



## From Unity to Fragmentation? OECD Country Groupings During Successive Crises (2019–2024)

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### Abstract

This study examines the macroeconomic cohesion and heterogeneity of OECD countries from 2019 to 2024 using cluster analysis based on key economic, social, and institutional indicators. The methodology identifies clusters reflecting similarities in macroeconomic patterns, while accounting for differences in wage-setting, governance, and policy uncertainty. Results show that Nordic, Benelux, and Oceania countries exhibited consistently high internal cohesion, whereas Central, Southern European, Balkan countries, Israel, and Turkey displayed more variable cluster membership, reflecting substantial heterogeneity in economic development. The Baltic states showed increasing cohesion from 2022, while Latin American OECD members remained largely dispersed. Cluster stability varied across years, highlighting descriptive differences rather than causal relationships, but offering insights into responses to overlapping shocks, including pandemics, geopolitical tensions, and climate policy uncertainty. These findings contribute to understanding uneven convergence among advanced economies and provide guidance for policymakers in evaluating macroeconomic stability, structural differences, and resilience under global uncertainty.

### Keywords

OECD Countries, Cluster Analysis, Macroeconomic Cohesion, Policy Uncertainty, ESG Sustainability

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### I. Introduction

The period 2019–2024 brought overlapping global crises affecting OECD economies, including the COVID-19 pandemic, energy shortages, inflation, and the refugee crisis from the war in Ukraine. These shocks influenced real incomes, employment, purchasing power, and overall economic stability.

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This study examines changes in selected socio-economic indicators in all 38 OECD countries during 2019–2024 and evaluates shifts in their relative positions within predefined groups reflecting geographic, historical, cultural, and political similarities.

The analysis uses six indicators: average annual wage, GDP per hour worked, household debt, inflation rate, unemployment rate, and real minimum wage, capturing income development, price stability, labour market conditions, and household finances.

Cluster analysis is applied separately for each year using Ward's method and Euclidean distance. Countries are grouped into 13 predefined regional-cultural clusters. Annual comparisons identify structural shifts and countries whose positions changed during the crisis period.

Previous studies commonly use clustering approaches to analyse countries' responses to major shocks, including pandemics, energy crises, and financial instability.

Research on macroeconomic convergence emphasises the interaction of growth, inequality, and institutional factors. Borowski, Fidrmuc, and Jaworski (2025) show that higher GDP per capita and lower inequality strengthen inflation synchronization in the eurozone. Country characteristics also matter: Konôpková (2019) finds greater instability in smaller economies, while Moučka and Němec (2025) show heterogeneous inflation expectations across households, firms, and professionals. Solarin et al. (2025) further confirm strong persistence in unemployment and inflation, highlighting the need for nuanced policy responses.

The COVID-19 pandemic disrupted convergence dynamics. Martinho (2021) and Popescu, Cristescu, and Paun (2023) show that GDP per capita convergence stalled in 2020, especially in economies with pre-existing imbalances. Sağlam (2025) finds technological progress more resilient than efficiency, with adaptive policies limiting long-term productivity losses. Sectoral and innovation policies also play a role: Ravšelj and Aristovnik (2017) and Žižka et al. (2019) show that R & D subsidies and cluster support improve corporate performance, depending on regional context.

Structural, fiscal, and behavioural factors further influence convergence. Lyulyov and Pimonenko (2025) show that green growth converges slowly due to institutional and technological gaps. Nguyen, Nghiem, and Doan (2025) identify convergence clubs in energy diversification and financial development, while Rath, Panda, and Akram (2023) document ICT convergence in emerging economies. Fiscal and social factors also matter: Mlčúchová (2024) examines EU corporate tax redistribution, Gubik and Farkas (2019) highlight country-specific drivers of student entrepreneurial intentions, and Vale (2024) identifies inequality convergence clubs in the eurozone.

Recent studies examine energy, ESG, and sustainability. Işık et al. (2024–2025) analyse ECON-ESG indicators, SDG interactions, climate vulnerability, supply chain digitalisation, economic complexity, and low-carbon energy transitions. Ongan et al. (2025) introduce Net ESG as a sustainability measure under uncertainty. These studies highlight the role of technological progress, institutional quality, and integrated environmental-energy policies in supporting resilient and sustainable convergence during successive crises.

OECD and EU convergence is multidimensional: macroeconomic, structural, behavioural, and environmental factors shape heterogeneous responses to shocks. While some blocs

(e.g., Nordic countries, Benelux, Oceania) remain cohesive, others fragment, showing that geographic proximity alone does not ensure stability during crises.

