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TÜRKİYE'DE PHILLIPS EĞRİSİNİ YENİDEN DÜŞÜNMEK: FREKANS ALANINDAN YENİ KANITLAR[1] [2]

RETHINKING THE PHILLIPS CURVE IN TÜRKİYE: NEW EVIDENCE FROM THE FREQUENCY DOMAIN

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Öz

Bu çalışma, tüm dünyada uzun bir aranın ardından yeniden gündeme gelen enflasyon oranı ile işsizlik oranı arasındaki kısa ve uzun dönemli ilişkiyi Türkiye ekonomisi için araştırmayı amaçlamaktadır. Bu amaç doğrultusunda, iki değişken arasındaki ilişki, 2005:01-2023:03 dönemine ait aylık bazda verilerle, frekans alanında nedensellik testi aracılığıyla analiz edilmiştir. Testin simetrik bulguları, işsizlikten enflasyona doğru tek yönlü ve kısa dönemli bir nedensellik ilişkisinin varlığına işaret etmektedir. Testin asimetrik bulguları ise iki önemli kanıt sağlamıştır. Bunlardan ilki, işsizliğin pozitif bileşeninden enflasyonun negatif bileşenine doğru tek yönlü ve uzun dönemli bir nedensellik ilişkisinin varlığıdır. İkincisi ise işsizliğin negatif bileşeninden enflasyonun pozitif bileşenine doğru tek yönlü ve kısa ve uzun dönemli bir nedensellik ilişkisinin varlığıdır. Bu bulgular, Phillips eğrisinin öngördüğü ödünleşimi doğrulamaktadır. Politika yapıcılar için enflasyon ve işsizlik sorunlarıyla mücadele ederlerken, makul bir enflasyona razı olmak kadar, işgücü piyasasında yapısal ve kurumsal reformlar yaparak verimliliği artırmaya çalışmak da önemlidir.

Anahtar Kelimeler: Enflasyon, İşsizlik, Phillips Eğrisi, Frekans Alanında Simetrik ve Asimetrik Nedensellik

JEL Sınıflaması: E31, E24, C29.

Abstract

This study aims to investigate the short- and long-run relationship between the inflation rate, which has come to the fore after a long break all over the world, and the unemployment rate for the Turkish economy. For this purpose, the relationship between the two variables is analyzed using a causality test in the frequency domain, with monthly data for the period 2005:01-2023:03. The symmetric findings of the test indicate the existence of a unidirectional and short-run causal relationship from unemployment to inflation. The asymmetric findings of the test provide two important pieces of evidence. The first of these is the existence of a unidirectional and long-run causal relationship from the positive component of unemployment to the negative component of inflation. The second is the existence of a unidirectional, short- and long-run causal relationship from the negative component of unemployment to the positive component of inflation. These findings confirm the trade-off predicted by the Phillips Curve. It is also important for policymakers to try to increase productivity by making structural and institutional reforms in the labor market, as far as settling for a moderate inflation rate while struggling with inflation and unemployment problems.

Keywords: Inflation, Unemployment, Phillips Curve, Symmetric and Asymmetric Causality in the Frequency Domain.

JEL Classification: E31, E24, C29.

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1. Introduction

The relationship between inflation and unemployment is at the heart of macroeconomics. However, there is no theoretical or empirical consensus regarding this relationship. The theoretical background of the relationship between these macroeconomic variables is explained by the Phillips curve (Buthelezi, 2023). This relationship, named after A. W. Phillips, initially represented the inverse relationship between the change in wages and the unemployment rate for the years 1861-1913. Accordingly, as the unemployment rate increases, the rate of increase in wages decreases. Then, Samuelson and Solow (1960) transformed the Phillips curve into an economic policy analysis tool and used the inflation rate instead of wages in their studies. The main idea of their study is that economic policymakers have to choose between different unemployment rates and price stability. In the other studies following their study, the new form of the Phillips curve showing the relationship between inflation and unemployment has begun to be used. M. Friedman and E. Phelps, who distinguished between short and long periods by using this new form and added a new dimension to the Phillips curve discussions, developed the natural unemployment rate hypothesis. According to this hypothesis, which draws on adaptive expectations, there is a short-run trade-off between the unpredictable part of the inflation rate and the deviation of the unemployment rate from its natural rate. This type of relationship can also be used by economic policy. According to the rational expectations idea that followed the previous idea, the view that there is no systematic relationship between inflation and unemployment becomes dominant (Yıldırım, 2019; pp.425-436). More recently, studies such as Akerlof et al. (2000) and Palley (2003) have brought up a completely different form of the Phillips curve. It is argued that this new Phillips curve is a twisted curve that initially has a negative slope, then has a positive slope, and eventually becomes vertical. The logic of this perspective is explained by the fact that inflation accelerates the relative wage and price adjustment in sectors where there is unemployment. Thus, inflation allows the labor market to "grease its wheels". If inflation exceeds a threshold level in a sector, the unemployed cause the real wage resistance to pull downward and a backward bend occurs (Bildirici & Ozaksoy Sonustun, 2018).

