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RESEARCH ARTICLE

Phillips Curve Analysis in D8 Countries

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Abstract

Today, unemployment is an important problem for almost all countries and is one of the major problems affecting countries economically. The purpose of this study is put forward the relationship between unemployment and inflation in D8 (Turkey, Iran, Pakistan, Bangladesh, Malaysia, Indonesia, Egypt, Nigeria) countries within the framework of the Phillips Curve Theory. For this purpose, unemployment and inflation data of the study covers the period between 1996 and 2020. In this study, dynamic panel data regression analysis was used. As a result of the study, statistically significant and negative results were determined in the lagged values of the dependent variable and the lagged values of the unemployment rate. Thus, the existence of a negative relationship between inflation and unemployment has been revealed and Phillips curve hypothesis confirm the statistically significant results.

Keywords: *D8, Unemployment, Inflation, Dynamic Panel Data Analysis, Phillips Curve*
Jel Codes: *E31, J64, C33*

D8 Ülkelerinde Phillips Eğrisi Analizi

Özet

Günümüzde işsizlik, neredeyse tüm ülkeler için önemli bir sorundur ve ekonomik yönden ülkeleri etkileyen büyük problemlerin başında gelir. Bu çalışmanın amacı, D8 (Türkiye, İran, Pakistan, Bangladeş, Malezya, Endonezya, Mısır, Nijerya) ülkelerinde işsizlik ve enflasyon arasındaki ilişkiyi Phillips Eğrisi Kuramı çerçevesinde ortaya koymaktır. Bu amaç doğrultusunda, çalışmanın işsizlik ve enflasyon verileri 1996-2020 dönemini kapsamaktadır. Çalışmada, dinamik panel veri regresyon analizi kullanılmıştır. Çalışma sonucunda, bağımlı değişkenin gecikmeli değerleri ve işsizlik oranının gecikmeli değerlerinde istatistiki olarak anlamlı ve negatif sonuçlar tespit edilmiştir. Böylece, enflasyon ve işsizlik arasında negatif ilişkinin varlığı ortaya konmuştur ve Phillips eğrisi hipotezini doğrular nitelikte istatistiki olarak anlamlı sonuçlar elde edilmiştir.

Anahtar kelimeler: *D8, İşsizlik, Enflasyon, Dinamik Panel Veri Analizi, Phillips Eğrisi*
Jel Kodu: *E31, J64, C33*

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1. INTRODUCTION

Even in developing, underdeveloped and even developed countries, economics is faced with the challenge of finding a solution for unemployment. For this reason, many countries are working to provide more employment by combating unemployment. Thus, individuals who are unemployed, who cannot find a job despite their willingness to work and accept the wages offered, contribute positively to the country's employment by contributing to production.

Unemployment should not be considered only on a country-by-country basis, as it is an important issue that is effective all over the world and has led to many macroeconomic efforts to reduce it. Radical development of social, cultural and economies of countries is aimed by controlling unemployment and the ultimate aim is the growth of the countries. Although there have been many studies in this direction, unemployment has not been controlled to the desired level and a stable policy has not been pursued. The reason for this is that, since unemployment is an important item for enterprises, the increase in costs paid to workers affects wages and causes inflation, thus creating a relationship between inflation and unemployment. The study expressing this relationship was carried out by A.W. Phillips.

In this problem between inflation and unemployment, Phillips Curve, which provides a basis for the studies focused on finding a solution to this important economic problem, is also widely accepted and shows the negative relationship between unemployment and inflation put forward by AW Phillips (Friedman, 1977: 455).

In line with this information, the analysis of the Phillips curve in the literature has been the subject of many academic studies recently. Studies for the world economies have become increasingly important and their number has increased. The studies were tested with economic analysis by making use of economic foundations.

This study aims to investigate the inflation and unemployment dynamics and the Phillips curve in detail, summarize the development of the Phillips curve and the studies in the literature, examine the econometric structure of the approach with a sample model, and estimate the Phillips curve with the help of the appropriate regression model. In addition, tests will be mentioned during the model determination stage and the appropriate model that best represents the data will be used. For this purpose, unemployment and inflation data of the D8 countries (Turkey, Iran, Pakistan, Bangladesh, Malaysia, Indonesia, Egypt, Nigeria) for the years between 1996 and 2020 were taken into consideration. In the established model, the data of these countries were empirically analysed by the system GMM, which is a dynamic panel data analysis method.

