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# INVESTIGATING OF PERSISTENCE IN CORE, FOOD AND ENERGY INFLATIONS: AN EVIDENCE FROM TIME-VARYING APPROACH

## *ÇEKİRDEK, GIDA VE ENERJİ ENFLASYONLARINDA KALICILIĞIN ARAŞTIRILMASI: ZAMANLA DEĞİŞEN YAKLAŞIMDAN BİR KANIT*

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**Abstract:** This study examines how inflation persistence evolves over time in Euro Area, the UK, the US, and OECD countries over the period of 1999:07-2021:09. We consider the persistence of core, energy, and food inflation, as well total inflation. Using an ARMA(1,1) model with time-varying autoregressive parameters based on the Kalman filter (TV-AR), we find that inflation persistence increases significantly during crisis periods and total persistence peaks during the COVID-19 pandemic. However, the persistence of energy inflation decreases due to the economic slowdown during the COVID-19 pandemic. These results highlight how inflation persistence is related to monetary policy objectives and conduct. The findings indicate that the various measures taken by the governments such as containment and closure policies, and travel restrictions to prevent the spread of COVID-19 cause to increase in total and food inflation persistences. Energy inflation persistence declines due to a slowdown in production during COVID-19.

**Keywords**: Inflation, Inflation Persistence, Political Economy, Time-Varying Model

***Öz:*** *Bu çalışmada 1999:07-2021:09 döneminde Avrupa Bölgesi, İngiltere, Amerika ve OECD ülkelerinde zamanla değişen enflasyon kalıcılığını incelenmektedir. Çalışmada, toplam enflasyonun yanında çekirdek, enerji ve gıda enflasyonları da dikkate alınmıştır. Kalman filtresine dayalı zamanla değişen otoregresif parametreli ARMA (1,1) modeli (TV-AR) kullanılan çalışmadan elde edilen bulgulara göre, kriz dönemlerinde enflasyon kalıcılığının arttığını ve COVID-19 pandemisi döneminde toplam enflasyonun zirve yaptığı sonucuna ulaşılmıştır. Bununla birlikte, COVID-19 pandemisi döneminde ekonomik yavaşlama nedeniyle enerji enflasyonu kalıcılığı azalmaktadır. Bu sonuçlar, enflasyon kalıcılığının para politikasının amaçları ile ilişkili olduğunu göstermektedir. Ayrıca, COVID-19 pandemisinin yayılımını önlemek amacıyla seyahat kısıtlamaları, kapanmalar gibi devletler tarafından alınan çeşitli önlemler toplam ve gıda enflasyon kalıcılıklarının artmasına neden olduğu tespit edilmiştir. Enerji enflasyon kalıcılığı ise COVID-19 döneminde üretimdeki yavaşlamadan dolayı azaldığı belirlenmiştir.*

***Anahtar Kelimeler:*** *Enflasyon, Enflasyon Kalıcılığı, Politik Ekonomi, Zamanla Değişen Model*

***JEL:*** *E52, E31, C22*

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## 1. Introduction

Inflation is a crucial macroeconomic indicator that adversely influences economic agents' consumption, investment, and saving by causing uncertainty in an economy. Therefore, it is important to investigate whether inflation becomes persistent for policymakers. Inflation persistence represents the time how much it takes an inflation shock to disappear. Inflation persistence is defined as the speed with which inflation turns into the equilibrium level after a shock (Willis, 2003, Marques, 2005). In terms of this definition, it is important to identify explicitly and accurately the equilibrium level (or long-term average) because the convergence rate of inflation to its equilibrium level after a shock is based on its equilibrium level before the shock in question (Marques, 2005). Inflation persistence is a significant factor in the determination of the effectiveness of monetary policy. In addition, the inflation persistence level shows the economy's sensitivity to exogenous shocks. Therefore, it is important to policy authorities (Yu et al., 2023).

Two exogenous shocks, which are the COVID-19 pandemic and the Russia-Ukraine war, have significantly influenced inflation around the world since the beginning of 2020. The policy measures taken to decrease the adverse impacts of the COVID-19 pandemic have led inflation uncertainty to increase worldwide. Although some economists have caveated about high inflation arising from large fiscal stimulus packages applied to recover the economy (Blanchard 2021, Summers 2021, Gagnon 2021, Goodhart and Pradhan 2021), other economists have had more optimistic expectations on inflation during the Covid-19 period (Ball et al. 2021, Brigone et al. 2021, Ha et al. 2021, Gopinath 2021). The upward pressure on prices due to the output passing over the potential level is much higher than the same downward pressure due to the output below the potential. This asymmetry in the Phillips curve is related to the effect of global indicators, which includes global recession, deterioration in the supply chain, global commodity prices, producer price competition, and exchange rates, which has played a crucial role in the sharp fluctuations in inflation rates during the COVID-19 period.