There are many studies (Kuştepeli, 2005; Petek and Aysu, 2016; Karahan and Çağlarırmak Uslu, 2018; Yıldız, 2021) that empirically discuss the relationships between inflation and unemployment and the Phillips curve for Türkiye. However, the inflation rate in Türkiye, which started to increase rapidly, especially after 2020, and ranked first among European countries, become a source of motivation to re-investigate the relationship in question. In this context, the study aims to investigate the relationships between inflation and unemployment. Symmetric and asymmetric causality tests in the frequency domain are used for this to allow the detection of short- and long-term relationships between variables. Thanks to these new methods to be used to investigate the existence of the Phillips curve in Türkiye, the study is expected to contribute to the literature.

The rest of the paper is organized as follows: Section 2 includes a summary of the empirical literature on the Phillips Curve. Then, Section 3 defines the data and econometric methodology used in the analysis. Subsequently, Section 4 evaluates the findings obtained from the analysis. Finally, Section 5 finalizes by including the implications and policy recommendations obtained from the findings of the study.

2. Literature Review

Studies examining the relationships between inflation and unemployment are quite diverse, and there are no fully agreed-upon findings in the empirical sense, just as in the theoretical sense. While studies such as Furuoka (2007), Zaman et al. (2011), Dritsaki and Dritsaki (2013), Bhattarai (2016), Vermeulen (2017), Güçlü and Ozaksoy Sonustun (2018), Karahan and Çağlarırmak Uslu (2018), Bokhari (2020) and Naqibullah et al. (2020) conclude that the evidence regarding the Phillips curve is valid only in the long term; Ho and Njindan Iyke (2018), Sahnoun and Abdennadher (2019) and Qin (2020) present evidence that the relationship in question is valid in both the long and short term. In contrast, Umaru et al. (2013), Petek and Aysu (2016), and Yıldız (2021) state that there is no relationship between inflation and unemployment in the short or long term.

Table 1. Literature Summary

Author(s)	Countries	Models	Results
Kuştepeli (2005)	Türkiye	OLS	There is no evidence of a Phillips curve.
Furuoka (2007)	Malaysia	VECM	There is a long-term causal relationship between unemployment and the inflation rate. Findings support the existence of the Phillips curve.
Zaman et al. (2011)	Pakistan	VECM	There is a long-term relationship between unemployment and the inflation rate. Findings support the existence of the Phillips curve.

