STRATEGIC MANAGEMENT, Vol. XX (202x), No. x, pp. 0xx-0xx

DOI: 10.5937/StraMan2600016Z

Received: February 25, 2026
Revised: May 07, 2026
June 08, 2026
Accepted: June 16, 2026
Published online: July 29, 2026

Strategic relevance of international inflation transmission for Europe and selected countries in the world

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Abstract

Background: Recent research indicates that inflation dynamics are increasingly driven by global factors, reducing the role of domestic determinants. The growing synchronisation of inflation across countries limits the effectiveness of purely national policy responses and requires a strategic approach to macroeconomic management in an integrated global environment.

Purpose: This paper provides a comprehensive analysis of international inflation transmission over 1999–2023, including the post-pandemic high-inflation episode. The objective is to assess how cross-border inflation linkages reshape the strategic space for monetary policy and whether institutional integration amplifies transmission effects.

Study design/methodology/approach: Using monthly data, we compute Spearman correlation matrices, time-shifted cross-correlations, and systematic bivariate Granger causality tests. The analysis compares regional blocs, such as the euro area and G7, with small open economies to test for transmission hierarchies and the impact of common-currency regimes.

Findings/conclusions: Results confirm strong and persistent international inflation linkages, particularly within the euro area. Data reveal complex bidirectional relationships rather than a simple hierarchy from large to small economies, where small open economies often function as early indicators of global inflationary pressures. These findings imply constrained strategic autonomy for national policy-makers and highlight the necessity of close coordination and forward-looking risk management at the institutional level.

Limitations/future research: The reliance on bivariate causality tests limits the identification of specific structural transmission channels. Future research should apply multivariate structural models to capture evolving strategic spillovers and the impact of recent geopolitical tensions beyond the current sample period.

Keywords

international inflation transmission, global inflation, inflation spillovers, Granger causality, cross-correlations, Europe, G7, strategic relevance, inflation

Introduction

Globalisation has significantly reshaped inflation dynamics, increasing the role of global factors while reducing the relative importance of domestic determinants (Jašová et al., 2020; Liu & Lee, 2021). Key external drivers include exchange rates and imported inflation. Lim and Sek (2015) show that these factors affect inflation differently depending on the inflation environment, with stronger effects observed in high-inflation economies. The concept of price convergence, rooted in the law of one price, suggests that integration should lead to aligned price levels across countries. Although this principle does not fully hold empirically (Isard, 1977), globalisation and market integration have contributed to partial convergence, particularly within the European Union (Hałka & Leszczyńska-Paczesna, 2019). Recent evidence indicates that the post-pandemic inflation surge was largely driven by supply-side factors, particularly commodity prices and energy shocks, rather than domestic policy responses (Dao et al., 2024; Basu, 2024; Ngepah et al., 2026). This highlights the growing importance of global transmission channels and suggests that traditional linear models may not fully capture inflation dynamics. In addition, financial innovation and digitalisation have altered the propagation of macroeconomic shocks, influencing cross-country inflation synchronisation (Nuta et al., 2025). Inflation co-movement across countries reflects synchronised business cycles and increasing integration through global value chains (Tiwari et al., 2015; Stângaciu et al., 2026). Empirical evidence further confirms strong global synchronisation of inflation, which may limit the effectiveness of national monetary policies (Szafranek, 2021), while inflation persistence remains a key characteristic, often challenging standard assumptions of stationarity (Vyrostková & Mirdala, 2022). Within the euro area, inflation convergence is influenced by a common monetary policy and economic integration, although deviations persist due to structural factors (Soares & Aguiar-Conraria, 2014; Brož & Kočenda, 2018). The transmission of inflation is also explained by imported inflation mechanisms, where exchange rate movements and external demand shocks propagate through domestic price dynamics (Nell, 2004; Liu, 2015). Despite extensive research on inflation synchronisation, limited attention has been paid to systematically distinguishing between co-movement and directional transmission across a broad set of countries. The aim of this paper is to examine international inflation transmission over the period 1999–2023, covering the formation of the euro area, the global financial crisis, and the recent inflation surge. The study contributes to the literature in two ways. First, it analyses inflation co-movement using correlation and cross-correlation techniques across a broad set of countries. Second, it applies systematic Granger causality tests to identify the direction and timing of inflation transmission, distinguishing synchronisation from predictive relationships.

1. Literature review

As long as the inflationary innovations originate in the home country, with all other variables held constant, the country can retain autonomy in setting economic policy. But if most of the domestic inflation is due to the transmission of inflation from abroad, domestic policy must be aligned with foreign influences (Jeong & Lee, 2001). From a broader macroeconomic perspective, inflation dynamics are characterised by complex and potentially non-linear relationships with real economic activity, further complicated by financial structures and policy uncertainty (He, 2023; Ghossoub, 2023; Morales-Alonso et al., 2026; Fulgence et al., 2023). This instability is also reflected in empirical modelling, where periods of elevated inflation are associated with deteriorating forecasting performance and structural breaks in standard econometric relationships (Ertl et al., 2025).

In the past, it has been argued that there is no transmission under flexible exchange rates inflation from foreign inflation shocks, but most of the shock is absorbed in the exchange rate flexibility, through a change in the exchange rate. This argument, however, has overlooked the effect of increasing international integration. The transmission of inflation has been confirmed under both fixed and flexible exchange rates. The larger a country's share of foreign trade, the more exchange rates affect its inflation rate (see Kolodko, 1987; Jeong & Lee, 2001).

The extant theoretical literature on the transmission of inflation is substantial and widely accepted. However, empirical research in this area is limited and controversial due to the complexity of transmission channels and sources (Liu, 2015).

Kolodko (1987) provided a seminal insight into the international transmission of inflation when highlighting the impossibility of its complete control within a single country. His research highlighted the key role of the floating exchange rate system in the international transmission of inflation. This perspective was further elaborated by Jeong and Lee (2001), who employed a case study of the G7 nations to demonstrate that the transmission of inflationary shocks is less pronounced under a flexible exchange rate regime. However, they also noted that countries' price levels exhibit a tendency to move together as a cointegrated system, irrespective of the exchange rate type.

Further, Yang et al. (2006) deepened the understanding of inflation transmission within the G7 by finding that unexpected changes in inflation have a long-run effect on price variation in the other countries of the group.

Moreover, Liu (2015) made a significant contribution to literature by offering novel insight into the impact of monetary policy on the transmission of inflation among nations. Specifically, the study demonstrated that following another country's monetary policy can significantly amplify the transmission of inflation between countries.

Recent research provides a more comprehensive perspective on the global nature of inflation. Elsayed et al. (2021) emphasise the role of oil price inflation as a key short-term transmitter of CPI inflation, while Cepni and Clements (2024) extend the analysis to European emerging markets, confirming the global dimension of inflation dynamics. Additional studies link price pressures to climate change and tourism patterns, pointing to the role of behavioural factors (Maráková et al., 2025), and to specific developments in cryptocurrency and energy markets (Loukil et al., 2026).

At the same time, recent contributions highlight the broader economic implications of inflation, including its effects on inequality within the European Union (Simionescu, 2025), country-specific macroeconomic drivers (Hohberger, 2025), and sectoral responses in financial markets (Valadkhani, 2025). These findings suggest that inflation transmission has important implications not only for market stability but also for economic policy design.

In the context of the European Union, Lopez and Papell (2012) find that inflation rates began to converge following the Maastricht Treaty, with the introduction of the euro contributing to reduced inflation volatility. However, Soares and Aguiar-Conraria (2014) report stronger synchronisation of inflation cycles prior to the adoption of the euro among the initial member states. More recent evidence by Brixová et al. (2024) highlights substantial heterogeneity in macroeconomic dynamics across EU countries, supporting the need to analyse both synchronisation and directional linkages. Karanasos et al. (2016) have highlighted the heterogeneity among European countries and the presence of inflation convergence only among specific groups of countries. Brož and Kočenda (2018) have provided comprehensive evidence of inflation convergence among EU countries, a phenomenon that has become more pronounced after the global financial crisis.

Recent contributions further emphasise that inflation transmission within the euro area is shaped by complex interactions between monetary and fiscal frameworks. Despite deep economic integration, empirical evidence suggests that international risk sharing remains incomplete, partly due to price rigidities and persistent structural frictions in product markets, including retail networks that continue to reflect national segmentation (Messner et al., 2024; Enders & Vespermann, 2024; Golpe et al., 2023). These findings highlight that, even within a monetary union, inflation dynamics are not fully homogenised and may exhibit country-specific transmission patterns.

From a global standpoint, Tiwari et al. (2015) identified that common movements in inflation are caused by a combination of short-term, medium-term, and long-term factors. Liu and Lee (2021) further corroborated this phenomenon, utilising a sample of 98 countries and demonstrating the predominant tendency for inflation rates to converge. Szafranek's (2021) examination, covering a large sample of 124 countries, confirms a strong correlation between global and domestic inflation, especially in closely integrated industrial economies.

Small open economies (SOEs) tend to exhibit heightened sensitivity to international volatility spillovers, which often dominate domestic stability factors. Empirical evidence suggests that the effectiveness of monetary transmission in these economies is strongly conditioned by the level of financial development and the specific policy frameworks, such as inflation targeting regimes, used to mitigate external shocks (Cross et al., 2025; Nair et al, 2025; Dridi & Boughrara, 2023).

The international transmission of inflation reflects a combination of real and financial linkages across economies. In addition to traditional channels, recent theoretical contributions highlight the role of credit conditions and liquidity constraints in shaping inflation dynamics and their interaction with labour market outcomes (Gu et al., 2025).

Monetary policy further interacts with wage-setting behaviour and inflation uncertainty, which can influence macroeconomic equilibrium through indirect channels (Lawler, 2006). At the same time, economic uncertainty—particularly during periods of heightened volatility—affects expectations and can amplify inflation dynamics (Silva & de Araújo, 2023). These effects are further reinforced by central bank communication, which plays an important role in shaping expectations and influencing future inflation paths (de Haan & Hoogduin, 2024).

Consequently, inflation cannot be viewed as a purely contemporaneous phenomenon, but rather as a process involving co-movement, lagged adjustments, and directional spillovers across economies. This motivates the joint use of correlation analysis and Granger causality to distinguish between synchronisation and predictive transmission mechanisms.

A review of the extant literature reveals evidence of robust international linkages and persistent inflation. However, most studies tend to concentrate on a limited set of economies, shorter samples from the pre-pandemic period, or uncontrolled measures of linkages. In contrast, the present study combines monthly data from a long period (1999–2023), a broad group of country pairs – including small open economies and unconventional partners – and the joint use of cross-correlations and Granger causality tests to analyse both the strength and direction of international inflation transmission.