In the early of the COVID-19 pandemic, inflation slumped swiftly in many countries due to the closure of large sectors and a decrease in demand. The downfall in global commodity prices played an important role in this fall. When considering the magnitude of the economic shrinkage and domestic recession in many countries, the fall in inflation was less than expected. The huge margin of domestic recession in many countries led to a leap to the flat part of the Phillips curve, in which any ongoing breakdown in economic activity had a minimum extra effect on inflation.

During the post-COVID-19 period, a recovery in economic activity with mitigating the stringency policies in many countries caused demand for energy and other commodities to rise, creating an abrupt boom in inflation. In addition, a slower recovery of supply chains, nourished by intense consumer demand and supply shocks, such as an increase in natural gas prices, has led inflation to increase more than expected worldwide. An increase in financial market-based inflation precautions might also represent risk premia dynamics. However, a more persistence inflationary pressure might bring up a more persistent rise in inflation expectations. US Federal Reserve Chairman Jerome Powell stated that inflation is not temporary (Forbes et al., 2021).

We investigate the time-varying degree of inflation persistence for the Euro Area, OECD countries, the United Kingdom, and the United States over the period of July 1999-September 2021. Inflation persistence is a crucial issue for especially central banks, as well as economists. So, our research questions are as follows:

- Which countries have higher persistence in inflation in the pre-COVID and post-COVID periods?
- How does the COVID-19 pandemic influence inflation persistence in terms of various inflations, such as total, core, food, and energy?
- How does inflation persistence differ in developed and emerging economies?
- Does inflation persistence varies over time, such as expansions and in recessions periods?

The study is expected to contribute to the literature in several ways. Firstly, we provide an empirical evaluation using the estimation method with time-varying dynamics to measure inflation persistence for the period of 1997:07-2021:09. The level of inflation persistence allows us to evaluate the extent to which central banks can control inflation. However, evaluating change in inflation persistence over time becomes more of an issue to implement responsible policy decisions for policy-makers although the degree of inflation persistence is substantial for economic policies. So, we use ARMA(1,1) model with time-varying parameters to measure the degree of inflation persistence, enabling us to investigate the change in inflation persistence over time and thus the possible effect of the COVID-19 pandemic. Thanks to this model, shifts in monetary policy preferences of central banks can be captured. In the literature, some studies (Atkeson and Ohanian, 2001; Stock and Watson, 2007, 2009; Faust and Wright, 2013) ruled out the time-varying trend of inflation and supposed that inflation is constant in the steady state. A few studies (Adolfson et al., 2007; Yazgan and Yilmaz Kuday, 2007; Yilmaz Kuday, 2007; Cogley and Sbordone, 2008) focused on changes in trend inflation to estimate inflation dynamics. However, limited studies investigated the time-varying inflation persistence (McKnight et al., 2020; Devpura et al., 2021; Canepa, 2022; Yu et al., 2023) to reflect shifts in monetary policy preferences in the framework of the New Keynesian Phillips Curve (NKPC) with a time-varying trend. Secondly, the studies focusing on inflation persistence (Caporin and Gupta, 2017; Boubaker, 2018; Bilici and Çekin, 2020; Tan and Liu, 2021; Caporale et al., 2022; Devpura et al., 2021; Canepa, 2022; Yu et al., 2023) only consider aggregate inflation. This paper aims to fill this gap in the literature by discussing the persistence of core inflation, energy inflation, and food inflation in addition to aggregate inflation. Since energy and food prices play a serious role in high inflation during COVID-19, we purpose to reveal separately the impacts of energy and food prices on inflation persistence. Lastly, our study covers an extensive dataset, including the OECD countries, Euro Area, the United States, and the United Kingdom. Hereby, we have an opportunity to compare the degree of inflation persistence across developed and emerging economies.

This study follows as follows. In the next section, the literature relating to inflation persistence is summarized. In Section 3, the model is discussed. Data are clarified in Section 4. Then, the empirical results are reported and interpreted in Section 5. In the last section, the results are evaluated and the policy recommendations are discussed.

## 2. Literature Review

Inflation persistence is an important indicator evaluating the efficiency of monetary policy. There is extensive literature examining inflation persistence. These studies (Dhyne et al. 2005; Altissiom et al. 2006, 2007; Benigno and Lopez-Salido, 2006; Cecchetti and Debelle, 2006, Gerlach and Tillmann, 2012) research the inflation persistence in terms of countries and sectors with different levels of disaggregation. These studies investigate the pricing behaviors of the companies on aggregate inflation persistence and also state that inflation persistence changes across sectors and countries. They also reveal the importance of different sectoral prices on inflation persistence and state that the same view should also be provided across regions in the same country. However, the studies examining the regional difference in inflation persistence are rather limited (Cecchetti et al., 2002; Beck and Weber, 2005; Busetti et al., 2006; Meller and Nautz, 2012). Gerlach and Tillmann (2012) research the degree of inflation persistence for the Asia-Pacific countries in terms of different economic regimes. They conclude that inflation persistence in the countries with inflation targeting decreased with the acceptance of inflation targeting; but, the countries with non-inflation targeting have a high degree of inflation persistence. Similarly, Bratsiotis et al. (2015) state that the degree of inflation persistence increases in economies, which less consider price stability targets. Kocenda and Varga (2008) research the effect of monetary policy strategies on inflation persistence in developed and developing countries. They indicate that the policy strategies with price stability targets help reduce inflation persistence.

