen, J. (2003) "A Kalman filter approach to estimating the UK NAIRU", Bank of England, WP179.

Guichard, S. and Rusticelli, E. (2011). "Reassessing the NAIRUs after the crisis", OECD, WP918.

Hodrick, R. and Prescott, C. (1997) "Postwar US business cycles: An empirical investigation", Journal of Money Credit and Banking, 29(1): 1-16.

IMF (2013) "World Economic Outlook: Hopes, Realities, Risks", Washington

Kalman, R. (1960) "A new approach to linear filtering and prediction problems", Journal of Basic Engineering, 82(1): 35-45.

Kalman, R. and Bucy, R. (1961) "New results in linear filtering and prediction theory", Journal of Basic Engineering, 83(1): 95-108.

Klinger, S. and Weber, E. (2016) "Decomposing Beveridge curve Dynamics by correlated unobserved components", Oxford Bulletin of Economics and Statistics, 78(6): 877-894.

Kuttner, K. (1994) "Estimating potential output as a latent variable", Journal of Economics and Business Statistics, 12(3): 361-368.

Laubach, T. (2001) "Measuring the NAIRU: Evidence from seven economies", Review of Economics and Statistics, 83(2): 218-231.

Melolinna, M.; Toth, M. (2016) "Output gaps, inflation and financial cycles in the United Kingdom", Bank of England, WP585.

Modigliani, F. and Papademos, L. (1975) "Targets for monetary policy in the coming year", Brooking Papers on Economic Activity, (1): 141-163.

Orlandi, F. (2012) "Structural unemployment and its determinants in the EU countries", European Economy Economic Papers, 455.

Ozer, M.O. (2020) "Analysis of the long-term relationship between inflation and unemployment rates in Turkey: Fourier approach to Phillips curve", Pamukkale University Journal of Social Science Institute, 39: 179-192.

Phelps, S. (1967) "Phillips curves, expectations of inflation and optimal unemployment over time", Economica, 34(135): 254-281.

Pissarides, C. (2000) "Equilibrium Unemployment Theory", MIT Press, Cambridge.

Richardson, P., Boone, L., Giorno, C., Meacci, M., Rae, D. and Turner, D. (2000) "The concept, policy use and measurement of structural unemployment: Estimating time varying NAIRU across 21OECD countries", OECD, WP250.

Rummel, O. (2015) "Estimating the output gap for Kenya: A practical guide to some state-space and Kalman filter trend-cycle decompositions", Bank of England, Centre for Central Banking Studies.

Turner, D., Boone, L., Giorno, C., Meacci, M., Rae, D. and Richardson, P.(2001) "Estimating the structural rate of unemployment for the OECD countries", OECD, WP33.

Us, V. (2014) "Estimating NAIRU for the Turkish economy using extended Kalman filter approach", Central Bank Review, 14(3): 63-94.

Uslu, H. (2020) "Jobless economic growth: An econometric analysis for Turkey in the framework of Okun law", Optimum Journal of Economics and Management Sciences, 7(1): 101-126.

Uslu, N.C., Karahan-Dursun, P. and Cer, S. (2019) "An empirical analysis on the validity of the Beveridge curve for Turkey", Aksaray Universitesi IIBF Dergisi, 11(1): 43-52.

Wall, H. and Zoega, G. (1997) "The British Beveridge curve: A tale of ten regions", FRB St. Louis, WP2001-007B.