2. Methodology

In our article, we test two related hypotheses.

H1: *Inflation transmission is stronger within the euro area than across other country groups.*

H2: *Inflation transmission predominantly occurs from larger to smaller economies.*

The first hypothesis is motivated by Brož and Kočenda (2018), who document strong inflation convergence among euro area members, suggesting that a common monetary policy and deep economic integration promote closer inflation linkages within the monetary union. The second hypothesis is based on the work of Jeong and Lee (2001), who show that increasing commodity market integration increases the scope for inflation transmission from large economies to smaller, more open economies. At the same time, our empirical framework, which combines cross-correlations with bivariate Granger causality tests, is designed to allow for asymmetric and bidirectional linkages, so that we can thoroughly assess the extent to which inflation transmission in the real world matches or deviates from this simple "large-to-small" benchmark.

Hypothesis 1 is primarily assessed using correlation and cross-correlation analysis, while Hypothesis 2 is evaluated using Granger causality tests, which allow us to identify the direction of predictive relationships. This combined framework enables us to distinguish between synchronisation and directional transmission.

To answer these two hypotheses, we compute a correlation matrix and cross-correlation between the selected countries. The analysis is conducted over the period from 1999 to 2023. The selected time period reflects both data availability and the need to capture key structural developments in the global economy. It includes the formation of the euro area, the global financial crisis, and the post-pandemic inflation surge, which together represent distinct phases of inflation dynamics. Data for 2024 were not included due to incomplete availability and limited cross-country comparability at the time of analysis. For the euro area comparison, the HICP (in percentage terms) was utilised, while for the other countries, monthly CPI data were employed, with the annual percentage change from the previous year being calculated. The HICP data are obtained from Eurostat. When examining the correlations between G7 inflation rate and its aggregate, data were taken from the OECD. When examining the correlations of CPI inflation rates between other countries and G7 countries without an aggregate, data from the International Monetary Fund were used.

The countries analysed in this study were grouped into several categories to ensure a comprehensive representation of diverse economic and geographic regions. The Eurozone countries included Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Greece, Slovenia, Cyprus, Malta, Slovakia, Estonia, Lithuania, Latvia, and Croatia. The G7 countries comprised Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States of America. The Nordic countries included Denmark, Finland, Iceland, Norway, and Sweden. The OPEC countries examined were Saudi Arabia, Ecuador, and Indonesia. Additionally, Haiti and China were included as individual cases outside these groupings.

The normality of the data was rejected using the Shapiro-Wilk test. Therefore, a nonparametric correlation method - Spearman's rank correlation coefficient - is used in this paper. Spearman's rank correlation coefficient is a non-parametric method for assessing the strength of the relationship between two variables that works with ordinal data instead of raw data. Its basis in the order of the data renders it well suited to the representation of trends in time series. However, it is important to note that some information is inevitably lost during the conversion process from raw data to ordinal data. Notably, this approach demonstrates resilience to the presence of outliers (Xiao et al., 2016).

Spearman's rank correlation coefficient is calculated by the formula:

$$r_s = 1 - \frac{6\sum d_i^2}{N(N^2-1)} \tag{1}$$

Where d_i is the difference between the ranking for each pair of data, and N is the number of pairs of data (Xiao et al., 2016).

The calculated individual correlations serve as input into a correlation matrix - a table in which the variables are displayed in both rows and columns, with the cell values representing the correlation between the variables. This representation allows us to more easily compare correlations across a larger number of countries (Bruce & Bruce, 2017).

In the context of international economic relations, the transmission of inflation from one country to another may occur with a time lag. Cross-correlation analysis can be employed to assess the correlation between inflation rates and the time lag. The cross-correlation in R is computed using the ccf() function. The function ccf(x, y) quantifies the linear correlation between x[t+k] and y[t], where k denotes the time shift. Given that the correlation matrix employed Spearman's rank-order correlation coefficient, which calculates the correlation at time shift 0, for simplicity, we do not refrain from reporting the cross-correlation without a time shift, i.e., at time shift 0 (R Core Team, 2021)

Cross-correlations provide information about the strength and timing of joint movements in inflation rates, but they cannot determine whether inflation in one country contains additional predictive information about inflation in another country beyond its own past. In order to address this limitation, the present study employs a set of bivariate Granger causality tests, as commonly used in empirical analyses of financial and economic linkages (Krkošková, 2020), to complement the correlation analysis.

To investigate the direction of international inflation transmission, we apply a systematic set of two-dimensional Granger causality tests within and between the following groups of countries: the eurozone vs. member states, the G7, small open economies (Slovakia, Estonia, Luxembourg, Haiti, and others), the Baltic countries, the V4 countries, the Nordic countries, and the OPEC countries. Conceptually, country j is said to Granger-cause country i if past values of inflation in j improve the prediction of inflation in i over and above the information contained in the past values of inflation in i itself.

Formally, for each ordered pair (i, j), we estimate an unrestricted regression of the form:

$$\pi_{i,t} = \alpha + \sum_{k=1}^{p} \beta_k \pi_{i,t-k} + \sum_{k=1}^{p} \gamma_k \pi_{j,t-k} + \varepsilon_t,$$

where $\pi_{i,t}$ denotes (possibly transformed) inflation in country i at time t and $\pi_{j,t}$ is inflation in country j.

Before estimating these regression models, we examine the time series of all inflation series using Augmented Dickey–Fuller tests and use the lowest order transformation (level or first difference) that leads to stationarity in Granger causality analysis. The tests are performed on monthly data using the grangertest() from the lmtest package in R for lag orders, and for each lag order we report the corresponding p-values with significance levels of 10%, 5% and 1% marked with the symbols *, **, and ***, and display them in tables in the style of a heat map, where darker shades indicate smaller p-values.

The combination of cross-correlations and Granger causality tests allows us to distinguish three dimensions of international inflation linkages: (i) synchronisation (how closely inflation rates move together), (ii) timing (which country tends to lead or lag), and (iii) predictive content (whether past inflation in one country systematically improves forecasts for another).

All statistical calculations are performed using the statistical software R 4.3.1 and 4.3.3 (R Core Team, 2021). Correlation matrices are plotted using the ggplot2 library (Wickham, 2016).

3. Results

In this section, we present results of computed cross-correlations between inflations in different groups of countries.

Table 1 Cross-correlation between euro area and individual countries of euro area

	Eurozone									
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Austria	0.38	**0.58**	**0.76**	**0.89**	**0.94**	**0.9**	**0.77**	**0.59**	0.4	0.23
Belgium	-0.05	0.15	0.4	**0.63**	**0.83**	**0.89**	**0.85**	**0.73**	**0.54**	0.34
Finland	0.28	0.47	**0.65**	**0.79**	**0.87**	**0.85**	**0.74**	**0.57**	0.36	0.19
France	0.4	**0.59**	**0.76**	**0.89**	**0.95**	**0.92**	**0.79**	**0.62**	0.41	0.23
Germany	0.3	0.5	**0.7**	**0.85**	**0.95**	**0.95**	**0.84**	**0.68**	0.5	0.3
Ireland	0.27	0.44	**0.6**	**0.72**	**0.8**	**0.79**	**0.72**	**0.59**	0.44	0.27
Italy	0.34	**0.54**	**0.75**	**0.89**	**0.96**	**0.93**	**0.8**	**0.62**	0.42	0.23
Luxembourg	0.05	0.2	0.38	**0.58**	**0.79**	**0.85**	**0.83**	**0.73**	**0.55**	0.35
Netherlands	0.19	0.38	**0.57**	**0.73**	**0.83**	**0.87**	**0.79**	**0.65**	0.48	0.29
Portugal	0.27	0.47	**0.66**	**0.8**	**0.88**	**0.87**	**0.76**	**0.58**	0.38	0.19
Spain	0.13	0.28	0.46	**0.65**	**0.81**	**0.87**	**0.85**	**0.74**	**0.57**	0.37
Greece	0.18	0.33	**0.51**	**0.67**	**0.78**	**0.81**	**0.76**	**0.63**	0.45	0.26
Slovenia	0.29	0.41	**0.53**	**0.63**	**0.69**	**0.68**	**0.6**	0.47	0.31	0.15
Cyprus	0.19	0.34	**0.52**	**0.69**	**0.82**	**0.83**	**0.77**	**0.65**	0.47	0.3
Malta	0.39	**0.58**	**0.74**	**0.82**	**0.81**	**0.75**	**0.57**	0.37	0.15	-0.02
Slovakia	0.32	0.45	**0.56**	**0.63**	**0.65**	**0.63**	**0.54**	0.43	0.3	0.2
Estonia	0.19	0.4	**0.61**	**0.8**	**0.92**	**0.92**	**0.84**	**0.67**	0.45	0.24
Latvia	0.23	0.41	**0.59**	**0.73**	**0.8**	**0.78**	**0.67**	0.5	0.3	0.12
Lithuania	0.2	0.4	**0.6**	**0.76**	**0.84**	**0.84**	**0.76**	**0.61**	0.43	0.25
Croatia	0.42	**0.6**	**0.75**	**0.86**	**0.91**	**0.88**	**0.75**	**0.57**	0.38	0.2

Source: the authors

An examination of the cross-correlation between the euro area aggregate and the individual euro area countries revealed at least moderate forward and backward correlations up to seven months in advance. These findings indicate a high degree of synchronisation and suggest that inflation shocks are transmitted relatively quickly across euro area economies.

The high correlation coefficients, particularly in the case of Italy and France, indicate a strong synchronisation of inflation dynamics within the euro area. From a policy perspective, this suggests that price shocks are transmitted rapidly across highly integrated economies. For the ECB, this reinforces the need to formulate monetary policy with respect to aggregate euro area inflation, while national fiscal policies may have only limited scope to offset imported inflation without generating internal imbalances within the monetary union.