In the literature, inflation persistence is measured using different econometric methodologies. Some studies apply unit root tests to test inflation persistence (Narayan, 2014; Arize and Malindretos, 2012; Narayan and Popp, 2013; Chen and Hsu, 2016; Gaglianone et al., 2018). These studies classify the results for inflation persistence into three groups. The first group reports the presence of a unit root in the inflation series while the second group indicates that the inflation series doesn't include a unit root. The last group investigates the nonlinear structure in the inflation series (Caglayan and Filiztekin, 2003; Lucey et al., 2017; Narayan et al., 2020). However, several studies focus on time-dependent inflation persistence (Narayan and Popp, 2013; Devpura et al., 2018, 2021). Devpura et al. (2018, 2020) suggest a time-varying unit root model with two structural breaks, which allows for a trend in the model, to evaluate the time-dependent inflation persistence. Some studies utilize the vector autoregressive (VAR) model (Alper and Üçer, 1998; Marques, 2004; Rumler and Valderrama, 2010; Lovcha and Perez-Laborda, 2018, Michau, 2019) and quantile autoregression model (Çiçek and Akar, 2013; Gaglianone et al., 2018), the others (Erlat, 2002, Granville and Zeng, 2019) use ARFIMA model and ARFIMA-GARCH models allowing for the long memory.

An exploration of the time-varying inflation persistency is of importance to evaluate the time-varying efficiency of monetary policy. The studies investigating the time-varying inflation persistence (Beechey and Österholm, 2009; Caporin and Gupta, 2017; Boubaker, 2018; McKnighy et al., 2020; Bilici and Çekin, 2020; Devpura et al., 2021, Tan and Liu, 2021, Yu et al., 2023) are rather scarce. Caporin and Gupta (2017) represent using an autoregressive fractionally integrated moving-average-generalized autoregressive conditional heteroskedastic model with a time-varying memory coefficient that the persistence of inflation volatility reaches a higher level in expansions than in recessions for the period of 1920:1–2014:5. Boubaker (2018)

analyzes inflation persistence through the time-varying fractional integration model allowing for the time-varying long-memory parameters based on the Smooth Transition Regressive model and reports the long-range dependence in the volatility of inflation series and high inflation persistence during the periods of inflation uncertainty. McKnight et al. (2020) explore the time-varying trend inflation persistence for the US and Euro Area to detect shifts in monetary policy preferences and develop theory-based forecasts for inflation persistence. For Turkey, Bilici and Çekin (2020) examine inflation persistence using the time-varying parameter estimation based on the Kalman filter and document that inflation persistence raises and has high volatility during the high inflation periods when the inflation expectations and pricing behaviors are destroyed, but declines with price stability. Devpura et al. (2021) investigate the time-varying inflation persistence using the time-varying structural break unit root test for Asian countries and find that the crisis periods and the changes in monetary policy regimes have important effects on inflation persistence. Tan and Liu (2021) propose a new structure to the ARFIMA-GARCH model, which considers time-varying mean and symmetric threshold GARCH to research inflation persistence in G7 countries. They indicate that there are excessive shocks and structural changes in inflation persistence in certain periods. For the period of September 1997-August 2022, Caporale et al. (2022) examine to what extent of the COVID-19 pandemic and the Russia-Ukraine war impacted inflation persistence using the fractional integration model in the European Union (EU27). They find evidence of a significant rise in inflation persistence due to both shocks and state that these impacts on inflation persistence are long-lasting but temporary. Using a time-varying GARCH-type model, Canepa (2022) analyzes inflation persistence in the US, Japan, France, and Italy during the period 1960Ql-2021Ql and exhibits that inflation uncertainty varies over time. Yu et al. (2023) analyze inflation persistence in the US using a time-varying auto-regressive distributed lag model during the 1959:Q1 to 2022:Q3. The analysis results reflect the inflation persistence in the US decreased during the global financial crisis but rebounded powerfully after the crisis until 2022.

The above studies only consider aggregate inflation persistence and ignore energy and food inflation persistence. With the Covid-19 pandemic, it has been seen that energy and food prices have noticeably increased due to deterioration in the supply-demand chain. This paper aims to fill the gap in the literature by investigating core inflation persistence, energy inflation persistence, and food inflation persistence, and the global and country-specific factors affecting inflation persistence using the time-varying parameter estimation method.