This study is expected to contribute to the literature in the context of D8 countries in terms of proving the existence of the Phillips curve theory in D8 countries as a result of the analyses performed and it is important as it can eliminate the gap in this area. Although there are many theoretical and empirical studies examining the Phillips curve in the literature, it is thought that the studies on the Phillips curve of the D8 countries are insufficient in the literature and therefore this study may contribute to the literature. In this context, it will be possible to reduce the deficiencies in the literature in D8 countries by shedding light on the implementation of policies on the basis of the relation between inflation and unemployment.

2. CONCEPTUAL FRAMEWORK

The definition of inflation, in general terms, is the continuous increase in prices of goods and services. Of course, the prices of goods and services can change over time and the important thing here is continuity. After a certain period of time, the continuous increase in prices affects goods and services as well as wages and hence salaries. However, if price increases in goods and services are higher than

salaries, purchasing power decreases at this point. In this case, individuals buy much less goods and services with the money they have (CBRT, 2013: 2).

Leaving the background of the inflation definition makes it seem quite simple. In order to evaluate the increase in prices as inflation, it must have levels that will have an impact on the economy and this should not be a one-off phenomenon. Although there are various criteria, they can be defined as inflation when they are generally reflected to all prices (Frisch, 1989: 1).

Unemployment rate is the main indicator of the economy as it is a dynamic guiding policy that can be proposed for labor markets. In this context, it is of great importance to evaluate correctly in order to reflect the whole economy impartially (Yüceol, 2005: 119).

Unemployment rate is the proportional expression of the unemployed population in the total labor force and therefore, the more intensive use of capital compared to labor causes the unemployment rate to increase further (Demir and Bakıcı, 2005: 476-486).

Unemployment have affected the economic structure negatively for almost a century and is a fact that cannot be eliminated despite the measures taken. It is a phenomenon that affects every area of society. The emergence of this phenomenon dates back to the period when labor is used for production (Kumaş, 2001: 10).

In Turkey, State Statistical Institute (SIS) data are considered as official unemployment figures. The State Institute of Statistics defines labor force as the sum of the employed and the unemployed, while the working-age population is the sum of those not included in the labor force and labor force (SIS, 1999: 11).

The International Labor Organization (ILO) makes an international comparison according to the criteria defined by the National Statistical Office to determine unemployment. Unemployment criteria defined by the International Labor Organization are not far from the general framework and include individuals who have the ability to do business and who are willing to work but cannot find a job (Sorrentino, 2000: 4).

Apart from the general definitions of unemployment, individuals are not only materially affected, but they also prevent growth in countries' national welfare. The most obvious example of this is seen in third world countries which provide the infrastructure for the formation of complex structure with unbalanced population growth. Unemployment rates even higher than the unemployment rates experienced in the 1930 recession occur in these countries (İyidiker, 1987: 9).

It can be said that unemployment and employment problems are generally seen in developing countries and this is of course compatible with rapid population growth. In this context, social and economic employment problems also occur (Kılıç, 1999: 101).

The phenomenon of unemployment, which has continued to the present day, has an important place in most of the Asian countries. Although the employment problems brought by unemployment vary according to countries, it is a general problem. Therefore, unemployment is a phenomenon that needs to be examined in more detail for some developing countries in this region (Ekin, 1968: 201).

As far as Asian countries are concerned, unemployment is at very high levels in almost all of them. Unemployment rates are high in each group, regardless of many criteria such as education levels, population growth and age groups. In addition to these, due to the periodic stagnation of agricultural activities, which constitute a large share of the labor force, the labor force resulting from underemployment has a great place in the economy (Ekin, 1968: 208).

Factors such as illiteracy rate, insufficient importance given to education, inexperience in professional life and economic dependence on the family have a significant share in increasing unemployment in developing and underdeveloped countries as well as unemployment stemming

from agricultural activities. The presence of these factors in individuals makes it difficult for them to get started in business life (Gürtan, 2011: 31).

