

# Economic Drivers of Consumer Price Growth in the EU–27 Service Industry during the Post-pandemic Period

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## Abstract

The post-pandemic period in the European Union is distinguished by the growth of business economic activity after two years of restrictions, growing debts and money supply, and extremely high inflation. This research analyses the Harmonised Index of Consumer Prices (HICP) in the service industries of the EU–27, comparing it to overall inflation and price growth in consumer goods markets. It also highlights the economic factors that contribute to the differences between service price growth in the EU–27. The results make it possible to classify the EU–27 countries according to the differences in service price changes. Consistent patterns of service HICP are highlighted, and the economic factors considering their relative importance to service HICP are ranked. Since 2022, public and governmental discussions concerning the post-pandemic inflationary shock have become prevalent, so this research allows us to understand the economic factors that caused such huge inflation and substantiates the need for monetary policy measures to slow down inflation.

**Keywords:** economics, inflation, consumer prices, services

**JEL:** C13, E31, E51, F44, L80, O52

## Introduction

The COVID–19 pandemic has affected European Union (EU) society, not only in terms of medical consequences but also through enduring social and economic consequences. Stukalo, Simakhova, and Baltgailis (2022, p. 122) expect that during the post-pandemic



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period, there will be a major redistribution of markets, a deepening of social inequalities, increased governmental intervention, and global problems in developing countries. Additionally, the return of rapid inflation to the core countries of the world economy occurred (Lapavitsas 2022, p. 149). The global economic lockdown slowed economic activities, so governments had to stimulate their economies by borrowing and spending large amounts of money, thereby stimulating inflation. According to Ho, Nguyen, and Nguyen (2021, p. 1), fiscal deficits are inflationary, and increased public debt can leave a country insolvent and make it default.

However, a sudden increase in public debt is justifiable to neutralise the pandemic economic losses, i.e., reduced GDP and tax revenues and increased bankruptcies, unemployment, and social support (Bresser-Pereira 2020, p. 241). According to monetary theory and the modern economic literature analysed by Sisay, Atilaw, and Adisu (2022, p. 1), the price level is one of the most important macroeconomic variables, and it remains the primary goal of macroeconomic policies to achieve sustainable growth while maintaining price stability. Nevertheless, the measures taken to manage COVID-19 raised inflation significantly when the prices of consumer goods and services started to climb rapidly. Boaretto and Da Silva (2019, p. 1450) argued that in the scientific literature, there are no strict determinations about the relative price growth rates in service industries compared to product markets. There is much evidence that the price of services tends to exhibit a high degree of inertia or persistence. In contrast, when comparing it to goods inflation, services inflation often exhibits less persistence. Counter-intuitively, this phenomenon is called the Services Inflation Persistence Puzzle. Therefore, this research aims to analyse the inflationary processes in EU-27 service industries during the post-pandemic period and reveal the economic factors that cause the differences in service inflation in different countries.

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## Literature review

Skare and Soriano (2022, pp. 303–304) analysed the COVID-19 shock wave mechanism in the European service industry. They applied monthly data from January 2015 to January 2021 from 16 European economies and concluded that the effect of the pandemic on the service industry in Europe differs across countries and sub-sectors. They also found that COVID-19's impact on the service industry was different in Western European economies compared to Central and Eastern European (ex-socialist) economies. Estrada (2021, p. 210) applied a developed simulator and found differences in developed, developing, and least-developed countries regarding how COVID-19 affected the inflation and unemployment in each type of country. Charalampidis and Guillochon (2022, p. 1093) compared the pandemic to the Great Recession, analysing the consumption, inflation, wages, and labour hours in services and nondurables. During the pan-

demic, a reduction in the consumption of services was far deeper than the reduction in the consumption of nondurables. This demand shock brought down the economic activity in services, inflation, interest rates, and employment. However, Charalampidis and Guillochon did not analyse the post-pandemic period.

Kim (2022, pp. 79–80) adapted Minsky's Inflation Theory, which holds that inflation is equal to the rate of increase of wages minus the rate of increase of labour productivity plus the rate of increase of the markup. At the end of the pandemic, household spending returned to its pre-pandemic level, together with growing income and correspondingly high levels of household debts. However, the productivity of the service industry (as the efficiency), turning inputs into outputs (Amirul et al. 2022, p. 2854), grew insufficiently.

An important driver of low productivity was the strong wage growth led by governmental policies to deal with the COVID–19-related lockdowns, e.g., furloughing workers and income support, which enhanced unemployment benefits. Nickel, Koester, and Lis (2022, p. 72) also agreed that wage growth is a major driver of services inflation in the euro area. Important measures of wage growth (compensation per employee or per hour worked) were heavily affected by the changing impact of government support measures related to job retention schemes. According to Ubide (2022, p. 96), in an environment where all labour inputs are increasing and all companies are raising prices, markups may no longer behave in a countercyclical manner, thus increasing the probability of a wage-price spiral in the economy. Conflitti and Zizza (2021, p. 2474) found that firms' inflation expectations are significantly affected by wage increases, which are set by contract renewals and the prices of raw materials. Meanwhile, Lieb and Schuffels' (2022, p. 2482) high inflation expectations were related to increased economic uncertainty.

In the current inflationary period, Urquhart (2022, p. 246) mentioned the Fiscal Theory of Price Level, which posits that fiscal components (debt, spending, revenues, and deficit) are keys that determine the economy's price level. As these components and inflation suffered significant imbalances between 2020 and 2022, inflation targeting and adjusting of interest rates (Altunbaş and Thornton 2022, p. 560) became more important as a monetary policy instrument of central banks. Gong and Qian (2022, p. 4783) found evidence that inflation targeting reduces the probability of an internal debt crisis in a country, a risk that has increased in many countries worldwide after the pandemic. Batayneh, Salamat, and Momani (2021, p. 2), who focused on the financial sector, mentioned that higher inflation implies less long-run financial activity. In economies with high inflation, intermediaries will lend less and allocate capital less effectively, and equity markets will be smaller and less liquid.

## The Harmonised Index of Consumer Prices in the EU–27's service industry

During the period 2016M01–2022M09, the prices of services in the EU–27 increased by 15.91%, on average, compared to 2015. However, the inflation growth rate was not constant in EU service industries. Until the end of 2018, the inflation in services did not exceed the European Central Bank's target to keep the annual price between 0% and 2%. Between 2016 and 2018, service prices grew by 1.42%, 1.39% and 1.43%, respectively. In 2019, the economy reached its peak in the business cycle in the decade after the economic crisis of 2009; the HICP of services increased to 2.16%. COVID–19 and the global economic lockdown reduced the inflation of services to 1.31%. Afterwards, inflation in the EU–27 service sectors accelerated significantly. In 2021, the HICP of services was 3.07%, while at the end of the 3<sup>rd</sup> quarter of 2022, it reached 5.13%.

Analysing the main service industry sub-sectors, the most significant price growth was observed in restaurants and hotels, where the HICP reached 125.05% in 2022M09 compared to 2015. The second is transport services, where prices increased by 14.95% during the same period. Other miscellaneous services, including personal care, hairdressing, electric appliance repair, child-care services, and counselling, became more expensive by an average of 14.84%. The HICP of recreation and culture in 2022M09 reached 111.85%, insurance services – 110.99%, and health services – 109.29%. The average spending on education for EU citizens increased by 7.26%. There was a decline in consumer prices in communication services, where the HICP was 94.12% compared to the 2015 baseline.

Comparing the EU–27 service markets to the consumer products markets, inflation in services was lower. The all-items HICP in 2022M09 was 121.56%, so the average price growth of services was 5.65% smaller. The highest price growth was observed in energy resources. Housing, water, electricity, gas, and other fuels were 36.13% more expensive compared to 2015. The price growth of energy in 2021 was 10.37%, and 19.91% during the first three quarters of 2022. In the consumer goods markets, the 2022M09 HICP of food and non-alcoholic beverages was 128.29%, alcoholic beverages and tobacco – 125.62%, furnishings, household equipment and routine household maintenance – 113.34%, and clothing and footwear – 108.35%.

The HICP in services during the period 2016M01–2022M09 varies significantly across the EU–27 countries. For some, this indicator has a cyclical pattern (Figure 1).