## 3. Model

The response of inflation to the shocks can be classified in three ways including short memory (a persistence declining at an exponential rate), long memory (a persistence decaying at a hyperbolic rate), and perfect memory (a persistence being infinite), which indicates different extents of the so-called responses (Baillie et al., 1996; Baum et al., 1999). However, another classification for inflation persistence by Batini and Nelson (2001) includes "*positive serial correlation in inflation*", "*lags between systematic monetary policy actions and their impact on inflation*", and "*lagged reactions of inflation to nonsystematic policy shocks*". According to the first description, inflation persistence is stated as the relationship between inflation and its past values and is called "*inflation inertia*". In terms of this description, inflation persistence can be demonstrated by the coefficient of the estimated AR(p) model.

The central bank is supposed to minimize the loss function. To solve this problem, the AR(1) process is taken into consideration by the central bank. In other words, inflation persistence indicates the speed of adjustment of the AR model. This adjustment level is depended on the relative preference of the central bank for output stability and the macroeconomic structural parameters (Beechey and Österholm, 2018). Clarida et al. (1999) and Beechey and Osterholm (2007) modified the AR(1) process for time-varying inflation persistence. The AR(1) process with time-varying persistence is as follows:

$$\pi_t - \pi^* = p_t(\pi_t - \pi^*) + u_t \qquad (1)$$

Also, MA(1) process is included in the inflation persistence model. The modified ARMA(1,1) model with time-varying parameters can be stated as follows:

$$\pi_t - \pi^* = p_t(\pi_t - \pi^*) + \theta_i\, u_{t-1} + u_t \qquad (2)$$

where $p_t$ shifts as a random walk, in other words, $p_t = p_{t-1} + e_t$. $p_t$ is the persistence parameter re-estimated in recursive stationary $|p| < 1$, and inflation persistence is covariance stationary (Hamilton, 1994), which means that the inflation persistence can be evaluated as stable. However, if $|p| \geq 1$, there is no covariance-stationary process for the inflation persistence, which indicates that the inflation persistence follows an explosive process. Supposing no correlation between $e_t$ and $u_t$, the inflation persistence model is estimated through a maximum likelihood estimator using the Kalman filter, in which $p_t$ behaves as an unknown state variable. This provides strong evidence that the inflation persistence has been non-stable and increase in recent times.

## 4. Data

This study aims to determine the degree of inflation persistence in the Euro area, the United Kingdom, the United States, and OECD countries. The sample involves the period from July 1999 to September 2021, including 267 observations at monthly frequency. We consider four inflation rates: 1) Total inflation is measured by the Consumer Price Index (CPI) annual growth rate for All Items. 2) food inflation is measured by the annual growth rate of CPI food and non-alcoholic beverages. 3) energy inflation is measured by the annual growth rate of CPI energy. 4) core inflation is measured by the annual growth rate of the Consumer Price Index for All Items nonfood and nonenergy. The data are obtained from the OECD database. The variables used in this study are given in Table 1.

**Table 1: The explanations for the variables used in the analysis**

| Variables | Description | Source |
|---|---|---|
| $\pi_{EA}$ | Consumer Price Index Total, Annual Growth Rate (%) in Euro Area | OECD database |
| $\pi_{UK}$ | Consumer Price Index Total, Annual Growth Rate (%) in the United Kingdom | OECD database |
| $\pi_{USA}$ | Consumer Price Index Total, Annual Growth Rate (%) in the United States | OECD database |
| $\pi_{OECD}$ | Consumer Price Index Total, Annual Growth Rate (%) in OECD countries | OECD database |
| $\pi food_{EA}$ | Consumer Price Index food and non-alcoholic beverages, Annual Growth Rate (%) in Euro Area | OECD database |
| $\pi food_{UK}$ | Consumer Price Index food and non-alcoholic beverages, Annual Growth Rate (%) in the United Kingdom | OECD database |
| $\pi food_{USA}$ | Consumer Price Index food and non-alcoholic beverages, Annual Growth Rate (%) in the United States | OECD database |
| $\pi food_{OECD}$ | Consumer Price Index food and non-alcoholic beverages, Annual Growth Rate (%) in OECD countries | OECD database |
| $\pi energy_{EA}$ | Consumer Price Index energy, Annual Growth Rate (%) in Euro Area | OECD database |
| $\pi energy_{UK}$ | Consumer Price Index energy, Annual Growth Rate (%) in the United Kingdom | OECD database |
| $\pi energy_{USA}$ | Consumer Price Index energy, Annual Growth Rate (%) in the United States | OECD database |
| $\pi energy_{OECD}$ | Consumer Price Index energy, Annual Growth Rate (%) in OECD countries | OECD database |
| $\pi core_{EA}$ | Consumer Price Index All Items nonfood nonenergy, Annual Growth Rate (%) in Euro Area | OECD database |
| $\pi core_{UK}$ | Consumer Price Index All Items nonfood nonenergy, Annual Growth Rate (%) in the United Kingdom | OECD database |
| $\pi core_{USA}$ | Consumer Price Index All Items nonfood nonenergy, Annual Growth Rate (%) in the United States | OECD database |
| $\pi core_{OECD}$ | Consumer Price Index All Items nonfood nonenergy, Annual Growth Rate (%) in OECD countries | OECD database |