The relationship between inflation and unemployment is a going controversial debate since the past. In the studies conducted by Hume, Thornton and Mill, it is seen that price change takes place as the relationship between unemployment and production level but remains in theory. In 1926, I. Fisher made his first statistical study on the relationship between price and unemployment with US data and as a result of the study, he determined the change in employment with strong causality relationship. In 1936, Tinbergen analysed the relationship between wage inflation and unemployment in the first econometric study and revealed the existence of the direct causal relationship. In the following years AJ Brown participated in this series of studies with a pioneering study in the statistical distribution diagram category. In this study, unemployment and wages were discussed. Although there are many studies on the relationship between wage inflation and unemployment, the Phillips curve is complementary in revealing this relationship (Büyükakın, 2008: 134-136).

AW Phillips explains the relationship between unemployment and inflation and makes an important contribution to the solution of the problems in the economy. The Phillips Curve illustrates the existence of a negative relationship between unemployment and inflation, but also explains the total supply and aggregate demand curves and the employment-price relationship (Friedman, 1977: 455).

The emergence of the Phillips curve is the result of a study by Phillips for the British economy in 1958. It originally refers to the negative relationship between the change in monetary wages and the unemployment rate. In this structure, which expresses the relationship between the demand for goods and services and supply, if the demand is higher than the supply, there is an increase in prices and decrease in prices if it is vice versa. In addition, since unemployment rate is high and labour demand is inadequate, wages will decrease, so employees will be reluctant to work at that wage level over time. Of course, the linear relationship between unemployment and wages is unlikely. Other factors affecting wages are the unemployment rate and the rate of change in retail prices, which have an important place in daily life (Phillips, 1958: 283).

Many studies have been carried out before Phillips' study, but what makes Phillips's article original is not a nonlinear and inverse relationship. The important point here is that it reveals that this inverse and non-linear relationship between wages and unemployment rate is stable (Frisch, 1977: 1290).

While there is a negative relationship between the short-term Phillips curve, unemployment rate and inflation rate in general terms, there is no such relationship between these variables in the long run. The source of this is the lack of inflation expectations in the Phillips curve. (Lightning and Karaman, 2003: 340).

After the original aspect of the Phillips curve was revealed, studies on this subject continued. In the late 1960s, Phelps (1967) introduced the adaptive expectations hypothesis to inflation expectations by introducing the Phillips curve strengthened by expectations by Friedman (1968). In their independent studies, they criticized the original Phillips curve. One of the criticisms is the Phillips curve approach, based on the view that employment is shaped by real wages and expected inflation, has the assumption that nominal wages in the labour market. A further criticism is that the Phillips curve assumption cannot be valid in the long run (Friedman, 1977: 457).

As the adaptive expectations hypothesis in the process formed with the expectations, economic units make their expectations according to the past figures, there may be expectations errors and therefore the evaluation of the expectations will result in economic inconsistency. In this context, in order to eliminate inconsistency, it would be appropriate to add the rules of rational behaviour to the stage of the formation of expectations (Maddock and Carter, 1982: 41).

3. LITERATURE

There are many domestic and foreign studies on the Phillips Curve. The objectives, scope and results of some of these studies are summarized below.

İyidiker (1987) in his article titled Unemployment Problem in Developing Countries and Turkey, report a study defending that employment-based policies could be helpful in achieving economic development and in the analysis of widespread unemployment phenomenon in developing countries, especially in many countries.

In his study Karabulut (2007) points out many reasons for unemployment problem in Turkey such as high population growth rate but insufficient quality of the workforce, inability to realize desired level of capital accumulation and investment, political and economic instability, skilled labor needs posed by the competitive environment. In this study, determination of the mentioned problems and possible solutions are discussed.

In terms of Malaysia, Tang and Lean conducted a study on the Phillips curve in 2007 to determine whether the trade-off presence of the Phillips curve was stable. In the study, which examined both the short-term and long-term Phillips curve exchanges with the data between 1970-2005, a stable trade-off presence was obtained between unemployment rate and inflation.

