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Exploring Inflation Dynamics with the Phillips Curve in Türkiye: Evidence from the Markov Regime Switching Model

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ABSTRACT

Unlike in many advanced and emerging market economies, inflation was already a problem for the Turkish economy before the COVID-19 pandemic. During the 1990s, Türkiye experienced severe inflation, which reached three digits in some months. Although inflation was reduced to single digits in the 2000s through a successful disinflation program under an implicit inflation targeting framework with a flexible exchange rate regime, price stability became a problem again after the global financial crisis. Inflation gradually increased during the 2010s and became out of control after late 2021. This study aims to explore inflation dynamics in Türkiye using the Phillips curve framework for different inflation environments. To this end, the Phillips curve equation, augmented with the exchange rate and oil prices, is estimated using the Markov regime switching model between January 2006 and September 2023. Two regimes are identified in the sample, namely low- and high-inflation regimes. According to the estimation results, the Phillips curve is invalid in both regimes. The unemployment gap is statistically insignificant despite its negative impact on current inflation. The increasing coefficient of backward inflation in the high regime reflects the resurgent indexation behavior, which was dominant before inflation targeting was introduced in Türkiye. The positive impact of oil prices is only statistically significant in the low regime. While an increase in the exchange rate significantly raises inflation in both regimes, the effect is greater in the high-inflation regime. These empirical findings indicate that the primary issues for controlling inflation in Türkiye are inflation inertia and exchange rate stability.

Keywords: *Inflation, Markov regime switching model, Monetary policy, the Phillips curve, Türkiye*

Türkiye'de Enflasyon Dinamiklerinin Phillips Eğrisi ile İncelenmesi: Markov Rejim Değişim Modelinden Kanıtlar

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ÖZ

Birçok gelişmiş ve yükselen piyasa ekonomisinin aksine enflasyon, Türkiye ekonomisi için COVID-19 pandemisi öncesinde de bir problemdi. Türkiye, 1990'lı yıllarda bazı aylarda üç haneli rakamlara ulaşan şiddetli bir enflasyon yaşadı. 2000'li yıllarda esnek döviz kuru ve örtük enflasyon hedeflemesi çerçevesinde başarılı bir dezenflasyon programı ile enflasyon tek haneli rakamlara düşürülmüş olsa da küresel finansal kriz sonrası dönemde fiyat istikrarı yeniden bir sorun haline geldi. Enflasyon 2010'lu yıllarda giderek arttı ve 2021'in sonlarında kontrolden çıktı. Bu çalışma, Phillips eğrisi çerçevesini kullanarak Türkiye'deki enflasyon dinamiklerini farklı enflasyon ortamları için incelemeyi amaçlamaktadır. Bu doğrultuda, döviz kuru ve petrol fiyatları ile genişletilmiş Phillips eğrisi denklemi, Ocak 2006 ve Eylül 2023 arası dönem için Markov rejim değişim modeli ile tahmin edilmiştir. Örneklemde düşük ve yüksek enflasyon rejimleri olmak üzere iki rejim tanımlanmıştır. Tahmin sonuçlarına göre, Phillips eğrisi her iki rejimde de geçersizdir. İşsizlik açığı, cari enflasyon üzerindeki negatif etkisine karşın istatistiksel olarak anlamsızdır. Geriye dönük enflasyon katsayısının yüksek rejimde artması, Türkiye'de enflasyon hedeflemesi öncesi dönemde hakim olan endeksleme davranışının yeniden canlandığını yansıtmaktadır. Petrol fiyatlarının olumlu etkisi yalnızca düşük rejimde istatiksel olarak anlamlıdır. Döviz kurundaki artış her iki rejimde de enflasyonu anlamlı biçimde arttırırken yüksek enflasyon rejimindeki etkisi daha büyüktür. Bu ampirik bulgular, Türkiye'de enflasyonun kontrol altına alınmasında öncelikli konuların enflasyon ataleti ve döviz kuru istikrarı olduğuna işaret etmektedir

Anahtar Kelimeler: *Enflasyon, Markov rejim değişim modeli, Para politikası, Phillips eğrisi, Türkiye*

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Introduction

During the 2010s, a low inflation environment prevailed in almost every economy; inflation dropped even in countries apparently unaffected by the global financial crisis (GFC) (Jordà & Nechio, 2020). The average global inflation was 2.1% between 2010 and 2020 (Binici *et al*., 2022: 3). Inflation consistently below the targets, especially in advanced economies, sparked a debate as to whether the Phillips curve (PC) is a reliable guide for central banks (Dorn, 2020; Jordà & Nechio, 2023). Many studies showed that the inflation-increasing effect of falling unemployment was reduced, particularly during low inflation periods, while the PC flattened (Stock & Watson, 2020; Costain *et al*., 2022; Forbes *et al*., 2022; Jørgensen & Lansing, 2023). However, the COVID-19 pandemic completely changed the picture. Inflation soared due to expansionary policies to recover from sluggish aggregate demand during the pandemic. Further, the impact of the Russia-Ukraine war on commodity prices made inflation control more challenging. In August 2022, global inflation increased to 7.5% (Binici *et al*., 2022: 3), while OECD inflation reached 10.7% in October 2022 (OECD, 2024). Thus, inflation once again came to the top of the agenda for the world economy.

Unlike in many advanced and emerging market economies, inflation was already a problem for the Turkish economy before the COVID-19 pandemic. During the 1990s, Türkiye experienced severe inflation, which reached three digits in some months. Fiscal dominance, a fragile banking sector, and political instabilities resulted in price stability not being the primary focus of the Central Bank of the Republic of Türkiye (CBRT) (Çufadar, 2023: 84). After the 2001 crisis, inflation was reduced to single digits in the 2000s through a successful disinflation program under an implicit inflation targeting (IT) framework with a flexible exchange rate regime. Between 2006 and 2010, when full-fledged IT was implemented, a price stability-oriented monetary policy was continued, and the gains of the implicit IT regime were preserved (Gülşen & Kara, 2021: 185).

In the post-GFC period, however, Türkiye gradually lost control of inflation. In particular, expectation formations were damaged after the CBRT adopted a complex monetary policy framework in late 2010 in response to accumulating macro-financial risks due to accelerating capital inflows. Furthermore, political pressures resulted in a monetary policy that was looser than required for price and exchange rate stability (Gürkaynak *et al*., 2015; Gürkaynak *et al*., 2023a). In August 2018, the Turkish economy was exposed to a currency shock, and the Turkish Lira (TL) depreciated by over 30% while increasing uncertainties and rising inflation expectations due to sharply rising exchange rates led to inflation exceeding 25% in October 2018 (İlhan *et al*., 2023: 165). Interest rate hikes and sluggish demand conditions only temporarily moderated inflation and exchange rates (Ulug *et al*., 2023: 2864).

In the second half of 2019, declining inflation due to the base effect and modest capital inflows created room for interest rate cuts, and the CBRT seized this opportunity (Orhangazi & Yeldan, 2023: 177). The policy rate was reduced gradually from 24% to 8.25% between July 2019 and May 2020 (CBRT, 2024b). During this period, the CBRT used its reserves intensively to keep the exchange rate under control in a low-interest rate environment (Orhangazi & Yeldan, 2023: 177). After August 2020, however, the credit boom to alleviate the effects of COVID-19 created upward pressures on inflation and exchange rates (Çufadar, 2023: 89). The CBRT managed inflation and exchange rates for almost one more year, thanks to the return to a tight monetary policy in November 2020 (Ulug *et al*., 2023: 2865).

September 2021 was a turning point for the Turkish economy. The CBRT started interest rate cuts and reduced the policy rate by 500 bp until December 2021. Inflation and exchange rates were utterly out of control, with TL depreciating by around 50% against the US dollar in three months. About 20% in September 2021, inflation jumped to 36% by the last month of the year (Gürkaynak *et al*., 2023b: 34-36).