The study's novelty lies in its novel multi-crisis focus on overlapping crises from 2019 to 2024, including COVID-19, energy shocks, inflation, and the refugee crisis from the Ukraine war. Unlike existing research, which often examines single shocks, this article considers multiple interacting crises and their differential effects on OECD macroeconomic cohesion.

The study uses annual hierarchical clustering of OECD countries across six macroeconomic indicators – average wages, GDP per hour worked, household debt, inflation, unemployment, and real minimum wage – using Ward's method and Euclidean distance. This approach identifies persistent convergence clusters and emerging divergences, capturing patterns beyond standard panel or single-variable analyses.

The research finds heterogeneous responses among geopolitical blocs: Nordic countries, Benelux, and Oceania remained cohesive, while Central and Southern Europe and the Middle Eastern bloc fragmented. These results challenge prior assumptions that geographic or cultural proximity ensures macroeconomic similarity, emphasizing the role of structural and policy resilience under successive shocks.

The analysis contributes by offering a multi-crisis, multi-dimensional, and dynamic perspective on OECD convergence, providing insights for policymakers to anticipate or mitigate fragmentation. Its temporal granularity, methodological rigor, and range of macroeconomic indicators make it a novel and relevant addition to the literature.

This study examines economic and inflation convergence in Europe and OECD countries, addressing:

1. Do European and OECD countries show economic convergence and identifiable convergence clubs?
2. How do fiscal policy and government spending affect inflation during shocks?
3. How is monetary policy transmitted across euro-area countries, and why do responses differ?
4. How do external shocks, especially energy prices, influence inflation convergence?
5. Can advanced volatility measures improve understanding of inflation trends?

Based on these questions, the hypotheses are:

- \* H1: Economic convergence is incomplete, with convergence clubs and persistent heterogeneity (Borsi and Metiu, 2015; Cuaresma, Ritzberger-Grünwald, and Silgoner, 2008).
- \* H2: Fiscal policy drives inflation beyond conventional taxation and spending (Barro and Bianchi, 2026).
- \* H3: Monetary policy follows common euro-area cycles, but country-specific exposures cause heterogeneous effects (Berend and Prüser, 2024).
- \* H4: Inflation convergence is mainly influenced by external shocks, especially energy prices (Pereira and Aguiar-Conraria, 2025; Stylianou, 2023).
- \* H5: Directional volatility measures improve understanding of inflation trends and turning points (García-Hiernaux, Gonzalez-Perez, and Guerrero, 2023).

## II. Database

To facilitate the comparison of clustering results, OECD countries were grouped into thirteen geopolitical blocs reflecting geography, historical development, institutional similarities, and commonly used regional classifications (Table 1).

These predefined blocs did not constrain the clustering. Hierarchical cluster analysis was conducted independently, allowing clusters to form based solely on macroeconomic similarities. The blocs serve only as a reference for comparing statistically identified clusters with historical regional groupings.

The dataset spans 2019–2024, covering pre- and post-COVID periods. Data from the OECD database were analysed using six key macroeconomic indicators affected by global crises. Average annual wage (USD, PPP, 2024) per full-time equivalent employee, calculated as total wages divided by full-time equivalents. It captures overall income and allows international and temporal comparisons.

GDP per hour worked (USD, PPP, current prices) measures labour productivity, reflecting labour input as well as capital, technology, and organisational efficiency. It provides a broader view of economic performance beyond individual productivity.

Household debt (% of net disposable income) includes all interest- or principal-bearing liabilities, mainly mortgages and consumer loans, indicating households' financial burden relative to income.

Inflation is measured as annual growth of the consumer price index (CPI), tracking price changes of a fixed basket of household goods and services. CPI increases indicate reduced purchasing power.

Unemployment Rate is the proportion (%) of the labour force without work but actively seeking employment. Includes employees, self-employed, unpaid family workers, and unemployed. Based on standardized labour force surveys, expressed as a seasonally adjusted percentage.

Real minimum wage is annual statutory minimum wage (USD, PPP, 2024), inflation-adjusted using the CPI and converted via PPP. Reflects minimum income across OECD countries. In countries without statutory minimum wages (e.g., Austria, Denmark, Sweden), it is set by collective agreements and treated as a proxy for institutional wage-setting differences. Variables were selected to capture key dimensions of macroeconomic performance and living standards. They represent complementary aspects of economic development, labour markets, price stability, and household financial vulnerability, providing a comprehensive view of OECD countries' socio-economic position.