Eser and Terzi (2008) in their study seek a solution to the current unemployment problem in Turkey within the framework of the European Employment Strategy implemented within the EU and examine policy proposals to increase employment in Turkey. Results of the study indicated that unemployment rate in Turkey is 10% and that there was a reduction in labor force participation rate year on year growth; because of these reasons growth was also adversely affected. It has been determined that the efforts to adapt to the European Employment Strategy and to improve the existing problems are carried out within the scope of İŞKUR. It was determined that after the preparation of the European Situation Report and its acceptance by the European Commission, the harmonization studies have been carried out in three stages: the preparation and signing of the Joint Evaluation Document and as a final step the drafting of the National Reform Program. Labor force policies are put forward with the most obvious aspects.

In their study, Munir and Furuoka (2009) used panel data analysis method to analyze the relationship between inflation and unemployment in five countries including Malaysia, Singapore, Indonesia, Thailand and the Philippines. According to the findings obtained from Phillips' study, which constituted a macroeconomic basis, the study concluded that there is no relationship between inflation and unemployment in these countries.

Bayraktar and Agenor (2010) examined the Phillips curve for eight middle-income countries. In the study including Chile, Colombia, Korea, Malaysia, Mexico, Morocco, Tunisia and Turkey, using two-step GMM technique a variety of models depending on the time delay has been used. Nested and non-nested tests were used to select specifications for each country and predictive capacity and stabilization were analyzed. As a result of this study, retroactive behaviors have a great effect on inflation dynamics except for Colombia and Korea. While world oil prices and relative input prices remain limited, borrowing costs are important for Korea and Mexico.

In 2010, Prayer and Gaur conducted a study on the Phillips curve on developed and developing Asian countries. Countries in this study include Japan, Hong Kong, Singapore, Korea, Philippines, Thailand, China and India and inflation determination is made within the framework of Phillips curve. Data for the 1990-2005 period were used and it was stated that the output gap was extremely important in explaining the inflation rate for almost all countries. However, the difference between developed and developing countries is that the shocks related to agricultural supply in developing countries are

more prominent. The finding that prospective Phillips curve for all of these countries is a better fit than the backward Phillips curve was also pointed out in the results of the study.

In a literature review study Kesici (2010), focuses on the effects of Turkey's high growth phase after the 2001 crisis on employment growth and unemployment. In the study, the level and composition of national income and the indicators of the labor market in the period between 2002 and 2007 are under the spotlight. The main objective is to present the results such as the increase in the unemployment rate in the labor market during the high growth phase and the limited increase in employment by making use of the relevant studies in the literature.

In another study, Topçu (2010) examined the relationship between unemployment and inflation in G8 countries using data from G8 countries for the period between 1993:1-2009:4 and Granger causality test in this study. As a result of the study, the existence of a bi-directional causality relationship in G8 countries was obtained, thus reaching the conclusion that unemployment is the cause of inflation and inflation is the cause of unemployment.

In their study, Altay et al. (2011) examined the years 2000-2010. Their study aimed to analyze the relationship between unemployment and inflation for the G8, which is composed of the eight most developed countries in the world in terms of economy and industry. As a result of the study, it was found that the causality relation in the short term is from inflation to unemployment. In the long run, causality relation was found to be from unemployment to inflation.

Dökmen and Aysu (2011) tested the relationship between growth of the state and unemployment rates, using the data between 1990 and 2007, by panel cointegration analysis for 17 OECD member countries. It is concluded that there is a statistical relationship between the load of the public and unemployment.

Razzaqi and Sherbaz (2011) include the study of the relationship between economic growth and energy on D8 countries. VAR Granger Causality, Johansen Cointegration and EVCM analyzes were used in the study and it was aimed to reveal the existence of short and long term correlation between economic growth and energy use in all D8 countries. As a result of this study, one-way or two-way causality relationship was obtained both in long term and short term in all D8 countries except Indonesia which could not establish causality in the short term.

In a study conducted in six Asia Pacific countries, Rülke (2012) discussed Phillips curve and Okun's Law in his study. The study, which includes Australia, Japan, Hong Kong, New Zealand, South Korea, and Taiwan, indicated that the results of Okun's law and Phillips curve estimates, different estimation lines, work cycle asymmetries, and time varying coefficients were very robust, considering the macroeconomic variables. As a result of this study, the confidence in macroeconomic variables is more evident in the 2007-2009 economic crisis and in long-term forecasts.

