ASYMMETRICAL IMPACTS OF GLOBAL DRIVERS ON INFLATION: EVIDENCE FROM NEW-KEYNESIAN PHILLIPS CURVE[1]

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ABSTRACT

This study examines inflation dynamics by introducing global factors to the New Keynesian Phillips Curve (NKPC) under various inflation conditions for developed countries from January 1998 to December 2022. The Threshold VAR (TVAR) model is employed to identify potential nonlinearity arising from asymmetric responses to shocks and regime switching. The results indicate a negative relationship between the inflation and unemployment, with the exception of Germany and Japan in high inflation conditions. Expected inflation has an important impact on inflation. Moreover, the variance between the 10-year government bond rate and the 3-month interbank rate leads to an increase in inflation during high inflation regimes. As for global factors, global supply chain pressure has a more pronounced impact on inflation during low inflation conditions, whereas changes in oil and commodity prices have a greater effect on inflation during high inflation conditions. The findings show that central banks have become more effective at stabilizing economies against domestic shocks, but challenges remain with external shocks.

Keywords: Inflation, new keynesian phillips curve, threshold VAR

JEL Codes: *E31, E52, C32*

Scope: *Economics*
Type: *Research*

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[1] Compliance with the ethical rules of the relevant study has been declared.

KÜRESEL BELİRLEYİCİLERİN ENFLASYON ÜZERİNDEKİ ASİMETRİK ETKİSİ: YENİ KEYNESYEN PHILPS EĞRİSİNDEN KANIT

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ÖZ

Bu çalışma, farklı enflasyon koşulları altında Yeni Keynesyen Philips Eğrisi'ne (NKPE) küresel faktörleri dahil ederek gelişmiş ülkeler için Ocak 1998 – Aralık 2022 dönem aralığında enflasyon dinamiklerini incelemektedir. Rejim değişiminden kaynaklanan olası doğrusal olmamayı ve şoklara asimetrik tepkileri tanımlamak amacıyla Eşik Değişkenli VAR (TVAR) yöntemi kullanılmıştır. Çalışmadan elde edilen sonuçlar, yüksek enflasyon koşullarında, Almanya ve Japonya haricindeki ülkelerde, işsizlik ve enflasyon arasında negatif bir ilişkiyi göstermektedir. Beklenen enflasyon, enflasyonun belirlenmesinde önemli bir rol oynamaktadır. Ayrıca, yüksek enflasyon rejiminde 10 yıllık devlet tahvili ve 3 aylık bankalar arası faiz oranı arasındaki fark enflasyonda artışa neden olmaktadır. Küresel faktörler açısından, küresel arz zincir baskısı düşük enflasyon koşullarındaki etkisi daha belirginken, petrol ve emtia fiyatlarındaki değişmeler yüksek enflasyon koşullarında enflasyon üzerinde daha büyük bir etkiye sahiptir. Çalışmadan elde edilen bulgular, merkez bankalarının yurtiçi şoklara karşı ekonomilerde istikrarı sağlamada daha etkili hale geldiğini, dış şoklarla ilgili zorlukların devam ettiğini göstermektedir.

Anahtar Kelimeler: *Enflasyon, yeni keynesyen philips eğrisi, eşik değişkenli VAR*

JEL Kodları: *E31, E52, C32*

Alan: *İktisat*
Türü: *Araştırma*

1. INTRODUCTION

As the global economy began to recover from the COVID-19 pandemic, supply chain disruptions became more pronounced, putting upward pressure on prices. Many companies found it challenging to meet the rising consumer demand due to widespread shortages of supplies and delays in delivery. The supply-demand imbalances caused by the pandemic resulted in a significant shortage of raw materials and container transportation, leading to price increases for these items. These challenges, along with their impact on inflation, were worsened by labor shortages, low inventory levels, and production delays due to COVID-19 containment measures and increases in commodity prices induced by the Russia-Ukraine war. While such disruptions were relatively rare before the pandemic, they have increasingly become a common occurrence in many countries (Binici, Centorrino, Cevik, & Gwon, 2022; Ascari, Bonam, & Smadu, 2024). Global inflation, which had been relatively stagnant for a decade, has significantly fluctuated over the past four years. It sharply declined during the pandemic due to reduced demand and oil prices but began to rise again by mid-2020 as demand recovered and supply chain disruptions worsened. By 2022, inflation reached its highest level since the mid-1990s (Ha vd. 2024). The COVID-19 pandemic have profoundly impacted the global economy and inflation, disrupting supply chains and leading to significant inflationary pressures and increased price stickiness (Usman & Gil-Alana, 2024). Global inflation has reached 7.5% as of August 2022. This ratio is 2.1% between 2010-2010 and 3.4% in 2020 (Binici et al., 2022). Inflation rate in the Euro Area reached the highest level in history with 8.4% in 2022. Similarly, inflation rate peaked at 9.5% in the UK, 8.7% in Gemany, 5.9% in France, 8.7% in Italy and 6.8% in Canada in this period. Therefore, global factors such as oil prices and supply chain pressures have increasingly become significant drivers of inflation. This problem is not only recurred in developing countries, but it has also become an important phenomenon in developed countries with low and stable inflation for long years.

The Covid-19 pandemic has led to a re-evaluation of the inflation-unemployment relationship. While unemployment fell sharply, inflation surged, contradicting traditional views. The Phillips curve, introduced by A.W. Phillips in 1958, appears outdated as inflation rose despite high unemployment early in the pandemic and continued to increase during recovery. This issue isn't unique to Covid-19, as past research has shown similar discrepancies. Additionally, the recession from the war in Ukraine raises questions about whether these crises indicate further failures of the Phillips curve and if different recessions require unique theoretical frameworks (Haschka, 2024).

The Phillips curve emerged as a relationship between wage inflation and unemployment in the U.K., with Phillips (1958) providing a theoretical basis that favored the "demand pull" explanation of inflation. Traditional Phillips curve analysis links inflation to cyclical indicators and lagged inflation, portraying it as a backward-looking phenomenon shaped by adaptive expectations or price-setting behaviors. In contrast, the new-Keynesian Phillips curve connects inflation to the output gap and includes a "cost push" effect influenced by expected inflation, indicating a forward-looking dynamic. This forward-looking nature stems from staggered nominal price setting, as articulated by Taylor (1980) and Calvo (1983), or through quadratic price adjustment costs (Rotemberg, 1982), making it essential in monetary policy analysis (Herz and Röger, 2024).

Due to its significance in policy-making, there is a substantial body of literature focused on inflation dynamics and the challenges of forecasting inflation (Stock & Watson, 2009; Edge & Gürkaynak, 2010; Ball & Mazumder, 2011; Dotsey, Fujita, & Stark, 2018). One approach in this literature remains largely neutral regarding the macroeconomic models that influence inflation trends, while another approach adopts a structural framework that establishes explicit connections to macroeconomic models grounded in microeconomic theories. A crucial aspect of the microfounded approach to understanding inflation dynamics is the estimation of the New Keynesian Phillips Curve (NKPC).

The theoretical microeconomic foundations that underpin nominal price rigidities serve to establish the NKPC as a pivotal instrument for central banks in the implementation of effective monetary policy. The NKPC articulates a nuanced relationship between inflation rates, the expectations of future inflation, and real economic activity, particularly in the context of cyclical fluctuations in the economy known as business cycles. By capturing how these factors interact over time, the NKPC offers comprehensive insights into the dynamics of inflation, making it an invaluable tool for policymakers. Consequently, it has achieved widespread acceptance in both practical applications and scholarly research, where it is frequently employed to model and predict inflationary trends (Mavroeidis, Plagborg-Møller, & Stock, 2014; Abbas, Bhattacharya, & Sgro, 2016; Abbas, 2023).

In this study, we aim to analyze the determinants of inflation based on the NKPC framework in Italy, Germany, France, Canada, Japan, and the United Kingdom under different inflation regimes. Inflation co-movement is one of the important research questions arising from heightened globalization of goods and financial markets. Studies show that this co-movement more pronounced inflation co-movement in advanced countries than in developing countries. This study covers Canada, Japan, Germany, Italy, France and the UK (G7 countries), as these developed countries exhibit higher co-movement and more homogenous macroeconomic structure. Ergemen (2022) shows that inflation has a global component, mainly driven by G7 countries, which explains, on average, 77% of the variation in 22 high-income OECD countries (Nazlioglu,Akin, Gurel., &Gunes, 2025).

We use the nonlinear Threshold VAR (TVAR) model to research whether the response of inflation to its determinants in the NKPC framework changes significantly across different inflation conditions. This model offers a flexible tool to capture potential nonlinearities arising from regime switching and asymmetric responses to shocks (Atanasova, 2003; Ferraresi, Roventini, & Fagiolo, 2015).

To this end, the following issues will be focused in this research:

- What have been the global factors contributing to inflation across different inflation regimes?
- How have the roles of global supply chain pressures and other global shocks evolved across different inflation regimes?
- Which factors have a greater impact on inflation in a high inflation environment?