During 2022 and the first half of 2023, the CBRT continued its loose monetary stance. During this period, inflation rose steadily until October 2022, peaking at 85.51% before the base effect support (CBRT, 2024a). In June 2023, the CBRT changed its mindset to an orthodox and price stability-oriented monetary policy. Accordingly, it raised the policy rate gradually from 8.5% in June to 42.5% by the end of the year (CBRT, 2024b). However, inflation increased by 23% in just the third quarter of 2023 due to the depreciation of TL, tax increases, wage adjustments, and rising global energy prices (CBRT, 2023: 1). As of January 2024, inflation is still a primary problem for the Turkish economy.

Forbes *et al*. (2021) point out that the PC simplifies many complex relationships, but with some modifications, its linear version can help understand high inflation dynamics, like in the pandemic. Similarly, this study adopts the PC approach to investigate the inflation dynamics in the Turkish economy with the Markov regime switching (MS) model. More specifically, an augmented PC equation is estimated by the Markov regime-switching intercept autoregressive heteroscedasticity (MSIAH) model from 2006:01 to 2023:09. While several studies have analyzed inflation drivers in Türkiye with different models, methods, and samples, few have used the regime switching methods (Önder, 2009; Çatık & Önder, 2011), which allows the analysis of inflation drivers for different inflation regimes. Furthermore, this study presents fresh evidence for understanding inflation dynamics by covering the pandemic period and the CBRT's monetary policy practices, which were incompatible with the Taylor principle (Gürkaynak *et al*., 2023b).

The paper is organized as follows. The next section provides theoretical explanations of the PC and a review of empirical studies on inflation dynamics based on the PC equation in Türkiye. The subsequent section explains the data and methodology. The empirical findings section reports the MS estimation findings, discusses them in relation to the literature, and presents the results of the robustness checks of alternative model specifications. The paper ends with the conclusion section.

Literature Review

A Brief Theoretical Review of the Phillips Curve

The PC, which Mankiw (2001: 45) describes as one of three key principles of macroeconomics, is fundamentally based on the short-run inflation-employment trade-off. The PC story began with the analysis of Phillips (1958), which examined the relationship between money wage growth and unemployment in the UK from 1861 to 1957. Phillips (1958) showed a stable and negative relationship between unemployment and nominal wage growth. That is, whenever there is increasing labor demand and unemployment is low, wages rise.

Lipsey (1960) then provided theoretical foundations to support this empirical relationship. Furthermore, Samuelson and Solow (1960) labeled this trade-off as the PC and modified the original PC equation by replacing money wage growth with inflation. They considered the PC as a menu of choices between price stability and unemployment, which paved the way for the fine-tuning policies that were popular in the 1960s (Dorn, 2020: 134).

The empirical and theoretical evolution of the PC continued with Phelps (1967) and Friedman (1968), who recognized the importance of inflation expectations and added this variable to the PC equation. Friedman's (1968) expectation-augmented PC can be specified as follows (Ball & Mazumder, 2019: 113):

$$\pi_t = \pi_t^e + \sigma(u_t - u_t^*) + \epsilon_t, \quad \sigma < 0 \tag{1}$$

where π_t denotes current inflation; π_t^e represents expected inflation; u_t is unemployment; and u_t^* is the natural rate of unemployment. As proxied expected inflation by past inflation, then Eq. (1) can be rewritten as follows:

$$\pi_t = \pi_{t-1} + \sigma(u_t - u_t^*) + \epsilon_t \tag{2}$$

Friedman (1968: 11) suggested that the inflation-unemployment trade-off is only temporary and results from anticipated inflation. That is, the PC exists only in the short run due to lags in expectation adjustment. Once expectations have been adjusted, the trade-off no longer exists in the long run (Chowdhury & Sarkar, 2017: 428).

After the PC failed to explain the stagflation crisis of the 1970s, it was increasingly criticized, especially by new classical economists. Sargent (1971), for example, suggested that the traditional expectation treatment cannot capture rational agents' forward-looking behavior, while Lucas (1976), in his famous critique, claimed that the coefficients of PC vary over time depending on policy responses. These shortcomings were then addressed by the new Keynesians, who introduced the new Keynesian Phillips curve (NKPC) (Chowdhury & Sarkar, 2017: 428). The NKPC considered forward-looking expectations in price settings under the assumption of sticky prices and rational economic agents (Abbas *et al.*, 2016: 379). The Calvo (1983) version of the NKPC assumed that firms operate in monopolistic competitive markets and can set prices based on markups over marginal costs. In each period, there is a possibility that firms may adjust their prices $(1-\theta)$ or keep them fixed (θ). The reduced form of the NKPC is specified as follows (Wardhono *et al.*, 2021: 2):

$$\pi_t = \beta E_t(\pi_{t+1}) + \lambda mc_t + \epsilon_t \tag{3}$$

where $E_t(\pi_{t+1})$ is the expected future inflation; mc_t is real marginal cost; and $\lambda=\frac{(1-\theta)(1-\theta\beta)}{\theta}$. Although there was considerable doubt about whether the output gap was an accurate proxy, it was used as a real marginal cost in early empirical studies (Mazumder, 2012: 324).

Based on experiences that even highly credible central banks bear output losses in a disinflationary process, Galí and Gertler (1999) added lagged inflation to the baseline pure forward-looking model to capture inflation persistence. Their model, called hybrid NKPC (HNKPC), is defined as follows:

$$\pi_t = \gamma_f E_t(\pi_{t+1}) + \gamma_b(\pi_{t-1}) + \lambda mc_t + \epsilon_t \tag{4}$$

where $\lambda = (1-\omega)(1-\theta)(1-\beta\theta)\phi^{-1}$ and the parameters are as follows:

$$\gamma_f = \beta\theta\phi^{-1}, \gamma_b = \omega\phi^{-1}, \phi = \theta + \omega[1-\theta(1-\beta)] \tag{5}$$

According to the HNKPC model, a fraction of the firms is supposed to be forward-looking in setting their prices $(1-\omega)$, while the others are backward-looking (ω). The HNKPC has two main differences from the NKPC. First, it uses labor income share instead of the output gap to proxy for marginal cost. Second, three model parameters are explicitly used to determine the coefficients: the discount factor (β), the degree of backward-looking (ω), and the degree of price stickiness (θ) (Galí & Gertler,1999: 203-211).

Empirical Review

This review focuses on studies investigating inflation dynamics in the Turkish economy using the PC framework and time-series methods. Analyzing 1988Q2-2003Q1, Yazgan and Yilmazkuday (2005) demonstrated that the benchmark NKPC is valid, whereas the HNKPC is not. Önder (2009) employed an MS model to explore the PC between 1987:01 and 2004:07. Three regimes were identified, namely, low, high and stable, and high and volatile inflation regimes. PC was strongly confirmed in the low-inflation regime but not the high-inflation regimes. The output gap was statistically insignificant in the high-inflation regimes, which indicated that the PC followed a nonlinear pattern. Similarly, Hasanov *et al*. (2010) employed the time-varying smooth transition regression method over 1980Q1-2008Q3 and found that the output gap-inflation nexus was regime-dependent.

Çatık *et al*. (2011) used the autoregressive distributed lag (ARDL) model to test the PC for relative price changes from 1996:01 to 2007:05. They found no inflation-output gap trade-off in the benchmark model. However, it became valid after the skewness and variance of relative price changes were added to the model. Arabacı and Eryiğit (2012) used a threshold regression model to investigate the threshold effect on the short-run PC for 1991Q1-2010Q4. They showed that the relationship between inflation and real economic activity was stable and nonlinear when the lagged value of the capacity utilization rate was used as a threshold variable. Gözgör (2013) examined the expectations-augmented PC and HNKPC between 2005:01 and 2012:06. The ordinary least squares findings indicated that the unemployment gap was statistically insignificant. That is, the expectations-augmented PC model was not valid. On the other hand, the GMM findings confirmed the HNKPC. Lagged and expected inflation and the producer price index all had significant and positive impacts on current inflation, while the coefficient of the unemployment rate was statistically significant and negative.