In Ay's (2012) study, it was intended to reveal to reveal the cause of the unemployment problem in Turkey, examine the policies applied for the issue and resolve what would be more appropriate employment policies to address the problem of unemployment. as a result of this study, the employment policies implemented found to be mostly inadequate in reducing unemployment.

Lee and Strazicich (2003) and Im et al. (2005, 2010) were used and structural breakage unit root tests were used in Özcan's (2013) study, which he examined the unemployment hysteria hypothesis, and as a result, it was found that unemployment series for most OECD countries point to hysteria.

In Nahidi and Badri (2014) study, which focused on unemployment and foreign direct investment in D8 countries, the aim was to analyze the relationship between unemployment and foreign direct investment in 6 countries of the D8 countries using panel data covering the period 2002-2010. As a result, direct foreign capital has a significant positive impact on unemployment. At the same time, it

was concluded that gross capital formation had a positive effect and unemployment had a negative effect on unemployment in the countries.

Taş and Bilen (2014), in their studies which addressed the unemployment problem, a prominent problem in the economic and social fields of young people, firstly tried to reveal the reasons of youth unemployment. In this direction, the practices of education policies and active employment policies towards youth were examined.

In their study Eryigit et al. (2015) 2013 examined and tested the relation between economic growth and unemployment in Turkey and the European Union countries, which have reached up to 28 members with Crotia's membership, for the period 2001-2011. In the analysis panel unit root tests, panel co-integration tests were used. In addition, Hausman Test was applied by establishing error correction model between unemployment and economic growth and it was seen that long term parameters were non-homogeneous, long and short term relationships were estimated with the Pooled Average Group Estimator (PMGE). Long-term relationship between unemployment and economic growth variables was tested with Westerlund Panel Co-integration Test and the results of the analysis showed that there was a long term cointegration relationship between the variables.

Turel's (2015) study, which aims to investigate the reasons of employment and unemployment, which is a major problem in Turkey and to make effective solution offers to minimize the problem of unemployment by increasing employment in the future in Turkey's economy, focused on private sector employees. As a result of the study, it was found that although the opinions of the employees about the causes of unemployment vary in demographic aspects such as gender and the sector in which they work, they do not differ in issues such as age, working time and education level. It is concluded that the solutions that can be effective in minimizing unemployment vary according to the demographic characteristics of the employees.

In the study of Keten (2017), the researchers tried to determine the effect of the relationship between unemployment and inflation on G8 countries and the existence of the effect of unemployment on inflation rate by Panel Unit Root Tests, Co-integration and Causality tests. According to the test results, it is concluded that there is a one-way relationship from inflation to unemployment.

4. DATA AND METHOD

The study includes D8, which means that eight developing countries Turkey, Iran, Pakistan, Bangladesh, Malaysia, Indonesia, Egypt, Nigeria covers.

Eight Islamic Developing Countries (Developing Eight, D-8) is a global organization rather than a regional one. Integration efforts between countries that are not based on a certain geographical basis and located in different and distant regions are defined as non-regional integration movements. D-8 can be given as an example of non-regional cooperation since it is an organization of which countries from different geographies are members as well as geographically bordering countries (Türkan and Alakuştekin, 2017: 138).

The study was carried out using inflation and unemployment data for these countries in the period 1996-2020. The figures of variables, inflation and unemployment, were taken from the database available at https://data.worldbank.org and https://developing8.org.

In this study, dynamic panel data analysis method was used.

Panel data is by definition a data set obtained as a result of combining different periods and different observations, more fundamentally, it is the combination of horizontal cross-section and time series (Davidson and MacKinnon, 1999: 296).

Panel data models are examined under two main headings as dynamic panel data model and static panel data model. The most important difference between dynamic panel data models and static

panel data models is the use of lagged variables within the model. Static panel data models do not include lagged variables, whereas dynamic panel data models can also include the lagged values of the dependent variable in the model in explaining the dependent variable (Yerdelen Tatoğlu, 2012: 65).