This study is expected to make a significant contribution to the existing literature in several ways. Firstly, earlier studies have examined the roles of domestic and global shocks affecting inflation fluctuations. For example, Charnavoki & Dolado (2014) use a FAVAR model to analyze how global supply, demand, and commodity prices affect inflation in Canada, finding that both commodity price and global demand shocks have a significant impact. Similarly, Finck & Tillmann (2022) use SVAR models to investigate these shocks' influence on inflation in emerging Asian economies, reporting they account for a substantial portion of inflation. Ha, Kose, Ohnsorge, & Yilmazkuday, (2023) analyze how global supply chain pressures and various shocks, such as oil price fluctuations, have impacted inflation across 55 countries from 1970 to 2022. They show that global shocks have increasingly become significant factors in driving variations in inflation over time. However, these studies ignore the effects of different economic conditions. This study evaluates the significance of both domestic and global factors in driving inflation, particularly under different inflationary conditions. In other words, the study aims to estimate the inflation dynamics in the NKPC framework under different inflation conditions, specifically low and high inflation regimes, using the TVAR model. This model allows us to capture asymmetric responses to shocks and nonlinearities arising from regime switching (Atanasova, 2003; Jiang, Wang, Ma, & Yang, 2021).

Secondly, we include global factors to NKPC model. Global factors such as the global commodity prices and disruption in the supply chain are important reasons for rising inflation during the Covid-19 period. Thus, the model includes the variables of crude oil price, the Bloomberg Commodity Index, global supply chain pressure index, and global economic policy uncertainty index.

The following sections are proposed for inclusion in the report: 'Literature Review' section will provide a comprehensive overview of the existing literature regarding market efficiency. 'Data' will explain the data that has been utilized for the analysis. 'Methodology' will outline the methodology implemented, along with the relevant context. 'Empirical Findings' will present the empirical findings obtained from the research. 'Conclusion' will summarize the results and offer corresponding recommendations based on the findings.

2. LITERATURE REVIEW

There are many studies related to explaining inflation dynamics in the literature. Some of these studies extensively investigate macroeconomic model generating the inflation path, while the another studies has taken a structural approach, connecting to macroeconomic models with microeconomic foundations. An important aspect of the microfounded approach to inflation dynamics involves estimating the NKPC. Several important concepts emerged in the late 1970s and 1980s, such as asymmetric information, efficiency wage hypothesis, staggered contracts, and the NKPC. The NKPC, among these contributions, provides the microeconomic basis for Keynesian macroeconomics (Abbas et.al., 2016). It operates on the assumption that inflation expectations are rational and that prices are inflexible, with future price expectations playing a crucial role in price setting (Haschka, 2024). This is based on the theoretical work of Taylor (1980), Rotemberg (1982), and Calvo (1983), which maintain the assumptions of nominal rigidities to explain inflation. These theoretical models, as highlighted by Roberts (1995), establish a common relationship known as the NKPC, which connects the inflation to a measure of real economic activity and expected inflation.

The NKPC has attracted the attention of many researchers, particularly following the estimation of the inflation structural model by Gali & Gertler (1999) and Sbordone (2002). Gali & Gertler (1999) aimed to create an empirical relationship between short-term inflation dynamics and real economic activity. Utilizing nominal labor compensation and labor productivity to estimate marginal costs, Sbordone (2002) calculates the anticipated price path based on the optimal pricing solution for firms. His findings reveal compelling evidence of substantial price rigidity and robust endorsement for the forward-looking pricing model.

However, Mazumder (2010) criticized the use of the labor share of income due to its countercyclical behavior.

There is currently a focus on studying inflation dynamics in the NKPC framework for both emerging and developed countries. This is typically done using linear econometric methods such as GMM (Abbas et.al., 2016; Hyder & Hall, 2020; Wardhono, Nasir, Qori'ah, & Indrawati, 2021; Ayisi & Mensah, 2023), panel (Byrne, Kontonikas, & Montagnoli, 2013), and DSGE (McKnight, Mihailov, & Rumler, 2020). However, there are only a limited number of studies that use nonlinear econometric models to investigate whether NKPC is supported (Chin, 2019; Kocoglu, 2023; Abbas, 2023; Loria & Tirado; 2023). Abbas et al. (2016) estimated the New Keynesian Phillips Curve (NKPC) for Canada, Australia, the UK, and New Zealand, including imported goods and the real exchange rate. Hyder and Hall (2020) examined the NKPC's validity in Pakistan's services, manufacturing, and agriculture sectors, finding that manufacturing is the most forward-looking. Wardhono et al. (2021) investigated inflation determinants in ASEAN countries using a Generalized Method of Moments (GMM) model, concluding that inflation is influenced by expectations, money supply, output gap, and exchange rate. Ayisi and Mensah (2023) analyzed drivers of food, non-food, core, and headline inflation in Ghana within the NKPC framework and found the model suitable for understanding inflation dynamics. Byrne et.al. (2013) analyze the characteristics of NKPC at sectoral and aggregate levels for 14 European countries for the period of 1971-2006. From the their findings, they concluded that sectoral heterogeneity is an important factor for aggregate inflation. They stated that heterogeneity reveals under-estimation of the effect of marginal costs in the NKPC model. McKnight et.al. (2020) developed a forecasting method based on the New Keynesian Phillips Curve that incorporates time-varying trend inflation to capture shifts in central bank preferences and monetary policy fort he Euro Area and the US. They found that the findings are robust across structural breaks, geographic regions, and different econometric specifications. Chin (2019) estimated the New Keynesian Phillips Curve (NKPC) using a time-varying parameter model for the United States from 1960 to 2017. He revealed that the relationship between inflation and output changes over time and is more pronounced during periods of high inflation, which is related to the degree of price rigidity. Kocoglu (2023) examined the factors driving inflation within the framework of the NKPC for Turkey from 2000 to 2021 bu using QARDL. His research revealed that the output gap has a negative effect on inflation, while aggregate expenditures contribute to an increase in inflation. Additionally, he found that both oil prices and the exchange rate have positive impacts on inflation. Abbas (2023) analyzed the NKPC for Canada, Australia, New Zealand, the UK, and the US using an Instrumental Variable Threshold Model. He demonstrated that the response of inflation to various driving forces is asymmetric under different economic and inflationary conditions. Loria and Tirado (2023) examined the factors influencing inflation in Mexico using the NKPC framework for the period from 2005 to 2022. They discovered that the unemployment gap has a stronger disinflationary effect than critical labor conditions. Additionally, improvements in the labor market can result in inflation if critical labor conditions are reduced.

Some studies have explored how domestic and global shocks influence fluctuations in inflation. For instance, Charnavoki & Dolado (2014) utilized a FAVAR model to assess the impact of global supply, demand, and commodity prices on inflation in Canada. Similarly, Finck & Tillmann (2022) employed SVAR models to analyze the influence of these shocks on inflation in emerging Asian economies. Additionally, Ha et al. (2023) examined the effects of global supply chain pressures and various shocks. However, this study highlights the importance of both domestic and global factors in driving inflation, particularly under varying inflationary conditions in framework of NKPC. We aim to estimate the inflation dynamics in the NKPC framework under different inflation conditions, specifically low and high inflation regimes, using the TVAR model. This model allows us to capture asymmetric responses to shocks and nonlinearities arising from regime switching.

Table 1 provides a summary of the latest empirical studies investigating inflation dynamics within the NKPC framework.

Table 1: Literature Review

Author(s)	Period	Country	Method	Findings
Byrne et.al. (2013)	1971-2006	Austria, Italy, Denmark, Belgium, France, Greece, Germany, Ireland, , Portugal, Spain, The Netherlands, UK, Sweden, and US	Weighted Mean Group estimator	The coefficient of lagged inflation is statistically significant in most countries and sectors. The model performs well in explaining inflation in the U.S., UK, and France, despite being less supportive for some smaller countries in their dataset.
Abbas et.al. (2016)	1959Q1-2011Q1	Canada, Australia, the United Kingdomand New Zealand	GMM	The open economy version of the NKPC is increasingly relevant in a globalized world where monetary policy decisions are often coordinated among countries. It's important for understanding inflation dynamics across developed

				countries.
Chin (2019)	1960Q1-2017Q4	US	GMM and Time Varying Parameter (TVP) model	The estimated output-inflation trade-off parameter varies over time and is higher during periods of high inflation. This time-varying trade-off is linked to price rigidity, which is inversely related to inflation. Forward-looking price-setting behavior predominantly explains inflation dynamics for most of the sample period.
Saygılı (2020)	1990-2016	OECD countries	Prais-Winsten regression heteroskedastic panels corrected standard errors (PCSE)	The dynamics of inflation are influenced by both country-specific and global factors, each playing a significant role. The impacts of these factors vary among sectors based on the level of integration into global value chains and the nature of trade. Understanding these dynamics is crucial in identifying the trade effects on inflation.
Hyder and Hall (2020)	1973-2013	Pakistan	GMM	The real marginal cost is a more accurate indicator of inflation compared to competing measures such as the labor share of income or output gap.
McKnight et.al. (2020)	1970Q1-2015Q4	Euro Area and United States	DSGE	The TVT-NKPC forecasts were consistently 10–20 percentage points more accurate than the AO benchmark, particularly at 8 and 12 quarters ahead in the US data.
Wardhono et.al. (2021)	2005Q1-2018Q4	ASEAN countries	GMM	The estimated NKPC models suggest that backward-looking behavior has a greater influence on inflation than forward-looking behavior. Inflation changes are influenced by factors such as inflation expectations, the output gap, money supply variations, and exchange rate fluctuations, indicating the relevance of NKPC models in

