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Rainer Maurer

The Divergence of Price Levels in the European Union

Until the global financial crisis of 2007-08, inflation differentials in the euro area could be explained by a general trend towards price level convergence; that is, countries with lower price levels tended to have higher inflation rates than countries with higher price levels. Since then, however, the trend has reversed: price levels in the euro area are now diverging. Time series analyses suggest that this divergence is not temporary but, rather, has been anchored in the time series process of price levels all along. This is true not only for the aggregate of the harmonised index of consumer prices but also for sub-aggregates of tradable goods. A potential explanation for these findings could be attributed to monopolistic price discrimination. Empirical studies have documented the significant role played by price discrimination based on per capita income in international trade. The price levels of the member states of the Economic and Monetary Union indeed display a clear positive correlation with GDP per capita. Furthermore, real GDP per capita between the member states of the monetary union is also diverging and – as to be expected in the case of a positive correlation between real GDP per capita and price levels – the divergence of nominal GDP per capita is larger than the divergence of real GDP per capita. This article describes these empirical findings, outlines possible explanations for them and discusses various options for responsive economic policy action.

In the early days of the Economic and Monetary Union (EMU), there were still significant structural differences between the member states' economies (Issing, 2008). To address this, proponents of the locomotive theory argued that a monetary union could serve as a catalyst for heightened economic integration. By eliminating the risk associated with nominal exchange rates, such a union could foster increased specialisation through trade, while also facilitating the integration of capital markets by promoting fluid capital movements. This, in turn, would increase the degree of economic integration between the member states and thus reduce the stability costs associated with a unified monetary policy imposed by the European Central Bank (ECB). Consequently, according to the locomotive theory, a monetary union could establish the prerequisites for its own survival.

An alternative perspective known as the coronation theory posited that economic structures must first align before establishing a definitive monetary union (Kenneth, 1999). According to this theory, without such convergence, the occurrence and severity of asymmetrical shocks would exceed the capacity of individual national fiscal policies to absorb them. Consequently, the stability costs associated with a unified monetary policy could rise to unsustainable levels, posing a long-term threat to the unity and coherence of the monetary union.

A crucial indicator of the degree of economic integration among the member states within a monetary union is the prevailing price level in these countries. Following the Balassa-Samuelson theorem, countries with below-average labour productivity should experience comparatively lower price levels for their consumption baskets. This is attributed to the fact that countries with lower labour productivity must compensate for this lack of productivity by issuing lower wages, since the prices for tradable goods are equalised by trade arbitrage. As a result of these lower wages, the prices for non-tradable goods are lower in countries with lower labour productivity such that their average total price levels are also lower. In a regime characterised by unhindered trade and capital mobility,

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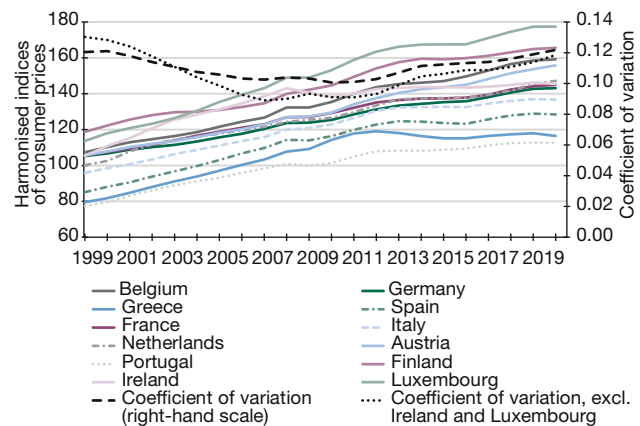
a process of catching up should then ensue, fostering a convergence of labour productivity and, consequently, long-term convergence of price levels. However, in reality, transaction costs hinder a perfect price convergence. In the presence of such costs, prices should converge until they differ by a certain margin, determined by the size of these transaction costs. Consequently, real exchange rates (i.e. the ratio of the price levels of the member states) are expected to oscillate around constants in the long run.

The expectation of such a long-run price convergence is supported in several publications by prominent European institutions. For instance, the European Commission emphasised in its 1990 publication “One Market, One Money” that “without a completely transparent and sure rule of the law of one price for tradable goods and services, which only a single currency can provide, the single market cannot be expected to yield its full benefits – static and dynamic” (European Commission, 1990, 19). When euro banknotes were introduced at the outset of 2002, the ECB highlighted in its Monthly Bulletin that “the introduction of the Euro banknotes and coins further reduces transaction costs and increases price transparency across borders. In turn, this should increase the strength of competition and, over time, reduce price level dispersion in the Euro area” (ECB, 2002, 39).