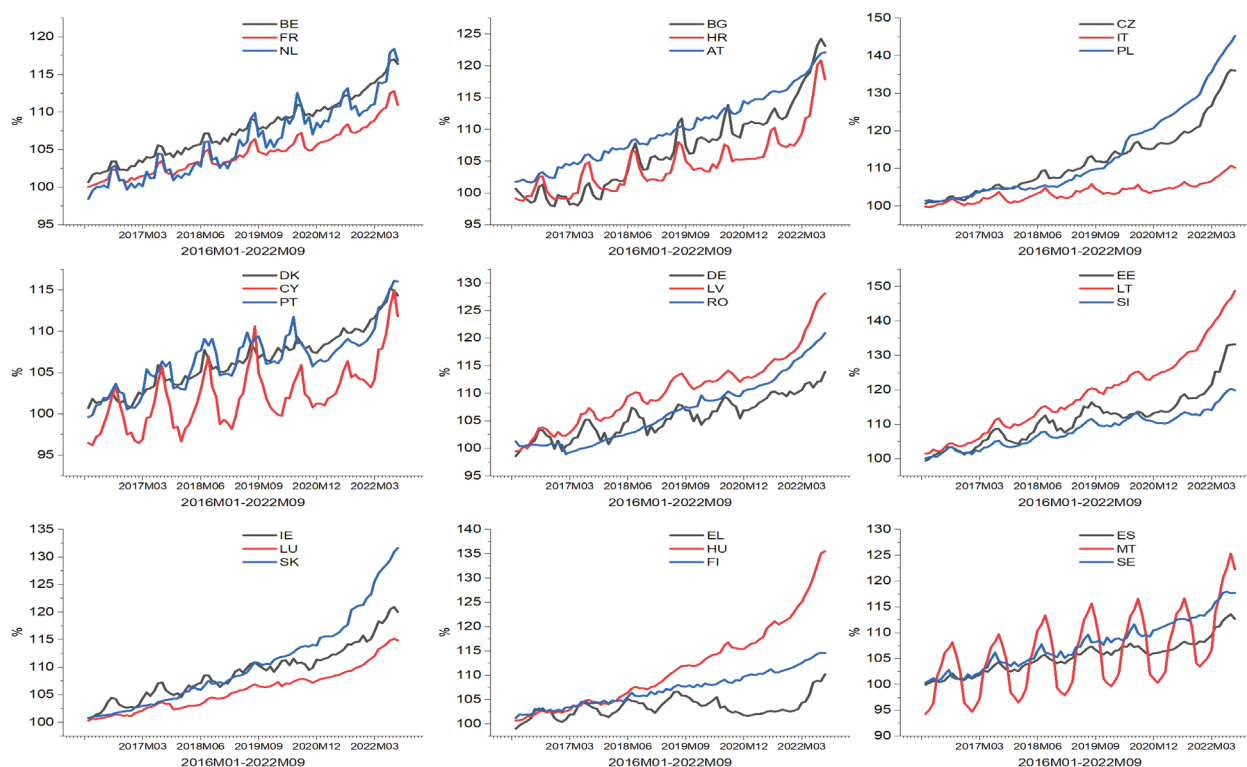


Figure 1. 2016M01 – 2022M09 HICP of services in EU-27 countries (2015 = 100%)

Source: author's visualisation based on Eurostat 2022e [PRC\_HICP\_MIDX].

A descriptive statistical analysis was conducted in the HICP of services in the EU using annual data, as well as the average monthly HICP growth rate from 2016M01–2022M09 ( $\Delta_{\text{Month}}$ ) in Table 1. The unweighted average and median of services' HICP grew constantly during the analysed period, especially accelerating in 2022. The statistical indicators of variance (standard deviation, inter-quartile range (IQR), and overall range) also constantly obtained higher values. A minimum HICP below 100% indicates that a decline in service prices was observed in some EU countries in 2018 compared to 2015. However, after 2019, inflation was typical for the overall EU service industry. Italy had the lowest inflation in service prices (110.20% HICP in 2022M09), while the highest was in Lithuania (148.72%). Since 2016M01, the average monthly growth rate of service prices in Lithuania was 0.591%. For comparison, the EU-27 monthly average was 0.273%. The least growth was in Italy (0.130%). After Lithuania, the countries with some of the highest average monthly growth rates of service prices were Poland, Czechia, Hungary, and Estonia. Their monthly growth values varied from 0.422%–0.548%.

**Table 1.** Descriptive statistics of services' HICP (%) in the EU–27 (2015 = 100%)

	2016M12	2017M12	2018M12	2019M12	2020M12	2021M12	2022M09	$\Delta_{\text{Month}}$
Mean	101.36	103.30	105.40	108.12	109.81	113.42	121.66	0.273
Median	101.46	103.50	105.58	108.09	110.23	112.52	117.82	0.234
Std. Deviation	1.83	2.51	3.19	4.21	5.47	7.41	10.46	0.126
IQR	1.78	3.13	3.31	4.63	6.84	8.56	11.17	0.167
Range	8.93	12.44	16.34	20.42	22.85	30.59	38.52	0.461
Minimum	95.68	97.65	98.54	100.25	101.17	102.45	110.20	0.130
Maximum	104.61	110.09	114.88	120.67	124.02	133.04	148.72	0.591
25th percentile	100.75	101.66	103.67	106.14	106.11	108.43	114.46	0.186
75th percentile	102.53	104.79	106.97	110.76	112.94	116.98	125.62	0.354
33.33 <sup>rd</sup> percentile	100.83	102.35	104.33	106.29	107.23	109.99	115.63	0.195
66.67 <sup>th</sup> percentile	102.15	104.44	106.57	109.81	110.98	115.03	122.15	0.264

Source: author's calculations based on Eurostat 2022b.

The structural averages (median, 33.33<sup>rd</sup> and 66.67<sup>th</sup> percentiles) of Table 1 were used to classify the EU–27 countries into two or three groups according to their HICP of services in 2022M09 (Table 2). To classify them into two groups, the criteria were selected as not exceeding the 2022M09 HICP median (low HICP group) and above this median (high HICP group). The extraction of three classes is based on 33.33<sup>rd</sup> and 66.67<sup>th</sup> percentiles, dividing the EU–27 countries into low, medium, and high HICP groups.

**Table 2.** Classification of EU–27 countries according to services' HICP in 2022M09

Classification into two groups	Below median (HICP < 117.82%)	Median (HICP = 117.82%)	Above median (HICP > 117.82%)
	IT, EL, FR, CY, ES, DE, DK, FI, LU, PT, BE, NL, SE	HR	SI, IE, RO, AT, MT, BG, LV, SK, EE, HU, CZ, PL, LT
Classification into three groups	Below 33.33 <sup>rd</sup> percentile (HICP < 115.63%)	Between 33.33 <sup>rd</sup> and 66.67 <sup>th</sup> percentiles	Above 66.67 <sup>th</sup> percentile (HICP > 122.15%)
	IT, EL, FR, CY, ES, DE, DK, FI, LU	PT, BE, NL, SE, HR, SI, IE, RO, AT	MT, BG, LV, SK, EE, HU, CZ, PL, LT

Source: author's calculations based on Eurostat 2022b.

Spectral analysis was employed to estimate the periodicity of service price changes in the EU–27. The peak frequency, period, peak power, and statistical significance at  $p < 0.05$  and  $p < 0.01$  levels were analysed. The aggregated spectral analysis results



are given in Figure 2 as Kernel density and bee-swarm plots. In the periodograms, 16 countries (59.3%) obtained the peak frequency values in the range 0.08281–0.08437 and the service HICP periods of 11.85–12.08 months. These countries are Belgium, Denmark, Germany, Estonia, Ireland, Spain, France, Croatia, Italy, Cyprus, Latvia, Malta, Netherlands, Portugal, Slovenia, and Sweden. However, most had a spectral analysis power below 20, demonstrating the weak seasonality of service price changes, despite the sufficient statistical significance.

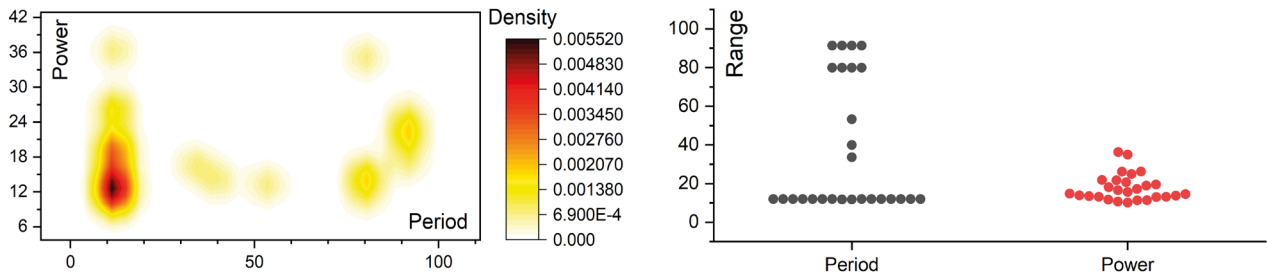


Figure 2. Kernel density and bee-swarm plots of spectral analysis results

Source: author’s visualisation based on Eurostat 2022e [PRC\_HICP\_MIDX].

