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# House Price Index and Economic Outlook in Europe: capture trends and patterns (2021-2023)

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# 1. Introduction and the framing of literature

The Housing Price Index (HPI) "*measures the price changes of all residential properties purchased by households (flats, detached houses, terraced houses, etc.), both newly built and existing, independently of their final use and independently of their previous owners*" (Eurostat, 2024).

This analysis aims to unveil and explain the dynamics of the HPI variable, considering its behavior and the other pertinent variables Eurostat considers.

The HPI is a crucial indicator in the economic outlook as it measures inflation in the residential property market, especially in repeat sales (Melser, 2023:625).

# 1. Introduction and the framing of literature

- The study covers the three years from 2021 to 2023 to capture trends and patterns, with quarterly values.

- Considering this period, in the fourth quarter of 2023, house prices, as measured by the HPI, decreased by 1.1% in the euro area but increased by 0.2% in the EU compared to the same quarter of the previous year.

- It covers 27 countries in the European Union (EU) and other European countries.

# 1. Introduction and the framing of literature

- The eight explanatory variables considered are those quarterly published by the Eurostat Database (2024) (https://ec.europa.eu/eurostat/web/main/home):

  - Construction Index (CI);
  - Final Consumption Aggregates (FCA);
  - Labour Cost Index (LCI);
  - Gross Domestic Product (GDP);
  - Housing Cost Overburden Rate (HCOR);
  - Official Activity Rate (OAR);
  - Rented Dwellings (RD), and
  - Official Benchmark Interest Rates (OBIR).

# 2. The overcrowding problem

- The house must provide a safe environment, with hygienic and comfortable conditions, suitable for the residents' uses and that motivates satisfaction through its "*use value*" (Chung & Carpenter, 2022).

- It is generally accepted by literature that for a house to provide aptness for use, it must contain spaces with area, dimensions, and equipment that allow the development of domestic functions, as well as tolerate convenient access to the spaces that constitute it, even in a digital word (Martella & Aman y Alcocer, 2024).

- The quality of housing, whether flats or single-family houses, varies greatly between the countries of the EU (European Commission, 2021).

# 2. The overcrowding problem

- The overcrowding problem may illustrate the challenges of applying uniform standards in a diverse, evolving multi-ethnic society and public health (e.g., Ramonet & Genest, 2023; Errazuriz, 2019; Myers et al., 2007).

- In the EU in 2022, 16.8% of the population lived in such conditions, down from 19.1% in 2010.

- The highest overcrowding rates in 2022 were observed in Latvia (41.7%), Romania (40.5%), and Bulgaria (36.2%), while the lowest rates were in Cyprus (2.2%), Malta (2.8%), and the Netherlands (2.9%) (Eurostat, 2023).

# 2. The overcrowding problem

- These fluctuations are a serious problem for humans and therefore from a social point of view.
- Without decent housing, the citizenry suffers.
- Citizenship beyond the nation-state always has new perspectives on governance congregations involving state and non-state actors.
- Therefore, society!

# 3. Methodology

The analysis of the HPI data was conducted using R software (2024; 2008).

The modeling technique that was employed was:

- GAM (Generalized Additive Models) follows a code tutorial based on the stats model's documentation (James et al., 2021).

- GAM is a flexible extension of the linear model that allows for including smooth, non-parametric functions of the predictors.

This approach is beneficial when the relationship between the variables is not strictly linear, allowing the model to adapt to more complex patterns in the data.

# 4. Discussion of Results

- In Table 1 it is possible to see that for the HPI variable, the minimum and maximum values vary considerably between quarters, indicating a large variation in the indicators over time.

- Descriptive statistics show a broad distribution of values in each quarter, with an average that tends to increase over time. Some values are significantly higher than the top quartiles in some quarters, indicating the presence of outliers.

# Table 1 - Housing Price Index: minimum and maximum values between quarters

| Quarter | Min. | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
|---|---|---|---|---|---|---|
| ***2021_Q1*** | -5.800 | 3.950 | 6.900 | 7.453 | 9.750 | 32.000 |
| ***2021_Q2*** | -4.800 | 5.525 | 9.600 | 9.480 | 12.475 | 29.200 |
| ***2021_Q3*** | 2.500 | 7.225 | 10.900 | 11.333 | 13.125 | 35.600 |
| ***2021_Q4*** | -5.20 | 7.00 | 11.25 | 12.87 | 15.78 | 59.80 |
| ***2022_Q1*** | 1.10 | 7.00 | 12.25 | 15.30 | 17.30 | 110.00 |
| ***2022_Q2*** | 2.00 | 7.20 | 12.80 | 17.26 | 16.52 | 160.70 |
| ***2022_Q3*** | -2.10 | 6.15 | 11.95 | 16.63 | 15.10 | 189.00 |
| ***2022_Q4*** | -6.40 | 4.70 | 6.35 | 12.65 | 11.53 | 167.80 |
| ***2023_Q1*** | -7.900 | 0.925 | 4.850 | 8.450 | 8.775 | 132.900 |
| ***2023_Q2*** | -9.600 | -2.575 | 2.550 | 5.160 | 6.650 | 95.900 |
| ***2023_Q3*** | -13.900 | -3.075 | 1.550 | 3.917 | 4.750 | 89.200 |
| ***2023_Q4*** | -14.400 | -0.725 | 2.850 | 4.600 | 5.700 | 75.500 |