The highest correlation is observed between the euro area aggregate and Italy a month later (see Table 1). An examination of Italy's trade profile reveals that 52.2% of its merchandise exports and 58.1% of commercial services are exported to European Union. Similarly, 50.5% of merchandise trade and 64.9% of commercial services are imported from the European Union to Italy (World Trade Organization, 2023, pp. 182–183). Given that the correlations were calculated from 1999, it is imperative to acknowledge that Italy adopted the euro in 2002, so for the majority of the observed period, the nation has been a constituent of the eurozone. In contrast, when examining Slovakia, which adopted the euro in 2009, the one-month lag correlations are the lowest when compared to all other euro area countries. An observation of the trading profile of Slovakia reveals that 79.9% of its exports of merchandise trade and 70.8% of its commercial services are directed to the European Union. Slovakia is importing 50.9% of its merchandise trade and 79.9% of its commercial services from the European Union (World Trade Organization, 2023, pp. 326–327). Even if these figures exceed those observed in Italy, it is impossible to conclude that the correlation increases with the duration of the euro period. Croatia serves as a compelling case study that contradicts this hypothesis. Croatia adopted the euro as its official currency in 2023, however its correlation with the eurozone was comparable to that of Italy. According to the data, 68.7% of Croatia's exports of merchandise and 67.6% of its commercial services are destined for the European Union. Conversely, the European Union accounts for 70.6% of Croatia's merchandise trade and 51.7% of its commercial services (World Trade Organization, 2023, pp. 92–93). A comparative analysis of the trading profiles of these countries from 2010 reveals that the figures for exports and imports remained relatively stable over time (World Trade Organization, 2010).

Our results uncover that the high correlations between the euro area aggregate and the individual euro area country support Mundell's optimum currency area argument, which additionally states that high labour mobility between countries is an important factor for an effective single currency (Mundell, 1961).

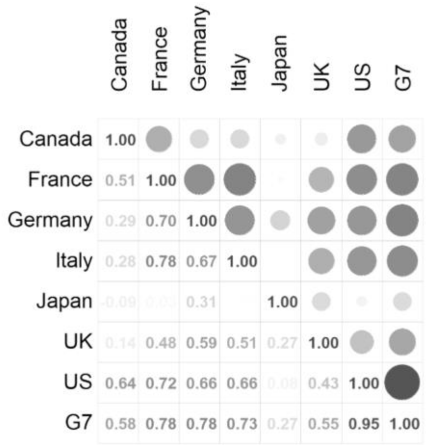

Figure 1 Correlations between countries of G7
Source: the authors

Looking at the correlations of inflation rates among the G7 countries (see Figure 1), the data indicates significant correlations among the single currency countries - France, Germany and Italy. Additionally, a high correlation between inflation was observed between Canada and its neighbouring country, the United States. Conversely, the United Kingdom exhibited low correlations with the other countries, likely attributable to its distinct monetary policy. Japan was not correlated with the other countries, including the G7 aggregate, presumably because of Japan's long-standing struggle with deflation and divergent monetary policies.

Table 2 Cross-correlation between euro area G7 countries and individual G7 countries

France										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
FR	-0.12	0.05	0.2	0.36	**0.59**	**0.62**	0.47	0.34	0.22	0.13
DE	-0.11	0.23	0.4	**0.57**	**0.75**	**0.76**	**0.55**	0.36	0.16	0.09
IT	0.26	0.41	**0.59**	**0.74**	**0.84**	**0.81**	**0.65**	0.48	0.34	0.27
JP	-0.24	-0.13	-0.03	0.06	0.04	-0.06	-0.24	-0.42	**-0.54**	**-0.56**
UK	0.15	0.3	0.42	0.5	**0.54**	0.47	0.3	0.18	0.11	0.07
US	-0.04	0.05	0.23	0.45	**0.71**	**0.75**	**0.62**	0.43	0.22	0.08
G7	-0.02	0.11	0.31	**0.53**	**0.78**	**0.79**	**0.6**	0.38	0.15	0.01
Germany										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
FR	-0.19	-0.04	0.08	0.23	0.48	**0.51**	0.37	0.26	0.15	0.16
DE	0	0.16	0.36	**0.55**	**0.76**	**0.75**	**0.57**	0.4	0.23	0.11
IT	0.08	0.23	0.38	**0.55**	**0.68**	**0.66**	**0.54**	0.4	0.28	0.22
JP	0.11	0.18	0.22	0.03	0.12	0.09	-0.32	-0.36	-0.36	-0.36
UK	0.15	0.32	0.44	**0.53**	**0.61**	**0.56**	0.4	0.24	0.14	0.14
US	-0.17	0	0.19	0.38	**0.65**	**0.68**	**0.57**	0.43	0.29	0.18
G7	-0.11	0.08	0.29	0.49	**0.74**	**0.75**	**0.58**	0.41	0.24	0.12
Italy										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	-0.02	0.06	0.19	0.34	**0.51**	**0.57**	**0.51**	0.44	0.35	0.27
FR	0.27	0.34	0.48	**0.65**	**0.81**	**0.84**	**0.74**	**0.59**	0.41	0.26
DE	0.22	0.28	0.4	**0.54**	**0.66**	**0.68**	**0.55**	0.38	0.23	0.08
JP	-0.31	-0.29	-0.25	-0.2	-0.12	-0.24	-0.35	-0.45	**-0.54**	**-0.59**
UK	0.13	0.24	0.36	0.46	**0.52**	0.49	0.37	0.27	0.2	0.12
US	0.06	0.1	0.23	0.4	**0.6**	**0.67**	**0.63**	**0.52**	0.38	0.26
G7	0.07	0.13	0.28	0.45	**0.64**	**0.7**	**0.61**	0.47	0.31	0.18

Source: the authors

Table 3 Cross-correlations between G7 countries

Canada										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
FR	0.13	0.22	0.34	0.47	**0.62**	**0.59**	0.36	0.2	0.05	-0.12
DE	0.1	0.15	0.26	0.37	**0.51**	0.48	0.23	0.08	0.04	-0.19
IT	0.27	0.35	0.44	**0.51**	**0.57**	**0.51**	0.34	0.19	0.06	-0.02
JO	-0.03	-0.16	-0.05	0.08	0.15	0.07	-0.11	-0.24	-0.37	-0.43
UK	-0.05	0.01	0.12	0.29	0.24	0.26	0.06	-0.1	-0.21	-0.28
US	-0.03	0.06	0.18	0.36	**0.68**	**0.67**	0.43	0.22	0.03	-0.12
G7	-0.04	0.07	0.21	0.41	**0.7**	**0.67**	0.39	0.16	-0.05	-0.2
Japan										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	-0.43	-0.37	-0.24	-0.11	0.07	0.15	0.08	-0.05	-0.16	-0.3
FR	**-0.56**	**-0.54**	-0.42	-0.24	0.06	0.04	0.06	-0.06	-0.13	-0.24
DE	-0.36	-0.32	-0.22	-0.08	0.08	0.18	0.22	0.18	0.1	0
IT	**-0.59**	**-0.54**	-0.35	-0.24	-0.02	0.05	0.22	0.25	0.09	-0.31
UK	-0.42	-0.32	-0.04	0.09	0.13	0.11	0.07	0.02	0	-0.1
US	-0.44	-0.4	-0.35	-0.2	0.05	0.17	0.18	0.11	0.02	-0.1
G7	-0.46	-0.42	-0.28	-0.11	0.17	0.28	0.26	0.17	0	-0.18
United Kingdom										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	-0.21	-0.16	-0.06	0.06	0.24	0.29	0.2	0.1	0.01	-0.05
FR	0.07	0.11	0.18	0.3	0.47	**0.54**	0.5	0.42	0.3	0.15
DE	0.14	0.2	0.29	0.4	**0.56**	**0.61**	**0.53**	0.44	0.32	0.15
IT	0.12	0.18	0.27	0.37	0.45	**0.52**	0.46	0.36	0.24	0.1
JP	0	0.07	0.11	0.13	0.09	-0.04	-0.2	-0.32	-0.42	-0.42
US	-0.08	0	0.01	0.13	0.37	0.47	0.45	0.36	0.23	0.01
G7	-0.02	0.01	0.1	0.25	0.48	**0.57**	0.5	0.38	0.22	0.06
United States										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	-0.12	0.03	0.22	0.43	**0.67**	**0.68**	0.36	0.18	0.06	-0.03
FR	0.08	0.22	0.43	**0.62**	**0.75**	**0.71**	0.45	0.23	0.05	-0.04
DE	0.18	0.29	0.43	**0.57**	**0.68**	**0.65**	0.38	0.19	0.08	-0.17
IT	0.26	0.38	**0.52**	**0.63**	**0.67**	**0.6**	0.24	0.06	-0.07	-0.19
JP	-0.2	-0.02	0.11	0.18	0.17	0.07	-0.16	-0.25	-0.29	-0.35
UK	0.1	0.23	0.36	0.45	0.47	0.37	0.13	0.01	-0.08	-0.14
G7	-0.01	0.16	0.39	**0.65**	**0.93**	**0.89**	**0.53**	0.24	0.02	-0.11

Source: the authors

Table 2 and Table 3 present cross-correlations between inflations of G7 countries. Compared to the euro area, the results for the G7 indicate a lower and more heterogeneous degree of inflation synchronisation. While strong bilateral linkages are observed, particularly between the United States and Canada, inflation dynamics across the G7 are not uniformly aligned. From a policy perspective, this suggests that inflation transmission in globally integrated but institutionally independent economies is more heterogeneous and influenced by bilateral trade linkages and country-specific monetary regimes. Canada exhibited the highest correlation with a one-month lag in both directions with the United States and the aggregate G7 (see Table 3). The result is in line with bilateral trade between the countries, as according to data from 2023, Canada is exporting more than 76% of its merchandise trade to the United States, while importing approximately 50% of its merchandise from the U.S. (World Trade Organization, 2023, pp. 70–71).

An examination of the French inflation correlations reveals a noteworthy correlation between France's inflation and that of Italy four months prior (see Table 2).

There is no significant correlation with time shifts for Japan and the United Kingdom (Table 3). This outcome stands in contrast to the findings reported by Jeong and Lee (2001) that the UK is a significant producer of inflationary innovations among the European Union countries. However, our results uncover that the UK did not affect inflation in France, Germany and Italy.