				explaining inflation dynamics in the ASEAN region.
Ayisi and Mensah (2023)	1970-2021	Ghana	GMM	The traditional NKPC model aligns with both deflator-based and CPI-based headline inflation. The study suggests that the NKPC model is suitable for examining inflation dynamics in Ghana.
Kocoglu (2023)	2000M1-2021M10	Turkey	Quantil ARDL (QARDL)	The production gap negatively affects inflation, but aggregate expenditures increase. Price asymmetries in crude oil have a positive impact on inflation. The relationship between international oil prices, output gaps, and CPI inflation is nonlinear in the context of the NKPC.
Abbas (2023)		New Zealand, the UK, Australia, Canada, and the US	Instrumental Variable Threshold Model	The response of inflation to the driving force is asymmetric in different economic and inflationary conditions. Price stickiness varies across different economic conditions, impacting the relationship between the output gap and inflation.
Loria and Tirado (2023)	2005Q1-2022Q4	Mexico	Nonlinear ARDL (NARDL)	The unemployment gap has a higher disinflationary effect than critical labor conditions. Improvements in the labor market can lead to inflation when critical labor conditions are reduced. These asymmetries can result in a low unemployment trap with high and growing precariousness.
Martins and Verona (2024)	1978Q1-2021Q4	US	Maximal Overlap DiscreteWavelet Transform	Unemployment and inflation expectations are the main predictors.
Haschka (2024)	1980-2022	US	Literature research	The correlation between inflation and unemployment has experienced a decline since the 1980s, particularly during the Covid-19 pandemic, attributable to the impacts of globalization and the enhanced stability of inflation expectations, resulting from the implementation of more

				credible monetary policies.

3. METHODOLOGY

The nonlinear Threshold VAR (TVAR) model researches whether the response of inflation to their determinants in framework NKPC changes considerably across different inflation conditions. This model provides a flexible instrument to obtain possible nonlinearities resulting from regime switching, and asymmetric response to shocks (Atanasova, 2003). The threshold variable is endogenous in TVAR model. Therefore, the parameters can be change in each regime. The state dependent dynamics of TVAR enables asymmetric and nonlinear impulse-response functions (Jiang et al., 2021).

The linear VAR model used in the study as follows:

$$Y_t = \sum_{i=1}^{p} A_i Y_{t-i} + \sum_{i=1}^{q} B_i X_{t-i} + \varepsilon_t$$

where Y_t and X_t are vectors of endogenous and, xogenous variables, respectively. A_i and B_i are matrices of coefficient. ε_t is the error vector, which has normal distrubition with mean zero and variance-covariance matrix $\sum E\varepsilon_t\varepsilon_t'$.

$$Y_t = \left(inf_t, \ expinf_t, \ unemp_t, intspread_t\right)'$$

$$X_t = \left(oil_t, \ commodity_t, \ gscpi_t, gepu_t\right)'$$

TVAR model (Balke, 2000; Atasanova, 2003) assumes the economy with two regime, and the regime switches depending on the value of threshold variable, and is the extended version of VAR model. TVAR model with two regimes can be written as follows:

$$Y_t = I\left[c_{t-d} \geq \gamma\right]\left(\sum_{i=1}^{p} A_i^1 Y_{t-i} + \sum_{i=1}^{q} B_i^1 X_{t-i}\right) + I\left[c_{t-d} < \gamma\right]\left(\sum_{i=1}^{p} A_i^2 Y_{t-i} + \sum_{i=1}^{q} B_i^2 X_{t-i}\right) + \varepsilon_t$$

where c_{t-d} is threshold variable determining what regime the economic system is. $I\left[c_{t-d} \geq \gamma\right]$ takes the value of one if $c_{t-d} \geq \gamma$, zero otherwise. A_i^1, A_i^2, B_i^1, and B_i^2 are regime parameters. In this study, inflation rate is used as a threshold variable. Therefore, $I\left[inf_{t-d} \geq \gamma\right]$ is an dummy indicator function with $I\left[inf_{t-d} \geq \gamma\right] = 1$ and 0 otherwise. Here the economic system is split into two regimes characterized by different phases of inflation rate, i.e., the low and high inflation regime. The high inflation regime indicates high degree of inflation rate where $I\left[inf_{t-d} \geq \gamma\right] = 1$, while the low inflation regime refers to low degree of inflation rate with $I\left[inf_{t-d} < \gamma\right] = 0$. d states the lag parameters of threshold variable.

The threshold nonlinearity of the model is tested by the C(d) test developed by Tsay (1998). This test researches the null hypothesis of linear model against the alternative hypothesis of nonlinear TVAR model. C(d) test have a chi-squared distribution with k(pk+1) degrees of freedom, where p is lag order and k i the number of endogenous variables. Then, the interval involving the potential breakpoint of the threshold variable is divided by certain grids, and the model is estimated for each grid to determine the optimal value of threshold variable (γ). The optimal threshold value is obtained based on the minimum selection criteria. The impulse-response functions (IRFs) are nonlinear because of changing between regimes. IRFs obtained from TVAR model are calculated as follows:

$$IRF_y\left(k, \varepsilon_t, \Omega_{t-1}\right) = E\left(Y_{t+k} | \Omega_{t-1}, \varepsilon_t\right) - E\left(Y_{t+k} | \Omega_{t-1}\right)$$

where Ω_{t-1} is past information set at time t-1, k is a pre-specified forecast horizon. Firstly, ε_{t+j}, $j = 1, \cdots, k$, randomly draws vectors of residuals of TVAR model. The series of shocks is obtained to generate forecasts based on initial conditions for each initial value. Secondly, one standard deviation shock (+1/-1) to the variable is included at time t to each shock series. Following Balke (2000), the ε_{t+j} simulates to remove any asymmetry stemming from sampling variation in the draws of ε_{t+j}, (Jiang et al., 2021).

4. DATA

We aim to analyze the determinants of inflation based on the NKPC framework in Canada, Japan, Germany, France, Italy, and the UK. According to the NKPC, the inflation rate is a function of real marginal cost of production and a forward-looking component (Gali & Gertler, 1999; Guay, Luger, & Zhu, 2003; Hornstein, 2008; Szabq & Jancovic, 2022). By following with the study of Gali & Gertler (1999), we utilize monthly data including the unemployment rate, long-short interest rate spread, and inflation expectation from January 1998 to December 2022. Inflation is measured by the percent change from a year ago in the consumer price index. Interest rate spread is measured 10-year Goverment Bond Rate minus 3 month interbank rates.

The different measures are used as a proxy for marginal cost in the literature. One of these measures is real unit labor costs. Gali & Gertler (1999) measure the marginal cost as a labor income share. Gali et al. (2001) include real unit labor in the NKPC model. They find that this model is appropriate to estimate European inflation. Leith & Malley (2005) state that the NKPC model is more appropriate for the Euro Area than the United States when labor income share is used as a proxy for real marginal cost. Similarly, Jondeau and Bihan (2005) and Rumler (2007) discuss that the labor income share may estimate the inflation dynamics in the Euro Area. The unemployment rate reflects real unit labor costs. Pehnelt (2007) use unemployment rate as a proxy for the real economic activity to estimate inflation dynamics in OECD countries. Therefore, we use unemployment rate as a proxy for marginal cost in the NKPC model.

The NKPC also involves the external factors affecting marginal cost (Gali & Monecalli, 2005; Blinder & Rudd, 2008; Gordon, 2011). Mihailov, Rumler, & Scharler, (2011) and Szafrenek (2017) show that external factors such as global commodity price index and oil price are important factors of increases in inflation. The COVID-19 pandemic has created inflation uncertainty around the world. Global factors such as the global commodity prices and disruption in the supply chain are important reasons for rising inflation during the Covid-19 period. Thus, the model includes the variables of crude oil price, the Bloomberg Commodity Index, global supply chain pressure index, and global economic policy uncertainty index. The Bloomberg Commodity Index serves as a reliable indicator of commodity futures price movements. This index undergoes annual rebalancing, with a weight of 2/3 assigned according to trading volume and 1/3 based on world production. Additionally, weight-caps are strategically applied at the level of commodity, sector, and group to ensure adequate diversification. The index's methodology offers a comprehensive approach to tracking commodities and provides valuable insights to businesses and academic institutions. The Global Supply Chain Preparedness Index (GSCPI) is designed to provide a comprehensive summary of potential supply chain disruptions by incorporating several commonly used metrics. This index aims to integrate various factors that may impact the supply chain, offering a holistic view of the overall preparedness of businesses to deal with potential disruptions. The GSCPI is a valuable tool that allows businesses to assess their supply chain risks and take proactive measures to mitigate potential threats. The Global Economic Policy Uncertainty (GEPU) Index is a GDP-weighted average of national EPU indices for 21 countries. The GEPU Index is derived from individual national EPU indices that reflect the relative frequency of newspaper articles in each country that contain a specific combination of terms related to economy (E), policy (P) and uncertainty (U). By aggregating these national indices, GEPU offers a comprehensive overview of the global economic policy uncertainty that can be useful for businesses, policymakers, and researchers. Table 2 shows the variables used in the study.