The graphs of the dynamics for four inflations are summarized in Figure 1. As seen from Figure 1, the mean inflation rates for Euro Area, OECD countries, the United Kingdom, and the United States are 1.51 percent, 2.09 percent, 2.11 percent, and 2.08 percent respectively in all periods. This indicates that the region with the lowest inflation is Euro Area, but the United Kingdom has the highest inflation. Similarly, the Euro Area has the lowest mean core inflation when compared to the other regions. The mean food inflation has the highest value for OECD countries (2.40%) while the United Kingdom has experienced the highest energy inflation (4.61%). The total inflation, food inflation, and energy inflation decreased in both Euro Area and the United Kingdom while an increase in the United States and OECD countries during the COVID-19 period. The energy inflation is less for all regions during the COVID-19 period than in the pre-COVID-19 period. The standard deviations of the inflation series are in the range of 0.39-7.33 for Euro Area, 0.34-8.79 for OECD countries, 0.40-7.61 for the United Kingdom, and 0.54-13.10 for the United States. The standard deviations of the energy inflation series are rather high for Euro Area (7.33), OECD (8.79), the United Kingdom (7.61), and the United States (13.10). The energy inflation and output gap series are negatively skewed, suggesting that they have fatter tails on

the left side of the distributions, while the other series are positively skewed. Core inflation and food inflation series appear to exhibit asymmetry and fat tail. That is, these series do not have a normal distribution.

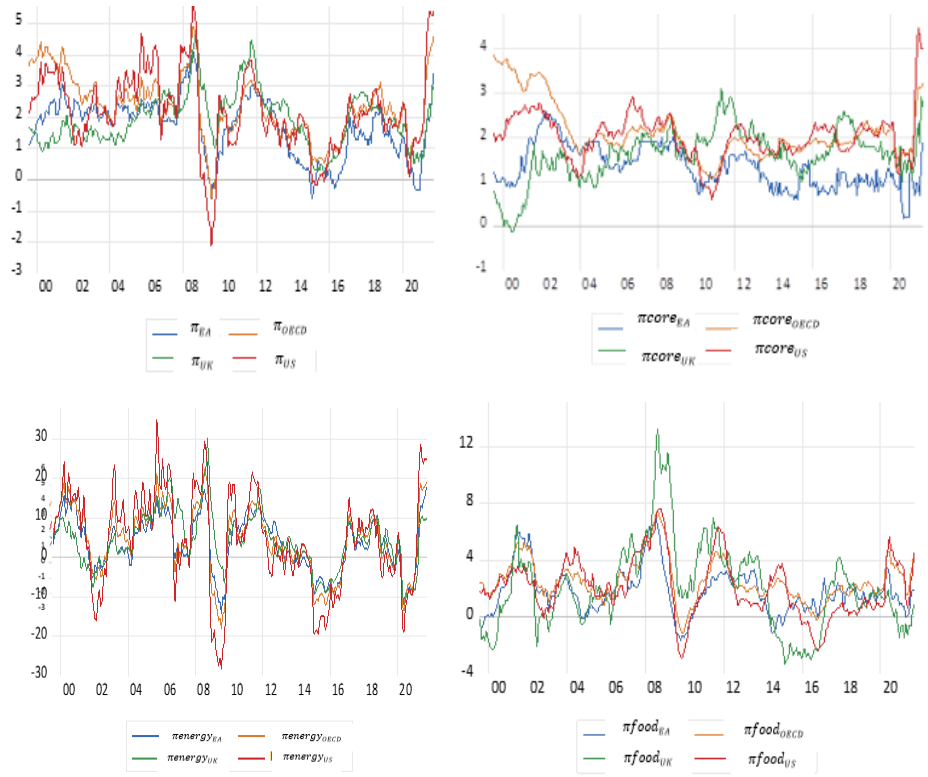


**Figure 1. The Graphs of Dynamics of Four Inflations**

## 5. Empirical Results

We test inflation persistence for Euro Area, the United Kingdom, the United States, and OECD countries. We take into account inflation persistence as a positive serial correlation in inflation, as defined by Batini and Nelson (2001). By this definition, inflation persistence can be estimated by an ARMA(p,q) model. However, ARMA(p,q) model assumes that mean inflation is constant, which can cause an overestimation of inflation persistence, as stated by Marques (2005). Besides, ARMA(p,q) model with time-invariant coefficients does not let it determine the effects of policy changes. Due to these problems, we use ARMA(p,q) model with a time-varying parameter. Through this model, we can show how the behaviors and expectations of economic agents will change depending on a change in economic policy, which states the critique by Lucas (1976). In terms of inflation persistence, we can see how it responds to changes in monetary policy.