Table 4 Cross-correlation between Slovakia and individual G7 countries

Slovakia (1999-2008)										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	0.16	0.22	0.31	0.43	**0.55**	**0.62**	**0.66**	**0.62**	**0.54**	0.41
FR	0.3	0.41	**0.52**	**0.6**	**0.64**	**0.63**	**0.58**	0.47	0.36	0.25
DE	0.21	0.31	0.42	**0.51**	**0.56**	**0.56**	**0.52**	0.43	0.34	0.23
IT	0.29	0.41	**0.54**	**0.65**	**0.72**	**0.72**	**0.67**	**0.56**	0.43	0.29
JP	-0.06	0.03	0.11	0.16	0.17	0.11	0.11	0.05	0.05	-0.15
UK	0.08	0.2	0.32	0.42	0.48	0.49	0.46	0.39	0.29	0.18
US	0.15	0.21	0.31	0.43	**0.55**	**0.61**	**0.65**	**0.62**	**0.55**	0.44
Slovakia (2009-2023)										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	0.16	0.3	0.45	**0.62**	**0.78**	**0.86**	**0.9**	**0.87**	**0.77**	**0.6**
FR	0.42	**0.59**	**0.75**	**0.87**	**0.94**	**0.94**	**0.87**	**0.75**	**0.59**	0.41
DE	0.38	**0.54**	**0.71**	**0.85**	**0.93**	**0.94**	**0.9**	**0.79**	**0.63**	0.45
IT	0.32	0.5	**0.69**	**0.84**	**0.93**	**0.94**	**0.89**	**0.74**	**0.57**	0.37
JP	0.31	0.42	**0.52**	**0.56**	**0.56**	**0.52**	0.41	0.26	0.1	-0.04
UK	0.38	**0.56**	**0.73**	**0.87**	**0.95**	**0.95**	**0.89**	**0.75**	**0.58**	0.39
US	0.16	0.28	0.42	**0.59**	**0.75**	**0.84**	**0.91**	**0.91**	**0.84**	**0.7**

Source: the authors

Table 4 reports cross correlations between Slovakia and countries of the G7 before and after the adoption of the euro in Slovakia. The observed increase in correlations following euro adoption indicates a structural shift in the transmission of inflation, reflecting deeper integration into the euro area. From a policy perspective, this suggests that domestic inflation dynamics have become more closely aligned with external developments, reducing the scope for independent monetary adjustment. Consequently, national policy responses may need to place greater emphasis on structural factors, such as labour market flexibility and productivity, as complementary mechanisms in the absence of autonomous monetary policy. The correlations before the euro were significantly lower than after the euro currency adoption. The increased correlations observed following the adoption of the euro with other countries serve to reinforce the argument that the optimum currency area is endogenous (Frankel & Rose, 1998), as evidenced by increased Slovakia's inflation correlation with France, Germany, and Italy. The correlations are notably high with all the countries except Japan and stay high even for four- and seven-month's shift. The existence of a high degree of correlation with other countries can be attributed to Slovakia's status as a small and open economy - the country is therefore more responsive to foreign inflation shocks (Cepni & Clements, 2024; WORLD BANK GROUP, 2023).

Table 5 Cross-correlation between specific countries and individual G7 countries

Luxembourg										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	0.08	0.28	0.47	**0.65**	**0.79**	**0.79**	**0.67**	**0.55**	0.42	0.28
FR	0.39	**0.56**	**0.71**	**0.82**	**0.88**	**0.83**	**0.67**	0.48	0.29	0.14
DE	0.36	**0.54**	**0.68**	**0.77**	**0.82**	**0.78**	**0.65**	**0.51**	0.34	0.17
IT	0.38	**0.59**	**0.75**	**0.84**	**0.85**	**0.8**	**0.65**	0.48	0.32	0.17
JP	0.24	0.35	0.4	0.42	0.35	0.25	0.06	-0.1	-0.22	-0.28
UK	0.39	**0.58**	**0.72**	**0.78**	**0.78**	**0.71**	**0.56**	0.41	0.27	0.16
US	0.05	0.23	0.43	**0.65**	**0.83**	**0.86**	**0.77**	**0.65**	0.5	0.33
China										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	-0.3	-0.2	-0.1	-0	0.07	0.08	0.01	-0.1	-0.16	-0.2
FR	-0.2	-0.1	0.07	0.17	0.2	0.18	0.07	-0.1	-0.13	-0.16
DE	-0.1	-0	0.06	0.13	0.16	0.13	0.05	-0.1	-0.13	-0.18
IT	-0.1	-0	0.04	0.09	0.07	0.03	-0.1	-0.2	-0.18	-0.17
JP	0.02	0.16	0.26	0.27	0.21	0.13	0.01	-0.1	-0.17	-0.18
UK	0.05	0.12	0.18	0.19	0.15	0.1	-0.1	-0.1	-0.07	-0.07
US	-0.2	-0.2	-0	0.12	0.21	0.2	0.09	-0.1	-0.17	-0.23
Haiti										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	0.15	0.16	0.23	0.35	0.49	**0.58**	**0.69**	**0.69**	**0.61**	0.49
FR	0.26	0.33	0.45	**0.56**	**0.66**	**0.69**	**0.67**	**0.58**	0.43	0.26
DE	0.27	0.34	0.43	**0.53**	**0.61**	**0.65**	**0.64**	**0.56**	0.44	0.31
IT	0.16	0.23	0.33	0.46	**0.59**	**0.63**	**0.62**	**0.52**	0.37	0.2
JP	0.12	0.21	0.31	0.41	0.46	0.4	0.4	0.29	0.16	0.07
UK	0.21	0.28	0.38	0.48	**0.55**	**0.56**	**0.52**	0.42	0.29	0.17
US	0.23	0.21	0.24	0.34	0.47	**0.55**	**0.63**	**0.62**	**0.53**	0.4
Saudi Arabia										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	-0.1	-0.1	-0.1	-0.1	-0	-0	-0.1	-0.1	-0.09	-0.08
FR	-0	-0.1	0	0.07	0.11	0.14	0.11	0.08	0.05	0.02
DE	0.06	0.05	0.07	0.09	0.1	0.11	0.1	0.09	0.1	0.09
IT	0.03	0.03	0.05	0.08	0.09	0.09	0.07	0.04	0.02	0.01
JP	0.01	0.01	0.06	0.09	0.11	0.12	0.09	0.04	0	-0.03
UK	0.25	0.24	0.26	0.27	0.26	0.25	0.22	0.19	0.17	0.16
US	-0.1	-0.1	-0.1	-0	0.03	0.05	0.04	0.03	0.01	0

Source: the authors

Further, we examined correlation between inflation in Luxembourg (see Table 5) - the world's most open country (WORLD BANK GROUP, 2023) and other G7 countries. Strong correlation with a monthly shift has been observed, with every country except Japan having an impact on

Luxembourg's inflation. The most substantial influences are observed with the United States and France.

Our results uncover no evidence of a relationship between a large and less open economy like China and the G7 countries even with time shifts (see Table 5). This result is explained by the fact that China's economic and political system is distinct from those of other countries.

When searching for a developing country for this study, Haiti, a developing country in North America, was selected (due to the data availability). The highest correlation is observed between the inflation of Canada and Haiti seven months later (see Table 5). The underlying cause of this phenomenon could be attributed to the robust bilateral relationship between these two nations (Canada.ca, 2025). A correlation of inflation is also observed between Haiti and France, Germany, Italy, and the USA, with a one-, three-, and seven-month lag.

Saudi Arabia is a founding member of OPEC and is one of the few countries in this group with data available for the period under review. A lack of correlation has been demonstrated between Saudi Arabia's inflation rates and those of the G7 countries even with time shifts (see Table 5).

Table 6 Cross-correlations between Estonia and Sweden with individual G7 countries

Estonia										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	0.08	0.25	0.45	**0.62**	**0.76**	**0.8**	**0.75**	**0.62**	0.46	0.29
FR	0.36	**0.55**	**0.71**	**0.82**	**0.86**	**0.84**	**0.7**	**0.52**	0.31	0.12
DE	0.32	**0.53**	**0.71**	**0.85**	**0.89**	**0.87**	**0.75**	**0.59**	0.41	0.23
IT	0.32	**0.53**	**0.73**	**0.87**	**0.9**	**0.85**	**0.7**	0.5	0.3	0.13
JP	0.28	0.41	**0.52**	**0.55**	0.49	0.41	0.25	0.07	-0.09	-0.2
UK	0.39	**0.6**	**0.78**	**0.87**	**0.87**	**0.82**	**0.67**	0.49	0.3	0.14
US	0.03	0.19	0.39	**0.6**	**0.78**	**0.86**	**0.86**	**0.76**	**0.61**	0.42
Sweden										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
CA	0.09	0.21	0.36	**0.53**	**0.72**	**0.79**	**0.81**	**0.77**	**0.66**	0.5
FR	0.31	0.47	**0.63**	**0.77**	**0.88**	**0.88**	**0.79**	**0.65**	0.46	0.27
DE	0.25	0.42	**0.6**	**0.77**	**0.88**	**0.91**	**0.86**	**0.74**	**0.59**	0.41
IT	0.23	0.38	**0.56**	**0.72**	**0.84**	**0.86**	**0.8**	**0.66**	0.47	0.27
JP	0.19	0.34	0.47	**0.56**	**0.76**	**0.56**	0.43	0.29	0.13	-0.01
UK	0.29	0.46	**0.64**	**0.78**	**0.88**	**0.88**	**0.81**	**0.68**	**0.51**	0.33
US	0.04	0.14	0.28	0.45	**0.64**	**0.73**	**0.78**	**0.76**	**0.68**	**0.54**

Source: the authors

Estonia, a European Union country and a member of the euro area since 2011, highly correlates with the majority of G7 countries (see Table 6). A substantial correlation exists between Estonia and the G7 in both time-shift directions. Apart from Japan, all G7 countries have exerted a significant influence on Estonia's inflation rate.

In Table 6, strong correlation is evident between German inflation and Swedish inflation one month later. Sweden exhibits a substantial correlation with other nations at this time lag, except for Japan. It is evident that the correlations diminish with an increased time lag. The inflation rates of Canada, France, Germany, Italy, and the United Kingdom exhibit a high degree of correlation with Sweden's inflation one month subsequent, though with the exception of Japan, the correlation is lower than with the reverse shift. In this direction, too, the correlation decreases as the time lag increases.