Arabacı and Özdemir (2014) split the 1990Q1-2013Q3 period into two sub-samples, excluding 2000 and 2001, and explored the HNKPC employing non-casual autoregression models. The HNKPC was valid in both sub-samples. Furthermore, lagged inflation had a greater impact on inflation in the 1990s, while expected inflation was at the forefront in the 2000s. Ardor *et al*. (2014) estimated the PC equation with the triangle model of inflation for 1998Q1-2014Q1. They employed three different non-accelerating inflation rate of unemployment (NAIRU) from various methods and verified the PC. Saraçoğlu *et al*. (2014) examined the HNKPC between 1998Q1 and 2013Q3 with three output gap variables obtained using different methods. The GMM findings confirmed the HNKPC for all models. Furthermore, the output gap calculated by the structural vector autoregressive (SVAR) model outperformed those obtained from the Hodrick and Prescott (HP) filter and the modified HP filter in explaining inflation. Başer Andiç *et al*. (2015) used Bayesian estimation techniques to investigate the HNKPC from 2005Q2 to 2012Q3. The lagged and expected inflation coefficients were close to each other. The output gap, as a proxy for the domestic real marginal cost, was more effective in explaining consumer inflation, whereas the real unit labor cost variable was more important in estimating services inflation.

Karahan and Çağlarırmak Uslu (2018) analyzed the PC using the ARDL and Kalman filter from 1996 to 2016. The ARDL findings showed that the PC existed only in the long run. The Kalman filter findings indicated that the negative effect of unemployment on inflation increased after the transition to an inflation targeting regime. Bildirici and Ozaksoy Sonustun (2018) used the nonlinear ARDL (NARDL) and nonlinear causality tests to investigate the unemployment-inflation nexus for the US, Türkiye, France, and Japan from 1960 to 2016. The NARDL indicated a negative long-run relationship between inflation and unemployment for all four countries. Bari and Şıklar (2021) used the GMM to explore the open-economy HNKPC between 2002:01 and 2020:07. They also divided the sample considering stable and depreciated exchange rate periods. In all samples, both backward and forward inflation increased current inflation, whereas the impact of the output gap was statistically insignificant. During the depreciation periods, the real effective exchange rate was more effective than the nominal exchange rate in explaining inflation and vice versa in stable periods.

Koç *et al*. (2021) used the PC approach with the time-varying parameter model to investigate the impact of expectations on inflation from 2007Q2 to 2019Q4. Inflation expectations had a pivotal effect on inflation, and this contribution remained stable in recent years, while the effect of the exchange rate on inflation dramatically increased after the 2018 currency shock. Kantur and Özcan (2022) used the GMM to investigate the cost channel extended NKPC between 2006 and 2019 with quarterly data. They found that the augmented NPKC can explain short-run inflation dynamics, while demand channel issues outweighed cost channel concerns. They concluded that the main dynamic to focus on for price stability is the exchange rate. Finally, Kocoglu (2023) adopted the NKPC approach to examine inflation dynamics from 2000:01 to 2021:10 using the quantile ARDL. The production output gap was statistically significant and negative across all quantiles, while the GDP output gap positively impacted inflation. While oil prices and the nominal exchange rate positively impacted inflation, the former's effect was asymmetric. When the domestic currency depreciated, the positive effect of oil prices on inflation was aggravated.

Data and Methodology

Data

This study explored inflation dynamics in Türkiye based on the PC equation for 2006:01-2023:09. Following the empirical literature, the PC equation was augmented with the exchange rate and oil prices. The estimated model is specified as follows:

$$\pi_t = \alpha_t + \beta\pi_{t-1} + \delta u_t + \theta ner_t + \gamma oil_t + \varepsilon_t \quad (6)$$

Here, π_t represents monthly inflation, which is the percentage change of the consumer price index; π_{t-1} is lagged inflation and stands for past inflation; u_t is unemployment; ner_t is the percentage change of the nominal exchange rate; and oil_t is the percentage change in the global price of Brent crude oil. The gap values of unemployment, nominal exchange rate, and oil prices were used in the study. These values were calculated as the difference between the actual variables, and their trends obtained by the HP filter.[1] Variables representing seasonality were adjusted. All series were gathered from the Federal Reserve Economic Data (FRED). Table 1 presents the descriptive statistics for the raw data.

Table 1. Descriptive Statistics

Variables	Obs.	Mean	Max.	Min.	Std. Dev.
π_t	213	1,255	13,575	-1,442	1,845
u_t	213	10,628	15,100	7,300	1,769
ner_t	213	4,711	26,999	1,170	5,347
oil_t	213	77,317	133,582	26,848	24,530

Source: Author's estimation.

[1] The HP filter's smoothing parameter (λ) was set as 14400.

Table 2. Unit Root Test Findings

	ADF		PP	
Variables	**Intercept**	**Intercept & Trend**	**Intercept**	**Intercept & Trend**
π_t	-3,749***	-4,812***	-6,756***	-7,859***
π_{t-1}	-4,094***	-5,177***	-6,832***	-7,909***
u_t	-3,376**	-3,369*	-3,820***	-3,810**
ner_t	-11,094***	-11,066***	-9,949***	-9,904***
oil_t	-10,322***	-10,296***	-9,740***	-9.706***

Source: Author's estimation.

Note: The maximum lags were set as 12, while optimal lag lengths were chosen based on the Schwarz Information Criterion (SIC) in the ADF test. Bandwidths were selected automatically considering the Newey-West method employing the Bartlett kernel in the PP test. ***, **, and * denote stationarity at 1%, 5%, and 10% significance, respectively.

Table 3. Transition Matrix and Regime Properties

	Transition Matrix	
	Low-Inflation Regime	**High-Inflation Regime**
Low-Inflation Regime	0,987	0,013
High-Inflation Regime	0,055	0,945

	Regime Properties		
	Observation	**Probability**	**Duration**
Low-Inflation Regime	185,4	0,811	77,89
High-Inflation Regime	27,6	0,189	18,17

The dates of maximum and minimum monthly inflation corresponded to the change in policy rates. Inflation reached its maximum in December 2021, soon after the beginning of interest rate cuts in September. Its lowest value was in November 2018, following the policy rate increases against the currency shock of August 2018. Unemployment fell to its lowest in June 2012 with the help of abundant global liquidity, while its maximum was in January 2019 due to increasing interest rates. A considerable difference between the lowest and highest values of the exchange rate reflects TL's instability. Especially since the last quarter of 2021, the exchange rate has jumped sharply. Finally, oil prices were highly sensitive to global shocks, unsurprisingly. While oil prices were lowest around the beginning of the pandemic in April 2020, they reached a maximum in July 2008, around the GFC. The unit root test findings are represented in Table 2.

The Phillips-Perron (PP) (Phillips & Perron, 1988) and the augmented Dickey-Fuller (ADF) (Dickey & Fuller, 1981) unit root tests were employed to examine the time-series properties of series. The empirical findings show that variables were stationary in their levels. Hence, all were treated as I(0).