Average wage and real minimum wage capture overall income and the lower bound of wages, reflecting purchasing power, institutional arrangements, and social protection, helping assess income convergence. GDP per hour worked measures labour productivity and economic efficiency, a key structural factor in long-term divergence. Unemployment represents labour market performance and sensitivity to shocks. Inflation (CPI) captures macroeconomic stability and purchasing power evolution, particularly during 2021–2023 inflation pressures. Household debt (% of disposable income) indicates financial vulnerability and sensitivity to interest rate changes.

**Table 1: 38 OECD countries grouped by geography, history, culture, and political development, with ISO 3166-1 alpha-3 codes**

| Block of countries                                            | Country                                              | Code |
|---------------------------------------------------------------|------------------------------------------------------|------|
| Anglophone Europe                                             | Ireland                                              | IRL  |
|                                                               | United Kingdom of Great Britain and Northern Ireland | GBR  |
| Balkan countries                                              | Greece                                               | GRC  |
|                                                               | Slovenia                                             | SVN  |
| Baltic countries                                              | Estonia                                              | EST  |
|                                                               | Latvia                                               | LVA  |
|                                                               | Lithuania                                            | LTU  |
| Benelux countries                                             | Belgium                                              | BEL  |
|                                                               | Luxembourg                                           | LUX  |
|                                                               | Netherlands                                          | NLD  |
| Developed countries of Western Europe                         | Austria                                              | AUT  |
|                                                               | France                                               | FRA  |
|                                                               | Germany                                              | DEU  |
|                                                               | Switzerland                                          | CHE  |
| Far Eastern countries                                         | Japan                                                | JPN  |
|                                                               | South Korea                                          | KOR  |
| Post-Soviet Central Europe                                    | Czechia                                              | CZE  |
|                                                               | Hungary                                              | HUN  |
|                                                               | Poland                                               | POL  |
|                                                               | Slovakia                                             | SVK  |
| Latin American countries                                      | Chile                                                | CHL  |
|                                                               | Colombia                                             | COL  |
|                                                               | Costa Rica                                           | CRI  |
|                                                               | Mexico                                               | MEX  |
| Middle Eastern countries                                      | Israel                                               | ISR  |
|                                                               | Turkey                                               | TUR  |
| Nordic countries                                              | Denmark                                              | DNK  |
|                                                               | Finland                                              | FIN  |
|                                                               | Iceland                                              | ISL  |
|                                                               | Norway                                               | NOR  |
|                                                               | Sweden                                               | SWE  |
| North American countries                                      | Canada                                               | CAN  |
|                                                               | United States of America                             | USA  |
| Oceania countries                                             | Australia                                            | AUS  |
|                                                               | New Zealand                                          | NZL  |
| Southern European countries (except for the Balkan countries) | Italy                                                | ITA  |
|                                                               | Portugal                                             | PRT  |
|                                                               | Spain                                                | ESP  |

Source: Own research; Ministry of the Interior of the Czech Republic (2025)

The selected indicators capture key structural and cyclical characteristics of OECD economies, including productivity, income, labour markets, price dynamics, and household financial stability, providing a multidimensional basis for cluster analysis. Their choice aligns with prior studies on macroeconomic convergence (e.g., Monfort, Cuestas, and Ordóñez, 2013; Martinho, 2021; Popescu, Cristescu, and Paun, 2023), with household debt reflecting growing financial vulnerability during shocks. OECD countries were chosen for their comparable institutional frameworks and economic structures, yet sufficient variation in productivity, labour markets, inflation, and household finances. The period 2019–2024 covers consecutive crises: COVID-19, post-pandemic recovery, the energy crisis after Russia's invasion of Ukraine, and the subsequent inflation surge, capturing both immediate disruptions and adjustment dynamics. Data were processed using SPSS.

### **III. Theory and Methods**

Cluster analysis was chosen for its exploratory focus, aiming to identify groups of countries with similar macroeconomic characteristics and track changes across successive crises. Unlike traditional econometric methods, it considers multiple indicators simultaneously and reveals latent structures, making it suitable for comparative macroeconomic studies with complex, non-linear relationships.

Cluster analysis, detailed in Everitt et al. (2011) and Romesburg (2004), has been widely applied to study economic convergence and cross-country similarity patterns (e.g., Monfort, Cuestas, and Ordóñez, 2013).

All variables were standardised using z-scores (mean = 0, SD = 1) to ensure equal contribution in clustering and prevent variables with larger ranges from dominating distance calculations.

Ward's hierarchical clustering with Euclidean distance was chosen for its widespread use in macroeconomic convergence studies. Ward's method minimizes within-cluster variance, producing compact, homogeneous clusters, while Euclidean distance captures overall multivariate differences and performs well with standardized variables.