We estimate ARMA(1,1) model with time-varying parameters with the maximum likelihood method using the Kalman filter for each inflation variety. These models are selected based on the minimum Akaike value, the model stationary assumptions, and the significance of parameters. The state space representations of these models can be stated as follows:

$$\pi_{i,t} = \pi^*(1-p_t) + p_t\pi_{i,t-1} + \theta_i\, u_{t-1} + u_t \quad (3)$$

$$\pi core_{i,t} = \pi core^*(1-p_t) + p_t\pi core_{i,t-1} + \theta_i\, u_{t-1} + u_t \quad (4)$$

$$\pi food_{i,t} = \pi food^*(1-p_t) + p_t\pi food_{i,t-1} + \theta_i\, u_{t-1} + u_t \quad (5)$$

$$\pi energy_{i,t} = \pi energy^*(1-p_t) + p_t\pi energy_{i,t-1} + \theta_i\, u_{t-1} + u_t \quad (4)$$

$$\pi_{i,t}: \{\pi_{EA,t}, \pi_{OECD,t}, \pi_{UK,t}, \pi_{US,t}\}$$

Figure 2, Figure 3, Figure 4, and Figure 5, respectively, show the graphs of the estimated values of the time-varying AR(1) coefficient indicating inflation persistence for Euro Area, OECD countries, the United Kingdom, and the United States. According to Figure 2, total inflation persistence has increased since Global Financial Crisis (GFC) in Euro Area. In other words, the AR parameters range from 0.70 to 0.80 before GFC, while AR parameters are closer to 1 since this date. Besides, the highest total inflation persistence in the Euro area is recorded during the Covid-19 pandemic. The AR parameters for food inflation are large in the Euro area for the entire period. Energy inflation persistence decreases markedly after GFC. The core inflation persistence has shown an increase again in Euro Area during the COVID-19 pandemic. According to Figure 3, total inflation persistence in OECD countries is high over all periods. The estimated AR parameters ranged from 0.90 to 1.6. The highest value of inflation persistence was recorded throughout the Covid-19 pandemic. Similarly, although food inflation persistence is high for the whole period, it increases markedly in 2021.

Contrary to this, energy inflation persistence decreases considerably after 2020 which is the starting date of the COVID-19 pandemic. The core inflation persistence tends to increase overall period. According to Figure 4, in the United Kingdom, total inflation persistence declines during the GFC, but after this date, it starts to rise again. Persistence sharply decreases in food inflation during the COVID-19 period. Energy inflation persistence is high overall period, so the AR parameters take the values between 0.92 and 0.95. For the core inflation persistence, the AR parameters have been significantly more before GFC. According to Figure 5, in the United States, the values of the AR parameters change between 0.90 and 1.20. The total inflation persistence is higher in pre-GFC than post-GFC. Food inflation persistence shows an increasing trend during the COVID-19 period. However, energy inflation persistence declines dramatically. Similarly, the core inflation persistence is significantly lower than in pre-COVID-19.