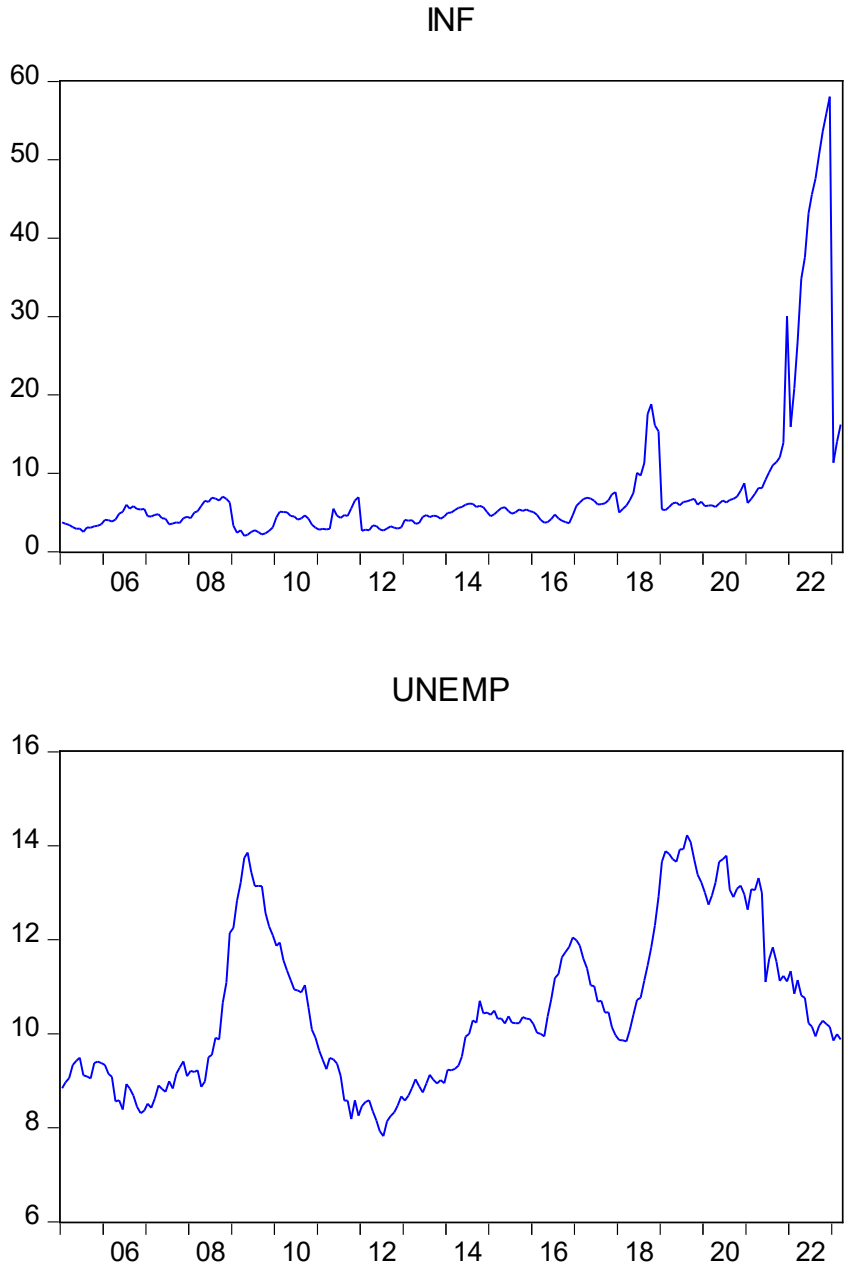
Dritsaki and Dritsaki (2013)	Greece	VAR	There is a long-term causal relationship between inflation and unemployment. Inflation shocks cause first a decrease and then a slight increase in unemployment shocks.
Umaru et al. (2013)	Nigeria	OLS, Granger Causality and Co-integration	There is no relationship between unemployment and inflation.
Bhattarai (2016)	OECD countries	Panel Data Analysis	There is a long-term relationship between unemployment and the inflation rate.
Petek and Aysu (2016)	Türkiye	Granger Causality and Co-integration	There is no causal relationship between unemployment and inflation.
Vermeulen (2017)	South Africa	VECM	There is a long-term negative relationship between unemployment and inflation.
Bildirici and Ozaksoy Sonustun (2018)	Japan, France, Türkiye, USA	NARDL	There is a long-term negative relationship between unemployment and inflation.
Ho and Njindan Iyke (2018)	Euro area	PMG and Threshold Regression	There is evidence for the existence of the Phillips curve in the short and long run.
Karahan and Çağlarırmak Uslu (2018)	Türkiye	ARDL	In the long run, the effect of unemployment on inflation is negative. The impact of unemployment on inflation has increased with the implementation of the inflation-targeting regime.
Abu (2019)	Nigeria	OLS, FMOLS, DOLS, CCR, ARDL	There is a trade-off between unemployment and inflation. Higher unemployment leads to lower inflation in the long run. There is unidirectional causality from inflation to unemployment.
Sahnoun and Abdennadher (2019)	North African countries	VECM	There is a unidirectional causality from inflation to unemployment in the short and long term.
Sasongko et al. (2019)	Indonesia	Panel Causality	There is a unidirectional causality from inflation to unemployment. The trade-off between inflation and unemployment is short-term.
Sasongko and Huruta (2019)	Indonesia	VAR	There is a unidirectional causality from unemployment to inflation.
Wulandari et al. (2019)	Indonesia	VECM	The inflation rate is affected by unemployment shocks. There is a unidirectional causality from unemployment to inflation.
Bokhari (2020)	Saudi Arabia	VECM	There is a long-term co-integration between inflation and unemployment. There is a negative causality from unemployment to inflation. There is no trade-off in the short term.
Korkmaz and Abdullazade (2020)	G6 countries	Panel Causality	There is a unidirectional causality from inflation to unemployment.
Naqibullah et al. (2020)	Malesia	ARDL	There is a long-term negative causality from unemployment to inflation. There is no relationship in the short term.
Qin (2020)	USA	VAR	Unemployment shocks have a significant impact on inflation. The Phillips curve is valid in the short and long run.
Yıldız (2021)	Türkiye	Fourier Co-integration	There is no co-integration or causality relationship between inflation and unemployment. The Phillips curve is not valid in Türkiye.
Buthelezi (2023)	South Africa	Markov Switching Regression	The relationship between inflation and unemployment is non-linear. Inflation affects unemployment differently in different periods of unemployment.