Table 7 Cross-correlations between individual V4 countries

Czech.Rep.										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Hungary	0.44	0.6	**0.73**	**0.8**	**0.79**	**0.75**	**0.65**	**0.51**	0.38	0.25
Poland	0.37	**0.53**	**0.68**	**0.79**	**0.85**	**0.84**	**0.76**	**0.65**	**0.52**	0.38
Slovakia	0.26	0.37	0.48	**0.57**	**0.62**	**0.62**	**0.57**	0.47	0.35	0.23
Hungary										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Czech.Rep.	0.25	0.38	**0.51**	**0.65**	**0.75**	**0.79**	**0.8**	**0.73**	**0.6**	0.44
Poland	0.33	0.46	**0.61**	**0.75**	**0.87**	**0.9**	**0.88**	**0.79**	**0.66**	**0.51**
Slovakia	0.36	0.46	**0.59**	**0.71**	**0.79**	**0.81**	**0.8**	**0.74**	**0.63**	0.5
Poland										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Czech.Rep.	0.38	**0.52**	**0.65**	**0.76**	**0.84**	**0.85**	**0.79**	**0.68**	**0.53**	0.37
Hungary	**0.51**	**0.66**	**0.79**	**0.88**	**0.9**	**0.87**	**0.75**	**0.61**	0.46	0.33
Slovakia	0.4	**0.51**	**0.63**	**0.73**	**0.8**	**0.81**	**0.77**	**0.67**	**0.53**	0.38
Slovakia										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Czech.Rep.	0.23	0.35	0.47	**0.57**	**0.62**	**0.62**	**0.57**	0.48	0.37	0.26
Hungary	0.5	**0.63**	**0.74**	**0.8**	**0.81**	**0.79**	**0.71**	**0.59**	0.46	0.36
Poland	0.38	**0.53**	**0.67**	**0.77**	**0.81**	**0.8**	**0.73**	**0.63**	**0.51**	0.4

Source: the authors

The Visegrad Four countries - the Czech Republic, Hungary, Poland, and Slovakia - share a portion of their history and are post-communist nations. The most significant correlation is observed between Poland's inflation and Hungary's inflation one month later, where the correlation is 0.9. It is important to note that even if these countries have a variety of their national currencies, the correlation between their inflation is significant, likely attributable to their close trade relationships (see Table 7).

Table 8 Cross-correlations between Baltic countries

Estonia										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Latvia	0.22	0.45	**0.67**	**0.82**	**0.88**	**0.84**	**0.69**	0.49	0.28	0.1
Lithuania	0.23	0.46	**0.68**	**0.85**	**0.92**	**0.89**	**0.76**	**0.57**	0.36	0.18
Latvia										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Estonia	0.1	0.28	0.49	**0.69**	**0.84**	**0.88**	**0.82**	**0.67**	0.45	0.22
Lithuania	0.22	0.4	**0.6**	**0.78**	**0.88**	**0.88**	**0.77**	**0.59**	0.38	0.19

Lithuania										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Estonia	0.18	0.36	**0.57**	**0.76**	**0.89**	**0.92**	**0.85**	**0.68**	0.46	0.23
Latvia	0.19	0.38	**0.59**	**0.77**	**0.88**	**0.88**	**0.78**	**0.6**	0.4	0.22

Source: the authors

The Baltic countries (Estonia, Lithuania and Latvia) share a common currency - the euro. Strong correlation of their inflations is observed at the one-month, four-month and seven-month lag (see Table 8).

Table 9 Cross-correlations between individual Nordic countries

Denmark										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Finland	0.37	**0.57**	**0.74**	**0.84**	**0.86**	**0.8**	**0.65**	0.47	0.3	0.16
Iceland	0.37	0.46	**0.53**	**0.55**	**0.51**	0.45	0.34	0.24	0.17	0.15
Norway	0.18	0.34	0.47	**0.55**	**0.58**	**0.55**	0.44	0.31	0.2	0.1
Sweden	0.34	**0.55**	**0.72**	**0.81**	**0.8**	**0.73**	**0.56**	0.38	0.22	0.1
Finland										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Denmark	0.16	0.3	0.47	**0.65**	**0.8**	**0.86**	**0.84**	**0.74**	**0.57**	0.37
Iceland	0.42	0.49	**0.54**	**0.55**	**0.52**	0.46	0.35	0.23	0.13	0.08
Norway	0.19	0.29	0.43	**0.53**	**0.61**	**0.63**	**0.56**	0.45	0.32	0.19
Sweden	0.29	0.48	**0.66**	**0.8**	**0.88**	**0.88**	**0.77**	**0.61**	0.43	0.24
Iceland										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Denmark	0.15	0.17	0.24	0.34	0.45	**0.51**	**0.55**	**0.53**	0.46	0.37
Finland	0.08	0.13	0.23	0.35	0.46	**0.52**	**0.55**	**0.54**	0.49	0.42
Norway	0.09	0.11	0.16	0.24	0.32	0.37	0.41	0.33	0.25	0.13
Sweden	0.07	0.1	0.16	0.26	0.37	0.42	0.44	0.41	0.35	0.28
Norway										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Denmark	0.1	0.2	0.31	0.44	**0.55**	**0.58**	**0.55**	0.47	0.34	0.18
Finland	0.19	0.32	0.45	**0.56**	**0.63**	**0.61**	**0.53**	0.43	0.29	0.19
Iceland	0.13	0.25	0.33	0.41	0.37	0.32	0.24	0.16	0.11	0.09
Sweden	0.33	0.44	**0.56**	**0.64**	**0.69**	**0.67**	**0.54**	0.41	0.27	0.15
Sweden										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Denmark	0.1	0.22	0.38	**0.56**	**0.73**	**0.8**	**0.81**	**0.72**	**0.55**	0.34
Finland	0.24	0.43	**0.61**	**0.77**	**0.88**	**0.88**	**0.8**	**0.66**	0.48	0.29
Iceland	0.28	0.35	0.41	0.44	0.42	0.37	0.26	0.16	0.1	0.07
Norway	0.15	0.27	0.41	**0.54**	**0.67**	**0.69**	**0.64**	**0.56**	0.44	0.33

Source: the authors

As far as the Nordic countries - Denmark, Finland, Iceland, Norway and Sweden, all these countries have a different national currency. The most significant correlation, with a value of 0.88, is between the inflation of Sweden and Finland with one-month shifts in both directions. The second most significant correlation in inflation rates is between Denmark's inflation and Finland's inflation one month later with a value of 0.86. At the four-month lag, this correlation remains significant with a value of 0.84. Iceland and Norway are countries having significantly lower correlations with other countries (see Table 9).

Table 10 Cross-correlations between individual OPEC members

Ecuador										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Indonesia	0.2	0.16	0.12	0.12	0.18	0.22	0.19	0.19	0.27	0.41
Saudi.Arabia	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.28	-0.26
Indonesia										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Ecuador	0.41	0.27	0.19	0.19	0.22	0.18	0.12	0.12	0.16	0.2
Saudi.Arabia	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.09	-0.12
Saudi.Arabia										
Country	-13	-10	-7	-4	-1	1	4	7	10	13
Ecuador	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.4	-0.4	-0.37	-0.37
Indonesia	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.09	-0.1

Source: the authors

At the time of writing, data regarding current OPEC members are only available for Saudi Arabia. In the context of former members of the Organization of the Petroleum Exporting Countries (OPEC), data are available for two nations: Ecuador and Indonesia. The cross-correlations between these countries were found to be minimal (see Table 10). The highest value was found at 0.41 - observed between Indonesia and Ecuador with a 13-month lag.

The results of the Granger causality tests presented in Tables 11–20 complement the preceding correlation analysis by providing evidence on the direction and timing of inflation transmission. While correlation analysis captures the degree of co-movement, Granger causality allows us to assess whether past inflation in one economy improves the prediction of inflation in another beyond its own past values. The focus therefore shifts from identifying synchronised inflation patterns to examining directional linkages and their temporal structure. Tables 11–13 summarise Granger causality relationships within the euro area and between the euro area and selected global economies. In most cases where cross-correlations indicated strong co-movement, statistically significant Granger relationships are also observed, suggesting that these linkages contain predictive content rather than reflecting purely contemporaneous movements. Focusing on the relationship between aggregate euro area inflation and national inflation rates (Table 11), the results show that the null hypothesis of no Granger causality is rejected for the majority of countries, often across multiple lag lengths (e.g., 4, 7, 10, and 13 months). At a one-month lag, the predictive relationship is weaker or absent in several smaller or structurally specific economies, such as Belgium, Ireland, Slovenia, and Estonia. However, at longer lags, statistically significant relationships emerge for almost all countries. This pattern indicates that the transmission of common inflationary shocks within the euro area operates primarily over short- to medium-term horizons. From an economic perspective, this is consistent with the gradual propagation of common shocks—such as energy price changes, global demand fluctuations, or supply disruptions—across member states. While these shocks may not be immediately reflected in national inflation rates, their effects become increasingly synchronised over time, generating measurable predictive relationships in monthly data. These findings provide strong support for H1, as they confirm a high degree of inflation transmission within the euro area.

Table 11 Granger causality between euro area and individual countries of euro area

Country	1	4	7	10	13
Austria	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Belgium	0.262	0.001 ***	0.002 ***	<0.001 ***	<0.001 ***
Finland	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
France	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Germany	0.009 ***	<0.001 ***	<0.001 ***	<0.001 ***	0.001 ***
Ireland	0.298	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Italy	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Luxembourg	0.812	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Netherlands	0.165	0.017 **	0.002 ***	<0.001 ***	<0.001 ***
Portugal	0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Spain	0.109	0.237	0.003 ***	<0.001 ***	0.002 ***
Greece	0.847	<0.001 ***	0.008 ***	0.029 **	0.032 **
Slovenia	0.834	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Cyprus	0.003 ***	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Malta	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Slovakia	<0.001 ***	<0.001 ***	0.001 ***	0.002 ***	0.001 ***
Estonia	0.412	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Latvia	0.080 *	0.044 **	0.010 **	0.065 *	0.041 **
Lithuania	0.941	0.038 **	0.002 ***	0.005 ***	0.049 **
Croatia	0.907	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***

*Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.*

Source: the authors

The fact that statistically significant relationships emerge primarily at longer lags—while remaining weak or absent at the one-month horizon in several economies such as Belgium, Ireland, and Estonia—indicates that common inflationary shocks propagate gradually rather than instantaneously across member states.

This pattern is consistent with the delayed transmission of external shocks, such as energy price changes or global demand fluctuations, which require time to be reflected in national price levels. At the same time, the persistence of statistically significant relationships across multiple lags in larger and more integrated economies, such as France, Germany, and Italy, suggests a stronger and more stable transmission mechanism within the core of the euro area.

From a policy perspective, these findings imply that aggregate inflation developments may provide an informative signal of future inflation trends at the national level, although the strength and timing of this signal vary across countries.

To complement this analysis, Table 12 examines the reverse direction of causality, assessing whether national inflation rates also contain predictive information for aggregate euro area inflation. The results indicate that, for a substantial number of countries, national inflation exhibits statistically significant predictive relationships with euro area inflation at least at one lag length.

Evidence of such relationships is observed for several economies, including Austria, Finland, France, Ireland, Italy, Luxembourg, and the Baltic states, where statistical significance appears across multiple lag structures. In contrast, for some countries—most notably Cyprus, Portugal, and Slovakia—the evidence of causality towards the euro area is limited or absent at conventional significance levels, indicating a weaker contribution to aggregate inflation dynamics.