Robustness was tested using alternative linkage methods (average and complete), which produced similar country groupings, indicating that clustering patterns reflect underlying data similarities rather than the choice of Ward's method. High cohesion indicates countries with similar macroeconomic characteristics, while silhouette and cophenetic measures confirm the robustness of the clustering.

Cluster quality was evaluated using the silhouette coefficient, which ranges from  $-1$  to  $1$ . Higher values indicate better clustering, with objects well matched to their own cluster and poorly matched to neighbouring clusters.

The cophenetic correlation coefficient was used to assess how well the hierarchical dendrogram represents the pairwise distance matrix. Higher values indicate a closer match to the original distance structure.

The number of clusters ( $k = 13$ ) was chosen for comparability with the predefined geopolitical blocs (Table 1), but clustering was performed without constraints, so clusters reflect empirical similarity. Alternative dendrogram cut levels were visually inspected, yielding

comparable higher-level groupings. This approach allows direct comparison between empirically derived clusters and historically defined regional groupings, ensuring that the analysis is both data-driven and contextually meaningful.

This enables comparison of data-driven clusters with historical regional blocs while keeping the clustering fully data-driven.

Cluster analysis divided the 38 OECD countries into relatively homogeneous groups using the six variables described.

Although methods like k-means, fuzzy clustering, and multidimensional scaling are used to study economic similarity, hierarchical clustering was preferred for its lack of a priori cluster assignment and its dendrogram visualization, facilitating interpretation of structural changes over time.

## IV. Results

### **Wage, GDP, and Labour Market Developments in OECD Countries (2019–2024)**

Average wages in OECD countries from 2019 to 2024 evolved amid global shocks – COVID-19, energy and inflation pressures, and increased migration – coinciding with changes in purchasing power and real household incomes.

From 2019 to 2024, OECD wage dynamics reflected successive crises. In 2019, macroeconomic conditions were stable with moderate wage growth and low unemployment. The 2020 COVID-19 shock led to business closures, higher unemployment, and slowed wage growth, though average wages sometimes rose due to job losses among lower-paid workers; governments introduced employment support measures (e.g., Germany’s short-time work schemes).

Recovery began in 2021, with uneven wage increases across countries (e.g., Baltic states and Hungary rising; Colombia, Ireland, Netherlands, and Poland stagnating), alongside ongoing supply-chain disruptions. In 2022, energy and food price shocks after Russia’s invasion of Ukraine caused high inflation, eroding real wages in many countries, notably Czechia and Sweden (> 7% decline), despite nominal increases.

In 2023, inflation persisted and refugee inflows affected European labour markets, particularly in Poland, Slovakia, Czechia, and Germany; some countries (Hungary, Lithuania, Slovenia) saw real wages approach pre-pandemic levels. By 2024, macroeconomic conditions stabilized, inflation moderated, and modest real wage growth returned, especially in Central and Eastern Europe, though Italy and Japan remained below pre-pandemic real wage levels.

Despite nominal wage gains, household purchasing power declined in parts of the period. Recovery was uneven, with some Central and Eastern European countries narrowing the gap with advanced Western economies, while others lagged.

### **GDP per Hour Trends (2019–2024)**

GDP per hour worked reflected macroeconomic volatility from 2019 to 2024. The OECD average rose slightly, but countries diverged. In 2020, the pandemic caused sharp declines in many economies, though the OECD average remained stable. Recovery in 2021–2022 was uneven, with energy and inflation shocks slowing growth in some countries. By 2024, GDP per hour remained below 2019 levels in Germany, France, Poland, and the UK, while South Korea, the US, Sweden, and Mexico maintained steadier growth. Some countries (e.g., Ireland, Estonia) showed higher volatility due to tax structures, multinational activity, or statistical revisions.

### **Unemployment Dynamics**

OECD unemployment rates fluctuated during 2019–2024. The pandemic in 2020 caused sharp increases, with double-digit rates in Costa Rica, Greece, Colombia, Spain, Turkey, and Chile. From 2021, rates gradually declined, aided by policy measures. By 2024, unemployment stabilized, remaining high in Spain, Greece, Colombia, and Turkey, but very low in Czechia, Japan, Poland, and South Korea.

### **Real Minimum Wage Developments**

Real minimum wages in OECD countries (2019–2024) were strongly affected by inflation. While nominal wages often rose, real values declined in some countries, including the US and Israel. In contrast, Poland, Lithuania, South Korea, Germany, the Netherlands, Turkey, and Mexico saw real gains. Countries without statutory minimum wages (Austria, Denmark, Finland, Iceland, Italy, Norway, Sweden, Switzerland) are excluded. Dendrograms describe similarity patterns among countries but do not imply causality.