Table 1 contains information such as country/country group, method, and findings regarding some studies that deal with the relationship between inflation and unemployment, and therefore the Phillips curve in a sense.

3. Data and Methodology

In this section of the study, the connection between inflation and unemployment in Türkiye is tested with monthly data for the period 2005:01-2023:03. Data on inflation (INF) and unemployment (UNEMP) were obtained from the Turkish Statistical Institute (TURKSTAT). Figure 1 shows time series graphs of logarithmic and seasonally adjusted variables. The inflation rate, which has followed a stable trend for many years, has experienced a significant increase after 2016, especially after 2018 and 2021. On the other hand, the unemployment rate, which reached its peak during the 2009 Global Financial Crisis, peaked again in 2019, but then it gradually decreased.

Figure 1. Time Series Graphs for Inflation and Unemployment



This study investigates the relationship between inflation and unemployment using the frequency domain causality test. This test was developed by Breitung and Candelon (2006) and is a Granger (1969) causality-based test. The difference between the test from the causality tests in a time domain is that it allows to detection short, medium, and long-term relationships between variables separately. The study also tests asymmetric causality in the

frequency domain by applying the negative and positive components procedure suggested by Hatemi-J (2012), as in some recent studies (Ranjbar et al., 2017; Saliminezhad & Bahramian, 2020; Perez-Montiel & Manera, 2021). Therefore, the relationship between the variables is tested both symmetrically and asymmetrically. To do this, first of all, a vector autoregressive (VAR) model with the optimal lag length determined by the information criteria is created separately for symmetric and asymmetric models. Asymmetric models, unlike symmetric models, examine the relationships between positive and negative components of variables. Then, the spectral density function specified by Breitung and Candelon (2006) is combined with the causality measure defined by Geweke (1982) and Hosoya (1991) and expressed as follows:

$$M_{y_t \to x_t}(\omega) = log\left[1 + \frac{|\Psi_{12}(e^{-i\omega})|^2}{|\Psi_{11}(e^{-i\omega})|^2}\right] \qquad (1)$$

If $\Psi_{12}(e^{-i\omega}) = 0$ in Equation 1, the measurement will be equal to zero. In this case, it is concluded that y_t at frequency ω is not the Granger cause of x_t. To test Granger causality at a particular frequency ω, the causality measure at that frequency is compared with the critical value of the two-degree-of-freedom Chi-square distribution. A significant probability value at a frequency of 0.5 and 2.5 indicates the existence of long-term and short-term causality, respectively.

4. Results

Before testing causality in the frequency domain, the stationarity levels of the series are investigated to determine the maximum lag length (d_{max}). For this purpose, the study uses traditional unit root tests such as Augmented Dickey-Fuller (ADF) developed by Said and Dickey (1984), Phillips-Perron (PP) developed by Phillips and Perron (1988), and structural breakpoint unit root test developed by Perron and Vogelsang (1992) and Perron (1997). The findings of the tests indicate that both the level values and the negative and positive components of the variables are I(1), that is, difference stationary. Following these findings, appropriate VAR models are determined according to the Schwarz information criterion and finally, the causality is tested in the frequency domain.

Table 2. Symmetric Causality Test Findings in the Frequency Domain

	Long term (*ω=0,5*)		**Short term (*ω=2,5*)**		**VAR(p+d_{max})**
H_0	**Test Stat.**	**Prob.**	**Test Stat.**	**Prob.**	
INF↛UNEMP	0.7989	(0.6706)	0.9123	(0.6336)	4
UNEMP↛INF	4.4616	(0.1074)	6.1341*	(0.0465)	

* represents significance at the 5% level.