The coexistence of forward and reverse predictive relationships suggests the presence of feedback effects within the euro area inflation process. This indicates that inflation transmission is not purely driven by aggregate developments but involves mutual interactions between national and euro area dynamics. At the same time, the presence of bidirectional relationships suggests that inflation transmission does not strictly follow a large-to-small pattern, providing only partial support for H2.

Table 12 Granger causality between euro area and individual countries of euro area

Lags	Austria	Belgium	Finland	France	Germany
1	**0.004*** **	**<0.001*** **	**0.006*** **	**0.013** **	0.999
4	0.073*	0.305	**0.007*** **	**0.011** **	0.124
7	**0.043** **	0.444	**0.010** **	0.062*	0.445
10	**0.036** **	0.509	**0.019** **	0.203	0.405
13	0.055*	0.564	**0.006*** **	0.660	**0.009*** **
Lags	Ireland	Italy	Luxembourg	Netherlands	Portugal
1	**<0.001*** **	**<0.001*** **	**<0.001*** **	**0.010** **	0.163
4	0.084*	0.143	**0.036** **	**0.002*** **	0.834
7	0.245	0.270	0.245	**0.023** **	0.725
10	**0.008*** **	0.063*	0.339	**0.001*** **	0.310
13	**0.030** **	0.284	0.793	**0.001*** **	0.531
Lags	Spain	Greece	Slovenia	Cyprus	Malta
1	**<0.001*** **	**0.022** **	**<0.001*** **	0.054	**<0.001*** **
4	**0.013** **	**0.001*** **	0.128	0.460	**0.010*** **
7	**0.023** **	**0.020** **	0.327	0.773	0.058*
10	**0.021** **	0.051*	0.496	0.703	**0.026** **
13	0.075*	0.381	0.697	0.930	0.239
Lags	Slovakia	Estonia	Latvia	Lithuania	Croatia
1	0.129	0.123	0.052*	0.403	**<0.001*** **
4	0.852	**<0.001*** **	**0.005*** **	**0.005*** **	0.484
7	0.874	**<0.001*** **	0.210	**0.008*** **	0.756
10	0.717	**<0.001*** **	0.260	**0.037** **	0.683
13	0.923	**0.004*** **	0.781	0.074*	0.656

Source: the authors

Overall, the results point to a heterogeneous but strongly interconnected inflation transmission mechanism within the euro area. While aggregate inflation plays a central role in shaping national dynamics, several member states also contribute to the evolution of euro area inflation through feedback effects. The strength and persistence of these relationships vary across countries, reflecting differences in economic structure, openness, and exposure to external shocks. Based on the results for the euro area, it can be concluded that in the majority of member states the relationship between national inflation and aggregate euro area inflation is bidirectional. This indicates the presence of reciprocal predictive linkages, where both aggregate and national inflation dynamics contain information about each other.

In contrast, for a limited number of countries—most notably Cyprus, Portugal, and Slovakia—the results point to a predominantly unidirectional relationship, where causality runs from the euro area aggregate to the national level, without significant feedback effects.

These differences may reflect structural characteristics of individual economies. In particular, smaller or less integrated economies may be more strongly influenced by common external shocks and aggregate euro area dynamics, while their own contribution to the formation of aggregate inflation remains comparatively limited.

Tables 13 and 14 extend the analysis to relations between euro area countries within the G7 (France, Germany, Italy) and other G7 members, as well as relations between G7 countries themselves. In numerous pairs for which cross-correlations had already indicated a strong link, statistically significant Granger relationships were also identified. These relationships were evident, for instance, between Germany and the United Kingdom, the United States and France, and also between Canada and the United Kingdom and Italy. This finding indicates that the phenomenon under investigation extends beyond the realm of parallel movement, encompassing the predictive content of past inflation values.

From a directional perspective, it is important that Granger causality is bidirectional in many cases. For example, inflation in the United States has been shown to cause inflation in selected European economies, while past inflation values in Europe have been found to be informative for inflation in the US. This pattern is consistent with the hypothesis of a common global inflation factor spreading across large advanced economies.
Concurrently, instances of Granger causality's absence or diminished robustness are evident, though the correlations remain significant, particularly in certain pairs involving Japan. The findings indicate that in the context of Japan, the inflation process is characterised by its specificity, whereby global economic fluctuations are reflected in the Consumer Price Index (CPI) through a distinct mechanism or with a different time structure. This phenomenon is not fully captured by the standard bivariate vector autoregression (VAR) model applied to monthly data.

Table 13 Granger causality between euro area G7 countries and individual G7 countries

France → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	**0.582**	0.117	**0.027** **	**0.033** **	**0.011** **
Japan	**0.045** **	**0.038** **	0.056 *	**0.010** ***	0.070 *
United_Kingdom	**0.534**	**0.020** **	0.052 *	**0.011** **	**0.011** **
United_States	**0.702**	0.206	0.177	**0.025** **	0.065 *

G7	0.336	0.297	0.226	**0.028** **	0.194
Germany → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	**0.685**	**0.011** **	**0.031** **	**0.032** **	**0.030** **
Japan	**0.027** **	0.136	**0.010** **	**0.015** **	**0.004** ***
United_Kingdom	**0.020** **	**<0.001** ***	**0.007** ***	**<0.001** ***	**<0.001** ***
United_States	**0.609**	0.169	0.347	**0.038** **	**0.008** ***
G7	0.425	0.250	0.499	0.095 *	0.061 *
Italy → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	**0.991**	**0.041** **	0.100 *	0.242	0.195
Japan	**0.552**	0.218	0.219	0.475	**0.752**
United_Kingdom	0.233	**0.004** ***	**0.006** ***	**0.009** ***	**0.038** **
United_States	**0.655**	0.216	0.478	**0.630**	**0.843**
G7	0.489	0.082 *	0.206	0.314	**0.568**

*Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.*

Source: the authors

A case in point is the economic relationship between Canada and the United States. Despite the high degree of economic interdependence between the two nations, there is an absence of robust Granger causality from Canada to the United States. However, in the reverse direction, a significant predictive relationship is evident, albeit with certain lags. This finding indicates that, within a bivariate framework grounded in monthly data, US inflation dynamics contribute more substantially to the additional information concerning Canadian inflation than vice versa. However, it is plausible that common global shocks, which are not explicitly captured by the model, may be operating in the background. Overall, these findings suggest that inflation transmission among major economies is characterised by complex and bidirectional linkages, rather than a simple hierarchical structure, providing only partial support for H2.

Table 14 Granger causality between G7 countries

Canada → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	—	—	—	—	—
France	0.304	**<0.001** ***	**<0.001** ***	**<0.001** ***	**0.002** ***
Germany	0.338	0.076 *	0.303	0.450	**0.755**
Italy	**0.015** **	**0.010** **	**0.013** **	**0.029** **	0.187
Japan	0.085 *	0.270	0.240	0.172	0.489
United_Kingdom	**0.914**	**<0.001** ***	**0.002** ***	**0.005** ***	**0.023** **
United_States	0.253	0.298	0.334	**0.615**	**0.913**
G7	**0.669**	0.288	**0.521**	**0.688**	**0.858**
Japan → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	0.061 *	0.265	0.085 *	0.051 *	**0.030** **
France	**0.005** ***	0.055 *	0.061 *	0.156	0.362
Germany	0.229	0.225	0.299	0.498	**0.765**
Italy	**0.040** **	0.185	0.222	0.142	0.192
Japan	—	—	—	—	—
United_Kingdom	**0.021** **	**0.005** ***	**0.027** **	0.052 *	0.133
United_States	**0.002** ***	0.069 *	0.194	0.252	0.196
G7	**0.001** ***	**0.017** **	0.066 *	0.106	0.200
United_Kingdom → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	**0.006** ***	0.092 *	**0.045** **	**0.030** **	**0.036** **
France	**0.003** ***	0.127	0.209	**0.022** **	0.059 *
Germany	**0.630**	**0.924**	**0.768**	0.396	0.279
Italy	**<0.001** ***	**0.011** **	**0.004** ***	**0.029** **	0.053 *
Japan	0.436	**0.804**	0.261	0.179	**0.631**
United_Kingdom	—	—	—	—	—
United_States	**<0.001** ***	**0.023** **	**0.019** **	**0.007** ***	**0.038** **
G7	**<0.001** ***	0.248	0.289	0.082 *	**0.042** **
United_States → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	0.395	**0.030** **	0.157	0.102	**0.024** **
France	**0.036** **	**0.002** ***	**<0.001** ***	**<0.001** ***	**<0.001** ***
Germany	0.138	**0.035** **	**0.008** ***	**0.009** ***	**0.025** **
Italy	**0.001** ***	**0.001** ***	**0.004** ***	**0.014** **	0.109
Japan	**0.004** ***	**0.009** ***	0.055 *	**0.026** **	0.089 *
United_Kingdom	**0.535**	**<0.001** ***	**<0.001** ***	**<0.001** ***	**<0.001** ***
United_States	—	—	—	—	—
G7	**0.037** **	0.166	0.357	0.295	0.220

*Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.*

Source: the authors

Tables 15 to 17 focus on small open economies in relation to the large G7 countries. The results demonstrate the value of Granger causality in providing additional insights beyond those achievable through correlation analysis alone.

Firstly, for Slovakia, Estonia, and Luxembourg, it is evident that the transmission is not exclusively unidirectional "from large to small," but frequently exhibits characteristics of asymmetry, manifesting as a bidirectional phenomenon. For example, in the case of Slovakia, statistically significant Granger causality is observed at medium lags (e.g., 4 and 7 months) with respect to Germany and the United Kingdom after the adoption of the euro, indicating that inflation dynamics in this small open economy contain predictive information for larger economies. In instances where a strong correlation is indicated by the data, Granger tests frequently corroborate the hypothesis that past inflation values in small, highly open economies are also informative of future inflation in some large countries. This does not imply that small economies are the primary drivers of global inflation; rather, it suggests that in bivariate time series, we observe common shocks that manifest at an earlier stage (e.g., through import prices, exchange rates, or changes in global demand). In such cases, Granger causality confirms the role of small countries as early indicators of global inflationary trends.