Methodology

This study employed an MS model to explore inflation dynamics within the PC framework in Türkiye. In MS models, different regimes, which generally range from two to four, can be identified. Furthermore, past regimes can recur throughout the sample (Baharumshah *et al.*, 2017: 249). Regime change is defined as an unobserved random variable instead of as the outcome of a deterministic event. This unobserved variable is called the state or regime variable (s_t). For the process of regime switching, the Markov chain is employed (Hamilton, 1994: 677-678). The N-state Markov chain with transition probabilities can be defined as follows:

$$P\{s_t = j | s_{t-1} = i, s_{t-2} = k, \ldots\} = P\{s_t = j | s_{t-1} = i\} = p_{ij} \quad (7)$$

where j and i denote states; p_{ij} shows transition probability across states; p_{ij} is the probability that state j is preceded by state i. Eq. (8) shows the NxN transition matrix that collects the transition probabilities whose sum equals 1 (Hamilton, 1994: 678-679):

$$P = \begin{bmatrix} p_{11} & p_{21} & \cdots & p_{N1} \\ p_{12} & p_{22} & \cdots & p_{N2} \\ \vdots & \vdots & \cdots & \vdots \\ p_{1N} & p_{2N} & \cdots & p_{NN} \end{bmatrix} \quad (8)$$

The MS models are estimated using the maximum likelihood (ML) method. Since the first-order conditions derived from the ML are nonlinear and have no closed solution (Çatık & Önder, 2011: 128), an expectation-maximization (EM) algorithm of Dempster *et al.* (1977) is used in the ML estimates by Hamilton (1990). The algorithm is developed to estimate the parameters of models with hidden stochastic or unobservable variables that affect the observed time series (Bildirici & Kayıkçı, 2021: 41). Iterations of the EM algorithm increase the ML function value (Hamilton, 1994: 689), while the iterations end once the parameters converge (Çatık & Önder, 2011: 128).

Of the various MS models, this study employed the MSIAH model, which considers both changes in the variance of the residuals across states and the entire parameter shift (Çatık & Önder, 2011: 127). The model, represented in linear form in Eq. (6), can be rewritten as follows for the MSIAH model:

$$\pi_t = \alpha(s_t) + \beta(s_t)\pi_{t-1} + \delta(s_t)u_t + \theta(s_t)ner_t + \gamma(s_t)oil_t + \varepsilon_t \quad (9)$$

When state variable (s_t) equals 1, the process is in the low-inflation regime; when it equals 2, the process is in the high-inflation regime (Baharumshah *et al.,* 2017: 249). The state variable strongly influences the estimated coefficients.

Empirical Findings

This study employed the MSIAH model to analyze the inflation drivers in Türkiye for different inflation regimes. Two regimes were identified in the sample, namely low- and high-inflation regimes. Table 3 presents the transition matrix and regime properties.

The transition matrix indicates that the switching probability from the high- to low-inflation regime was higher at 5.5% than vice versa at 1.3%. During the sample period, the low-inflation regime dominated in terms of a longer duration and higher probability. Figures 1-3 illustrate the regime variable and its probabilities over the sample period.

Figures 2 and 3 show that the low-inflation regime dominated the sample. However, this does not mean that inflation was not a problem during these periods, given that annual inflation has remained above its targets since 2011 and has been double-digit since almost 2017. Some observations that could have been in the high regime may have fallen into the low regime as a result of the recent spike in inflation.

The first transition from the low to the high inflation regime was in September 2018, following the currency shock. The monetary authorities' effective and timely interventions tamed sharp price and exchange rate movements so that the first high-inflation regime lasted only three months. The second switch from the low to the high-inflation regime was in November 2021, right after the beginning of interest rate cuts, and the sample ended with this high-inflation regime.

Before evaluating the estimation findings, it is necessary to test the model's nonlinearity. Based on the likelihood ratio (LR) test, the null hypothesis that the linear model is valid was rejected, thereby confirming the nonlinear model (Bildirici, 2020: 2255). Moreover, the two-regime MSIAH model was verified by comparing the nonlinear and linear models in terms of the log-likelihood and the Akaike information criterion (AIC) values (Çatık & Önder, 2011: 135; Altuğ & Bildirici, 2012: 17; Baharumshah *et al.*, 2017: 251). Table 4 presents the estimation results.

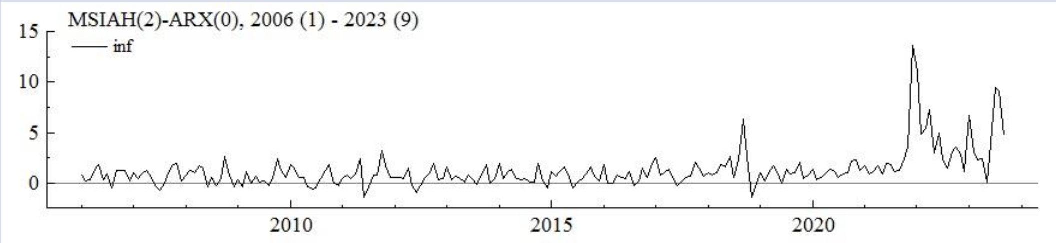

Figure 1. Inflation Rate

Source: Author's estimation.

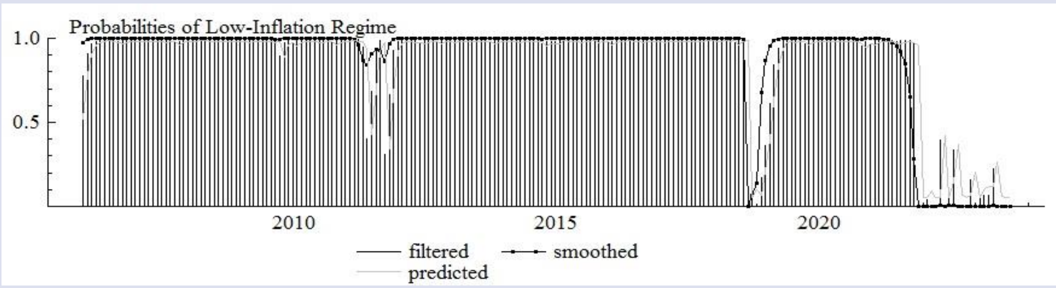

Figure 2. Low-Inflation Regime Probabilities

Source: Author's estimation.

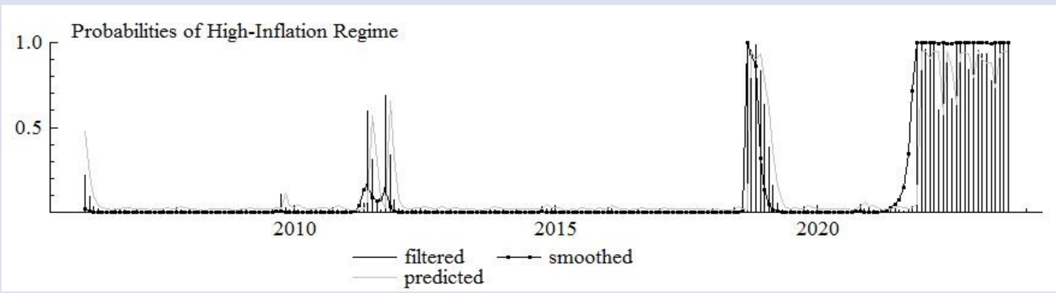

Figure 3. High-Inflation Regime Probabilities

Source: Author's estimation.

Table 4. Estimation Results

Low-Inflation Regime (Standard Error: 0,722)			
Variables	**Coefficient**	**Standard Error**	**t-value**
α_t	0,621***	0,076	8,079
π_{t-1}	0,233***	0,072	3,224
u_t	-0,039	0,066	-0,590
ner_t	0,061***	0,015	3,929
oil_t	0,014**	0,006	2,205
High-Inflation Regime (Standard Error: 0,297)			
Variables	**Coefficient**	**Standard Error**	**t-value**
α_t	1,876*	1,083	1,731
π_{t-1}	0,540***	0,206	2,623
u_t	-0,549	1,652	-0,332
ner_t	0,293***	0,064	4,525
oil_t	0,0632	0,063	0,991
LR Linearity Test: 148,882	**Chi (6) = (0,000)*** **	**Chi (8) = (0,000)*** **	**Davies= (0,000)*** **
	Log-likelihood	**AIC**	
Nonlinear model	-276,606	2,728	
Linear model	-351,050	3,352	

Source: Author's estimation.
Note: ***, **, and * show significance at 1%, 5%, and 10%, respectively.