Table 2 Description of the Variables

Variables	Explanations	Data Source
inf	Inflation rate (the percent change from a year ago in the consumer price index)	https://fred.stlouisfed.org/
expinf	The expected inflation	https://fred.stlouisfed.org/
unemp	Unemployment rate	https://fred.stlouisfed.org/
intspread	10-year Goverment Bond Rate minus 3 month interbank rates	https://fred.stlouisfed.org/
oil	Crude oil price	https://fred.stlouisfed.org/
commodity	Bloomberg Commodity Index	www.investing.com
gscpi	Global Supply Chain Pressure Index	www.investing.com
gepu	Global Economic Policy Uncertainty Index	www.policyuncertainty.com

Sources: https://fred.stlouisfed.org/ , www.policyuncertainty.com , www.investing.com

Table 3 indicates the descriptive statistics for the variables. According to Table 2, Japan appears to have the lowest inflation rate (0.18%) and unemployment rate (3.96%) among the countries listed. Following Japan, France and Germany have relatively lower inflation rates than the other countries. On the other hand, Canada, Italy, and the UK seem to have an average inflation rate of around 2%. It seems that France and Italy have the highest unemployment rates, with 9.16% and 9.5% respectively. When standard deviation values are examined, it appears that GSCPI is the variable with the highest risk among the external factors affecting inflation. Additionally, OIL has a negative skewness value, whereas COMMODITY, GEPU, and GSCPI have positive skewness values, indicating that extreme events occurred for oil prices. Furthermore, it seems that the null hypothesis assuming that the returns distribute normally for the Jarque–Bera test is rejected at level 5% for all variables.

5. EMPIRICAL RESULTS

It is important to consider structural change in analyzing macroeconomic variables. There can be various reasons behind structural change, such as economic crisis, policy changes, and regime shifts. Ignoring structural changes in time series leads to biased outcomes in an econometric model, which causes the wrong non-rejection of the null hypothesis of non-stationarity against alternative of structural breaks (Perron, 1989; 1997; Leybourne and Newbold, 2003). Thus, it's crucial to consider the presence of a structural break in the data when conducting the test of non-stationarity. Otherwise, there's a risk of incorrectly concluding that the series has a stochastic trend, which means that any shock -

demand, supply, or policy-induced - will have long-term effects on the variable. This understanding of the economic content of the result is essential for accurate analysis. Therefore, we use Lee-Stratizizch (2003) and Lumsdaine Papell (1997) with two structural breaks to research stationarity of the variables. The results are given in Table 4.

	County-Specific Factors												
	Canada			France			Germany			Global Factors			
	INF	UNEMP	INTSPREAD	INF	UNEMP	INTSPREAD	INF	UNEMP	INTSPREAD	LCOMMODITY	LGEPU	LOIL	GSCPI
Mean	2.089	7.131	0.9409	1.48	9.169	1.1955	1.631	6.471	0.8736	2.0569	2.088	1.711	0.008
Median	1.985	7.1	0.7833	1.41	9	1.156	1.434	6.45	0.7853	2.0498	2.064	1.757	-0.259
Maximum	8.133	14.1	3.4265	6.20	12.1	2.839	8.820	11.2	2.5778	2.3674	2.640	2.126	4.316
Minimum	-0.949	4.9	-1.6115	-0.7253	7	-0.9295	-1.040	2.9	-1.2296	1.7846	1.714	1.054	-1.652
Std. Dev.	1.357	1.111	0.9761	1.13	1.140	0.7857	1.393	2.578	0.7653	0.1228	0.217	0.240	1.006
Skewness	1.705	1.883	0.5038	1.52	0.559	-0.076	2.568	0.161	0.0972	0.1436	0.371	-0.64	2
Kurtosis	7.712	12.46	2.8411	7.35	3.298	2.5035	12.48	1.628	2.5424	2.1029	2.275	2.701	7.329
Jarque-Bera	423.08***	1297.83***	13.0068***	353.43***	16.7538***	3.3703	1453.50***	24.8134***	3.0898	11.0914***	13.4561***	21.7348***	434.2804***

	Italy			Japan			UK		
	INF	UNEMP	INTSPREAD	INF	UNEMP	INTSPREAD	INF	UNEMP	INTSPREAD
Mean	1.918	9.507	2.0446	0.18	3.965	0.7019	2.201	5.588	0.9668
Median	1.878	9.4	1.8862	0	4.1	0.6483	1.9	5.2	0.9576
Maximum	11.83	13.2	5.5724	3.99	5.5	2.017	9.6	8.5	3.9834
Minimum	-0.583	5.9	-0.7551	-2.5151	2.2	-0.289	0.2	3.5	-1.6037
Std. Dev.	1.720	1.841	1.2943	1.09	0.946	0.5912	1.479	1.314	1.1975
Skewness	2.575	0.063	0.3575	1.11	-0.243	0.2255	2.693	0.675	0.3039
Kurtosis	14.29	1.976	2.9289	4.89	1.837	1.8606	12.43	2.425	2.5495
Jarque-Bera	1926.73***	13.2957***	6.4548**	107.27***	19.8716***	18.7715***	1476.59***	26.9667***	7.1557**

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

Based on the results presented in Table 4, it can be observed that the null hypothesis of non-stationarity cannot be rejected for INF, indicating that INF has a unit root at level for all countries. Similarly, the variable UNEMP is not stationary at level value for all countries except Canada. Furthermore, INTSPREAD has a unit root at level value except for France and Japan. In terms of global factors, the analysis reveals that COMMODITY, OIL, and GEPU are trend stationary at first difference, while GSCPI is trend stationary at level. These findings provide important insights into the the stationarity of the variables and can inform further analysis and modeling efforts.

Macroeconomic series can display nonlinear patterns (Enders, 2010). If the series or the relationship between these series has nonlinear behaviors, the results based on linear analysis are biased. Thus, we apply Tsay, White, Keenan, Teraesvirta and LR tests to determine whether the variables exhibit nonlinear structures. According to the results in Table 5, all variables show nonlinear behaviors because the null hypothesis of linear structure is rejected for each of them. For this reason, we use KSS (Kapetanios, Shin, & Snell, 2003) nonlinear unit root test to research stationarity of variables. This test is based on ESTAR (Exponential Smooth Transition Autoregressive) process. It tests the null hypothesis of a unit root against the alternative hypothesis of global stationarity ESTAR process (Güriş vd., 2020). When examined Table 5, it is seen that INF exhibits global stationarity ESTAR process at first difference for all countries. LIP is stationarity at 5% significance level for all countries except Canada. UNEMP has a unit root at level except Canada.However, INTSPREAD is global stationarity at level except Canada and the United Kingdom. In terms of global factors, LCOMMODITY, LGEPU, LOIL and GSCPI become global stationary at first difference.

Firstly, we apply the C(d) test recommended by Tsay (1998) to test the existence of multiple regimes in the TVAR model. It tests the null hpothesis of a linear VAR model against a TVAR model. The inflation rate is determined as threshold variable. According to Akaike information criteria, the optimal lag length is 1. The suitability of the TVAR model was assessed through the application of the C(d) test statistics. The results of this nonlinearity test, generated via iterative regression estimation utilizing lag parameters d and alternative starting points m0=50 and m0=100, are presented in Table 6. The choice of delay parameter d is based on the maximum value of Chi-Square test statistic. The test results show that the null hypothesis that linear model is valid is rejected for all delays at the 5% significance level. This result provides stong evidence in favor of TVAR model against the linear VAR model, and supports the existence of two regimes given by changes in inflation. Threshold values based on grid search that maximizes the determinant of the variance-covariance matrix for Canada, Germany, France, Japan, Italy, and the UK are 2.04, 2.26, 2.01, 1.90, 2.20, and 2.30, respectively. Thus, low inflation regime occurs when inflation rate is less than threshold value; otherwise the economy are in high inflation regime