Malta, Germany, Cyprus, and the Netherlands obtained the highest peak power in the spectral analysis within the range of 20.78 to 36.36. Therefore, the seasonality of service price fluctuations within a year is most pronounced in these countries. Their Lomb periodograms are given in Figure 3, with the power significance at 8.058 ( $p < 0.05$ ) and 9.693 ( $p < 0.01$ ) levels.

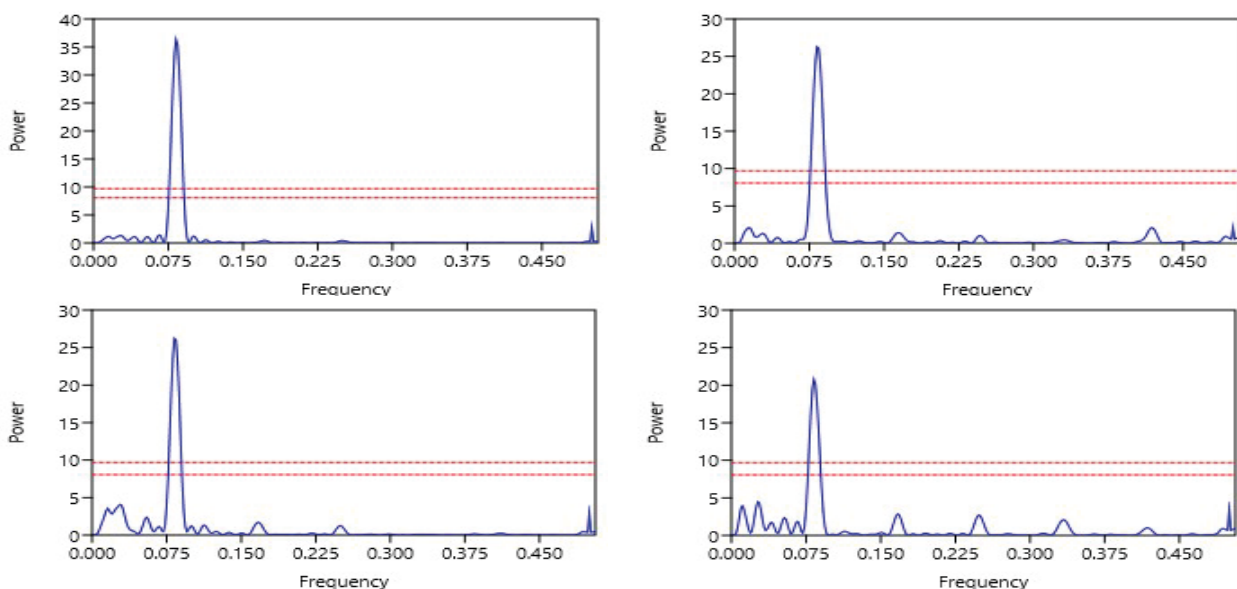
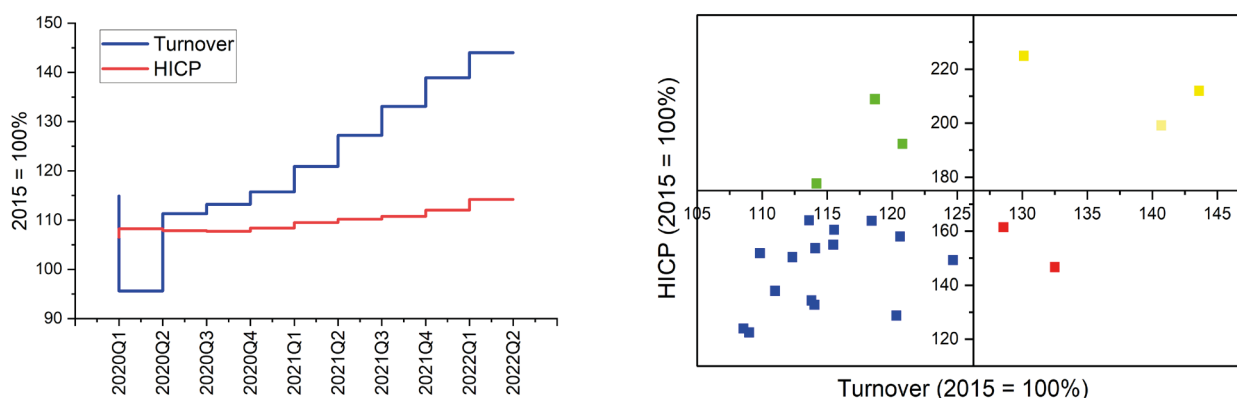


Figure 3. Service HICP Lomb periodograms of Malta (top-left), Germany (top-right), Cyprus (bottom-left), and the Netherlands (bottom-right)

Source: author’s visualisation based on Eurostat 2022e [PRC\_HICP\_MIDX].

## Consumption and international trade of services in EU-27

The turnover of service enterprises in the EU at the beginning of the COVID-19 pandemic in 2020Q2 declined by 19.3%. Following the restricted demand during the economic lockdown, the prices of services tended to decline until 2020Q4, when the HICP of services was 107.71%. By 2022Q2, the overall turnover in service sectors had reached 144.0% compared to 2015. The overall price index in 2022Q2 was 114.2%, so real growth of service consumption in the EU was observed during the high inflation period (Figure 4).

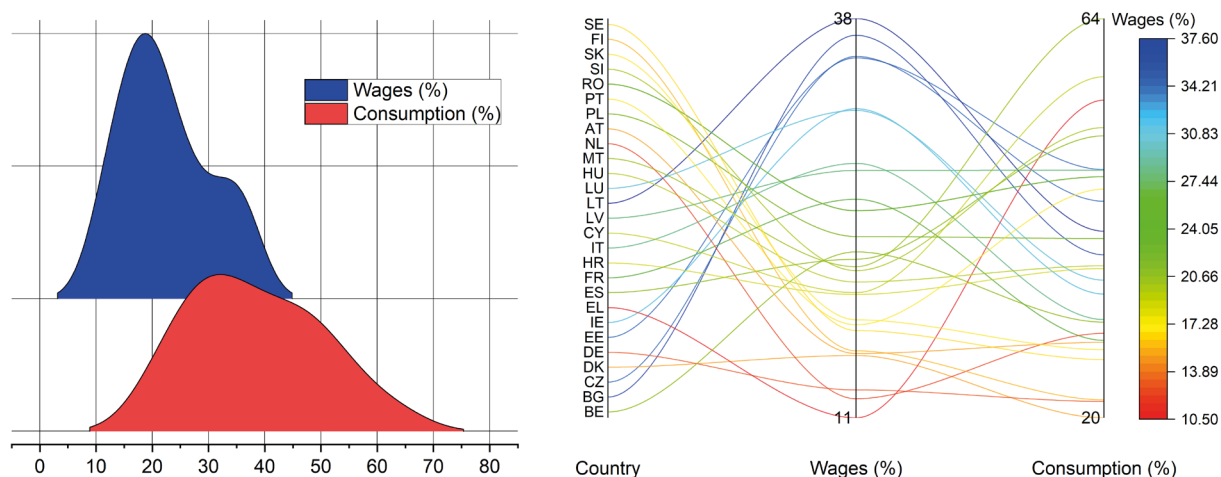


**Figure 4.** Service HICP and turnover indices in overall EU-27 2020Q1 - 2022Q2 (left chart) and each member state in 2022Q2 (right chart)

Source: author's visualisation based on Eurostat 2022e [PRC\_HICP\_MIDX]; 2022k [STS\_SETU\_Q].

Until 2022Q2, Luxembourg, Romania, and Bulgaria experienced the highest service turnover growth (177.6% to 208.9%) and the lowest service inflation (114.2% to 120.8% HICP) relative to other countries. The consumers of these countries experienced the highest growth in purchasing power considering the proportions of service HICP and turnover increase in service enterprises (the green sector in Figure 4). Similarly, the highest service turnover growth was in Hungary, Lithuania, and Poland (199.1%–224.9%); however, the prices of services were higher by 30.1 to 43.6% (the yellow sector in Figure 4). Czechia and Slovakia had the least growth in service purchasing power relative to other countries, with the 2022Q2 HICP of services ranging from 128.6% to 132.5%, while the turnover grew only by 146.7% to 161.5% (the red sector in Figure 4). The other EU countries, except for Estonia, France, Ireland, and Sweden, whose turnover statistics were unavailable, had moderate service turnover growth (below 165% compared to 2015); the HICP of services did not exceed 125%.





**Figure 5.** Ridgeline and parallel plots of EU-27 wages and household final consumption expenditure growth rates in 2020Q2–2022Q2

Source: author's visualisation based on Eurostat 2022c – wages and salaries and final consumption expenditures of households statistical databases.