Differences in the significance and size of the coefficients across the regimes indicate nonlinear inflation dynamics. In the low-inflation regime, lagged inflation, the exchange rate, and oil prices significantly and positively impacted inflation. Although the effect of the unemployment gap was consistent with the theoretical expectations, it was statistically insignificant. This indicates that the PC was invalid and that other drivers explained inflation. When switching to the high-inflation regime, nothing changed for the PC, and the unemployment gap coefficient was still insignificant. While the impact of oil price on inflation turned statistically insignificant, the positive effects of lagged inflation and exchange rate remained significant. Furthermore, the coefficient of past inflation and the exchange rate considerably increased. That is, inflation persistence is still a problem for the Turkish economy, while the exchange rate is a critical variable that needs to be closely managed to control inflation.

The empirical findings that did not support the PC confirm those of Yazgan and Yilmazkuday (2005), Önder (2009), Çatık *et al*. (2011), Gözgör (2013), Karahanlı and Çağlarırmak Uslu (2018), and Bari and Şıklar (2021). These studies found the economic activity variable to be inconsistent with theoretical expectations for specific models, periods, regimes, or the sample as a whole. On the other hand, the positive coefficient of the exchange rate in both regimes confirms Öğünç *et al*. (2018), Bari and Şıklar (2021), Koç *et al*. (2021), Yilmazkuday (2022), Kantur and Özcan (2022), Kocoglu (2023), and Ulug *et al*. (2023). Finally, the inflation-increasing effect of oil prices in the low regime is consistent with Bari and Adalı (2020), Yilmazkuday (2022), Kocoglu (2023), and Özmen and Özşahin (2023).

Most of the literature has reported a significant positive effect of inflation expectations on current inflation. On the other hand, the finding in this study that the coefficient of past inflation was greater in the high than the low regime is quite similar to Önder (2009) and Arabacı and Özdemir (2014). The former study found a rising impact of lagged inflation in the high-inflation regime, while the latter reported a greater impact of past inflation in the high inflation environment of the 1990s.

Robustness checks were performed by employing the output gap[2] and the lagged unemployment gap instead of the unemployment gap. These estimation results did not provide any new information. The regime properties and probabilities, as well as the significance, size, and sign of the coefficients of both models, aligned with those of the main model (see Table A1 and A2 in the Appendices).

Conclusion

Adopting the PC framework and using the MSIAH, this study explored inflation dynamics in Türkiye from January 2006 to September 2023. Two regimes were defined in the sample, namely the low- and high-inflation regimes. The switching dates from the low to the high-inflation regime were September 2018 and November 2021, corresponding to the currency shock and the CBRT's change in monetary policy stance, respectively. While the first high-inflation regime was short-lived, the second prevailed until the end of the sample.

The estimation results showed that the PC was invalid in both regimes. The unemployment gap had a negative impact on current inflation, although this effect was statistically insignificant. Lagged inflation had a positive

[2] The output gap was measured using the industrial production index (ip_t). Similar processes were performed to calculate the output gap. Specifically, the output gap was calculated as the difference between the percentage change in the industrial production index, and its trend obtained by the HP filter (λ=14400).

and statistically significant effect on inflation, with a greater coefficient in the high regime. Oil prices only had a statistically significant effect in the low regime. An increase in the exchange rate significantly raised inflation in both regimes, with a greater effect in the high regime

The greater coefficient of backward inflation in the high regime reflects resurgent indexation behavior, which was dominant before the CBRT adopted inflation targeting. Furthermore, the greater impact of the exchange rate in the high regime is consistent with previous studies reporting higher exchange rate pass-through for Türkiye in recent years (Kara & Sarıkaya, 2021; Gayaker *et al*., 2021; İlhan *et al*., 2023). The empirical findings of this study suggest that inflation inertia and exchange rate stability are the primary issues in controlling inflation in Türkiye. Thus, the CBRT should attach utmost importance to these variables in its efforts to achieve price stability.

Extended Abstract

During the 2010s, a low inflation environment prevailed in almost every economy; inflation dropped even in countries apparently unaffected by the GFC (Jordà & Nechio, 2020). The average global inflation was 2.1% between 2010 and 2020 (Binici *et al.,* 2022: 3). Inflation consistently below the targets, especially in advanced economies, sparked a debate as to whether the PC is a reliable guide for central banks (Dorn, 2020; Jordà & Nechio, 2023). Many studies showed that the inflation-increasing effect of falling unemployment was reduced, particularly during low inflation periods, while the PC flattened (Stock & Watson, 2020; Costain *et al*., 2022; Forbes *et al*., 2022; Jørgensen & Lansing, 2023). However, the COVID-19 pandemic completely changed the picture. Inflation soared due to expansionary policies to recover from sluggish aggregate demand during the pandemic. Further, the impact of the Russia-Ukraine war on commodity prices made inflation control more challenging. In August 2022, global inflation increased to 7.5% (Binici *et al*., 2022: 3), while OECD inflation reached 10.7% in October 2022 (OECD, 2024). Thus, inflation once again came to the top of the agenda for the world economy.

Unlike in many advanced and emerging market economies, inflation was already a problem for the Turkish economy before the COVID-19 pandemic. During the 1990s, Türkiye experienced severe inflation, which reached three digits in some months. Although inflation was reduced to single digits in the 2000s through a successful disinflation program under an implicit inflation targeting framework with a flexible exchange rate regime, price stability became a problem again after the global financial crisis. Inflation gradually increased during the 2010s and became out of control after late 2021. This study aims to explore inflation dynamics in Türkiye using the Phillips curve framework for different inflation environments. To this end, the Phillips curve equation, augmented with the exchange rate and oil prices, is estimated using the MSIAH model between January 2006 and September 2023.

Although there have been various studies in Türkiye that have analyzed the factors leading to inflation using different models, methods, and samples, only a few have utilized regime switching methods (Önder, 2009; Çatık & Önder, 2011). This method makes it possible to analyze inflation drivers for different inflation regimes. Additionally, this study presents fresh evidence for understanding inflation dynamics by covering the pandemic period and the CBRT's monetary policy practices, which were incompatible with the Taylor principle (Gürkaynak *et al*., 2023b).

In MS models, different regimes, which generally range from two to four, can be identified. Furthermore, past regimes can recur throughout the sample (Baharumshah *et al*., 2017: 249). Regime change is defined as an unobserved random variable instead of as the outcome of a deterministic event. This unobserved variable is called the state or regime variable (s_t). For the process of regime switching, the Markov chain is employed (Hamilton, 1994, pp. 677-678). Furthermore, the MS models are estimated using the ML method. Iterations of the EM algorithm increase the ML function value (Hamilton, 1994, p. 689), while the iterations end once the parameters converge (Çatık & Önder, 2011: 128).

Two regimes were identified in the sample, namely low- and high-inflation regimes. The transition probabilities indicated that the low-inflation regime dominated the sample. However, this does not mean that inflation was not a problem during these periods, given that annual inflation has remained above its targets since 2011 and has been double-digit since almost 2017. Some observations that could have been in the high regime may have fallen into the low regime as a result of the recent spike in inflation.

Based on the LR test, the null hypothesis that the linear model is valid was rejected, thereby confirming the nonlinear model (Bildirici, 2020: 2255). Moreover, the two-regime MSIAH model was verified by comparing the nonlinear and linear models in terms of the log-likelihood and the AIC values (Çatık & Önder, 2011: 135; Altuğ & Bildirici, 2012: 17; Baharumshah *et al*., 2017: 251).