Empirical findings

Contrary to these theory-based expectations, an empirical examination reveals a significant divergence in the long-term trajectories of the harmonised indices of consumer prices (HICP) since the establishment of the EMU, as depicted in Figure 1. The coefficient of variation, i.e. the ratio of the standard deviation of the time series to their mean, demonstrates that the price levels of the member states had been converging from 1999 until 2007. However, since 2007, this trend has reversed and the price levels are now diverging. This reversal becomes even more pronounced if the outliers, Luxembourg and Ireland, are omitted. The type of convergence measured by the coefficient of variation is also called sigma convergence. It implies that the variance of the price levels of different countries decreases over time. Another type of convergence is called beta convergence. It implies that countries with lower price levels tend to have higher inflation rates than countries with higher price levels. Mathematically speaking, the two convergence concepts are related to each other: sigma convergence implies beta convergence but not vice versa (Maurer, 1995, 3). From this it follows that, over the first decade of the EMU, countries with lower-than-average price levels, such as Portugal, Greece and Spain, experienced higher-than-average inflation rates, while countries with higher price

Figure 1
Price level divergence between EMU founding states



Note: Given that the Eurostat HICP is an index time series in which the base year value is equal to 100%, the graphical analysis requires an adjustment for the purchasing power parities (PPP) deviation in the base year. The HICPs are adjusted using 1999 PPP.

Source: Eurostat (2022a, 2022b).

levels, like Austria, Belgium, France, Finland and Germany, experienced lower-than-average inflation rates, as implied by the Balassa-Samuelson theorem. However, the global financial crisis of 2007-08 and the following European debt crisis seem to have brought this process to a halt and caused a reversal.

One explanation for these findings could be that the divergence of the overall HICP price level was primarily driven by the fact that a large proportion of the HICP components are service sector goods and, as such, non-tradables. However, a closer look at the disaggregated components of the HICP shows that this presumption is, on the whole, incorrect.¹ While the coefficient of variation is roughly half as large for the total goods HICP component as it is for the total service HICP component, a similar trend reversal is recognisable for both components. Consequently, the component of the HICP that should mostly include tradable goods is not characterised by a long-term convergence of prices driven by trade arbitrage. Maurer (2022) finds that reducing the aggregation level further to the three-digit level does not necessarily lead to more convergence. For example, three-digit service-sector HICP components such as restaurants and hotels or communication services reveal a similar divergence pattern to three-digit tradable HICP components, such as clothing, non-alcoholic beverages, motor cars or industrial durables.

¹ See Figure 2 in Maurer (2022).

Thus, the graphical evidence supports the hypothesis that the great recession and the following European debt crisis might have reverted the tendency of EMU price levels to converge. It is possible, however, that the observable divergence is only temporary and that a relatively weak error correction mechanism still exists in the long-term time series process. It is also possible that there exist “convergence clubs” of structurally similar countries that are not recognisable in the diagrams. Therefore, Maurer (2022) analyses the time series behaviour of real exchange rates (RER) between member states of the EMU by conducting country pairwise tests. It is a common finding that price levels typically follow random walks, i.e. the current price level equals the price level of the previous period plus a current random shock plus, possibly, a constant drift parameter. This random walk time series behaviour has also been confirmed for the HICP (Maurer, 2022). As a consequence, a test for actual price level convergence requires a test for the stationarity of RER. While stationary RER are compatible with temporary deviations but imply long-term convergence towards non-zero constant margins, a contrarian result, RER that follow random walks are necessary and sufficient for the long-term divergence of price levels.

To test the unit root hypothesis against the stationarity hypothesis for the 12 founding member states of the EMU, 66 country pairs of RER are calculated for each of the nine aforementioned HICP indices (all items, total goods, clothing, non-alcoholic beverages, motor cars, industrial durables, total services, restaurants and hotels, communication services) on a monthly basis for the sample period from January 1999 to September 2019. As specified in Maurer (2022), the random walk hypothesis can be rejected only in four out of a total of 594 cases, specifically for the all-items RER of Germany/Belgium and Luxembourg/Italy and the communication services RER of Spain/Germany and Luxembourg/Greece. It is interesting to note that the random walk hypothesis for the RER of tradable goods is not systematically rejected more frequently than for non-tradable services. Moreover, it is not possible to detect any kind of stationarity clusters between structurally similar countries.