### **Cluster Analysis (2019–2024)**

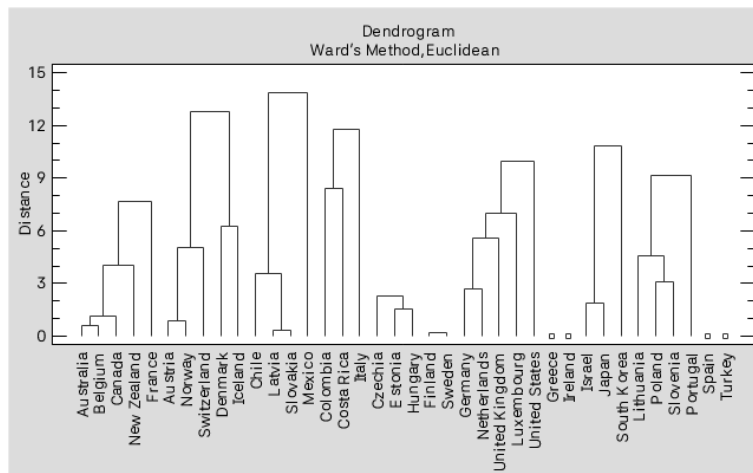
Figures 1–6 present dendrograms for 2019–2024, showing hierarchical clustering of 38 OECD countries using six standardized macroeconomic indicators. For comparison with the predefined geopolitical blocs (Table 1), the dendrogram was cut to yield 13 clusters, grouping countries with similar macroeconomic characteristics. Clusters were formed iteratively, starting with each country as a separate observation and merging the closest pairs until 13 clusters remained.

The clustering highlights groups of countries with similar macroeconomic profiles, without implying causation or the effects of specific events.

### **Regional Cluster Patterns**

Anglophone Europe (Ireland, UK) showed high volatility. Ireland often moved toward the Western core during the pandemic, while the UK oscillated between clusters, sometimes aligning with Benelux or Germany. Differences persisted through 2023–2024 due to distinct economic trajectories and fiscal policies.

Balkan countries (Greece, Slovenia) frequently clustered differently, reflecting heterogeneous economic and structural conditions.

**Figure 1: Dendrogram of 38 OECD countries into 13 clusters, 2019**

Source: SPSS output (2025)

Cluster 1: Australia, Belgium, Canada, France, New Zealand

Cluster 2: Austria, Denmark, Iceland, Norway, Switzerland

Cluster 3: Chile, Latvia, Mexico, Slovakia

Cluster 4: Colombia, Costa Rica, Italy

Cluster 5: Czechia, Estonia, Hungary

Cluster 6: Finland, Sweden

Cluster 7: Germany, Luxembourg, Netherlands, United Kingdom, United States

Cluster 8: Greece

Cluster 9: Ireland

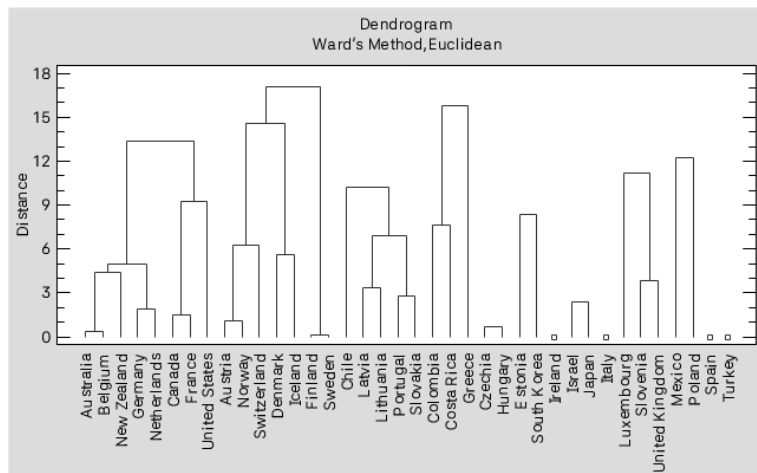
Cluster 10: Israel, Japan, South Korea

Cluster 11: Lithuania, Poland, Portugal, Slovenia

Cluster 12: Spain

Cluster 13: Turkey

**Figure 2: Dendrogram of 38 OECD countries into 13 clusters, 2020**



Source: SPSS output (2025)

Cluster 1: Australia, Belgium, Canada, France, Germany, Netherlands, New Zealand, United States