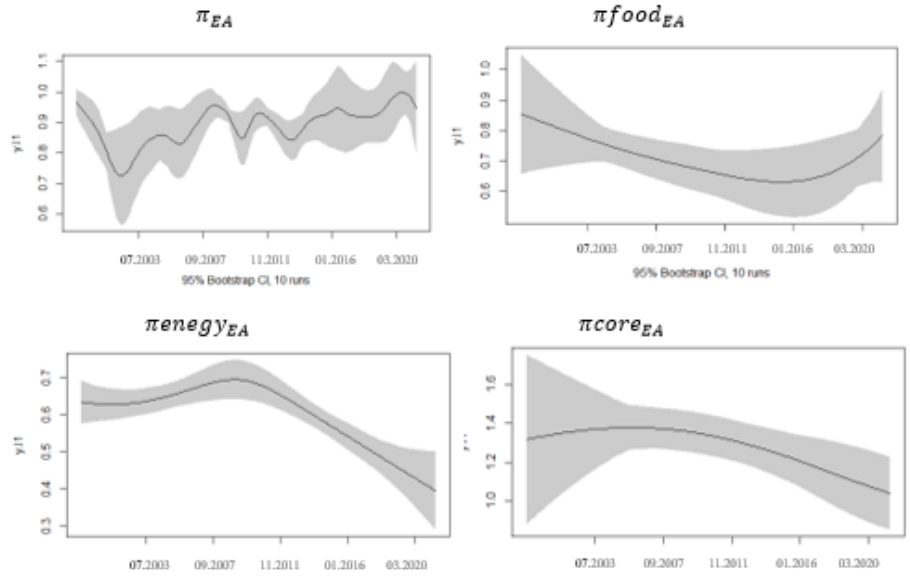


**Figure 2 The Graphs of Persistence in Total, Food, Energy and Core Inflations for Euro Area**

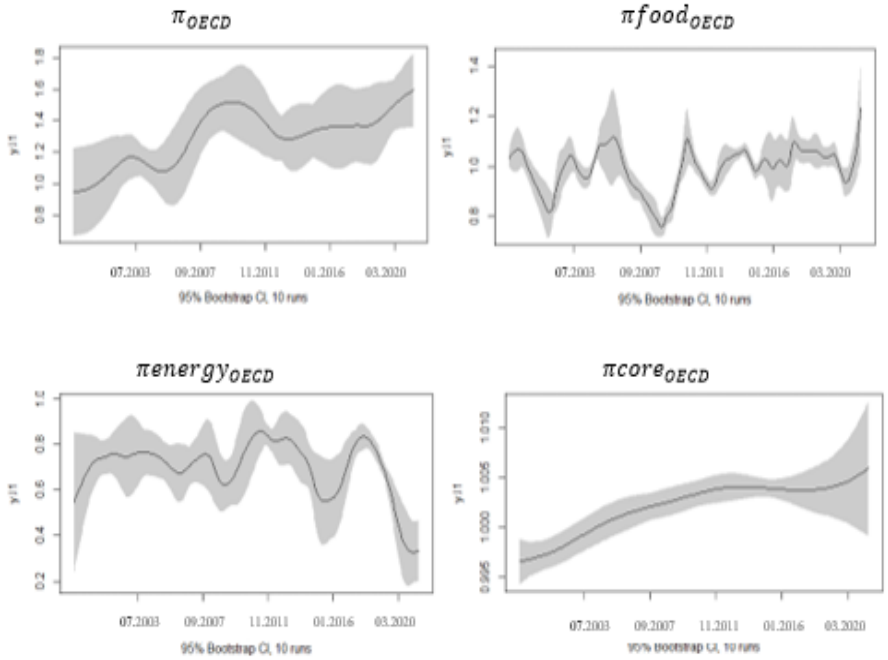


**Figure 3 The Graphs of Persistence in Total, Food, Energy and Core Inflations for OECD**

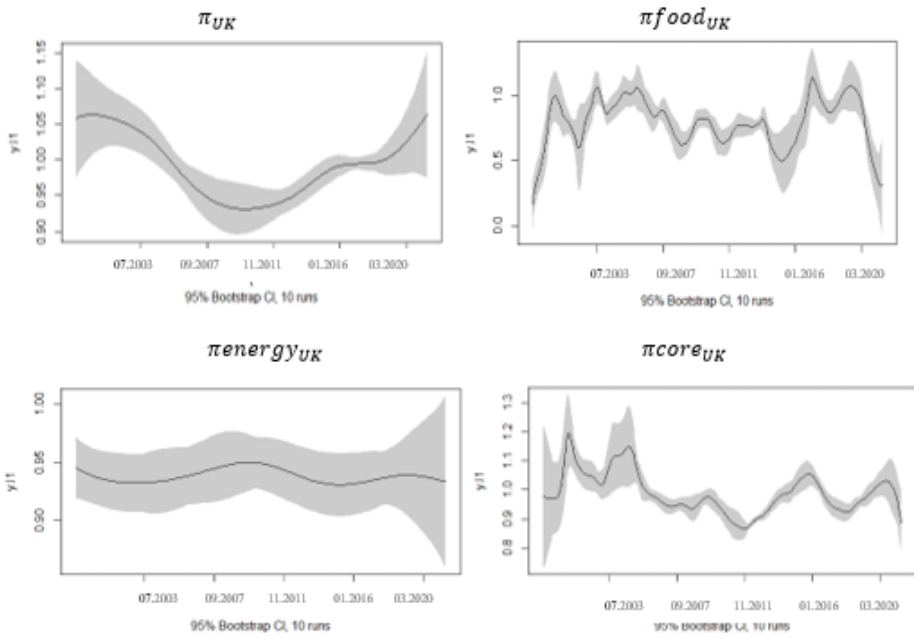


**Figure 4 The Graphs of Persistence in Total, Food, Energy and Core Inflations for the United Kingdom**

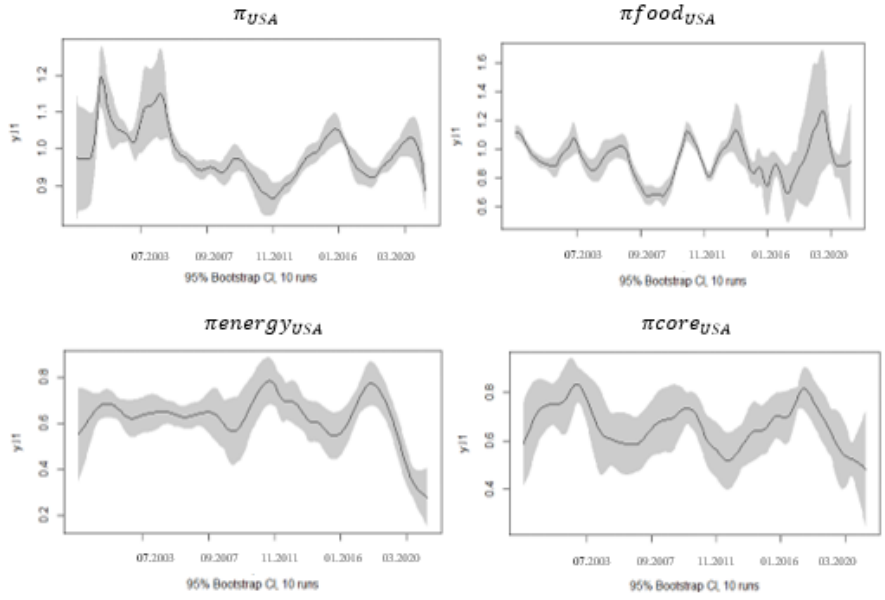


**Figure 5 The Graphs of Persistences in Total, Food, Energy and Core Inflations for the United States**

The results from the TV-AR models can be summarized in Table 2.

**Table 2 The Summary Results for Inflation Persistence**

| | GFC | Pre-COVID19 | COVID-19 | Post-COVID19 |
|---|---|---|---|---|
| $\pi_{EA}$ | increase | decrease | increase | increase |
| $\pi_{UK}$ | decrease | increase | increase | increase |
| $\pi_{USA}$ | decrease | increase | decrease | increase |
| $\pi_{OECD}$ | increase | decrease | increase | increase |
| $\pi food_{EA}$ | decrease | decrease | increase | increase |
| $\pi food_{UK}$ | decrease | increase | decrease | decrease |
| $\pi food_{USA}$ | decrease | decrease | increase | increase |
| $\pi food_{OECD}$ | decrease | decrease | increase | increase |
| $\pi energy_{EA}$ | increase | decrease | decrease | decrease |
| $\pi energy_{UK}$ | increase | decrease | decrease | decrease |
| $\pi energy_{USA}$ | increase | increase | decrease | decrease |
| $\pi energy_{OECD}$ | increase | increase | decrease | decrease |
| $\pi core_{EA}$ | increase | decrease | decrease | decrease |
| $\pi core_{UK}$ | decrease | increase | decrease | decrease |
| $\pi core_{USA}$ | increase | increase | increase | decrease |
| $\pi core_{OECD}$ | increase | İncrease | increase | increase |

## 6. Conclusion

Determining the behavior of inflation is crucial to evaluate monetary policy. In an economy with persistent inflation, convergence to equilibrium will be delayed due to inflation shocks. In such a case, the fight of the monetary authority against inflation gets hard and the monetary authority implements different tools and policies to return inflation to the equilibrium level. In this study, we purpose to measure the time-varying inflation persistence in the Euro Area, the UK, the USA, and OECD countries. We take into consideration the core, food, and energy inflation persistence besides the total inflation. In other words, in this study, we examine total, food, energy, and core inflation persistences for Euro Area, the UK, the USA, and OECD countries by using the TV-AR model.