These surprising findings prompt the question of whether the calculation of the RER could be imposing overly stringent restrictions. This is because each price level is inherently assigned a rigid coefficient of one. In a world where transaction costs hinder immediate arbitrage activities, such restrictions might prove too strong. A less restrictive test of the hypothesis, that the components of RER are “kept together” in the longer run by arbitrage activities, is the cointegration test. Maurer (2022) uses the Johansen (1995) cointegration test based on the framework

of a vector autoregression model to test for cointegrating relationships between the price levels.

The test outcomes suggest that the notion of a self-stabilising relationship between price pairs is more frequently supported compared to the more restrictive unit root tests (Maurer, 2022). Nonetheless, the findings reveal that there is no systematic difference between the behaviour of the HICP components for tradable goods and non-tradable services. Out of the 594 potential cointegration relationships examined, 112 fail to reject the null hypothesis that a cointegration vector exists at the conventional significance level of 5%. However, in a mere 40 cases, the estimated cointegration parameters display the theoretically expected signs. The number of cointegration vectors for “total goods” matches that of “total services” despite involving different pairs of countries. It is not possible to identify specific country clusters where the existence of cointegrating relationships is less frequently rejected than in other cases. Furthermore, there is no discernible clustering around northern or southern European countries.

These empirical findings shed light on the behaviour of price levels in the Eurostat HICP and its subcomponents across the founding member states of the EMU. It is revealed that these price levels, along with the country pairs of the RER, tend to follow random walks rather than remaining stationary around a linear trend. Moreover, the majority of RER components do not exhibit cointegration. Somewhat unexpectedly, the results do not generally indicate a higher occurrence of stationary RERs for tradable goods compared to non-tradable services.

The findings reveal that price behaviour within the EMU, as measured by the HICP, predominantly adheres to individual country-specific patterns. The evidence does not suggest a discernible influence of the ECB’s monetary policy on these patterns. Furthermore, there is no indication that efforts to incorporate a common drift parameter, derived from the ECB’s inflation target, into the random walk processes of price levels have been successful. Similarly, attempts to introduce suitable stochastic shocks to impact the stochastic process of price levels, with the aim of achieving cointegration across member states, have not yielded the desired outcome.

One should be cautious when interpreting the results because the analysis only focuses on eight out of the 97 subcomponents of the HICP available over the sample period. However, the absence of systematic differences in the results between the all-items HICP, total services (all-items HICP excluding goods), and total goods (all-items HICP excluding services) appears to suggest that the unanalysed subcomponents are unlikely to yield sig-

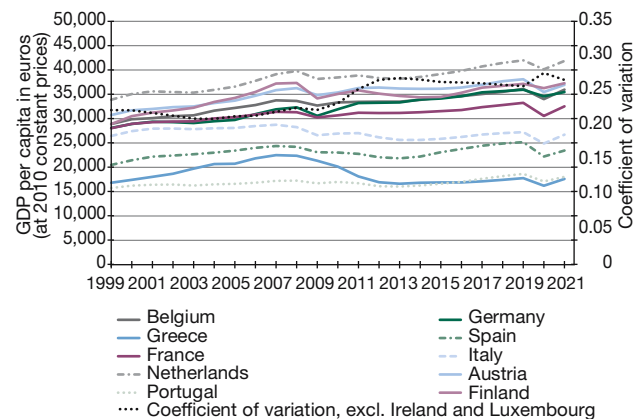
nificantly different outcomes on average. Nevertheless, exploring the time series behaviour of additional HICP subcomponents in future research could potentially offer valuable insights. Another shortcoming of Maurer's (2022) empirical analysis is its limitation to the 11 founding members of the EMU. The reason for this limitation is the minimum length of the sample period needed for a time series analysis, which is not guaranteed for younger member countries. Moreover, it is questionable whether the neglected nine member states, with their shorter EU integration histories, could change the overall picture.

Potential explanations

The findings pertaining to the tradable HICP subcomponents require particular explication, given that the European single market, coupled with the elimination of nominal exchange rate risk, should theoretically provide a solid foundation for risk-free trade arbitrage. Why, though, is this important premise of the Balassa-Samuelson theorem not fulfilled in reality?