Table 4: The Results for Lee-Strazicich and Lumsdaine Papell Tests

	Lee-Strazicich Test						Lumsdaine Papell Test					
	Model A (Crash Model)			Model C (Trend Shift Model)			Breaks in Intercept			Breaks in Intercept and Trend		
		Breaking Points			Breking Points			Breaking Point			Breaking Points	
	LM-stat	D1t	D2t	LM-stat	DT1t	DT2t	t-stats	D1t	D2t	t-stats	DT1t	DT2t
Canada												
INF	-2.89	2006:8	2020:5	-5.59**	2003:9	2020:6	-3.86	2003:3	2008:9	-5.47	2003:3	2019:4
ΔINF	-12.3***	2001:2	2005:8	-13:5***	2009:5	2020:7	-13.30***	2003:2	2011:5	-13.33***	2009:9	2013:5
UNEMP	-4.82***	2009:1	2020:6	-7.02***	2009:1	2020:1	-6.522**	2008:10	2019:4	-6.9136	2008:10	2019:4
INTSPREAD	-2.9150	2001:4	2008:10	-4.0012	2002:2	2008:9	-3.330	2005:1	2008:9	-4.4901	2002:9	2008:9
ΔINTSPREAD	-9.98***	2007:8	2010:1	-10.7***	2002.1	2020.2	-10.02***	2002:3	2007:9	-10.58***	2002:3	2009:7
France												
INF	-3.461*	2001:12	2009:8	-3.9136	2003:2	2017:9	-4.5022	2008:7	2012:10	-5.3225	2008:10	2012:8
ΔINF	-9.80***	2009:5	2015:4	-11.0***	2007:3	2009:6	-10.90***	2009:7	2015:1	-11.23***	2008:7	2011:11
UNEMP	-1.4459	2013:8	2017:1	-3.6405	2000:7	2012:12	-4.2725	2008:10	2012:3	-4.1214	2001:8	2012:8
ΔUNEMP	-10.7***	2002:5	2008:2	-11.3***	2005:7	2008:1	-11.28***	2001:8	2008:2	-11.49***	2003:8	2008:2
INTSPREAD	-3.468*	2001:11	2008:12	-4.743*	2006:4	2009:3	-7.070***	2001:8	2008:10	-8.3557	2003:5	2008:10
Germany												
INF	-3.3040	2004:3	2010:12	-4.3715	2008:9	2018:5	-4.0294	2008:8	2013:7	-4.5839	2008:9	2012:12
ΔINF	-9.66***	2003:12	2009:9	-11.5***	2008:7	2010:11	-11.23***	2003:5	2009:7	-11.52***	2009:7	2015:1
UNEMP	-1.0476	2002:8	2010:5	-1.3582	2002:7	2007:1	-4.2720	2002:3	2009:4	-4.2720	2002:3	2010:10
ΔUNEMP	-7.06***	2001:6	2005:2	-8.30***	2001:5	2005:8	-8.586***	2001:8	2005:4	-8.6761	2001:8	2005:4
INTSPREAD	-3.7597**	2001:8	2008:12	-4.5512	2004:6	2009:3	-3.8123	2007:5	2010:10	-7.601***	2003:5	2008:10
ΔINTSPREAD	-9.21***	2004:4	2009:11	-9.73***	2008:10	2011:11	-9.438***	2001:8	2008:10	-10.25***	2008:10	2012:2
Italy												
INF	-2.7540	2012:9	2014:12	-3.3064	2012:12	2017:3	-3.9087	2008:10	2012:9	-5.6038	2008:10	2012:9
ΔINF	-7.85***	2001:1	2017:1	-11.0**	2009:9	2020:6	-9.825**	2002:11	2008:7	-12.01***	2012:9	2018:11

				*			*					
UNEMP	-1.0873	2011:10	2014:6	-4.3086	2007:5	2014:10	-5.2809	2008:3	2011:8	-5.6040	2006:5	2011:10
ΔUNEMP	-12.9***	2011:2	2014:2	-13.1***	2011:7	2014:4	-13.16***	2007:4	2014:11	-13.32***	2011:7	2015:9
INTSPREAD	-2.7325	2008:10	2012:2	-3.5955	2007:1	2011:7	-5.7633	2008:10	2013:9	-5.8181	2003:5	2008:10
ΔINTSPREAD	-10.7***	2008:3	2016:7	-11.0***	2008:8	2012:12	-10.80***	2008:3	2011:11	-11.36***	2008:10	2015:3
Japan												
INF	-3.74**	2009:4	2014:10	-4.3728	2013:11	2020:7	-4.2906	2008:10	2015:3	-5.2398	2008:10	2015:3
ΔINF	-11.2***	2004:10	2014:9	-11.8***	2008:3	2014:6	-11.90***	2008:7	2014:6	-12.21***	2008:7	2014:5
UNEMP	-1.4208	2001:8	2013:8	-2.7277	2003:8	2009:3	-5.3728	2008:10	2013:2	-5.9312	2008:10	2017:5
ΔUNEMP	-14.6***	2001:11	2010:10	-16.0***	2006:11	2009:7	-15.44***	2007:7	2018:5	-16.55***	2005:11	2009:7
INTSPREAD	-5.28***	2007:7	2020:2	-6.74***	2004:2	2015:11	-6.182**	2003:6	2019:3	-7.411***	2003:6	2015:12

	Lee-Strazicich Test						Lumsdaine Papell Test					
	Model A (Crash Model)			Model C (Trend Shift Model)			Breaks in Intercept			Breaks in Intercept and Trend		
		Breaking Points			Breking Points			Breaking Point			Breaking Points	
	LM-stat	D1t	D2t	LM-stat	DT1t	DT2t	t-stats	D1t	D2t	t-stats	DT1t	DT2t
United Kingdom												
INF	-1.4364	2010:1	2020:6	-3.4197	2006:7	2020:7	-1.5021	2002:1	2011:9	-3.7088	2013:9	2019:4
ΔINF	-9.35***	2015:4	2020:6	-11.1***	2008:8	2020:7	-10.3***	2005:9	2011:9	-11.0***	2011:9	2017:11
UNEMP	-1.1009	2009:8	2013:2	-2.505	2008:9	2014:8	-5.6170	2008:4	2013:12	-5.6617	2008:4	2019:4
ΔUNEMP	-8.82***	2011:12	2020:7	-9.45	2008:3	2014:1	-9.00***	2009:5	2013:1	-9.66***	2008:4	2014:6
INTSPREAD	-2.0818	2009:3	2014:12	-3.31	2008:10	2020:5	-4.1552	2008:8	2013:12	-5.4864	2008:8	2019:4
ΔINTSPREAD	-10.5***	2009:7	2020:7	-12.0**	2004:1	2009:7	-11.8***	2002:4	2010:4	-12.4***	2008:8	2012:6
Global Factors												
LCOMMODITY	-1.8750	2011:8	2015:6	-3.40	2005:9	2020:5	-4.8207	2008:6	2014:6	5.2626	2008:6	2014:8
ΔLCOMMODITY	-11.1***	2001:9	2020:6	-11.***	2004:8	2020:5	-11.3***	2008:6	2014:4	-11.6***	2008:6	2012:2
LGEPU	-5.42***	2007:12	2016:5	6.2365	2007:10	2014:1	-6.77**	2003:4	2013:1	-6.7348	2003:4	2013:1
LOIL	-3.0277	2004:9	2014:11	-5.2**	2004:12	2014:11	-5.7617	2003:9	2014:9	-6.2386	2008:9	2014:9
ΔLOIL	-12.7***	2008:10	2020:3	-11.***	2000:11	2008:8	-11.87***	2009:2	2016:2	-12.051***	2009:2	2016:2
GSCPI	-5.46***	2016:5	2020:2	-6.6***	2012:4	2019:12	-6.24**	2011:4	2019:4	-6.911**	2009:12	2014:2

Note: ***,**, and * indicate a statistical significance of 1%, 5%, and 10% levels, respectively.

Table 5: Nonlinearity Tests and Nonlinear KSS Unit Root Test

	Teraesvirta	White	Keenan	Tsay	LR	KSS Unit root	
						Intercept	Intercept and Trend
Canada							
INF	5.4095*	6.0272**	7.6560***	1.3844**	31.3106*	-0.5610	-0.8799
	(0.066)	(0.0491)	(0.006)	(0.033)	(0.0636)		
ΔINF						-7.6920***	-7.6896***
LIP	0.4369	0.9430	0.0902	10.2969***	52.37***	-1.7326	-3.0062**
	(0.8037)	(0.6240)	(0.7641)	(0.0000)	(0.0000)		
ΔLIP						-10.639***	-10.6490***
UNEMP	5.9916**	10.6424***	14.0228***	25.4717***	34.0601***	-6.18***	-6.0368***
	(0.0499)	(0.0048)	(0.0002)	(0.0000)	(0.0000)		
INTSPREAD	0.1832	0.2816	0.0718	25.1929***	29.4744***	-2.7153*	-3.1664**
	(0.9124)	(0.8686)	(0.7888)	(0.0000)	(0.0000)		
ΔINTSPREAD						-3.9213***	-4.1219***
France							
INF	4.7648*	3.3612	2.5316	1.1723	35.8607**	-0.0809	-0.2119
	(0.092)	(0.1862)	(0.1126)	(0.2929)	(0.0597)		
ΔINF						-6.7296***	-6.6802***
LIP	43.4455***	28.4007***	13.7220***	46.8935***	69.9224***	-9.2495***	-9.6102***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
UNEMP	4.9056*	4.8291*	2.4951	1.4848	36.685***	-1.9630	-2.0516
	(0.091)	(0.0906)	(0.1152)	(0.2187)	(0.0000)		
ΔUNEMP						-7.3481***	-7.7783***
INTSPREAD	6.3231**	1.0491	0.0018	1.5854	39.0144***	-3.6131***	-3.5802***
	(0.0416)	(0.5918)	(0.9659)	(0.1103)	(0.0000)		
Germany							
INF	17.0882***	11.9128***	3.1190*	3.9217***	16.8768**	0.5385	0.0988
	(0.0001)	(0.0025)	(0.0784)	(0.0008)	(0.0301)		
ΔINF						-3.9598***	-4.1437***
LIP	5.7538*	4.097	0.1107	8.7195***	45.7515***	-3.2864***	-7.5965***
	(0.0563)	(0.1289)	(0.7403)	(0.0000)	(0.0000)		
UNEMP	6.4751**	6.5270**	4.8107**	5.3561**	11.6067**	-0.7883	-1.0481
	(0.0392)	(0.0382)	(0.0290)	(0.0213)	(0.0429)		
ΔUNEMP						-3.3431***	-3.3590***
INTSPREAD	1.7501	1.1099	0.3571	0.8585	15.8297**	-3.8502***	-3.7703***
	(0.4168)	(0.5740)	(0.5504)	(0.6115)	(0.0367)		
Italy							
INF	39.4369***	20.2324***	0.7245	8.5609***	42.6330***	1.0164	1.1353
	(0.0000)	(0.0000)	(0.3953)	(0.0000)	(0.0000)		
ΔINF						-6.6042***	-6.6356***
LIP	89.5416***	41.3704***	34.4965***	23.4039***	54.0195***	-12.3114***	-13.5075***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
UNEMP	1.2298	1.0674	0.3130	0.3138	3.5811	-1.4921	-1.6955
	(0.5406)	(0.5864)	(0.5762)	(0.5757)	(0.3292)		
ΔUNEMP						-3.1061**	-3.1058**
INTSPREAD	2.2865	0.7461	0.1505	1.8967	12.7813*	-3.4918***	-3.2348**
	(0.3187)	(0.6886)	(0.6983)	(0.1302)	(0.0622)		
Japan							
INF	1.1707	0.9606	3.0361*	1.3431	24.3943	-1.4291	-2.8498*
	(0.5569)	(0.6185)	(0.0825)	(0.0478)	(0.2446)		
ΔINF						-5.0808***	-5.1264***
LIP	6.4050**	5.9551*	8.1241***	5.1780***	22.9082***	-3.9901	-3.5993
	(0.0406)	(0.0509)	(0.0046)	(0.0016)	(0.0011)		
UNEMP	3.6563	2.5015	0.1487	0.1494	5.0371	-0.9221	-3.4302***
	(0.1607)	(0.2862)	(0.7004)	(0.6993)	(0.3095)		
ΔUNEMP						-8.6003***	-8.6419***
INTSPREAD	5.3761*	4.0398	0.4248	1.7960**	10.6346	-3.7305***	-5.1992***
	(0.0681)	(0.1326)	(0.5150)	(0.0349)	(0.3301)		
United Kingdom							
INF	15.7884***	7.8930**	1.0278	1.1096	12.1306	0.9573	0.5720
	(0.0000)	(0.0193)	(0.3114)	(0.3566)	(0.1385)		
ΔINF						-5.2213***	-5.3932***
LIP	3.4708	0.9426	0.6994	6.0354***	52.3201***	-2.7491	-4.5026***
	(0.1763)	(0.6241)	(0.4036)	(0.0000)	(0.0000)		