The final consumption expenditures of households in the EU-27 during the inflation growth period of 2020Q2–2022Q2 increased significantly more than wages and salaries. This disproportion can be seen in the ridgeline distribution plot (Figure 5). The unweighted average wage growth during this period was 22.4%, while household consumption expenditures increased by 38.4%. In 12 countries, wage growth did not exceed 19.7%, but overall, EU consumption grew more than 19.9%. This indicates that, on average, inflation was stimulated by more spending on consumer goods and services compared to the income growth in EU households. The parallel plot (Figure 5) indicates that Lithuania, Bulgaria, Czechia, and Estonia had the highest wage growth (34.9% to 37.5%). All these countries also belong to the highest services' price growth group (HICP is above the 66.67 percentile).

Malta, Cyprus, Greece, Slovenia, and Spain had the most significant consumption increase (more than 50%). Simultaneously, these five countries had the highest difference between household consumption expenditures and wage growth rates, in the range of 30.1% to 44.8%.

Analysis of international trade of services in 2021's balance of payments shows that most EU-27 countries are net service exporters (Figure 6). Extra-EU trade exhibits a particularly positive balance, except for Ireland and Malta, which are net importers of services (–€52.2 billion and –€140.2 million, respectively). Belgium, Denmark, Germany, France, Italy, Slovakia, Finland, and Sweden had a negative intra-EU trade balance (from –€183.8 million to –€36.2 billion). The most active international trading and money flows in the service industry are in Germany, Ireland, France, Netherlands, Luxembourg, and Belgium.

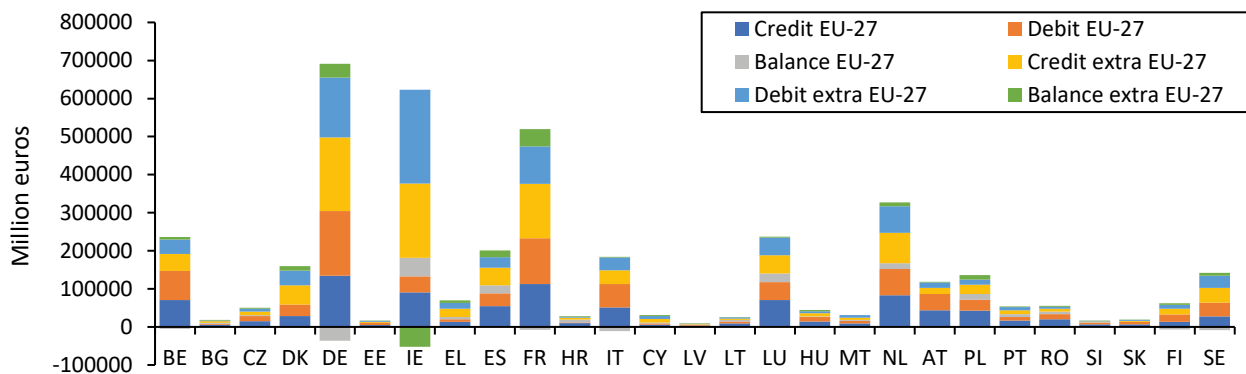


Figure 6. Balance of payments for services in the EU-27 (year 2021)

Source: author’s visualisation based on Eurostat 2022f.

## Economic factors of service price growth in the post-pandemic recovery

After the COVID-19 restrictive measures were lifted, Europe faced a new economic problem related to electricity price volatility and the rapid price growth of other energy resources. The internal energy markets of most EU-27 countries became locked in a relentless upward climb from the beginning of 2022. On average, electricity prices in 2022M09 had increased by 61.7% compared to 2015. The highest HICP of electricity was in Estonia (384.1%), Belgium (282.6%), and the Netherlands (246.9%). This indicator also exceeded 200% in Italy, Sweden, Latvia, Lithuania, and Denmark. The smallest growth was in Slovenia, Croatia, and Luxembourg. In Malta, the price has not changed at all since 2016 (Figure 7).

The growth in electricity prices in the EU is related to declining internal generation and the increasing disproportion between energy supply and demand. The EU-27’s electricity generation has a cyclical pattern; however, in general, the generation amounts since 2017 have declined (the negative linear trend in Figure 8).

Overall electric power generation from 2017–2021 declined by 9.8%, from 2.748 million GWh to 2.721 million GWh. The reduction in the supply of natural gas from Russia to Europe in 2022 was another factor in the growth of electric energy prices. Although European countries use several ways to generate electric power, such as nuclear, hydroelectric, coal, wind, and solar, the price of natural gas is hugely influential in setting electricity prices because gas-burning generators are most often switched on when the power grids need more electricity. The prices of gas and liquid fuels started to climb rapidly in the EU, undoubtedly stimulating the growth of inflation, includ-

ing the prices of services. The HICP of gas in 2022M09 was 186.6%, while liquid fuels reached 197.6% (Figure 8).

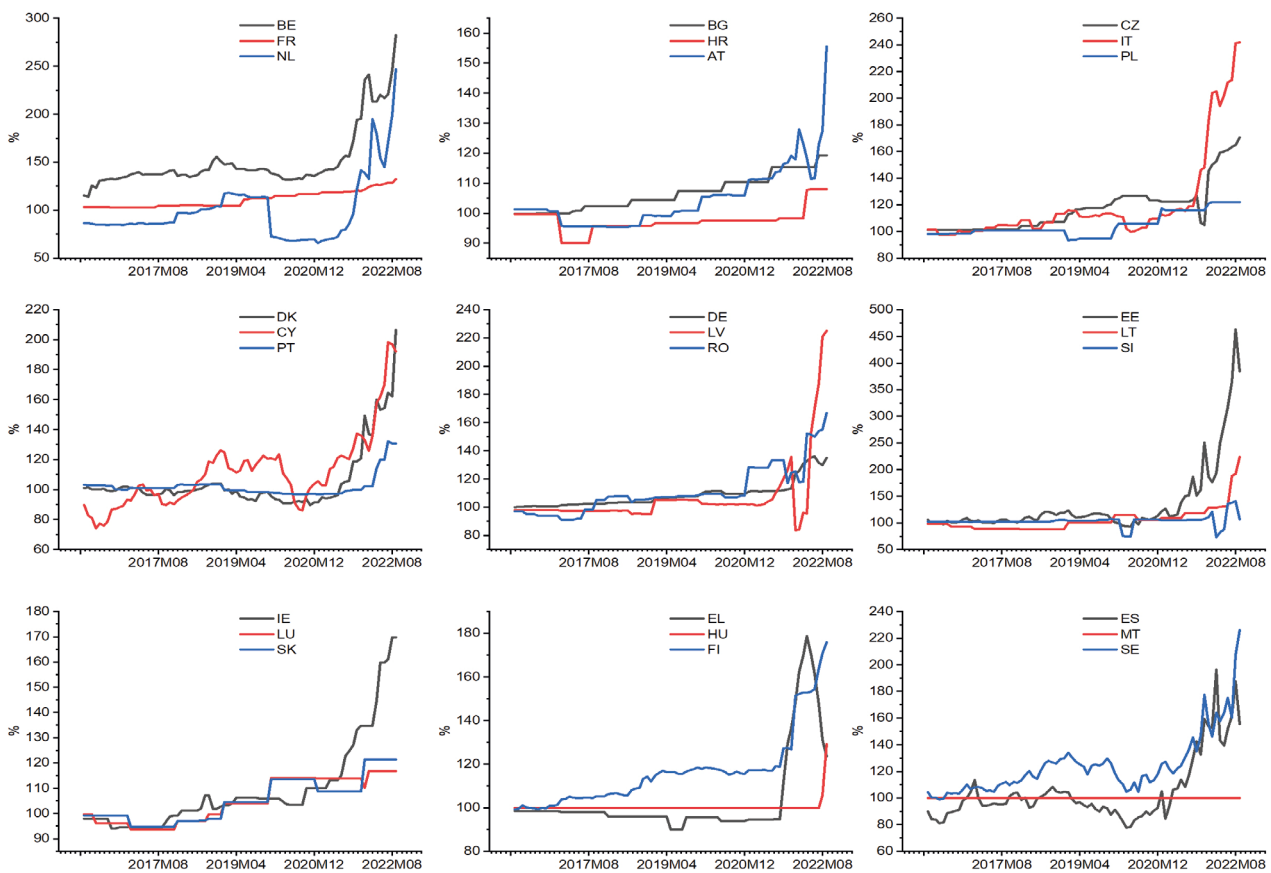
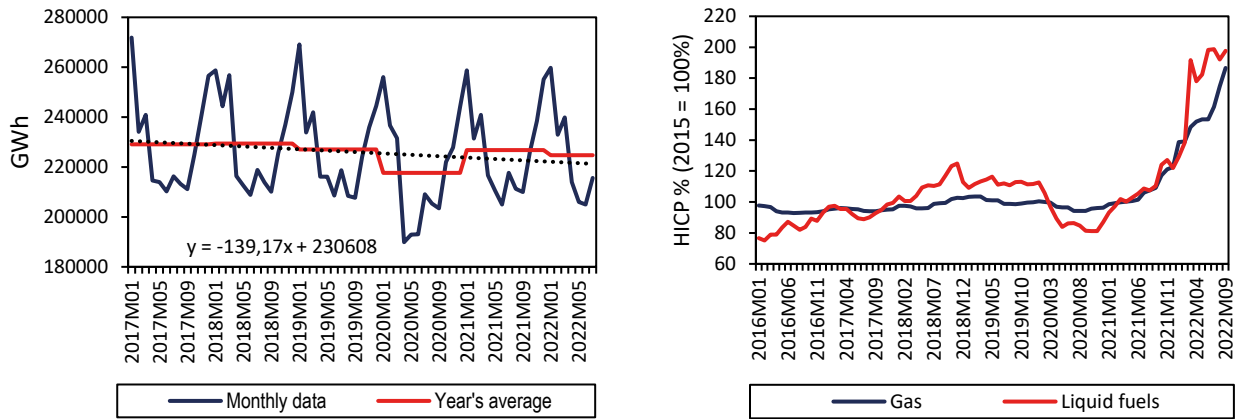


Figure 7. 2016M01-2022M09 electricity price index in the EU-27 (2015 = 100%)

Source: author's visualisation based on Eurostat 2022e – electricity HICP monthly data (index) [CP0451] statistical database.