A potential explanation for these findings could be attributed to monopolistic price discrimination, particularly the prevalence of intra-industrial trade between the member states of the EMU. The prohibition of nationality-based price discrimination, also known as geo-blocking, was introduced under EU Regulation 302 in 2018. However, it is important to note that even this regulation does not explicitly prevent the selling of goods or services at varying prices to all consumers, irrespective of their nationality, across different countries. Empirical studies have extensively documented the significant role played by price discrimination based on per capita income in international trade. Based on US export data from 1989-2000, Alessandria and Kaboski (2011) show that US exporters sell the same goods at significantly lower prices to low-income countries. This type of price discrimination "is about twice as important as any local non-traded inputs, such as distribution costs, in explaining the differences in tradable prices across countries" (Alessandria and Kaboski (2011, 91). Simonovska (2009) calculates, based on microeconomic data from a Spanish apparel manufacturer, that "doubling a destination's per-capita income results in an 18% increase in the price of identical items sold there" (Simonovska, 2009, 1). The PPP-corrected HICP price levels also display a positive correlation with per capita GDP. Indeed, below-average income countries like Greece, Portugal and Spain display below-average price levels, while above-average income countries like Austria, Belgium, France, Finland and Germany display above-average price levels. The correlation is stronger for the all-items HICP, but is also significant for the all-goods HICP. This indicates that the

Figure 2
Real per capita GDP divergence between EMU founding states



Source: Eurostat (2022c).

growing per capita GDP divergence (Figure 2) could be a driver of price divergence.²

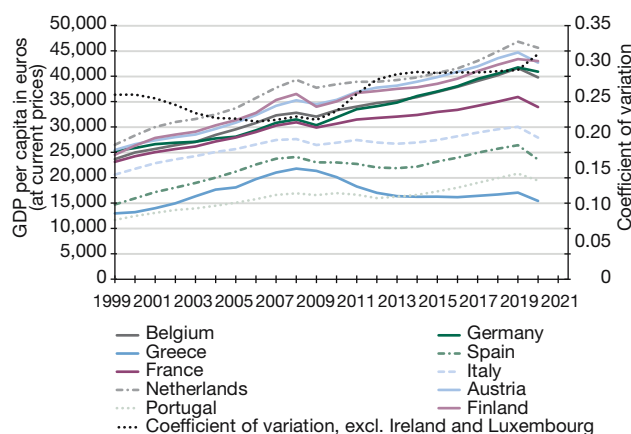
If countries with larger growth of per capita GDP also experience a larger growth of price levels, their nominal per capita GDP should display an even larger divergence than their real per capita GDP. The coefficient of variation in Figure 3 shows that this is actually the case. The growth of the coefficient of variation of real per capita GDP from a level of 0.22 to a level of 0.27 corresponds to a total increase of 19%, while the growth of the coefficient of variation of nominal per capita GDP from a level of 0.25 to a level of 0.31 corresponds to a total increase of 22%.

Policy conclusions

The empirical findings presented by Maurer (2022) raise concerns over the extent to which the time series behaviour of the HICP within the EMU is compatible with the ECB's concept of a single monetary policy (Issing, 2001). Despite the relatively low inflation rates of the past, which have resulted in small absolute price discrepancies, the absence of cointegration implies that substantial inflationary shocks could potentially lead to greater divergence in

² Figures 2 and 3 exclude the data of Luxembourg and Ireland from the calculation of the coefficient of variation. Luxembourg had a per capita GDP of approximately €85,000 in 2021, while Ireland had a per capita GDP of €70,000 in 2021. Ireland experienced a very strong increase of per capita GDP starting in 2014, when the Irish per capita GDP was around €40,000. This strong increase was most likely caused by a relocation of company earnings to Ireland for tax reduction purposes. The very high per capita GDP of Luxembourg is also due to its position as a financial hub. Adding both countries largely inflates the coefficient of variation as well as the tendency of per capita GDP to diverge.

Figure 3

Nominal per capita GDP divergence between EMU founding states

Source: Eurostat (2022c).

price levels in the future. Such a scenario has the potential to undermine the credibility of the ECB's monetary policy, especially in countries experiencing significant deviations from the declared target inflation rate.

In the event that market mechanisms fail to reduce the widening gap in price levels, the implementation of more tailored and country-specific policies may become necessary. One potential approach to address this mounting price divergence is through coordinated country-specific fiscal policies. Alternatively, a more targeted monetary policy could be pursued, such as the establishment of country-specific minimum reserve requirements as proposed by Holz (2007). It is worth noting that Article 19.1 of the ECB Statute grants the European Central Bank full legal authority to determine the minimum reserve rates. Another avenue for the implementation of country-specific monetary policies lies in the adoption of country-specific main refinancing rates. There is already a historical precedent for this approach in the United States' Federal Reserve System, which, between 1914 and 1941, employed district-specific discount rates (Fraser Archive, 1943). On balance, then, while there may be political motivations to uphold the principle of a single monetary policy, it is important to recognise the existence of alternative approaches that warrant consideration.

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