UNEMP	0.6933	0.5168	0.1515	1.7612**	19.8595*	-0.9511	-0.9906
	(0.7070)	(0.7722)	(0.6973)	(0.0227)	(0.0691)		
ΔUNEMP						-3.0419**	-3.0062**
INTSPREAD	1.6701	0.6834	0.4387	6.7189***	9.3883	-2.3930*	-1.9594
	(0.4338)	(0.7105)	(0.5082)	(0.0000)	(0.2602)		
ΔINTSPREAD						-6.5260***	-6.5242***
Global Factors							
LCOMMODITY	3.2263	2.5527	0.4141	1.7293*	37.1483***	-2.4374*	-2.7317*
	(0.1992)	(0.2790)	(0.5203)	(0.0739)	(0.0000)		
ΔLCOMMODITY						-4.3355***	-4.3381***
LGEPU	1.5518	0.9293	0.0095	6.5030***	36.0933***	-2.3946*	-3.8800***
	(0.4602)	(0.6283)	(0.9222)	(0.0000)	(0.0000)		
ΔLGEPU						-5.8352***	-5.8343***
LOIL	0.2932	0.3145	0.1845	5.3959***	11.7035*	-2.5868*	-6.3275***
	(0.8636)	(0.8544)	(0.6677)	(0.0012)	(0.0895)		
ΔLOIL						-6.4961***	-6.4318***
GSCPI	8.1820**	7.6553**	4.0750**	1.9204	12.4437*	-1.9052	-2.5517*
	(0.0167)	(0.0217)	(0.0444)	(0.1263)	(0.0699)		
ΔGSCPI						-4.7508***	-4.7444***

*Note: The values in the parenthesis indicate the probabilities. The critical values are -2.*22, -2.93 and -3.40 at 10%, %5 and 1% significance levels, respectively. ***,**, and * indicate a statistical significance of 1%, 5%, and 10% levels, respectively.

Table 6: The Results of C(d) Nonlinearity Test

	d	m0	Canada	France	Germany	Italy	Japan	United Kindom
C(d)	1	50	57.13***	265.48***	242.67***	196.24***	159.61***	175.97***
statistics	1	100	54.97***	181.98***	190.23***	183.04***	143.89***	145.99***
	2	50	47.47***	255.98***	213.10***	196.42***	144.30***	154.70***
	2	100	40.45***	223.73***	163.19***	187.57***	136.40***	154.42***
	3	50	28.58***	202.95***	193.40***	198.07***	124.71***	130.16***
	3	100	28.18***	168.72***	151.72***	206.33***	123.09***	123.94***
	4	50	20.88***	158.01***	165.18***	190.21***	88.64***	116.49***
	4	100	57.57***	135.47***	148.72***	189.32***	98.71***	149.71***
	5	50	20.38***	143.67***	135.73***	233.68***	79.93***	125.53***
	5	100	20.97***	140.42***	140.52***	202.30***	80.89***	135.23***
	6	50	19.5**	139.93***	133.23***	175.98***	77.32***	121.69***
	6	100	18.14**	158.25***	122.81***	187.88***	82.90***	109.07***
	7	50	20.64***	116.03***	126.34***	170.56***	77.21***	147.71***
	7	100	18.86**	132.84***	134.10***	169.62***	72.59***	132.69***
γ			2.04	2.26	2.01	1.90	2.20	2.30
AIC			-2106.06	-3684.23	-3662.71	-2956.46	-3616.42	-3743.01

Note: ***,**, and * indicate a statistical significance of 1%, 5%, and 10% levels, respectively.

Figure 1 depicts the graphs related to regime classification based on the threshold variable (inflation rate) for Canada, France, Germany, Italy, Japan, and the United Kingdom. The dark areas represent a high inflation regime, while the light areas indicate a low inflation regime. As shown in Figure 1, the inflation rates in all countries sharply increase after 2022. The substantial increase in inflation can be attributed to several factors, including implemented expansionary fiscal policies during the COVID-19 pandemic, deterioration in global supply chains, increases in demand, and rises in commodity prices.

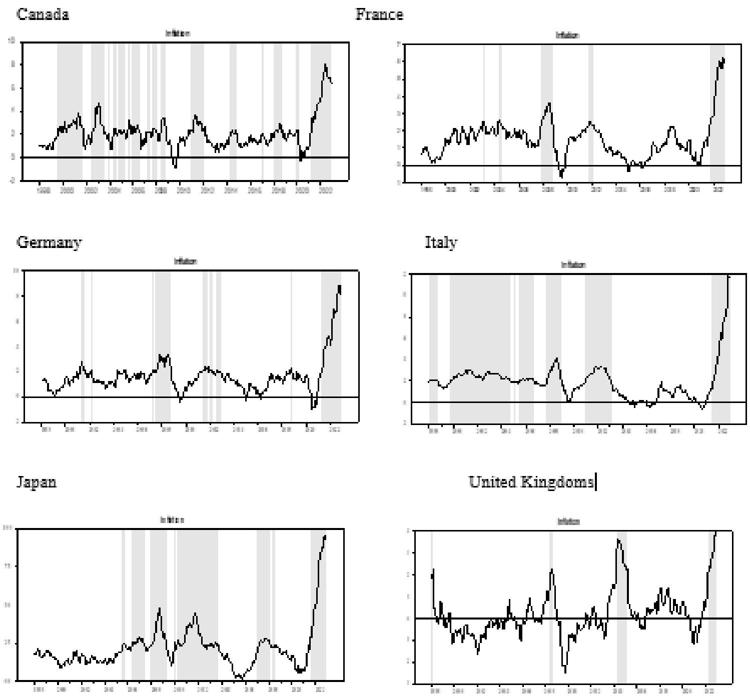

Figure 1: Regime Classification

In Figure 2, the impulse-response graphs in both high and low inflation regimes for Canada are represented. According to the graph in Figure 2, during the low inflation regime, the inflation tends to decrease over three months in response to a one standard deviation shock in unemployment. On the other hand, expected inflation has a positive effect on the inflation rate, which persists for up to twelve months. Interestingly, the interest spread doesn't seem to have a significant impact on the inflation rate. When it comes to global factors, GSCPI leads to a decline in inflation in the first month. While commodity prices enhances inflation over two months, GEPU reduces it. It's also worth noting that the response of inflation to oil prices isn't statistically significant. During the high inflation regime, unemployment can lead to a decrease in the inflation rate over a period of two months. However, expected inflation and the interest spread can increase the inflation rate over approximately three months. When taking global factors into consideration, it can be observed that the inflation rate responds positively to commodity and oil prices for a period of three months. GEPU and GSCPI can also increase the inflation rate, but the effect of GSCPI takes longer to materialize than the effect of GEPU.