Cluster 2: Austria, Denmark, Finland, Iceland, Norway, Sweden, Switzerland

Cluster 3: Chile, Latvia, Lithuania, Portugal, Slovakia

Cluster 4: Colombia, Costa Rica, Greece

Cluster 5: Czechia, Hungary

Cluster 6: Estonia, South Korea

Cluster 7: Ireland

Cluster 8: Israel, Japan

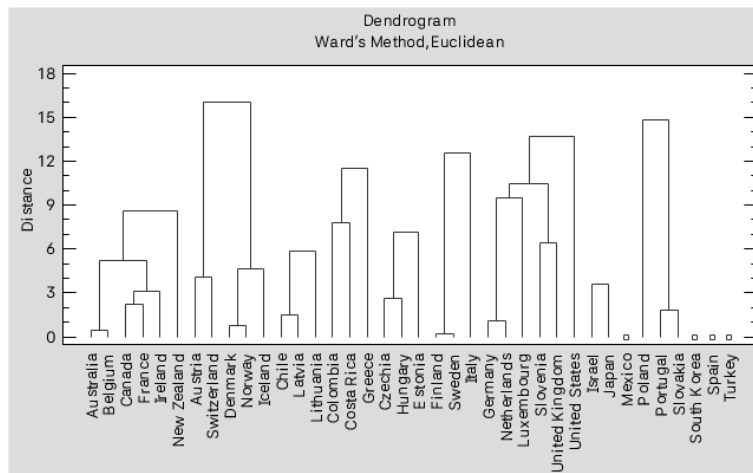
Cluster 9: Italy

Cluster 10: Luxembourg, Slovenia, United Kingdom

Cluster 11: Mexico, Poland

Cluster 12: Spain

Cluster 13: Turkey

**Figure 3: Dendrogram of 38 OECD countries into 13 clusters, 2021**

Source: SPSS output (2025)

Cluster 1: Australia, Belgium, Canada, France, Ireland, New Zealand

Cluster 2: Austria, Denmark, Iceland, Norway, Switzerland

Cluster 3: Chile, Latvia, Lithuania

Cluster 4: Colombia, Costa Rica, Greece

Cluster 5: Czechia, Estonia, Hungary

Cluster 6: Finland, Italy, Sweden

Cluster 7: Germany, Luxembourg, Netherlands, Slovenia, United Kingdom, United States

Cluster 8: Israel, Japan

Cluster 9: Mexico

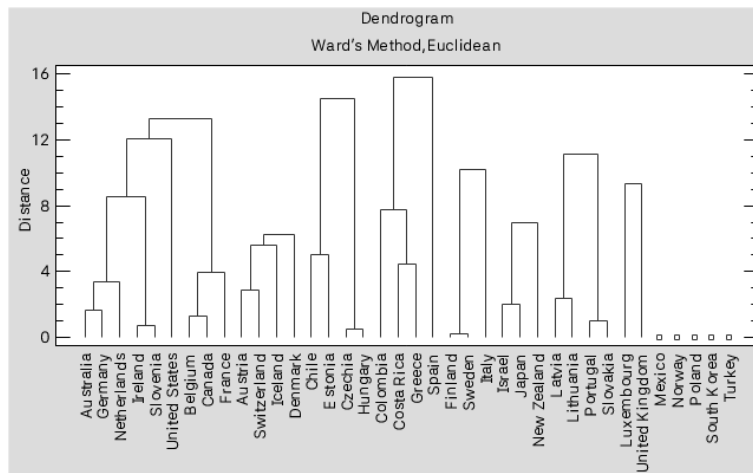
Cluster 10: Poland, Portugal, Slovakia

Cluster 11: South Korea

Cluster 12: Spain

Cluster 13: Turkey

**Figure 4: Dendrogram of 38 OECD countries into 13 clusters, 2022**



Source: SPSS output (2025)

Cluster 1: Australia, Belgium, Canada, France, Germany, Ireland, Netherlands, Slovenia, United States