Dynamic panel measures how the dependent variable of the previous period affects the dependent variable of the current period based on the data model (Zeren & Ergun, 2010: 76).

Only time series or only section series cannot be used to measure micro-dynamic and macro-dynamic effects because they often do not provide exact estimates of dynamic coefficients. For this reason, dynamic panel data analysis is used to predict micro-dynamic and macro-dynamic effects (Hsiao, 2003: 5).

Although there are independent variables and lagged values of variables among the factors affecting a dependent variable, models that can also include lagged values of independent variables are called dynamic models (Ugur, 2009: 99).

Dynamic panel data models are functionally expressed as follows (Baltagi, 2005: 135):

$$Y_{it} = dY_{i,t-1}X'_{it}\beta + u_{it} \quad (1)$$

i = 1, …… .., N t = 1, ……., T and $u_{it} = y_{it}+u_i$

The term i located in the function u_i indicates that the unit is constant over the entire time and Y_{it} and also $Y_{i,t-1}$This unit is defined as a function of the effect. Located to the right of the model $Y_{i,t-1}$ and error term u_i have correlations (Baltagi, 2005: 135). Due to this correlation, OLS estimates are biased and consistent. (Zeren and Ergun, 2010: 7).

In this study, the relationship between inflation and unemployment is analyzed by using cross-sectional data within a specific time dimension and by using the process of inflation rate over time and Dynamic Panel Data Analysis method. In this process, including the lagged values of the inflation rate as an independent variable has led to the formation of the Autoregressive Dynamic Panel structure. In the econometric studies using such dynamic panel data analysis, Arellano and Bond's Generalized Moments Estimator is used as GMM estimator (Güngör, Yerdelen, 2015).

The GMM method is a widely used method in dynamic panel data studies since it is easy to implement and also can be applied with simple assumptions about vehicle variables. GMM has two basic approaches in the implementation phase. These are the difference GMM approach and the system GMM approaches. The difference GMM approach was developed by Arellano and Bond (1991). The structure in the content includes the first differences of the variables in the model in order to prevent errors that may arise from the basic structure of the model, and also the lagged value of the independent variable as instrumental variable, enabling the establishment of the model variable (Dökmen, 2012; Demirel, 2014).

The system GMM approach was developed as a result of studies by Arellano and Bover (1995) and Blundell and Bond (1998). The system GMM method, which is based on combining difference approach and level approach, has more effective results in terms of having less deviation and more effective results than difference GMM method. In addition to these characteristics, the fact that it has more effective results than the GMM approach in case the number of countries is small is one of its important features (Çetin and Seker, 2014; Dökmen, 2012). Due to these advantages, the system GMM method was applied in the study and the results are summarized in tables.

There are three important tests to test GMM estimators. The first one is Wald Chi, which tests the significance of the variables used in the model as a whole.2nd Test. The second step is the Sargan test, which tests whether the variables used in the model are valid or not, or in other words if there

is excessive determination constrain in the panel estimation. Finally, it is the Arellano-Bond (AB) test that helps us to test the autocorrelation problem of the model (Dökmen, 2012: 48).

The Wald test applied in the model takes the model as a whole and shows its general significance. The hypothesis H_0 founded for Wald test is as follows: the model is not significant. The validity of the vehicle variables in the model is tested with Sargan test and H_0 its hypothesis is that the tool variables used in the model are valid. AR (1) and AR (2) tests are used to test autocorrelation in the model. The H_0hypothesis established for AR (1) test is that there is autocorrelation in the model, but the hypothesis established for the AR (2) test. H_0 is that there is no autocorrelation in the model (Demirel, 2014: 80).

In the panel data, it is very likely that the series will be affected by shocks and in this case, it is of great importance that unit root tests are performed because consistent results cannot be obtained (Nazlıoğlu, 2010: 4).

Among the unit root tests commonly used are Levin, Lin and Chu (2002), Harris and Choi (2001), Maddala and Wu (1999), Tzavalis (1999), and Im, Pesaran and Shin (2003) (Eviews User Guide 2, 2014: 484).