Table 15 provides documentation of Granger causality between Slovakia and individual G7 countries prior to and following the adoption of the euro. Prior to the adoption of the euro, the majority of p-values fail to indicate statistically significant Granger causality in the direction of Slovakia to G7, or vice versa, thereby aligning with a comparatively lower level of integration. However, following 2009, a more pronounced occurrence of significant relationships is evident, particularly at lags of 4–13. These relationships are observed not only in the direction from Slovakia to the G7 aggregate and select individual countries (namely Germany, the United Kingdom, and the United States), but also in the opposite direction. In terms of interpretation, this lends support to the hypothesis that, following its adoption of the euro, Slovakia has become an increasingly integral part of the broader European and transatlantic inflation cycle. This is not to suggest, however, that Slovakia is a "source" of global inflation, but rather that it functions as a node where global shocks are able to manifest themselves in a timely manner and are detectable in the bivariate VAR.

Table 15 Granger causality between Slovakia and individual G7 countries

Slovakia → G7 countries (Granger causality) Slovakia_1999_2008					
Country	1	4	7	10	13
Canada	**0.774**	**0.995**	**0.820**	0.246	**0.537**
France	**0.879**	**0.554**	0.331	0.413	0.220
Germany	**0.691**	0.298	**0.636**	0.408	0.201
Italy	**0.798**	**0.979**	**0.871**	0.066 *	0.254
Japan	0.165	**0.021** **	0.100 *	0.418	0.492
United_Kingdom	**0.526**	**0.688**	**0.929**	**0.911**	0.336
United_States	**0.955**	**0.967**	**0.998**	**0.899**	**0.947**
G7	**0.657**	**0.690**	**0.976**	**0.769**	**0.984**
Slovakia → G7 countries (Granger causality) Slovakia_2009_2023					
Country	1	4	7	10	13
Canada	**0.658**	**0.036** **	**0.009** ***	**0.026** **	**0.029** **
France	**0.619**	0.396	**0.683**	**0.937**	**0.576**
Germany	0.466	**0.001** ***	**0.005** ***	**0.030** **	0.220
Italy	**0.869**	**0.049** **	0.327	**0.589**	0.233
Japan	**0.913**	**0.660**	**0.944**	**0.598**	**0.891**
United_Kingdom	0.086 *	**0.044** **	0.165	**0.021** **	0.195
United_States	**0.855**	0.250	**0.029** **	**0.037** **	**0.017** **
G7	**0.734**	0.190	**0.044** **	0.066 *	**0.033** **

*Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.*

Source: the authors

Table 16 examines Granger causality relationships between selected economies (Luxembourg, China, Haiti, and Saudi Arabia) and G7 countries.

For Luxembourg, statistically significant relationships are identified only for a subset of countries, most notably Italy and the United Kingdom, and to a lesser extent Canada and the United States, primarily at medium lags. This selective pattern suggests that Luxembourg does not act as a broad source of inflationary transmission but rather reflects specific linkages within the European core.

In contrast, the results for China display a substantially broader and more consistent pattern. Statistically significant relationships are observed across multiple G7 countries—including France, Germany, Italy, Japan, and the United States—as well as for the G7 aggregate, typically at medium-term horizons. Compared to other economies in the sample, China stands out as the only case with systematic and cross-country predictive linkages. For instance, statistically significant relationships are observed between China and Germany and France at multiple lag structures, confirming its role as a key transmission hub in global inflation dynamics. This pattern is consistent with its central role in global value chains, where changes in production costs and pricing dynamics can gradually transmit to advanced economies. It should be emphasised, however, that these results capture predictive relationships rather than structural causality.

For Haiti, no consistent or robust evidence of Granger causality is detected. Most relationships are statistically insignificant, with only sporadic weak significance and no systematic pattern across countries or lags. This outcome is consistent with Haiti's limited integration into global trade and production networks.

The results for Saudi Arabia are mixed and country-specific. Statistically significant relationships are observed for selected European G7 economies—particularly France, Germany, and Italy—mainly at medium lags, while linkages with other countries and the G7 aggregate remain weak or absent. This heterogeneity likely reflects the specific structure of the Saudi economy, including administered prices and the dominant role of energy markets, which affect inflation transmission in a non-uniform way.

Overall, the results highlight substantial heterogeneity in inflation transmission from specific economies to advanced countries. While China exhibits broad and systematic predictive linkages, other economies show only selective or negligible relationships, indicating that global inflation dynamics are driven by a combination of highly integrated hubs and more isolated or regionally constrained economies.

Table 16 Granger causality between specific countries and individual G7 countries

Luxembourg → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	0.052 *	**0.036** **	0.065 *	0.085 *	0.163
France	0.202	0.468	**0.563**	0.423	0.181
Germany	**0.617**	0.180	0.066 *	0.134	0.355
Italy	**0.003** ***	**0.003** ***	**0.016** **	**0.026** **	0.124
Japan	0.152	0.280	0.104	**0.024** **	0.108
United_Kingdom	0.291	**0.022** **	**0.043** **	**0.004** ***	**<0.001** ***
United_States	0.462	0.298	0.455	**0.036** **	0.160
G7	0.080 *	0.162	0.308	**0.040** **	0.299
China → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	**0.751**	0.187	**0.016** **	**0.038** **	0.201
France	0.106	**0.001** ***	**<0.001** ***	**<0.001** ***	**0.045** **
Germany	**0.636**	**<0.001** ***	**<0.001** ***	**<0.001** ***	**<0.001** ***
Italy	0.067 *	**0.001** ***	**<0.001** ***	**<0.001** ***	**0.029** **
Japan	0.107	**<0.001** ***	**<0.001** ***	**<0.001** ***	**0.003** ***
United_Kingdom	**0.040** **	**0.035** **	0.053 *	0.106	0.423
United_States	0.241	0.120	**0.007** ***	**<0.001** ***	**0.028** **
G7	**0.045** **	**0.006** ***	**<0.001** ***	**<0.001** ***	**0.008** ***
Haiti → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	0.114	**0.572**	0.151	0.068 *	0.244
France	0.091 *	**0.756**	**0.815**	**0.631**	0.435
Germany	0.146	**0.605**	**0.754**	**0.734**	**0.707**
Italy	0.080 *	0.472	**0.713**	**0.843**	**0.979**
Japan	0.486	0.194	0.257	0.126	**0.768**
United_Kingdom	**0.945**	**0.665**	**0.738**	0.188	0.354
United_States	0.122	**0.957**	**0.810**	0.085 *	0.442
G7	0.094 *	**0.910**	**0.841**	0.189	0.456
Saudi_Arabia → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	**0.569**	0.365	**0.650**	**0.785**	**0.918**
France	0.118	**0.002** ***	**0.010** **	**0.025** **	0.125
Germany	**0.908**	**0.024** **	**0.016** **	0.053 *	0.210
Italy	0.181	**0.002** ***	**0.017** **	**0.050** **	**0.534**
Japan	**0.962**	**0.952**	**0.772**	0.092 *	0.380
United_Kingdom	**0.603**	**0.580**	0.173	0.204	**0.042** **
United_States	0.384	0.284	0.419	0.363	**0.725**
G7	**0.584**	0.153	0.403	0.424	**0.814**

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Source: the authors

Table 17 extends the analysis to smaller open European economies by examining Granger causality relationships for Estonia and Sweden in relation to G7 countries.

The results indicate that both economies exhibit statistically significant relationships with several G7 countries, particularly at medium-term horizons (lags of 4 to 10 months). These patterns suggest that inflation dynamics in these economies are closely linked to broader international developments.

Compared to larger economies, the timing of significant relationships indicates that Estonia and Sweden may respond relatively quickly to external inflationary shocks. This is consistent with their high degree of trade openness and integration into global supply chains, which increases sensitivity to external price developments.

It is evident that Estonia, as a small euro area economy, and Sweden, as a highly open non-euro economy, are therefore part of the broader European-North Atlantic inflation cycle. Concurrently, these countries frequently exhibit a rapid response to external shocks, which may occur prior to the onset of inflation in larger economies.

Table 17 Granger causality between Estonia and Sweden with individual G7 countries

Estonia → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	0.293	0.159	0.077 *	0.015 **	0.026 **
France	0.492	0.075 *	0.057 *	0.017 **	0.090 *
Germany	0.454	0.112	0.001 ***	0.007 ***	0.006 ***
Italy	0.160	0.214	0.245	0.400	0.380
Japan	0.384	0.039 **	0.004 ***	0.016 **	0.131
United Kingdom	0.450	0.035 **	0.048 **	0.005 ***	<0.001 ***
United States	0.479	0.742	0.047 **	0.039 **	0.083 *
G7	0.861	0.366	0.007 ***	0.005 ***	0.033 **
Sweden → G7 countries (Granger causality)					
Country	1	4	7	10	13
Canada	0.336	0.004 ***	0.030 **	0.044 **	0.049 **
France	0.088 *	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Germany	0.392	0.207	0.053 *	0.142	0.557
Italy	0.039 **	0.074 *	0.363	0.477	0.328
Japan	0.766	0.056 *	0.160	0.089 *	0.673
United Kingdom	0.383	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
United States	0.232	0.304	0.459	0.475	0.509
G7	0.728	0.304	0.455	0.529	0.449

*Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.*

Source: the authors

The regional perspectives are summarised in Tables 18 to 21. In this particular instance, Granger causality serves to complement the correlation results by unveiling the dynamics occurring within the block, in addition to the direction of predictive links.

As illustrated in Table 18, the existence of Granger causality is documented between the V4 countries. The majority of pairs (e.g., Poland versus Hungary, the Czech Republic versus Hungary, and Slovakia versus Hungary) demonstrate statistically significant p-values in both directions and at multiple lags. This finding serves to corroborate the elevated degree of intra-regional interconnectedness that has previously been observed in the correlation matrices. From an economic interpretation perspective, this corresponds to a common regional inflation cycle in which it is difficult to identify a clear "leader". Rather, it is a system in which countries provide each other with predictive information because they all respond to similar shocks.