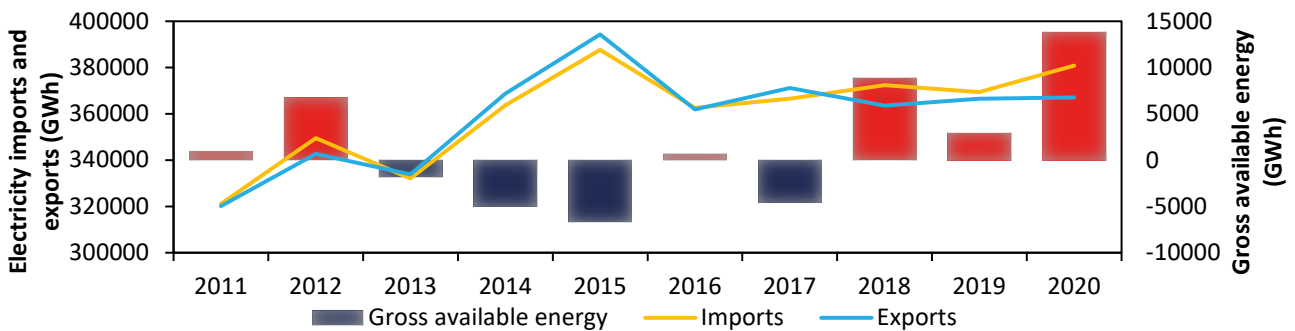
Recently, a larger proportion of the EU-27 (63%) became net importers of electricity. The negative international trade balance has increased the statistical value of gross available energy in the EU, which is calculated by subtracting the energy exports from imports. In 2020, the indicator reached a maximum of 13,834 GWh (Figure 9). Conversely, net exporters of electricity remain Belgium, Bulgaria, Czechia, Germany, Ireland, France, Netherlands, Slovenia, and Sweden. Cyprus has an electricity trade balance of 0.



**Figure 8.** 2017M01–2022M07 net electricity generation (left chart) and 2016M01–2022M09 HICP of gas and liquid fuels (right chart) in the EU-27

Source: author’s visualisation based on Eurostat 2022h – gas [CP0452], and liquid fuels [CP0453] statistical databases; 2022e.

As the service industry has an intangible character, energy costs, labour expenses and productivity have a significant impact on service prices. Figure 10 compares total hours worked and wage growth in the service industry of 25 EU countries (statistical data from the Netherlands and Germany were unavailable). The comparative basis is 2015, with an index equal to 100%. On average, the number of hours worked in services increased by 13.5% between 2015 and 2022Q2, while salaries grew by 65.7%. Romania, Hungary, and Lithuania had the highest growth in service industry labour costs.



**Figure 9.** 2011–2020 electricity imports, exports, and gross available energy in the EU-27

Source: author’s visualisation based on Eurostat 2022k – electrical energy imports [B\_190300] and exports [B\_190500] statistical database.

As expected, the volume index of production in services significantly declined during the beginning of the COVID–19 pandemic in 2020 compared to the previous year. However, there was also a decline in the growth rate in the first half-year of 2022 (Figure 10). However, this analysis included only a sample of eight EU countries for which recent statistics were available: Germany, France, Latvia, Lithuania, Hungary, Roma-

nia, Finland, and Sweden. Thus, the calculated means of every period were supplemented by  $\pm 1.96$  standard errors, creating intervals for the expected overall EU-27 means with 95% probability. The statistical characteristics of service production volume indices are given in Table 3. The inflationary shock, slowing real service production growth, and a two-decade-low unemployment rate of 6.0% in 2022M07–2022M08, indicate a possible peak point of the business cycle.

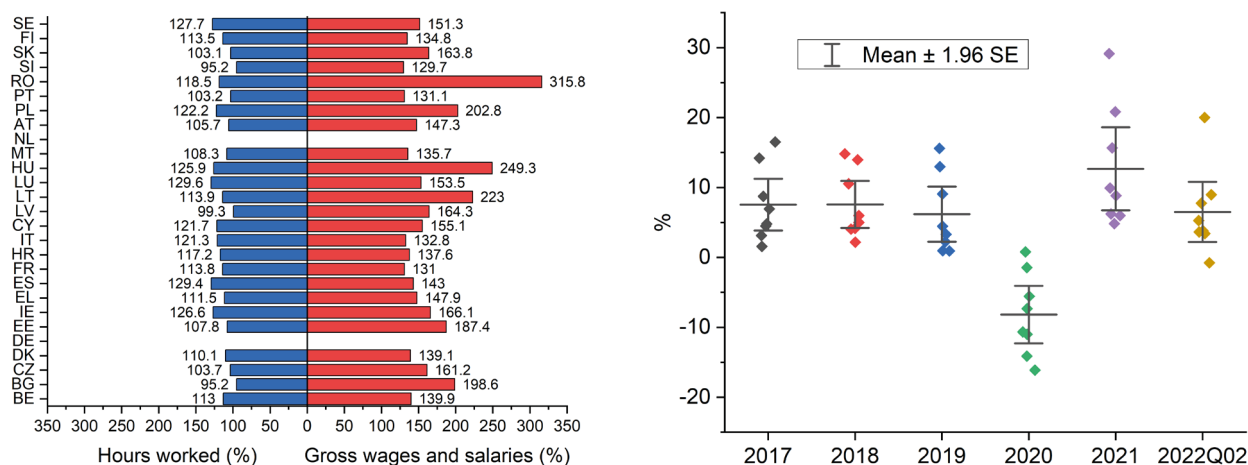


Figure 10. 2022Q2 volume of work done (hours worked), gross wages and salaries (left chart), and volume index of production in services (right chart) of EU countries

Source: author's visualisation based on Eurostat 2022g; 2022j.

Table 3. Sample statistics of services production volume index (%)

Period	Mean	Standard error	Confidence -95%	Confidence +95%
2017	7.53 750	1.881 008	3.0 896	11.98 538
2018	7.58 750	1.712 396	3.5 383	11.63 667
2019	6.18 750	2.007 970	1.4 394	10.93 559
2020	- 8.20 000	2.089 942	- 13.1 419	- 3.25 807
2021	12.65 000	3.034 210	5.4 752	19.82 477
2022Q02	6.48 750	2.193 695	1.3 002	11.67 477

Source: author's calculations based on Eurostat 2022b.

The profitability of the service industry is usually higher than in manufacturing due to the use of fewer materials and their related expenses. The intangible manner of services makes it possible to set higher profit margins, which makes it possible to absorb the cost growth in energy and labour markets, resulting in minimal price changes in the commodities market. Figure 11 compares the average gross operating rate, calculated as the ratio of gross operating surplus to turnover, between the EU-27 service in-

dustry and manufacturing. The comparative datum lines of manufacturing indicate that this real economy had average gross operating rates of 9.5% and 9.4% in 2019 and 2020, respectively. The highest profitability of services is in real estate activities, where these values exceed 40%. Information and communication services, professional, scientific, and technical activities, together with administrative and support services, are also at high levels. COVID-19 positively impacted these sectors as their profit margins increased slightly. Transportation and storage, together with accommodation and food service activities, have relatively lower gross operating rates (6.6%–13.1%). These sectors were more sensitive to the COVID-19 pandemic, as their profitability declined.