Cluster 2: Austria, Denmark, Iceland, Switzerland

Cluster 3: Chile, Czechia, Estonia, Hungary

Cluster 4: Colombia, Costa Rica, Greece, Spain

Cluster 5: Finland, Italy, Sweden

Cluster 6: Israel, Japan, New Zealand

Cluster 7: Latvia, Lithuania, Portugal, Slovakia

Cluster 8: Luxembourg, United Kingdom

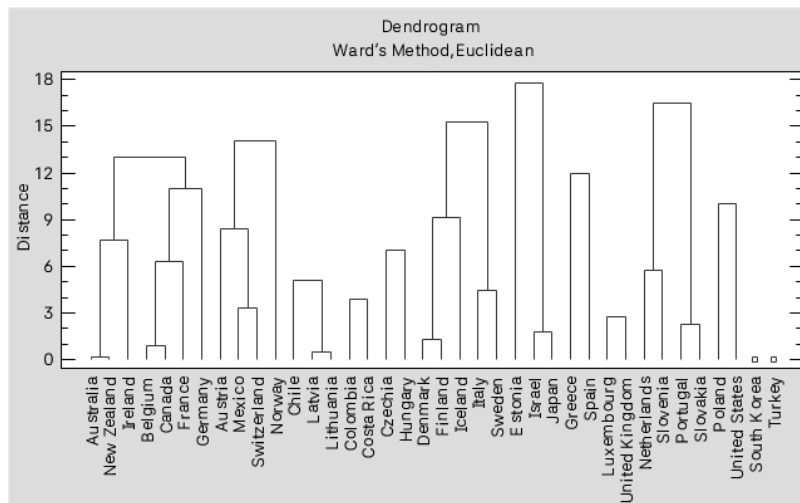
Cluster 9: Mexico

Cluster 10: Norway

Cluster 11: Poland

Cluster 12: South Korea

Cluster 13: Turkey

**Figure 5: Dendrogram of 38 OECD countries into 13 clusters, 2023**

Source: SPSS output (2025)

Cluster 1: Australia, Belgium, Canada, France, Germany, Ireland, New Zealand

Cluster 2: Austria, Mexico, Norway, Switzerland

Cluster 3: Chile, Latvia, Lithuania

Cluster 4: Colombia, Costa Rica

Cluster 5: Czechia, Hungary

Cluster 6: Denmark, Finland, Iceland, Italy, Sweden

Cluster 7: Estonia, Israel, Japan

Cluster 8: Greece, Spain

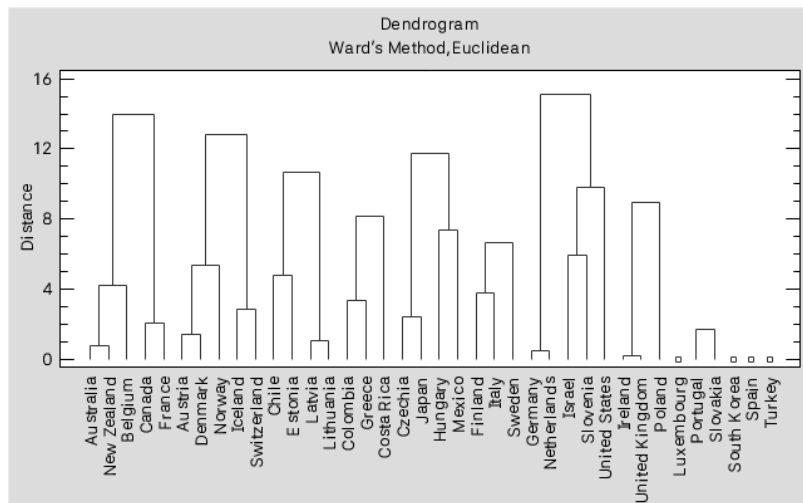
Cluster 9: Luxembourg, United Kingdom

Cluster 10: Netherlands, Portugal, Slovakia, Slovenia

Cluster 11: Poland, United States

Cluster 12: South Korea

Cluster 13: Turkey

**Figure 6: Dendrogram of 38 OECD countries into 13 clusters, 2024**

Source: SPSS output (2025)

Cluster 1: Australia, Belgium, Canada, France, New Zealand

Cluster 2: Austria, Denmark, Iceland, Norway, Switzerland

Cluster 3: Chile, Estonia, Latvia, Lithuania

Cluster 4: Colombia, Costa Rica, Greece

Cluster 5: Czechia, Hungary, Japan, Mexico

Cluster 6: Finland, Italy, Sweden

Cluster 7: Germany, Israel, Netherlands, Slovenia, United States

Cluster 8: Ireland, Poland, United Kingdom

Cluster 9: Luxembourg

Cluster 10: Portugal, Slovakia

Cluster 11: South Korea

Cluster 12: Spain

Cluster 13: Turkey

Baltic states (Estonia, Latvia, Lithuania) initially fragmented but increasingly clustered together from 2022, often with other small European nations, likely due to shared security and energy-inflation exposure.

Benelux (Belgium, Luxembourg, Netherlands) remained stable, generally clustering with the Western OECD core (USA, Canada, Germany, France), though Luxembourg occasionally deviated.