Levin, Lin, Chu's (2002) test gave more robust results compared to horizontal root unit test because it is effective with small samples and it tests individual unit root tests against the alternative hypothesis to test the presence of limited strength and uses a model as follows (Baltagi, 2005: 240; Çetin and Ecevit, 2010).

$$\Delta y_{it} = p y_{i,t-1} + \sum_{L=1}^{p_i} \theta_{iL} \Delta y_{it-L} + a_{mi} d_{mt} + \varepsilon_{it} \quad (2)$$

$m = 1,2,3$. In the model d_{mt} is the deterministic variables vector, and a_{mi} expresses the coefficients vector. The zero hypothesis for the hypothesis established in the model is p_i=0, the alternative hypothesis is p_i<0 (Baltagi, 2005: 240; Cetin and Ecevit, 2010).

Im, Pesaran and Shin (IPS) unit root test tests unit root for each horizontal section separately and it is a testing process considering the heterogeneous coefficient between the panels depending on the average of individual unit root tests (Baltagi and Kao, 2000; Baltagi, 2005; İnal). (2009). Im, Pesaran and Shin (IPS) unit root test uses a model as follows:

$$\Delta y_{it} = \mu_i + \beta_i y_{i,t-1} + \sum_{k=1}^{p_i} \theta_{i,k} \Delta y_{i,t-k} + y_i t + \varepsilon_{it} \quad (3)$$

The model includes both trendy and constant effects, and i's can continue from 1 to N and t can take values from 1 to T. The hypothesis to be established in the model is $\beta_i = 0$, the alternative hypothesis is $\beta_i < 0$. If the null hypothesis is rejected, it means that the series is stationary (Baltagi, 2005: 240; Çetin and Ecevit, 2010).

Since the variables and data are quite high in panel data unit root tests, it has more accurate results than the one-way unit root tests used in statistics (Mercan & Karakaya, 2015: 587).

5. MODEL AND FINDINGS

In 1958, Phillips created the PC (Phillips Curve) equation in his work which sheds light on many of the current researches. He analysed the effect of the change in unemployment rate on the change in monetary wages during this process. In this study, inflation in wages is considered as the dependent variable and unemployment rates as the independent variable. The model Phillips used in his study is as follows: (Topçu, 2010: 208).

$$INF = \beta_1 + \beta_2 U + e \quad (4)$$

In this study, for D8 countries, Phillips' model was chosen for D8 countries and the model formed the theoretical basis of the study. Variables in the model are described as follows:

Table 1: Definitions of variables

VARIABLES	DEFINITION
INF	Inflation rate
U	Unemployment rate
β_1	Fixed term
β_2	Coefficient
e	Error term

First of all, unit root tests were performed to determine the stationary levels of the variables. Thus, the variables used in the stationary state in the model to be established will cause the autocorrelation problem to disappear.

Eviews 9 package program was used for the study and Im, Pesaran, and Augmented Dickey-Fuller and Phillip-Perron methods were used for the stability testing of the data set. After testing the stability of the series, according to the unit root test results, it was determined that inflation and unemployment figures are integrated at I (1) level. The results are shown in Table.

Table 2: Unit root test results

TEST NAME	VARIABLE	STATIONARY LEVEL	P VALUE	NUMBER OF SECTIONS	NUMBER OF OBSERVATIONS
IM-Pesaran and Shin W-stat	ΔINF	I(1)	0.0000	8	176
	ΔU	I(1)	0.0000	8	176
Fisher Chi-square - ADF	ΔINF	I(1)	0.0000	8	176
	ΔU	I(1)	0.0000	8	176
Fisher Chi-square - PP	ΔINF	I(1)	0.0000	8	176
	ΔU	I(1)	0.0000	8	176

Dynamic panel data analysis was applied to analyze the relationship between the unit root tests and the variables determined to be stationarity and the results are shown in Table 3. According to the findings, an inverse relationship was found between inflation and unemployment figures for D8 countries and results confirming the Phillips curve theory were found.