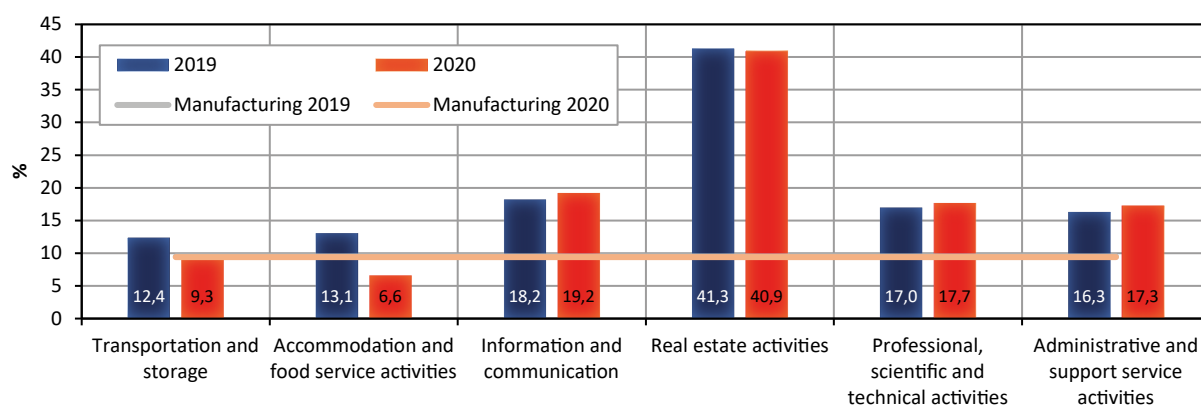


Figure 11. Average gross operating rate of the service industry compared to manufacturing in the EU-27

Source: author's visualisation based on Eurostat 2022a [TIN00155].

The outbreak of COVID-19 and the global economic lockdown triggered a rapid increase in public and private indebtedness in the EU. The overall consolidated gross debt of the EU-27 governments between 2020Q1 and 2022Q2 increased by 18.3%, from €11.1 to 13.1 trillion. The leader of public debt growth was Estonia (+127.3%), although it has the lowest indebtedness, At €5.7 billion (Figure 12). The other countries where debt grew were Czechia, Romania, and Lithuania (from +49.2% to +63.3%). The aggregated loan portfolio of credit institutions mostly grew in Slovakia, Ireland, and Belgium (from +31.6% to +35.0%).

Based on government consolidated gross debt and loans of credit institution indices (2020Q1 = 100%), four sectors were aggregated, setting the limit of the indebtedness growth indices to 120%. Slovakia, Romania, Estonia, Czechia, Luxembourg, Bulgaria, Lithuania, Austria, and Germany exceeded this value in both indebtedness indicators and are concentrated in the red sector of Figure 12. Slovenia, Hungary, Latvia, Malta, and Poland were the countries where public debt grew significantly while maintaining a moderate bank loan portfolio growth (blue dots in Figure 12). Contrasting trends were observed in Ireland, Belgium, Finland, Portugal, and France



(yellow dots in Figure 12). The other eight countries increased their public and private indebtedness by less than 20%.

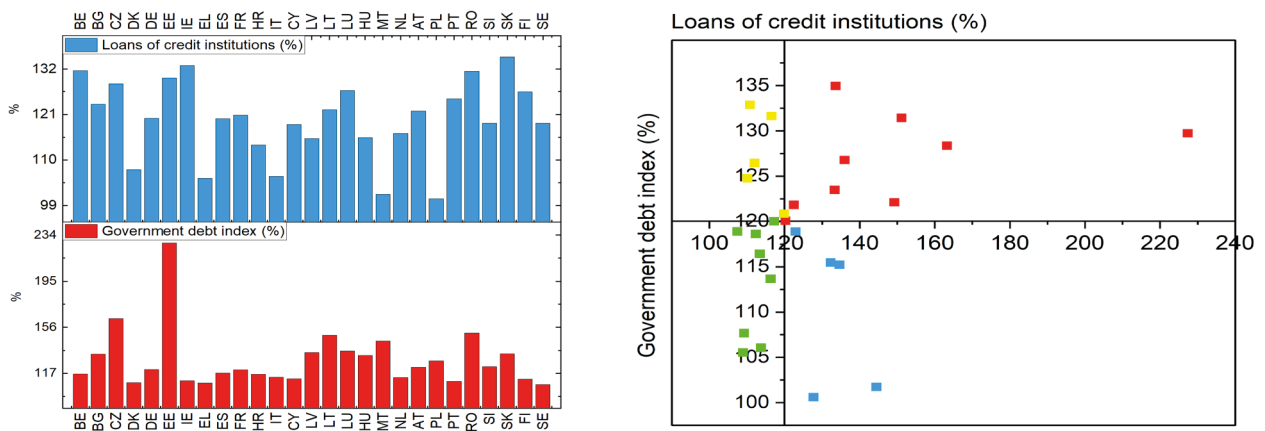


Figure 12. Government consolidated gross debt and loans of credit institution indices of period 2020Q1-2022Q2 in the EU-27

Source: author's visualisation based on Eurostat 2022d; 2022i.

The sudden increase in money supply in the financial system could not keep inflation low. The prices of services and consumer goods began to climb rapidly in 2022. These inflationary processes were caused by extremely low central bank interest rates until 2022, stimulating borrowing and surplus demand for goods and services (Figure 13).

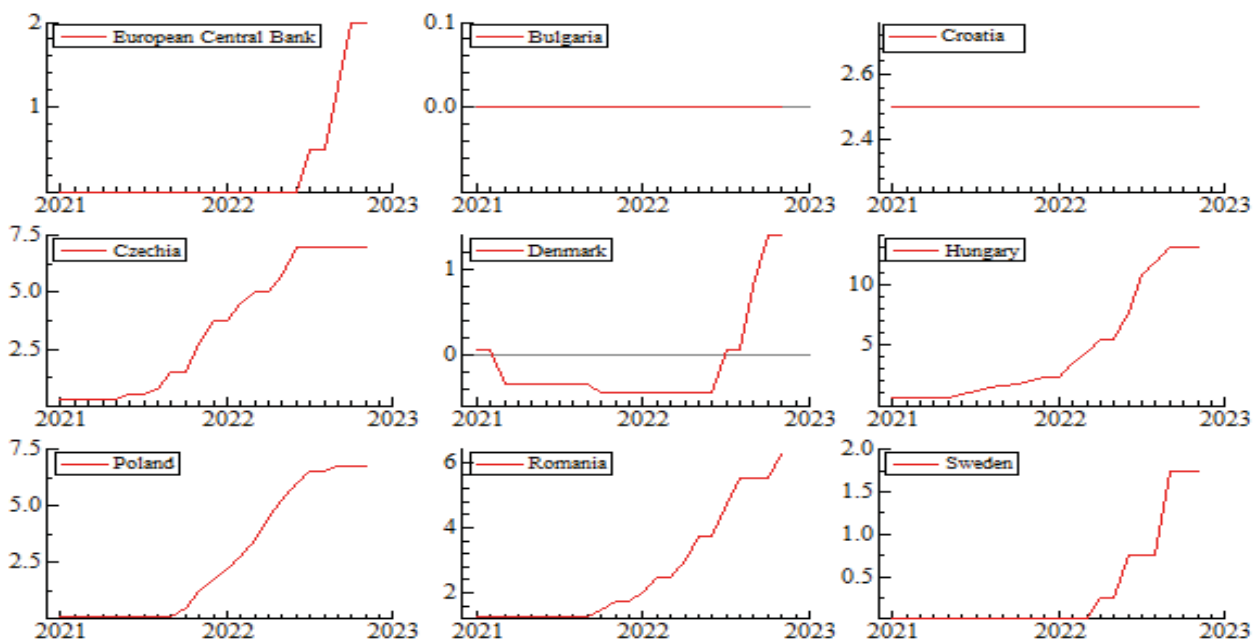


Figure 13. Central bank interest rates from 2021M01-2022M11 in the EU-27 (%)

Source: processed by author according to key ECB interest rates – European Central Bank n.d. and non-EMU central banks' – Central banks – summary of current interest rates n.d.

Reacting to the growing inflation, most central banks of non-euro countries began to raise interest rates in the second half-year of 2021. The European Central Bank followed in the summer of 2022 to reduce the price shock in the product and service markets of the euro area.

## Statistical dependencies between service price growth and economic factors

Statistical analysis was conducted to model the dependencies between economic factors and the HICP of services. The data sample comprises 11 indices (the first 11 items in Table 4) and seven indicators (the last seven items in Table 4) as independent variables.