Figure 3 illustrates the impulse-response graphs for high and low inflation regimes for France. During the low inflation regime, a one standard deviation shock in the unemployment rate has a negative effect on the inflation rate. Furthermore, expected inflation causes the inflation rate to increase over a period of 12 months. However, the interest spread does not seem to have a significant impact on the inflation rate. Commodity and oil prices can cause a decline in the inflation rate over a period of 3 months. On the other hand, the inflation rate positively responds to GSCPI, and this effect continues for over 12 months. Interestingly, it appears that the inflation rate increases simultaneously with GEPU. During the high inflation regime, the inflation rate positively responds to unemployment rate, expected inflation, and interest spread, but the impact of the interest spread takes longer. In terms of global factors, commodity and oil prices enhance the inflation rate over a period of 3 months. The inflation rate simultaneously decreases in response to changes in GEPU. However, GSCPI does not have a significant impact on inflation.

Figure 4 presents the impulse-response graphs for Germany, highlighting some interesting trends. During a low inflation regime, the unemployment rate leads to a decrease in the inflation rate over a one-month period. Additionally, the inflation rate positively responds to the expected inflation over 12 months, although the interest spread does not have a significant effect on the inflation rate. It is observed that commodity and oil prices as well as GSCPI positively affect the inflation rate, but the effect of GSCPI takes longer. On the other hand, GEPU does not have a significant impact on the inflation rate. During a high inflation regime, the response of the inflation rate to the unemployment rate is statistically significant only for the first month. One standard deviation shocks in the expected inflation and interest spread also enhance the inflation rate during this regime. Furthermore, it is seen that the inflation rate positively responds to commodity and oil prices and GSCPI, and this effect lasts long in terms of global factors.

Figure 5 depicts the impulse-response function for Italy. In a low inflation regime, the unemployment rate has a significant effect on the inflation rate only during the first month. Conversely, expected inflation tends to increase the inflation rate over a period of 12 months, with no significant effect observed for the interest spread. When considering global factors, it seems that commodity and oil prices can have a positive impact on the inflation rate over a two-month period, while the GSCPI can lead to an increase in the inflation rate over a 12-month period. However, in a high inflation regime, the effects are observed over a longer period of 12 months, with the unemployment rate leading to a decrease in the inflation rate, while expected inflation and the interest spread tend to increase it.

In terms of global factors, changes in GSCPI, commodity, and oil prices can have an even more significant impact on the inflation rate, with the effect of oil prices being observed over a shorter period of two months. Lastly, it is worth noting that GEPU has a negative impact on the inflation rate over a period of three months. Figure 6 shows the impulse-response graphs for Japan. The inflation rate significantly and negatively responds to a one standard deviation shock in the unemployment rate in the first month. Conversely, the expected inflation enhances the inflation rate throughout 12 months. Commodity and oil prices have an increasing effect on inflation for 3 months. GSCPI leads to a rise in the inflation rate over 12 months. However, the inflation rate negatively responds to changes in GEPU throughout 3 months. During the high inflation regime, the unemployment rate, the expected inflation, and the interest spread positively affect the inflation rate; however, the effect of the expected rate takes longer than the others. The response of the inflation rate to GSCPI, commodity, and oil prices is positive and significant over 12 months. However, GEPU does not have a significant impact on the inflation rate.

In Table 7, there are insights into the inflation rates of the United Kingdom. During low inflation periods, a rise in unemployment can cause inflation to increase simultaneously. Additionally, expected inflation over 12 months can have a positive impact on inflation rates. Interest spread can also affect inflation rates, causing them to rise over a period of 3 months. When examining global factors, commodity and oil prices can lead to an increase in inflation rates over a period of 3 months, while GSCPI has a positive impact on inflation rates for 1 month, but GEPU has a negative impact on inflation rates over 1 month. During high inflation periods, the impact of unemployment on inflation rates is not significant. Instead, expected inflation can cause inflation rates to increase for a period of 4 months. Changes in interest spread can also cause inflation rates to rise. Interestingly, global factors like commodity and oil prices can have a longer-term impact on inflation rates, leading to an increase over time. Similarly, GSCPI can enhance inflation rates for a period of 12 months. However, inflation rates respond negatively to changes in GEPU for only the first month.

6. CONCLUSION

The NKPC explains the dynamics of inflation within macroeconomic models underpinned by microeconomic principles and rational expectations. The NKPC considers factors such as price expectations and expected real marginal cost in determining prices, making it important for monetary policy decisions. In simple terms, it suggests that inflation depends on how people expect prices to change in the future and the real cost of production. However, it's important to note that the way inflation behaves can be different in times of low and high inflation. As a result, a simple linear NKPC model may not capture these differences in inflation and business cycles.

Recent developments on a global scale, such as the COVID-19 pandemic and the Russia-Ukraine conflict, have led to increased interest in the role of global factors in the rapid rise in inflation. In this study, we research the global and domestic factors explaining inflation in NKPC framework for G7 countries in low and high inflation regimes. We use the Threshold VAR (TVAR) model to obtain the response of inflation to its determinants under different inflation regimes. We have observed a negative correlation between inflation and the unemployment rate across all countries in both low and high inflation regimes, except for Germany and Japan. These two countries have notably high unemployment rates in high inflation scenarios, indicative of the stagflation phenomenon. For instance, Germany encountered a similar economic downturn towards the end of 2022. The inflation and unemployment rates for Germany in 2022 stood at 7.9% and 5.3% respectively. Furthermore, our analysis demonstrates that changes in expected inflation and commodity prices exert a more pronounced influence on inflation during low inflation periods. Conversely, during high inflation periods in G7 countries, expected inflation, the variance between the 10-year Government Bond rate and the 3-month interbank rate, commodity prices, and global supply chain pressures play a significantly more pivotal role in driving inflation.

The findings show inflation rates in all countries have sharply increased after 2022 due to expansionary fiscal policies during the COVID-19 pandemic, global supply chain disruptions, increased demand, and higher commodity prices. Our empirical results support the view that global factors, such as global supply chain pressure, and commodity and crude oil prices, play an important role in the increase in inflation. These factors contribute significantly and positively to G7 inflation, especially during the high inflation regime. Inflation responds asymmetrically to driving factors in different inflationary conditions. Crude oil and commodity price asymmetries have a positive effect on inflation. The unemployment rate and expected inflation are key factors in determining inflation in the context of the NKPC. The relationship between GSCPI, GEPU, and inflation is nonlinear. The findings from the study align with the conclusions drawn by Abbas (2023) and Loria & Tirado (2023).

The findings suggest that global supply chain constraints and fluctuations in commodity and oil prices during periods of heightened inflation influence the recent escalation of inflation in G7 nations. Furthermore, the study indicates that the enduring impact of global supply chain pressures on inflation, as well as the substantial influence of changes in oil and commodity prices, particularly affect inflation in countries that are net importers of energy and commodities and possess extensive global trade and financial interconnections.

The evolving impact of domestic and global shocks indicates significant changes in monetary policy over time. Our findings suggest that central banks have become more effective at stabilizing their economies in response to domestic shocks, but they still face challenges when dealing with external shocks. Strains in global supply chains have significantly contributed to inflation trends in many advanced economies since late 2020. While these supply chain issues have been gradually easing, it is likely that supply bottlenecks will continue to exert inflationary pressures for some time. However, a persistent challenge remains in stabilizing the effects of global shocks. This emphasizes the importance of firmly anchoring inflation expectations and may necessitate stronger policy actions to prevent second-round effects from external shocks, such as fluctuations in oil prices and disruptions in global supply chains.

7. CONFLICT OF INTEREST STATEMENT

There is no conflict of interest between the authors.

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No funding or support was used in this study.

9. AUTHOR CONTRIBUTIONS

D.E.: Idea
D.E.: Conception
D.E.: Supervision
D.E.: Collection and/or processing of resources
D.E.: Analysis and comment;
D.E.: Literature Review;
D.E.: Write the article;
D.E.: Critical Review

10. ETHICS COMMITTEE STATEMENT

Ethics committee principles were complied with in the study and necessary permissions were obtained in accordance with the principles of intellectual property and copyrights.