Differences in the significance and size of the coefficients across the regimes indicate nonlinear inflation dynamics. In the low-inflation regime, lagged inflation, the exchange rate, and oil prices significantly and positively impacted inflation. Although the effect of the unemployment gap was consistent with the theoretical expectations, it was statistically insignificant. This indicates that the PC was invalid and that other drivers explained inflation. When switching to the high-inflation regime, nothing changed for the PC, and the unemployment gap coefficient was still insignificant. While the impact of oil price on inflation turned statistically insignificant, the positive effects of lagged inflation and exchange rate remained significant. Furthermore, the coefficient of past inflation and the exchange rate considerably increased.

The empirical findings that did not support the PC confirm those of Yazgan and Yilmazkuday (2005), Önder (2009), Çatık *et al*. (2011), Gözgör (2013), Karahanlı and Çağlarırmak Uslu (2018), and Bari and Şıklar (2021). These studies found the economic activity variable to be inconsistent with theoretical expectations for specific models, periods, regimes, or the sample as a whole. On the other hand, the positive coefficient of the exchange rate in both regimes confirms Öğünç *et al*. (2018), Bari and Şıklar (2021), Koç *et al*. (2021), Yilmazkuday (2022), Kantur and Özcan (2022), Kocoglu (2023), and Ulug *et al*. (2023). Finally, the inflation-increasing effect of oil prices in the low regime is consistent with Bari and Adalı (2020), Yilmazkuday (2022), Kocoglu (2023), and Özmen and Özşahin (2023).

Most of the literature has reported a significant positive effect of inflation expectations on current inflation. On the other hand, the finding in this study that the coefficient of past inflation was greater in the high than the low regime is quite similar to Önder (2009) and Arabacı and Özdemir (2014). The former study found a rising impact of lagged inflation in the high-inflation regime, while the latter reported a greater impact of past inflation in the high inflation environment of the 1990s.

Robustness checks were performed by employing the output gap and the lagged unemployment gap instead of the unemployment gap. These estimation results did not provide any new information. The regime properties and probabilities, as well as the significance, size, and sign of the coefficients of both models, aligned with those of the main model (see Table A1 and A2 in the Appendices).

The greater coefficient of backward inflation in the high regime reflects resurgent indexation behavior, which was dominant before the CBRT adopted inflation targeting. Furthermore, the greater impact of the exchange rate in the high regime is consistent with previous studies reporting higher exchange rate pass-through for Türkiye in recent years (Kara & Sarıkaya, 2021; Gayaker *et al.*, 2021; İlhan *et al.*, 2023). The empirical findings of this study suggest that inflation inertia and exchange rate stability are the primary issues in controlling inflation in Türkiye. Thus, the CBRT should attach utmost importance to these variables in its efforts to achieve price stability.

Contribution Rates and Conflicts of Interest

Etik Beyan	Bu çalışmanın hazırlanma sürecinde bilimsel ve etik ilkelere uyulduğu ve yararlanılan tüm çalışmaların kaynakçada belirtildiği beyan olunur.	**Ethical Statement**	It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.
Yazar Katkıları	Çalışmanın Tasarlanması: Aİ (%100) Veri Toplanması: Aİ (%100) Veri Analizi: Aİ (%100) Makalenin Yazımı: Aİ (%100) Makale Gönderimi ve Revizyonu: Aİ (%100)	**Author Contributions**	Research Design: Aİ (%100) Data Collection: Aİ (%100) Data Analysis: Aİ (%100) Writing the Article: Aİ (%100) Article Submission and Revision: Aİ (%100)
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Çıkar Çatışması	Çıkar çatışması beyan edilmemiştir.	**Conflicts of Interest**	The author has no conflict of interest to declare.
Finansman	Bu araştırmayı desteklemek için dış fon kullanılmamıştır.	**Grant Support**	The author acknowledges that he received no external funding in support of this research.
Telif Hakkı & Lisans	Yazar dergide yayınlanan çalışmasının telif hakkına sahiptir ve çalışması **CC BY-NC 4.0** lisansı altında yayımlanmaktadır.	**Copyright & License**	The author publishing with the journal retains the copyright to his work licensed under the **CC BY-NC 4.0**

Appendices

Table A1. Estimation Results (Output Gap)

Low-Inflation Regime (n: 182,3, Prob.: 0,810, Duration: 61,18, Standard Error: 0,701)			
Variables	**Coefficient**	**Standard Error**	**t-value**
α_t	0,609***	0,077	7,898
π_{t-1}	0,244***	0,074	3,282
ip_t	-0,007	0,016	-0,432
ner_t	0,060***	0,015	4,023
oil_t	0,015**	0,006	2,258
High-Inflation Regime (n: 30,7, Prob.: 0,189, Duration: 14,29i Standard Error: 2,180)			
Variables	**Coefficient**	**Standard Error**	**t-value**
α_t	1,510	1,043	1,447
π_{t-1}	0,607***	0,177	3,415
ip_t	-0,039	0,142	-0,275
ner_t	0,296***	0,063	4,655
oil_t	0,049	0,058	0,855
LR Linearity Test: 148,756	**Chi (6) = (0,000)*** **	**Chi (8) = (0,000)*** **	**Davies= (0,000)*** **
	Log-likelihood		**AIC**
Nonlinear model	-276,693		2,729
Linear model	-351,071		3,352

Source: Author's estimation.
Note: ***, **, and * show significance at 1%, 5%, and 10%, respectively.

Table A2. Estimation Results (Lagged Unemployment Gap)

Low-Inflation Regime (n: 184,4, Prob.: 0,809, Duration: 73,03, Standard Error: 0,715)			
Variables	**Coefficient**	**Standard Error**	**t-value**
α_t	0,619***	0,077	8,011
π_{t-1}	0,234***	0,073	3,178
u_{t-1}	-0,037	0,066	-0,568
ner_t	0,060***	0,015	3,930
oil_t	0,014**	0,006	2,234
High-Inflation Regime (n: 28,6, Prob.: 0,190, Duration: 17,23 Standard Error: 2,170)			
Variables	**Coefficient**	**Standard Error**	**t-value**
α_t	1,942	1,186	1,637
π_{t-1}	0,577***	0,184	3,138
u_{t-1}	0,695	1,493	0,465
ner_t	0,297***	0,064	4,607
oil_t	0,057	0,060	0,959
LR Linearity Test: 149,056	**Chi (6) = (0,000)***	**Chi (8) = (0,000)***	**Davies= (0,000)***
	Log-likelihood		**AIC**
Nonlinear model	-276,541		2,728
Linear model	-351,069		3,352

Source: Author's estimation.

Note: ***, **, and * show significance at 1%, 5%, and 10%, respectively.

References

Abbas, S. K., Bhattacharya, P. S., & Sgro, P. (2016). The new Keynesian Phillips curve: An update on recent empirical evidence, *International Review of Economics and Finance,* 43, 378-403. http://dx.doi.org/10.1016/j.iref.2016.01.003

Altuğ, S., & Bildirici, M. (2012). Business Cycles in Developed and Emerging Economies: Evidence from a Univariate Markov Switching Approach, *Emerging Markets Finance and Trade,* 48(6), 4-38. https://doi.org/10.2753/REE1540-496X480601

Arabacı, Ö., & Eryiğit, K. Y. (2012). A Threshold Regression Estimation of Philips Curve: Turkey Case, *Eskişehir Osmangazi Üniversitesi İİBF Dergisi,* 7(2), 29-47.