Table 4. Data sample characteristics

Abbreviation	Indicator	Period
WSA	Wages and salaries in service industry (%)	2020Q2-2022Q2
FCH	Final consumption expenditures of households (%)	2020Q2-2022Q2
AIC	Actual individual consumption (%)	2020Q2-2022Q2
CGD	General government consolidated gross debt (%)	2020Q1-2022Q2
LCI	Loans of credit institutions (%)	2020Q1-2022Q2
LCC	Labour cost in the whole economy (%)	2021Q2-2022Q2
ENH	Electricity, gas, and other fuels HICP (%)	2015-2022M09
ELP	Electricity HICP (%)	2015-2022M09
ENT	Number of enterprises (%)	2019-2020
GOS	Enterprise gross operating surplus (%)	2019-2020
GRE	Employment in the whole economy (%)	2019-2020
TPP	Turnover per person employed (thousand euros)	2020
GVV	Gross value added per employee (thousand euros)	2020
IPP	Investments per person employed (thousand euros)	2020
ETB	Electricity imports to exports ratio (%)	2020
BPI	Debit to credit ratio of services in the balance of payments intra-EU (%)	2021
BPE	Debit to credit ratio of services in the balance of payments extra-EU (%)	2021
UNE	Unemployment rate (%)	2022M09

Source: author's methodology.

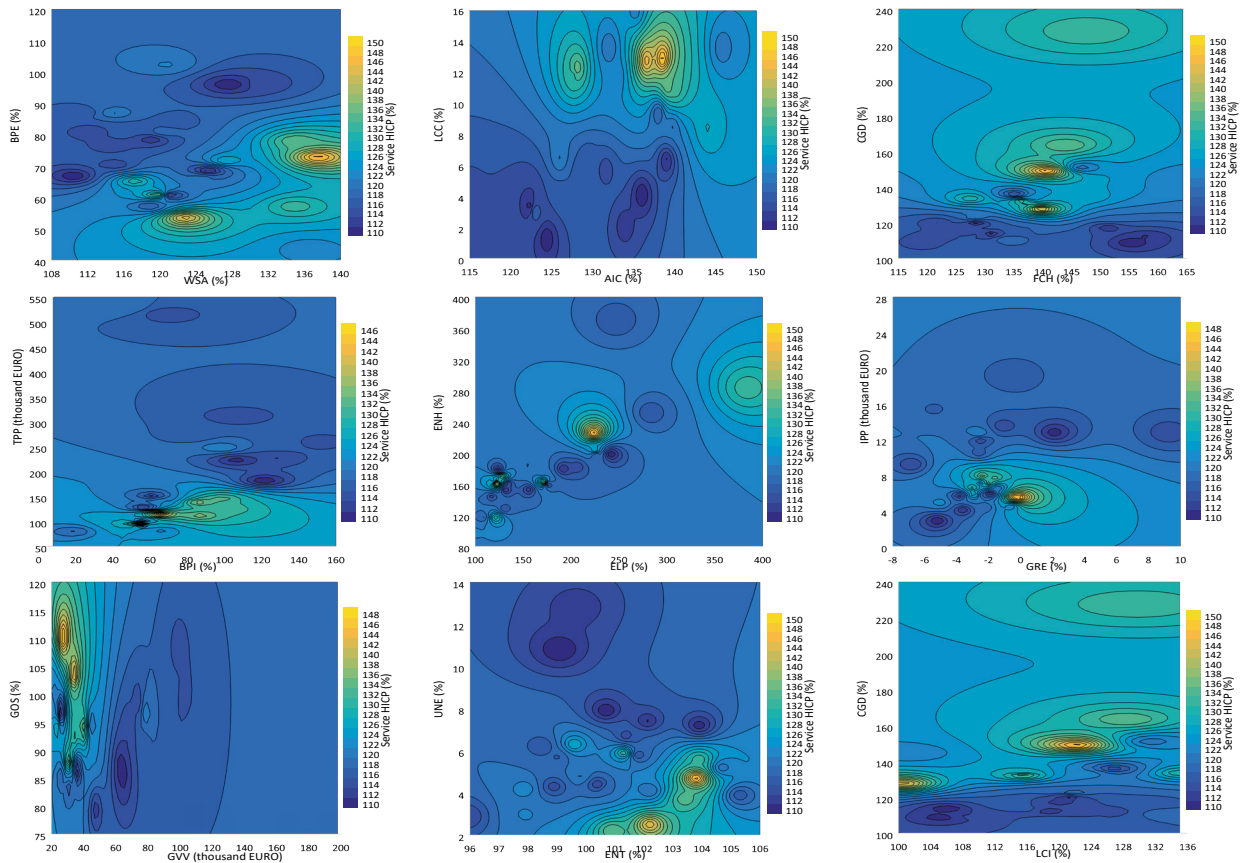


Figure 14. Economic factors of service HICP in the EU-27

Source: author's calculations based on Eurostat 2022b.

The spectral analysis of contour charts in Figure 14 identified the main common factors of high service HICP values. A relatively higher increase in service prices is typical in countries with high wage growth wages in the service industry, labour cost in the whole economy, and general government consolidated gross debt; net extra-EU and intra-EU exporters of services with lower turnover per person employed; electricity, gas, and other fuels HICP more than 200%; stagnating or declining employment in the whole economy during the COVID-19 pandemic and low investments per person employed; low gross value added per employee and a higher enterprise gross operating surplus; a growing number of enterprises and unemployment rate during the post-pandemic recovery, regardless of their reliance on credit institutions for loans.

The univariate Fisher's ANOVA ranking, employed as a supervised feature selection algorithm, was used to rank the input attributes according to their relevance. The discrete target attribute was set as the three-group clustering of EU-27 countries in Table 2 depending on services' HICP in 2022M09.

**Table 5.** The univariate Fisher’s ANOVA ranking results

N	Attribute	F	F (max normalized)	p-value	N	Attribute	F	F (max normalized)	p-value	N	Attribute	F	F (max normalized)	p-value
1	LCC	21.87		0.000004	7	IPP	3.24		0.057018	13	ETB	0.95		0.400291
2	CGD	7.49		0.002970	8	TPP	3.13		0.062045	14	ENT	0.77		0.475029
3	UNE	4.58		0.020666	9	BPE	2.23		0.129450	15	GOS	0.55		0.581532
4	WSA	4.07		0.030050	10	BPI	1.31		0.287602	16	ENH	0.53		0.594691
5	GVV	3.54		0.044784	11	LCI	1.10		0.348346	17	GRE	0.45		0.640732
6	AIC	3.28		0.054901	12	FCH	0.98		0.390122	18	ELP	0.11		0.900254

Source: author’s calculations based on Eurostat 2022b.

Analysing Table 5 allows us to classify the service price growth factors into three importance levels. LCC, CGD, UNE, WSA, GVV, and AIC had the highest impact on inflation. IPP, TPP, BPE, BPI, LCI, and FCH had an intermediate impact on service prices. The least important factors are ETB, ENT, GOS, ENH, GRE, and ELP.

The average values of service HICP factors in the two-group clustering of EU–27 countries (below (1) and above (2) the HICP 2022M09 median) according to Table 2 are given in Table 6. The indicators are separated into three table sectors according to the results of the univariate Fisher’s ANOVA ranking.

**Table 6.** Average values of service HICP factors in two groups of EU–27 countries

Indicator	LCC (%)	CGD (%)	UNE (%)	WSA (%)	GVV (€) <sup>1</sup>	AIC (%)
Group 1	4.4	115.2	6.6	118.8	65.2	127.8
Group 2	11.5	142.5	4.3	126.4	48.7	135.8
Difference	7.1	27.3	-2.3	7.6	-16.5	8.0
Indicator	IPP (€) <sup>1</sup>	TPP (€) <sup>1</sup>	BPE (%)	BPI (%)	LCI (%)	FCH (%)
Group 1	9.6	225.3	77.5	89.2	118.4	135.0
Group 2	8.3	157.4	74.4	73.5	121.3	142.1
Difference	-1.3	-67.8	-3.1	-15.7	2.9	7.0
Indicator	ETB (%)	ENT (%)	GOS (%)	ENH (%)	GRE (%)	ELP (%)
Group 1	241.2	100.6	92.1	183.7	-1.9	176.7
Group 2	903.9	101.4	98.5	174.4	-2.4	168.7
Difference	662.7	0.8	6.5	-9.3	-0.5	-8.0

<sup>1</sup>Thousand euros

Source: author’s calculations based on Eurostat 2022b.

The top sector of Table 6 contains the differences in the highly impactful inflation factors. The cost of labour in the whole economy (2021Q2–2022Q2) index is 7.1% higher in the group of high-service HICP countries. The general government consolidated

gross debt (2020Q1–2022Q2) index is 27.3% higher. The EU–27 encountered the challenge of a significant increase in service prices, despite having lower total unemployment (–2.3%) and higher wage and salary growth (7.6%). This was accompanied by lower productivity, as measured by a –16.5% decrease in gross value added per employee, and a growing trend in actual individual consumption. Following the intermediate importance factors, lower investments and turnover per person employed are typical for high-service HICP countries. The lower intra-EU and extra-EU debit-to-credit ratios of services in the balance of payments indicate that inflation is typical for more service-exporting countries. Inflation is driven by the relatively high growth in money supply due to loans of credit institutions and increasing final consumption expenditures of households. The least important factors (the bottom sector of Table 6) also showed the differences between the EU–27. In electricity-importing countries with higher levels of business activity and profitability, there was higher price growth in the service industry. Interestingly, despite this, the energy price growth in these countries remained relatively lower. The more significant decline in employment during the beginning of the COVID–19 pandemic was also in the group of high inflation countries.