Table 2 shows the findings of the symmetric causality test in the frequency domain. According to the findings of this test, there is no causality from inflation to unemployment in the short or long term. However, there is a significant unidirectional causality from unemployment to inflation at the 5% level in the short term. That is, the inflation rate is affected by the unemployment rate in the short term.

Table 3. Symmetric Causality Test Findings in the Frequency Domain

	Long term (*ω=0,5*)		**Short term (*ω=2,5*)**		**VAR(p+d_{max})**
H_0	**Test Stat.**	**Prob.**	**Test Stat.**	**Prob.**	
INF^+↛$UNEMP^+$	0.8883	(0.6413)	0.0329	(0.9836)	4
$UNEMP^+$↛INF^+	1.1537	(0.5616)	2.6629	(0.2640)	
INF^-↛$UNEMP^+$	0.1651	(0.9207)	0.4536	(0.7970)	4
$UNEMP^+$↛INF^-	10.619*	(0.0049)	4.8099	(0.0902)	
INF^+↛$UNEMP^-$	4.5607	(0.1022)	1.9225	(0.3824)	8
$UNEMP^-$↛INF^+	12.154*	(0.0022)	10.516*	(0.0052)	
INF^-↛$UNEMP^-$	3.5144	(0.1725)	1.0341	(0.5962)	4
$UNEMP^-$↛INF^-	2.5652	(0.2773)	1.2102	(0.5460)	

* represents significance at the 5% level.

Table 3 presents the findings of the asymmetric causality test in the frequency domain. Although there are eight findings between different components of the variables, there are two significant findings. The first of these is the unidirectional and long-term causal relationship from the positive component of the unemployment rate to the negative component of the inflation rate. The second is a unidirectional causal relationship in both the short and long term, from the negative component of the unemployment rate to the positive component of the inflation rate. The first of these findings means that increases in the unemployment rate (decreases in employment) reduce

inflation in the long run. The second one indicates that decreases in the unemployment rate (increases in employment) increase the inflation rate in both the short and long term.

The most important result pointed out by the symmetric and asymmetric findings is the confirmation of the Phillips curve, which represents the trade-off between inflation and unemployment, in the short and long term. In this respect, the study is similar to the findings of studies such as Furuoka (2007), Zaman et al. (2011), Bildirici and Ozaksoy Sonustun (2018), Ho and Njindan Iyke (2018), Sasongko and Huruta (2019) and Qin (2020). Therefore, despite studies such as Kuştepeli (2005), Petek and Aysu (2016) and Yıldız (2021) with contrary findings, the findings of this study are not a surprise. The relationships between inflation and unemployment are not always clear-cut because many other factors also play a role in the economy. So, the relationship between such macroeconomic indicators may vary over time and space.

5. Conclusion

This study aims to re-investigate the connections between inflation and the unemployment rate for the Turkish economy by using monthly data for the period 2005:01-2023:03. In this study, which tests the validity of the Phillips curve in a sense, short- and long-term relationships between variables are examined with symmetric and asymmetric causality tests in the frequency domain. The findings of the symmetric test indicate the existence of a short-term and unidirectional causality from unemployment to inflation. The findings of the asymmetric test provide evidence of the existence of a unidirectional causality from the positive component of the unemployment rate to the negative component of inflation in the long term, and from the negative component of the unemployment rate to the positive component of inflation in both the short and long term. The findings confirm the Phillips curve, which emphasizes the inverse relationship between inflation and unemployment, in the short and long term. However, this relationship is only unidirectional. In other words, increases in the unemployment rate reduce inflation and decreases in the unemployment rate increase inflation. Accordingly, a high unemployment rate can reduce inflation through the demand channel by reducing consumption expenditures and restricting wage increases through the pressure it creates in the labor market. In addition, in case of high unemployment, financial instability may occur as the ability of individuals and companies to pay their debts will decrease. Therefore, this situation could also lead to a recession in the economy as a whole. The opposite is also true. That is to say, a low unemployment rate can trigger an increase in inflation by providing an increase in aggregate demand. However, neither high unemployment nor price instability are desirable. Therefore, policymakers who want to control inflation should not ignore this trade-off between unemployment and inflation. However, especially considering what has happened in the Turkish economy in recent years, it can be seen that the increase in inflation is not only due to the decrease in unemployment rates. Therefore, it is necessary to consider the effects of many factors that trigger inflation, such as companies' balance sheets, global events, and policy preferences. Future studies can conduct analyses that separate the effects of unemployment and other driving forces of inflation on inflation, especially in recent years.

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