Table 18 Granger causality between individual V4 countries

Czech Republic → V4 countries (Granger causality)					
Country	1	4	7	10	13
Hungary	<0.001 ***	0.005 ***	0.002 ***	<0.001 ***	<0.001 ***
Slovakia	0.333	0.044 **	0.023 **	0.039 **	0.021 **
Poland	0.573	<0.001 ***	<0.001 ***	<0.001 ***	0.003 ***
Hungary → V4 countries (Granger causality)					
Country	1	4	7	10	13
Slovakia	0.787	0.121	0.130	0.063 *	0.083 *
Czech Republic	0.023 **	0.011 **	0.053 *	0.025 **	0.168
Poland	0.022 **	<0.001 ***	<0.001 ***	<0.001 ***	<0.001 ***
Poland → V4 countries (Granger causality)					
Country	1	4	7	10	13
Hungary	<0.001 ***	0.008 ***	<0.001 ***	<0.001 ***	<0.001 ***
Slovakia	<0.001 ***	0.017 **	0.106	0.435	0.207
Czech Republic	<0.001 ***	0.127	0.143	<0.001 ***	<0.001 ***
Slovakia → V4 countries (Granger causality)					
Country	1	4	7	10	13
Hungary	<0.001 ***	0.004 ***	0.002 ***	0.008 ***	0.002 ***
Czech Republic	0.518	0.085 *	0.033 **	0.101	0.167
Poland	0.969	0.001 ***	0.003 ***	0.002 ***	0.243

*Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.*

Source: the authors

As illustrated in Table 19, an analysis of the Baltic countries (Estonia, Latvia and Lithuania) reveals Granger causality that is even stronger and more universal than that observed in the V4. The vast majority of pairs demonstrate remarkably low p-values for the majority of lags and in both directions. For example, inflation in Estonia shows statistically significant predictive relationships with both Latvia and Lithuania across multiple lag lengths, confirming a strong and persistent transmission mechanism within the Baltic region. This finding supports the view that the Baltic economies exhibit not only highly synchronised inflation (as indicated by correlations), but also a clear predictive structure, where past inflation developments in one country systematically improve the prediction of inflation in the others. This finding further supports the view that the Baltic region exhibits not only highly synchronised inflation (according to correlations), but also a very clear predictive structure – past inflation values in one country are systematically informative of inflation in the others.

In the Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden – see Table 20), Granger causality relationships are present, but to a lesser extent than in the V4 or Baltic countries. It is evident that certain pairs of countries exhibit discernible predictive links, such as Norway and Finland, and Sweden and Denmark. Conversely, other pairs demonstrate spatial limitations or manifest only at specific lags. When considered in conjunction with the correlation results, this suggests that, despite the Nordic bloc sharing part of a common price cycle, differences in monetary regimes (euro vs. own currency), economic structure (e.g., the oil sector in Norway), and market size mean that the predictive content between countries is not as symmetrical.

Table 19 Granger causality between Baltic countries

Estonia → Baltic countries (Granger causality)

Country	1	4	7	10	13
Lithuania	<0.001***	<0.001***	<0.001***	<0.001***	<0.001***
Latvia	<0.001***	<0.001***	<0.001***	0.001***	0.004***

Latvia → Baltic countries (Granger causality)

Country	1	4	7	10	13
Lithuania	0.481	<0.001***	<0.001***	0.002***	0.046**
Estonia	0.023**	<0.001***	0.005***	0.007***	0.105

Lithuania → Baltic countries (Granger causality)

Country	1	4	7	10	13
Latvia	0.649	<0.001***	<0.001***	<0.001***	<0.001***
Estonia	0.277	<0.001***	0.022**	0.009***	0.085*

*Note: *** p < 0.01, ** p < 0.05, * p < 0.10.*

Source: the authors

Table 20 Granger causality between individual Nordic countries

Denmark → Nordic countries (Granger causality)

Country	1	4	7	10	13
Norway	0.904	0.002***	0.004***	0.005***	0.027**
Finland	<0.001***	<0.001***	<0.001***	<0.001***	0.004***
Sweden	<0.001***	0.012**	0.005***	0.009***	0.011**
Iceland	0.280	0.156	0.199	0.070*	0.002***

Finland → Nordic countries (Granger causality)

Country	1	4	7	10	13
Norway	0.597	0.075*	0.102	0.104	0.122
Denmark	0.005***	0.160	0.399	0.280	0.178
Sweden	0.136	0.073*	0.499	0.120	0.106
Iceland	0.217	0.057*	0.223	0.192	0.296

Iceland → Nordic countries (Granger causality)

Country	1	4	7	10	13
Norway	0.526	0.983	0.497	0.056*	0.524
Denmark	0.321	0.387	0.820	0.927	0.996
Finland	0.102	0.517	0.764	0.538	0.505
Sweden	0.487	0.776	0.368	0.171	0.717

Norway → Nordic countries (Granger causality)

Country	1	4	7	10	13
Denmark	0.020**	0.134	0.208	0.341	0.228
Finland	<0.001***	0.001***	<0.001***	0.007***	0.086*
Sweden	<0.001***	<0.001***	<0.001***	0.001***	0.005***
Iceland	0.081*	<0.001***	<0.001***	<0.001***	0.052*

Sweden → Nordic countries (Granger causality)

Country	1	4	7	10	13
Norway	0.362	0.002***	0.009***	<0.001***	0.003***
Denmark	0.007***	<0.001***	<0.001***	<0.001***	<0.001***
Finland	0.162	<0.001***	<0.001***	<0.001***	<0.001***
Iceland	0.237	0.089*	0.003***	0.030**	0.182

*Note: *** p < 0.01, ** p < 0.05, * p < 0.10.*

Source: the authors

The focus of Table 21 is on the Organisation of the Petroleum Exporting Countries (OPEC) and former members of the organisation, namely Ecuador, Indonesia and Saudi Arabia. In the majority of the observed directions and lags, the null hypothesis of non-Granger causality is not rejected, with the exception of a few pairs (notably Ecuador–Indonesia), where significant p-values are evident. However, these are not consistent across all lags and directions, and therefore they are interpreted with caution. In conjunction with the negligible correlations between inflation in these countries, this lends further credence to the hypothesis that consumer inflation in oil-producing countries is substantially influenced by domestic policies and particular institutional factors, as opposed to a shared "OPEC inflation cycle" at the CPI level.

Table 21 Granger causality between individual OPEC members

Ecuador → OPEC countries (Granger causality)					
Country	1	4	7	10	13
Indonesia	**0.002** ***	**0.007** ***	**0.614**	**0.807**	0.099 *
Saudi Arabia	0.298	**0.925**	**0.987**	**0.983**	**1.000**
Indonesia → OPEC countries (Granger causality)					
Country	1	4	7	10	13
Ecuador	0.368	**0.020** **	**<0.001** ***	**<0.001** ***	**0.032** **
Saudi Arabia	**0.572**	**0.877**	**0.973**	**0.998**	**0.942**
Saudi Arabia → OPEC countries (Granger causality)					
Country	1	4	7	10	13
Ecuador	**0.536**	**0.866**	**0.823**	**0.946**	**1.000**
Indonesia	**0.521**	**0.815**	**0.810**	**0.900**	**0.924**

*Note: *** p < 0.01, ** p < 0.05, * p < 0.10.*

Source: the authors

In the majority of cases where strong correlations are observed in Tables 1–10, corresponding Granger relationships are also identified – that is to say, not only is there simultaneous movement, but also predictive relationships with a time lag. Within these relationships, the direction of Granger causality is frequently bidirectional, which is consistent with the notion of common global or regional shocks rather than a simple model of a single dominant "leader." Conversely, there are instances where the transmission is found to be asymmetric (e.g., between small open economies and large countries or within certain developing economies), or where Granger relationships are weak and ambiguous (as observed in some Nordic countries and non-Western economies). These observations highlight the limitations of the bivariate approach and the need for cautious interpretation. Overall, these findings confirm that inflation transmission across regions is characterised by heterogeneous and often bidirectional relationships, rather than a simple hierarchical structure. This provides further evidence that the assumption of predominantly one-directional transmission from larger to smaller economies (H2) is only partially supported.

Conclusion

This study provides a comprehensive analysis of inflation dependencies across multiple countries and regions from 1999 to 2023, covering both the pandemic crisis and the subsequent high-inflation period. Using cross-correlation analysis and correlation matrices with time shifts, complemented by bivariate Granger causality tests, we examined inflation transmission patterns between numerous country pairs in Europe and globally. We tested two primary hypotheses: (i) inflation transmission is stronger among euro area countries, and (ii) inflation flows from larger to smaller economies. The analysis fills a research gap by combining a long time horizon, the post-pandemic inflation spike, and a broad set of non-traditional country pairings that have rarely been studied together.

The correlation patterns and Granger-causality results provide a clear assessment of our two hypotheses. First, the density and strength of significant linkages within the euro area are visibly higher than in most other country groups, which supports Hypothesis 1 that inflation transmission is particularly strong inside the monetary union. Second, Hypothesis 2 is only partially supported: large advanced economies (especially the euro area aggregate and the United States) often Granger-cause inflation in smaller and more open economies, but reverse and bidirectional relationships are also common, indicating that these smaller economies are not just passive recipients of external inflation shocks.

Our empirical results highlight several specific patterns. Within the single-currency area, we find relatively strong correlations between the euro area aggregate and individual euro area members for forward and backward time shifts up to seven months. In the G7, inflation in France, Germany, and Italy is closely linked with that in Canada and the United States, and we document robust connections between G7 inflation and that of small open economies such as Slovakia, Luxembourg, and Estonia – particularly for Slovakia after euro adoption. By contrast, China and some commodity exporters (such as Saudi Arabia and selected OPEC members) show weak or unstable linkages with G7 inflation, while Japan's distinct pattern is consistent with its protracted deflationary environment. Regional clusters such as the V4, Baltic, and Nordic groups also display significant intra-regional inflation co-movements.

Our findings point to several targeted policy implications. First, the tight synchronisation of inflation within the euro area means that national central banks cannot act in isolation: monetary policy and fiscal measures must be closely coordinated at the ECB level to prevent one country's policies from amplifying area-wide price pressures. Secondly, the role of the G7 economies—particularly that of France, Germany, and the United States—as net transmitters of inflation underscores the necessity for these large actors to sustain credible, rule-based inflation-targeting frameworks, given the transitive nature of their decisions and their impact on smaller partners. Finally, small open economies such as Slovakia, Estonia and Luxembourg should build external-inflation indicators into their policy rules and reinforce exchange-rate and reserve buffers to cushion imported shocks.

Future research could concentrate on several key areas. First, the use of structural models, such as (S)VAR models or local projection methods, would allow researchers to go beyond Granger-type predictive causality and disentangle whether inflation transmission flows primarily through trade channels, financial linkages, commodity prices, or common global shocks. Second, extending the sample beyond 2023 would enable an assessment of inflation transmission in the context of recent geopolitical tensions, persistent supply-chain disruptions, and possible regime shifts in monetary policy.

Declarations

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Funding

Not applicable

Acknowledgements

Not applicable

Use of Artificial Intelligence (AI) Tools

The following AI tools were used during the preparation of this manuscript: ChatGPT and DeepL. AI was used solely for language editing and grammar checking. All intellectual content, arguments, findings, and conclusions are the sole work of the authors.

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