Arabacı, Ö., & Özdemir, M. (2014). A Non-Causal Autoregression Based Estimation of New Keynesian Phillips Curve for the Turkish Economy, *İktisat İşletme ve Finans,* 29(342), 45-70. https://doi.org/10.3848/iif.2014.342.4183

Ardor, H. N., Tokatlıoğlu, İ., & Öztürk, F. (2014). Türkiye Ekonomisi İçin Enflasyonun Üçgen Modeli İle Phillips Eğrisi Denklemi Tahmini, *Ekonomik Yaklaşım,* 25(91), 29-53.

Baharumshah, A. Z., Soon, S-V., & Wohar, M. E. (2017). Markov-switching analysis of exchange rate pass-through: Perspective from Asian countries, *International Review of Economics and Finance,* 51, 245-257. https://dx.doi.org/10.1016/j.iref.2017.05.009

Ball, L., & Mazumder, S. (2019). A Phillips Curve with Anchored Expectations and Short-Term Unemployment, *Journal of Money, Credit and Banking,* 51(1), 111-137. https://doi.org/10.1111/jmcb.12502

Bari, B., & Adalı, Z. (2020). How Oil Prices Drive Inflation in Turkish Economy: Two Different Channels, *Fiscaoeconomia,* 4(3), 705-721. https://doi.org/10.25295/fsecon.786956

Bari, B., & Şıklar, İ. (2021). An Estimation of the Open Economy Hybrid New Keynesian Phillips Curve for Turkey, *Fiscaoeconomia,* 5(3), 1081-1100. https://doi.org/10.25295/fsecon.981011

Başer Andiç, S., Küçük, H., & Öğünç, F. (2015). Inflation Dynamics in Turkey: In Pursuit of a Domestic Cost Measure, *Emerging Markets Finance and Trade,* 51(2), 418-431. https://doi.org/10.1080/1540496X.2015.1019771

Bildirici, M. E., & Ozaksoy Sonustun (2018). Backward bending structure of Phillips Curve in Japan, France, Turkey and the U.S.A., *Economic Research-Ekonomska Istraživanja,* 31(1), 537-549. https://doi.org/10.1080/1331677X.2018.1441046

Bildirici, M. E. (2020). The relationship between cement production, mortality rate, air quality, and economic growth for China, India, Brazil, Turkey, and the USA: MScBVAR and MScBGC analysis, *Environmental Science and Pollution Research,* 27, 2248-2263. https://doi.org/10.1007/s11356-019-06586-w

Bildirici, M., & Kayıkçı, F. (2021). The Relation Between Growth, Energy Imports, Militarization and Current Account Balance in India, Brazil, Turkey and Pakistan, *Economic Computation and Economic Cybernetics Studies and Research,* 55(3), 37-54. https://doi.org/10.24818/18423264/55.3.21.03

Binici, M., Centorrino, S., Cevik, S., & Gwon, G. (2022). Here Comes the Change: The Role of Global and Domestic Factors in Post-Pandemic Inflation in Europe, *IMF Working Paper,* 2022/241. https://www.imf.org/en/Publications/WP/Issues/2022/12/09/Here-Comes-the-Change-The-Role-of-Global-and-Domestic-Factors-in-Post-Pandemic-Inflation-in-525754 Accessed: 24.12.2023

Calvo, G. A. (1983). Staggered prices in a utility-maximizing framework, *Journal of Monetary Economics,* 12(3), 383–398. https://doi.org/10.1016/0304-3932(83)90060-0

CBRT (2023). Inflation Report, 2023-IV. https://www.tcmb.gov.tr/wps/wcm/connect/EN/TCMB+EN/Main+Menu/Publications/Reports/Inflation+Report/2023/Inflation+Report+2023+-+IV Accessed: 12.01.2024.

CBRT (2024a). Inflation Data, https://www.tcmb.gov.tr/wps/wcm/connect/EN/TCMB+EN/Main+Menu/Statistics/Inflation+Data Accessed: 12.01.2024.

CBRT (2024b). Central Bank Interest Rates, https://www.tcmb.gov.tr/wps/wcm/connect/EN/TCMB+EN/Main+Menu/Core+Functions/Monetary+Policy/Central+Bank+Interest+Rates/1+Week+Repo Accessed: 12.01.2024.

Chowdhury, K. B., & Sarkar, N. (2017). Is the Hybrid New Keynesian Phillips Curve Stable? Evidence from Some Emerging Economies, *Journal of Quantitative Economics,* 15, 427-449. https://doi.org/10.1007/s40953-016-0059-y

Costain, J., Nakov, A., & Petit, B. (2022). Flattening of the Phillips Curve with State-Dependent Prices and Wages, *The Economic Journal,* 132(642), 546-581. https://doi.org /10.1093/ej/ueab063

Çatık, A. N., Martin, C., & Önder, A. Ö. (2011). Relative price variability and the Phillips Curve: evidence from Turkey, *Journal of Economic Studies,* 38(5), 546-561. https://doi.org/10.1108/01443581111161814

Çatık, A. N., & Önder, A. Ö. (2011). Inflationary Effects of Oil Prices in Turkey: A Regime-Switching Approach, *Emerging Markets Finance and Trade,* 47(5), 125-140. https://doi.org/10.2753/REE1540-496X470506

Çufadar, A. (2023). Türkiye'de yakın dönem merkez bankacılığı ve uygulanan politikaların sonuçları, *ODTÜ Gelişme Dergisi,* 50, 81-114.

Dempster, A. P., Laird, N. M., & Rubin, D. B. (1977). Maximum likelihood from incomplete data via the EM algorithm, *Journal of the Royal Statistical Society Series B (Methodological),* 39(1), 1-38.

Dickey, D. A., & Fuller, W. (1981). Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root, *Econometrica*, 49(4), 1057-1072. https://doi.org/10.2307/1912517

Dorn, J. A. (2020). The Phillips Curve: Poor Guide for Monetary Policy, *Cato Journal,* 40(1), 133–152.

Forbes, K., Gagnon, J., & Collins, C. (2021). Pandemic inflation and nonlinear, global Phillips curves, *VOXEU Columns,* https://cepr.org/voxeu/columns/pandemic-inflation-and-nonlinear-global-phillips-curves Accessed: 27.12.2023

Forbes, K., Gagnon, J. E., & Collins, C. G. (2022). Low Inflation Bends the Phillips Curve around the World, *Economia,* 45(89), 52-72. https://doi.org/10.18800/economia .202201.003

FRED (2024). Federal Reserve Economic Data, https://fred.stlouisfed.org/ Accessed: 02.01.2024.

Friedman, M. (1968). The Role of Monetary Policy, *The American Economic Review,* 58(1), 1–17.

Galí, J., & Gertler, M. (1999). Inflation dynamic: A structural econometric analysis, *Journal of Monetary Economics,* 44(2), 195-222. https://doi.org/10.1016/S0304-3932(99)00023-9

Gayaker, S., Ağaslan, E., Alkan, B., & Çiçek, S. (2021). The deterioration in credibility, destabilization of exchange rate and the rise in exchange rate pass-through in Turkey, *International Review of Economics and Finance,* 76, 571-587. https://doi.org/10.1016/j.iref.2021.07.004

Gözgör, G. (2013). The New Keynesian Phillips Curve in an Inflation Targeting Country: The Case of Turkey, *International Journal of Economic Sciences and Applied Research,* 6(1), 7–18.

Gülşen, E., & Kara, H. (2021). Policy Performance and the Behavior of Inflation Expectations, *International Journal of Central Banking,* 17(4), 179-224.

Gürkaynak, R. S., Kantur, Z., Taş, M. A., & Yıldırım-Karaman, S. (2015). Monetary Policy in Turkey after Central Bank Independence, *İktisat İşletme ve Finans,* 30(356), 09-38. https://doi.org/10.3848/iif.2015.356.4592

Gürkaynak, R. S., Kısacıkoğlu, B., Lee, S. S., & Şimşek, A. (2023a). Türkiye'nin Enflasyon Tercihleri. A. S. Akat and S. Gürsel (Eds.), *Çıkmaz Yol: Dünden Yarına Türkiye Ekonomisi,* (pp. 123-148) In. İstanbul: İstanbul Bilgi Üniversitesi Yayınları.