The classification and regression tree (CRT) was developed to classify the EU–27 countries into three service HICP groups based on the Table 2 classes (Figure 15). The classification accuracy is 100%.

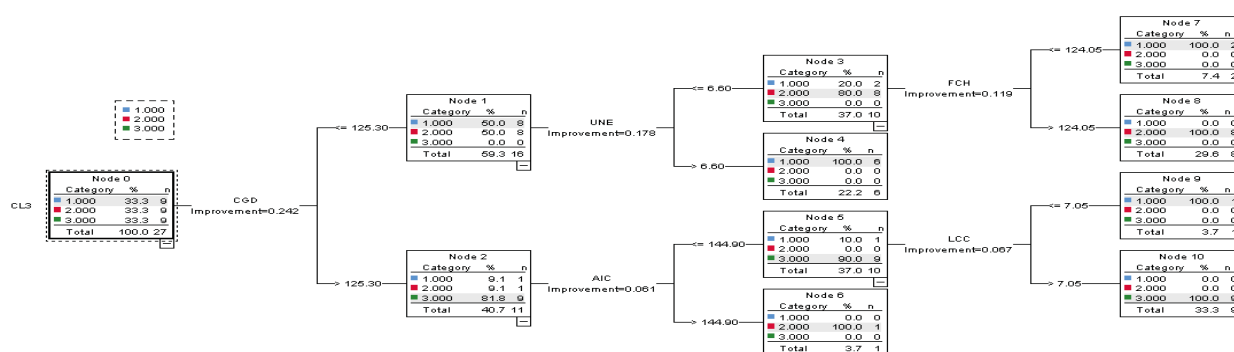


Figure 15. Classification and regression tree for the prediction of service HICP class

Source: author’s calculations based on Eurostat 2022b.

When classifying the EU–27 countries into three service HICP groups, the first criterion is the general government consolidated gross debt index. During the COVID–19 pandemic period from 2020Q1 to 2022Q2, none of the countries with the highest service HICP growth had an indicator equal to or lower than 125.3%. In 2022M09, the EU–27 countries in group 3 of Figure 15 demonstrated the highest service HICP growth. This was attributed to their labour costs in the whole economy growing by more than 7.05% during the COVID–19 pandemic period from 2021Q2 to 2022Q2, in addition to their actu-

al individual consumption being equal to or lower than 144.9% during the same period, exceeding this threshold. The least service HICP growth (group 1 in Figure 15) was observed in countries with a general government consolidated gross debt index lower than or equal to 125.3% and an unemployment rate higher than 6.6% in 2022M09. If unemployment was lower than or equal to this value, countries with the index of final consumption expenditures of households lower than or equal to 124.05% in 2020Q2–2022Q2 also avoided the intermediate or highest service HICP growth.

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## Conclusion

The results of the analysis of post-pandemic inflationary processes have shown that they were typical for the overall EU service industry. Italy had the lowest inflation in service prices, while Lithuania had the highest. The other countries with the highest average monthly growth rates of service prices were Poland, Czechia, Hungary, and Estonia. Additionally, the spectral analysis of this research revealed the typical seasonality of service price fluctuations within a year in Malta, Germany, Cyprus, and the Netherlands.

The comparative analysis revealed that Luxembourg, Romania, and Bulgaria had the highest service turnover growth and the lowest service inflation. Thus, the consumers in these countries experienced the highest growth of purchasing power considering the proportions of service HICP and turnover increase in service enterprises. Similarly, Hungary, Lithuania, and Poland also had the highest service turnover growth; however, the prices of services in these countries were significantly higher. Czech and Slovak consumers suffered from the smallest growth in service purchasing power.

According to the cost structure and profitability analysis, because the service industry mainly has an intangible character, labour expenses, energy, and productivity significantly impact service prices. In addition, after the COVID–19 pandemic restrictive measures were lifted, Europe faced a new economic problem related to electricity price volatility and the rapid price growth of other energy resources, which undoubtedly increased service prices. The profitability of the service industry is higher than in manufacturing, making it possible to set higher profit margins and absorb the cost growth in energy and labour markets.

The COVID–19 pandemic period and global economic lockdown triggered the sudden growth of public and private indebtedness in the EU. The empirical findings on the interrelation between government finance and service prices indicated that the leaders in terms of public debt growth were Estonia, Czechia, Romania, and Lithuania. The aggregated loan portfolio of credit institutions mostly grew in Slovakia, Ireland, and Belgium. The sudden increase in money supply in the financial system could not



keep inflation low. The prices of services began to climb rapidly in 2022. These inflationary trends in the EU economies were caused by extremely low central bank interest rates until 2022, which stimulated borrowing and generated surplus aggregated demand in the EU-27.

The detailed spectral analysis that modelled the dependencies between 18 economic factors and the HICP of services identified the main common factors of high service HICP values. A relatively higher increase in service prices is typical in countries with high wage growth in the service industry, labour costs in the whole economy, and general government consolidated gross debt. These countries are net extra-EU and intra-EU exporters of services with lower turnover per person employed, with the HICP of electricity, gas, and other fuels more than 200%. The stagnating or declining employment in the overall economy during COVID-19 and low investments per person employed were typical. During the post-pandemic recovery, high service price growth countries exhibited a combination of low gross value added per employee, higher enterprise gross operating surplus, a growing number of enterprises, and an increased unemployment rate. In addition, the univariate Fisher's ANOVA ranking indicated that the factors with the highest impact on service inflation were the labour cost in the whole economy, general government consolidated gross debt, unemployment rate, wages and salaries in the service industry, gross value added per employee, and actual individual consumption. The developed classification and regression tree confirmed that it is possible to classify the EU-27 countries correctly according to the analysed macroeconomic factors that impact service prices.

Reacting to growing inflation, most central banks of non-euro countries began to raise their interest rates in the second half-year of 2021. The European Central Bank followed in the summer of 2022 and also started to increase the interest rates to reduce the price shock in the product and service markets of the euro area. The increase in the price level of money is expected to lead to a reduction in the money supply from 2023, which may result in decreased demand for services and increased competition among service providers. The increased competition should reduce prices because the profitability of the service industry is very high (in some sub-sectors exceeding 40%). The increasing of prices based on the profit maximisation principle of service enterprises will be restricted due to declining demand, and it will positively affect customers' purchasing power without the risk of bankrupting service enterprises. An increased demonstration of customer market power is also necessary to reduce the detrimental inflationary processes that have been observed since 2022 in the EU. The prolonged inflation reflects the surplus demand; therefore, customers' attitudes should be changed, promoting more reasonable consumption. The growing deposit interest rates should stimulate savings after the sudden injections of borrowed money into the financial systems during the COVID-19 pandemic. Central banks, governments, and individuals should target inflation and limit the decline of the purchasing power of money. A reasonably slowed turnover of money should reduce the economic imbalances between supply and demand, leading to a decline in inflation.

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## **Ekonomiczne czynniki wzrostu cen konsumpcyjnych w sektorze usługowym w UE–27 w okresie postpandemicznym**

Okres postpandemiczny w Unii Europejskiej wyróżnia się wzrostem aktywności gospodarczej przedsiębiorstw po dwóch latach obostrzeń, wzrostu zadłużenia i podaży pieniądza oraz niezwykle wysokiej inflacji. W niniejszym badaniu przedstawiono wyniki analizy zharmonizowanego wskaźnika cen konsumpcyjnych (HICP) w sektorach usługowych w UE–27, porównując go z ogólnym poziomem inflacji i wzrostem cen na rynkach dóbr konsumpcyjnych. Wskazano również czynniki ekonomiczne, które przyczyniają się do występowania różnic między poziomami wzrostu cen usług w krajach UE–27. Wyniki umożliwiają klasyfikację krajów UE–27 ze względu na różnice w zmianach cen usług. Wskazano ustalone wzorce HICP usług i uszeregowano czynniki ekonomiczne, biorąc pod uwagę ich względne znaczenie dla HICP usług. Od 2022 roku powszechne stały się publiczne i rządowe dyskusje dotyczące postpandemicznego szoku inflacyjnego, niniejsze badania pozwalają zatem zrozumieć czynniki ekonomiczne, które spowodowały tak ogromną inflację i uzasadniają potrzebę zastosowania środków polityki pieniężnej w celu spowolnienia inflacji.

**Słowa kluczowe:** ekonomia, inflacja, ceny konsumpcyjne, usługi