Table 3: Dynamics panel regression analysis results of D8 countries

The dependent variable: INF Observation period : 1996-2020				
Variable	Coefficient	Standard Error	t-Statistic	P Value
ΔINF(-1)	-0.120039	0.054787	-2.191016	0.0300
ΔINF(-2)	-0.194681	0.066203	-2.940673	0.0038
ΔU(-2)	-2.592939	0.475331	-5.455022	0.0000
Wald Chi2(2) : 8.647555 (0.0038)		Sargan Chi2(6) : 3.292712 (0.1927)		
AR(1) : -2.011497 (0.0443)		AR(2) : -0.085364 (0.9320)		

In the model, Wald test, Sargan test and Arello and Bond test were applied to test the consistency of GMM estimators. The model is tested with the Wald test, which tests the significance of the model as a whole. With a strong significance level of 0.0038, the model was found to have holistic significance, meaning that the variables can remain within the model. In other words, the Wald test tests whether the independent variables are significant in explaining the dependent variables. Thus, significant results confirming the negative slope Phillips curve was found.

According to the Sargan test which tests the validity and internality problem of the tool variables used in the model, there is no internality problem in the model, that is, the tool variables are external. Accordingly, it was concluded that the error term was not correlated with independent variables. Finally, the autocorrelation problem of the model was tested by Arellano and Bond's autocorrelation test. Accordingly, AR (1) and AR (2) test statistics were used to test the first and second condition autocorrelation. As expected, AR (1) test was significant and AR (2) test was insignificant. Therefore, the presence of first-order autocorrelation was considered natural due to the nature of the model, whereas no second-order autocorrelation was found. Diagnostic tests of the model tell us that the model findings are interpretable.

When the relationship between inflation and unemployment of the D8 countries in Table 3 is examined, it is observed that there is a negative and statistically significant relationship between the two lagged values at -0.120039 and -0.194681 coefficient rates. In the model, the two lagged values of the unemployment rate are negatively and statistically significant with the coefficient -2.592939. The findings are consistent with the literature and expectations. The fact that the unemployment rate coefficient is strong has an informative importance in terms of job opportunities and development levels of countries. In this study conducted on developing countries, the fact that there is a strong coefficient relationship between unemployment and inflation indicates that countries have improved in terms of job opportunities.

6. CONCLUSION

On his study on the UK economy in 1958, AW Phillips (1958) demonstrated the inverse and at the same time stable relationship between the rate of change in monetary wages and the unemployment rate, and illuminated many academic fields by providing foundation for studies since then. Phillips' work is very important for this study because of the fact that it is a guide to reveal the opposite relationship between inflation and unemployment.

As in the past, today inflation and unemployment remain as a serious macroeconomic problem for both developed and developing countries. As a result of these reasons, the production potential in the countries prepares the basis for many structural problems such as national income, unemployment, loss of wealth, foreign trade and taxes. For this reason, the study aims to minimize the problems of developing countries by emphasizing the importance of applying correct policies in most areas of the economy by providing guidance to economic politicians in the future.

For all purposes, inflation and unemployment figures covering the period 1996-2020 were used to obtain the Phillips curve for the D8 countries. Panel analysis method was used to obtain more powerful results from the data. Stability of all series was analysed and it was found that they were stationary at I (1) level. In the next stage, stationary series were subjected to regression analysis and their results are shown in tables.

The results obtained from the dynamic panel regression analysis revealed the existence of a negative relationship between inflation and unemployment and the results confirming the Phillips curve theory were obtained. In this context, the results aimed at the study have been obtained and it is of great importance that improvement results are obtained with appropriate policies will be implemented in the fight against unemployment in D8 countries.

In this context, since the rate of population growth and insufficiency of available resources pave the way for the unemployment problem in general, the creation of new investment areas may be among the steps to reduce unemployment for the D8 countries, but resource utilization can be made more efficient by making population planning even if it does not have sufficient efficiency in reducing unemployment. As a major step in reducing unemployment, for developing countries such as D8 accelerating industrialization is a step that will lead to economic stability, reduction of unemployment and the revival of the economy in all of the D8 countries. With the acceleration of industrialization and new developments in agricultural field, it is basically a step towards the emergence of job opportunities. An increase in agricultural projects such as irrigation and infrastructure projects, new schools, hospitals, etc. will create employment areas for more people. For these reasons, it provides a positive support to economic development, and at the same time, the policies which are proposed to ensure stability within the framework of developing countries are very important as it will make significant developments such as increase in national income and growth of the economy.

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