Gürkaynak, R. S., Kısacıkoğlu, B., & Lee, S. S. (2023b). Exchange rate and inflation under weak monetary policy: Turkey verifies theory, *Economic Policy,* 1-42. https: //doi.org/10.1093/epolic/eiad020

Hamilton, J. D. (1990). Analysis of time series subject to change in regime. *Journal of Econometrics,* 45(1-2), 39-70. https://doi.org/10.1016/0304-4076(90)90093-9

Hamilton, J. D. (1994). *Time series analysis.* Princeton: Princeton University Press.

Hasanov, M., Araç, A., & Telatar, F. (2010). Nonlinearity and structural stability in the Phillips curve: Evidence from Turkey, *Economic Modelling,* 27, 1103-1115. https://doi.org/10.1016/j.econmod.2010.03.009

İlhan, A., Akdeniz, C., & Özdemir, M. (2023). Time-Varying Exchange Rate Pass-Through to Domestic Prices: Evidence from Turkey, *Romanian Journal of Economic Forecasting,* 26(3), 162-182.

Jordà, Ò., & Nechio, F. (2020). Inflation Globally. G. Castex, J. Gali, and D. Saravia (Eds.), *Changing Inflation Dynamics, Evolving Monetary Policy* (pp. 269-316) In. Central Bank of Chile Series on Central Banking, Analysis, and Economic Policies, 27.

Jordà, Ò., & Nechio, F. (2023). Inflation and wage growth since the pandemic, *European Economic Review,* 156*,* https://doi.org/10.1016/j.euroecorev.2023.104474

Jørgensen, P. L., & Lansing, K. J. (2023). Anchored Inflation Expectations and the Slope of the Phillips Curve, *Federal Reserve Bank of San Francisco Working Paper Series,* 2019-27. https://doi.org/10.24148/wp2019-27

Kantur, Z., & Özcan, G. (2022). Dissecting Turkish inflation: theory, fact, and illusion, *Economic Change and Restructuring,* 55, 1543-1553. https://doi.org/10.1007/ s10644-021-09357-1

Kara, H., & Sarıkaya, Ç. (2021). Enflasyon Dinamiklerindeki Değişim: Döviz Kuru Geçişkenliği Güçleniyor Mu?, *Koç University-TÜSİAD Economic Research Forum Working Paper Series,* 2121. https://eaf.ku.edu.tr/wp-content/uploads/ 2021/11/erf_wp_2121.pdf Accessed: 15.01.2024.

Karahan, P., & Çağlarırmak Uslu, N. (2018). A Dynamic Analysis on the Validity of the Phillips Curve for Turkey, *Finans Politik & Ekonomik Yorumlar*, 55(636), 89-99.

Kocoglu, M. (2023). Drivers of inflation in Turkey: a new Keynesian Phillips curve perspective, *Economic Change and Restructuring,* 56*,* 2825–2853. https://doi.org/10.1007 /s10644-023-09532-6

Koç, Ü., Öğünç, F., & Özmen, M. U. (2021). The Role of Expectations in the Inflation Process in Turkey: Have the Dynamics Changed Recently? *CBRT Working Paper,* 21/02. https://www.tcmb.gov.tr/wps/wcm/connect/EN/TCMB+EN/Main+Menu/Publications/Research/Working+Paperss/ Accessed: 27.12.2023

Lipsey, R. G. (1960). The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1862-1957: A Further Analysis, *Economica,* 27(105), 1–31. https://doi.org/10.2307/2551424

Lucas Jr., R. E. (1976). Econometric policy evaluation: A critique. In. K. Brunner and A. Meltzer (Eds.), *The Phillips curve and labour markets* (19-46). New York: Carneige-Rochester conference series on public policy. https://doi.org/10.1016/S0167-2231(76)80003-6

Mankiw, N. G. (2001). The Inexorable and Mysterious Trade-off between Inflation and Unemployment, *The Economic Journal, 111*(471), C45-C61.

Mazumder, S. (2012). European Inflation and the New Keynesian Phillips Curve, *Southern Economic Journal,* 79(2), 322–349. https://doi.org/10.4284/0038-4038-2011.149

OECD (2024). Inflation (CPI) Data, https://data. oecd.org/price/inflation-cpi.htm Accessed: 10.01.2024.

Orhangazi, Ö., & Yeldan, A. E. (2023). "*Türkiye Modeli*" – 2021 ve Sonrası: Rastgele hedefler, gerçekleşmeler ve bir bilanço, *ODTÜ Gelişme Dergisi,* 50, 171-194.

Öğünç, F., Özmen, M. U., & Sarıkaya, Ç. (2018). Inflation Dynamics in Turkey from a Bayesian perspective, *CBRT Working Paper,* 18/10. https://www.tcmb.gov.tr/wps/ wcm/connect/EN/TCMB+EN/Main+Menu/Publications/Research/Working+Paperss/ Accessed: 28.12.2023.

Önder, A. Ö. (2009). The stability of the Turkish Phillips curve and alternative regime shifting models, *Applied Economics,* 41(20), 2597–2604. https://doi.org/10.1080/00036840701222645

Özmen, İ., & Özşahin, Ş. (2023). Effects of global energy and price fluctuations on Turkey's inflation: new evidence, *Economic Change and Restructuring,* 56, 2695-2728. https://doi.org/10.1007/s10644-023-09530-8

Phelps, E. S. (1967). Expectations of Inflation and Optimal Unemployment over Time, *Economica,* 34(135), 254–281. https://doi.org/10.2307/2552025

Phillips, A. W. (1958). The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957, *Economica,* 25(100), 283–299. https://doi.org/10.2307/2550759

Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regression, *Biometrika*, 75(2), 335–346. https://doi.org/10.1093/biomet/75.2.335

Samuelson, P. A., & Solow, R. M. (1960). Analytical Aspects of Anti-Inflation Policy, *The American Economic Review,* 50(2), 177–194.

Saraçoğlu, B., Yiğit, Ö., & Koçak, N. A. (2014). Türkiye İçin Çıktı Açığı Tahmininde Alternatif Yöntemler, *Business and Economics Research Journal*, 5(3), 43-65.

Sargent, T. J. (1971). A Note on the "Accelerationist" Controversy, *Journal of Money, Credit and Banking,* 3(3), 721-725. https://doi.org/10.2307/1991369

Stock, J. H., & Watson, M. W. (2020). Slack and Cyclically Sensitive Inflation, *Journal of Money, Credit and Banking,* 52(S2), 393–428. https://doi.org/10.1111/jmcb.12757

Ulug, M., Işık, S., & Mert, M. (2023). The effectiveness of ultra-loose monetary policy in a high inflation economy: a time-varying causality analysis for Turkey, *Economic Change and Restructuring,* 56, 2855-2887. https://doi.org/10.1007/s10644-023-09535-3

Wardhono, A., Nasir, M. A., Qori'ah, C. G., & Indrawati, Y. (2021). Movement of Inflation and New Keynesian Phillips Curve in ASEAN, *Economies,* 9(1), 34. https://doi.org/10.3390/ economies9010034

Yazgan, M. E., & Yilmazkuday, H. (2005). Inflation Dynamics of Turkey: A Structural Estimation, *Studies in Nonlinear Dynamics & Econometrics,* 9(1), 1-13. https://doi.org/10.2202/1558-3708.1228

Yilmazkuday, H. (2022). Drivers of Turkish Inflation. *Quarterly Review of Economics and Finance*, 84*,* 315-323. https://doi.org/10.1016/j.qref.2022.03.005