Developed Western Europe (France, Germany, Austria, Switzerland) also showed relative stability, forming the backbone of Western clusters with occasional links to Nordic countries.

Far Eastern countries (Japan, South Korea) generally formed distinct clusters from 2019 to 2024, rarely coinciding. This reflects unique macroeconomic profiles, including inflation,

labour markets, and monetary policies. Despite occasional short-term alignments with small economies, they remained largely isolated from the Western core.

Post-Soviet Central Europe (Czechia, Hungary, Poland, Slovakia) showed declining cohesion, with countries increasingly in separate clusters due to divergent inflation, energy dependence, and fiscal strategies.

Latin America (Chile, Colombia, Costa Rica, Mexico) was highly dispersed, occasionally forming subgroups and sometimes aligning with Central Europe, reflecting diverse development and economic models.

Middle East (Israel, Turkey) showed the lowest cohesion. Israel clustered with advanced economies, while Turkey remained separate, reflecting instability, high inflation, and unconventional policies.

Nordic countries (Denmark, Finland, Iceland, Norway, Sweden) consistently formed cohesive clusters, with only minor deviations from country-specific shocks.

North America (Canada, United States) clustered together only in some years (2020 and 2022). In 2023, the United States clustered with Poland, reflecting differences in inflation dynamics and policy responses.

Oceania (Australia, New Zealand) maintained strong cohesion, briefly deviating in 2022 when New Zealand grouped with Israel and Japan, reflecting short-term post-pandemic dynamics.

Southern European countries (Italy, Portugal and Spain) never clustered together during the analysed period. Spain frequently appeared as a single-country cluster (2019–2021 and 2024), while Italy and Portugal tended to group with different sets of European economies. A temporary convergence between Spain and Greece occurred in 2022 and 2023, but this pairing disappeared again in 2024.

## Summary

The period 2019–2024 served as a “cohesion test” for OECD countries. Some regions (Nordic, Benelux, Oceania) remained stable, while others (Southern Europe, Central Europe, Middle East, Latin America) fragmented. Cluster dynamics reflected economic structures, policy coordination, and exposure to overlapping shocks.

## V. Discussion

The results align with existing research on economic and inflation convergence in Europe and OECD countries. Fiscal factors strongly influenced inflation during 2020–2023 (Barro and Bianchi, 2026), while monetary policy transmission caused heterogeneous outcomes across euro-area countries (Berend and Prüser, 2024). Economic convergence remains incomplete, with convergence clubs shaped by geographical and institutional factors (Borsi and Metiu, 2015; Cuaresma, Ritzberger-Grünwald, and Silgoner, 2008). Inflation dynamics are complex: directional volatility anticipates turning points (García-Hiernaux, Gonzalez-Perez, and Guerrero, 2023), and common energy shocks rather than structural alignment explain apparent convergence (Pereira and Aguiar-Conraria, 2025; Stylianou, 2023).

Overall, country-specific factors and external shocks are decisive in observed patterns. Directional volatility measures help interpret turning points in inflation, while energy and fiscal shocks explain deviations from structural alignment. Findings show novel differences.

## VI. Conclusion

Cluster stability varied across 2019–2024, with average silhouette coefficients of 0.70–0.90, indicating generally well-separated clusters. Nordic, Benelux, and Oceania countries remained highly cohesive, while Central and Southern Europe, the Balkans, Israel, and Turkey showed lower cohesion. The Baltic states' cohesion increased from 2022, whereas Latin American countries remained dispersed. Cluster membership fluctuated across years, reflecting descriptive macroeconomic patterns rather than causal effects.

These findings highlight persistent heterogeneity and uneven convergence among OECD countries, offering insights for policymakers on macroeconomic stability and structural differences. Future research could extend this approach by incorporating broader measures of global uncertainty, including ESG-based sustainability indices and environmental governance policy uncertainty, to assess the impact of climate policy, geopolitical tensions, pandemics, or monetary shocks on macroeconomic convergence.

The clustering results broadly support the study's hypotheses. H1 is confirmed, as several relatively stable clusters emerge (e.g., the Nordic countries, Benelux, and Oceania), while other regions exhibit persistent heterogeneity across years. H2–H4 are broadly consistent with the observed clustering patterns, suggesting that fiscal responses, monetary transmission mechanisms, and external shocks (such as the COVID-19 pandemic, energy price shocks, and subsequent inflationary pressures) contributed to shifts in cluster composition. H5 is also supported, as the variability of cluster membership over time indicates that directional volatility measures help capture changes in inflation dynamics and potential turning points.

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