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APPENDIX

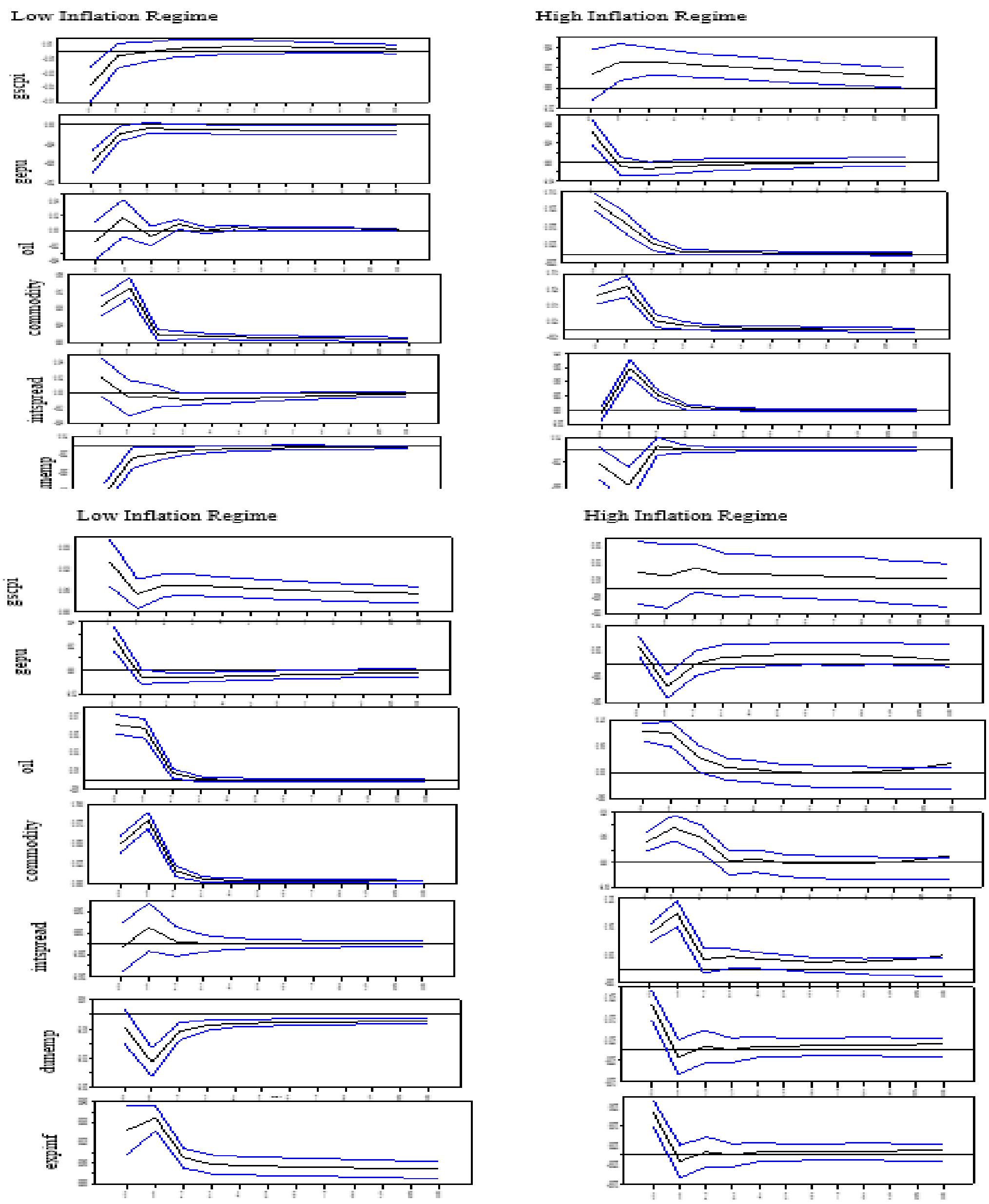

Figure 3 Impulse-Response Functions For France

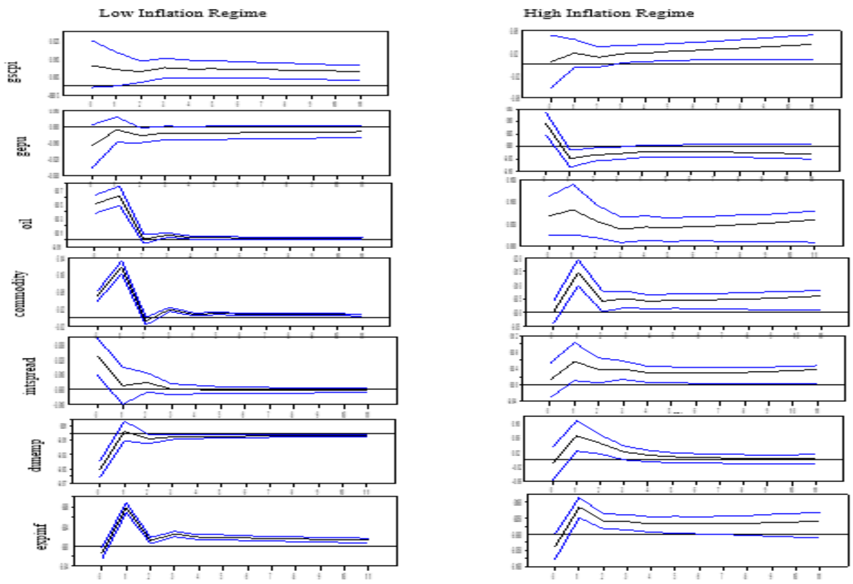

Figure 4 Impulse-Response Functions For Germany

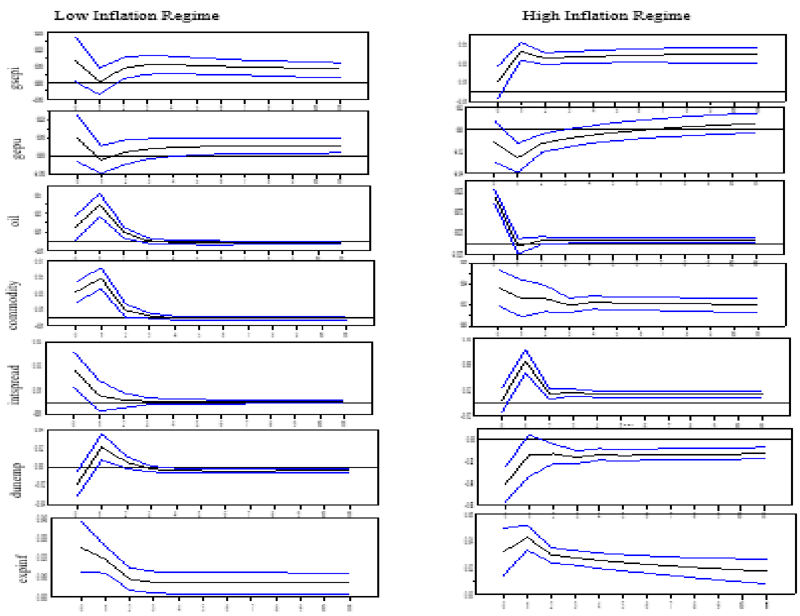

Figure 5 Impulse-Response Functions For Italy

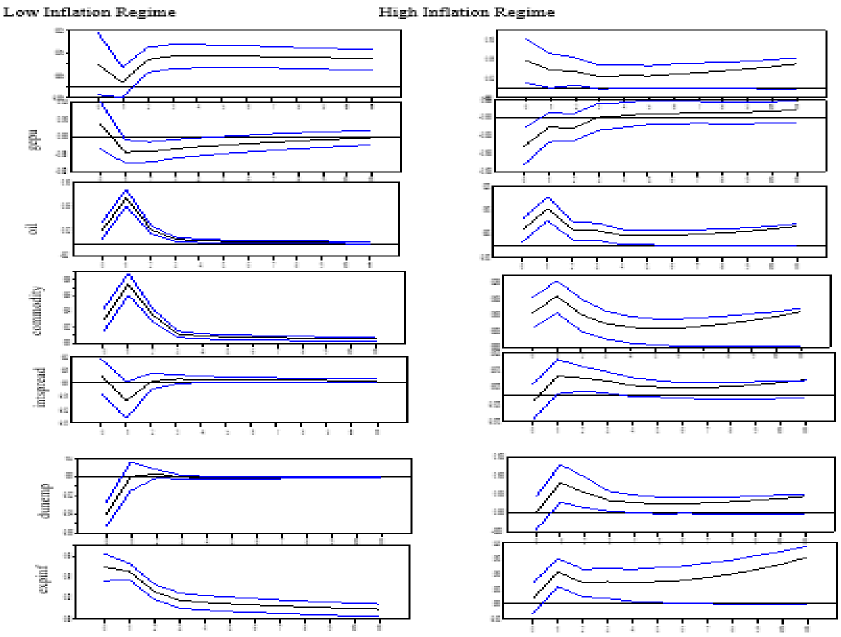

Figure 6 Impulse-Response Functions For Japan

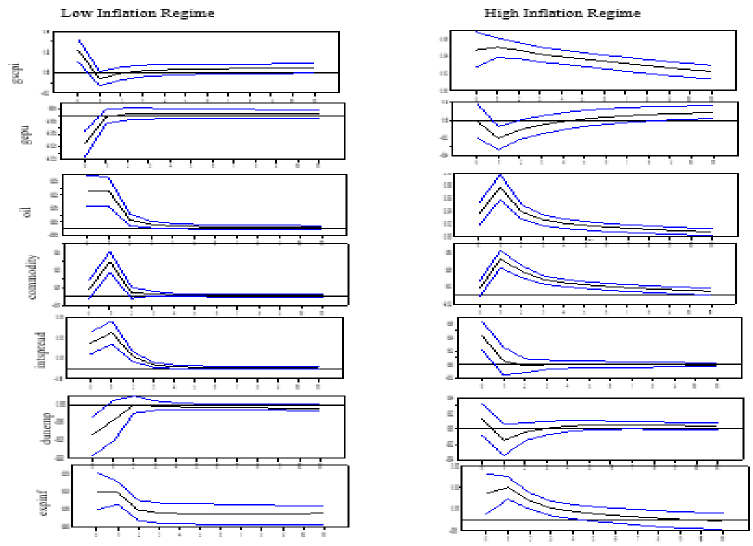

Figure 7 Impulse-Response Functions For The United Kingdom