The results show that Euro Area experienced the highest total inflation persistence during the Covid-19 pandemic. Similarly, this finding is valid for OECD countries. Supply and demand factors such as incremental costs from deterioration in the supply chain, past increases in commodity prices, containment measures, and a desire to compensate for past losses can be stated as the reason for high inflation during the COVID-19 period (Jordà et al. 2022, Açıkgöz et al., 2021). Especially, food inflation has increased significantly since 2021. These results stem from the deterioration in the food supply chain, global climate change, and increasing demand. In the United Kingdom, energy and food inflations reach their peak level by 2021 due to the economic recovery and accordingly increasing demand following the removal of closure measures. The United States experiences an abrupt increase in inflation, especially in food prices in 2021. The empirical findings support the studies of Yu et al. (2023) and Caporale et al. (2022).

Consequently, the empirical findings indicate that the various measures taken by the governments such as containment and closure policies, and travel restrictions to prevent the spread of COVID-19 cause a rise in total and food inflation persistence.

Energy inflation persistence declines due to a slowdown in production during COVID-19.

The findings show the fact that uncertainty from inflation persistence varies over time has substantial policy implications. Exhibiting the degree of inflation persistence over time and structural shifts in the inflation dynamics is important to implement efficient monetary policy implemented by central banks. Global factors have an important impact on inflation persistence in shaping the inflation dynamics. The future study is planned to focus on how global factors play a role in inflation persistence.

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