# Table 2 - The Construction Index (CI) variable

| Country | Time Function | Country | Time Function |
|---|---|---|---|
| **Belgium** | Y = 100 + f(Quarter) | **Malta** | Y = 98 + f(Quarter) |
| **Bulgaria** | Y = 100 + f(Quarter) | **Netherlands** | Y = 107 + f(Quarter) |
| **Czechia** | Y = 105 + f(Quarter) | **Austria** | Y = 100 + f(Quarter) |
| **Denmark** | Y = 98 + f(Quarter) | **Poland** | Y = 105 + f(Quarter) |
| **Germany** | Y = 102 + f(Quarter) | **Portugal** | Y = 94 + f(Quarter) |
| **Estonia** | Y = 103 + f(Quarter) | **Romania** | Y = 102 + f(Quarter) |
| **Ireland** | Y = 98 + f(Quarter) | **Slovenia** | Y = 92 + f(Quarter) |
| **Greece** | Y = 102 + f(Quarter) | **Slovakia** | Y = 102 + f(Quarter) |
| **Spain** | Y = 102 + f(Quarter) | **Finland** | Y = 108 + f(Quarter) |
| **France** | Y = 103 + f(Quarter) | **Sweden** | Y = 103 + f(Quarter) |
| **Croatia** | Y = 99 + f(Quarter) | **Norway** | Y = 115 + f(Quarter) |
| **Italy** | Y = 101 + f(Quarter) | **Switzerland** | Y = 96 + f(Quarter) |
| **Cyprus** | Y = 97 + f(Quarter) | **Bosnia and Herzegovina** | Y = 88 + f(Quarter) |
| **Latvia** | Y = 121 + f(Quarter) | **Montenegro** | Y = 124 + f(Quarter) |
| **Lithuania** | Y = 99 + f(Quarter) | **North Macedonia** | Y = 97 + f(Quarter) |
| **Luxembourg** | Y = 100 + f(Quarter) | **Albania** | Y = 98 + f(Quarter) |
| **Hungary** | Y = 117 + f(Quarter) | **Serbia** | Y = 96 + f(Quarter) |

# Table 3 - The Final Consumption Aggregate (FCA) variable

| Quarter | Min. | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
|---|---|---|---|---|---|---|
| *2021_Q1* | 1536 | 7875 | 29773 | 59094 | 55614 | 403002 |
| *2021_Q2* | 1550 | 8276 | 30486 | 61599 | 57054 | 419296 |
| *2021_Q3* | 1695 | 8547 | 31221 | 64962 | 58870 | 439956 |
| *2021_Q4* | 1822 | 8863 | 31746 | 66348 | 60893 | 445322 |
| *2022_Q1* | 1898 | 9338 | 31837 | 67815 | 61133 | 453712 |
| *2022_Q2* | 2072 | 9763 | 32963 | 70122 | 63037 | 462272 |
| *2022_Q3* | 2161 | 10215 | 33466 | 71942 | 63966 | 475576 |
| *2022_Q4* | 2201 | 10555 | 33769 | 73302 | 64559 | 483093 |
| *2023_Q1* | 2297 | 10690 | 35013 | 74402 | 65418 | 487913 |
| *2023_Q2* | 2376 | 10749 | 35311 | 75280 | 65748 | 493383 |
| *2023_Q3* | 2453 | 11015 | 34688 | 75998 | 66434 | 496005 |
| *2023_Q4* | 2513 | 11265 | 34995 | 76845 | 67000 | 501901 |

# Table 4 - The Labour Cost Index (LCI) variable

| |
|---|
| Business Economy |
| Industry, construction, and services (except activities of households as employers and extra-territorial organizations and bodies) |
| Mining and quarrying |
| Manufacturing |
| Electricity, gas, steam, and air conditioning supply |
| Water supply; sewerage, waste management, and remediation activities |
| Services of the business economy |
| Wholesale and retail trade; transport; accommodation and food service activities; information and communication |
| Financial and insurance activities; real estate activities; professional, scientific, and technical activities; administrative and support service activities |
| Public administration and defense; compulsory social security; education; human health and social work activities; arts, entertainment, and recreation; other service activities |

# The GDP variations over quarters

- GDP exhibits variations over quarters, usually showing a drop from the last quarter of the year (Q4) to the first quarter of the following year (Q1).

- A linear regression model was used where the dependent variable is GDP in the fourth quarter of 2023 (Q4_2023) and the independent variable is GDP in the first quarter of 2022 (Q1_2022).

- ***The results reveal that for every increase of one unit in Q1_2022, Q4_2023 increases by approximately 1.1117 units.***

# The Variable Housing Cost Overburden Percentage (HCOP)

- The linear regression model for the variable Housing Cost Overburden Percentage (HCOP) was adjusted to analyze the housing cost overburden in different countries and years. The mathematical expression of the model is:

- $HousingCostOverburdenPercentage = \beta 0 + \beta 1 \times CountryBulgaria + \beta 2 \times CountryNetherlands + CountrySpain\ldots + \beta n-1 \times Year2022 + \beta n \times Year2023$

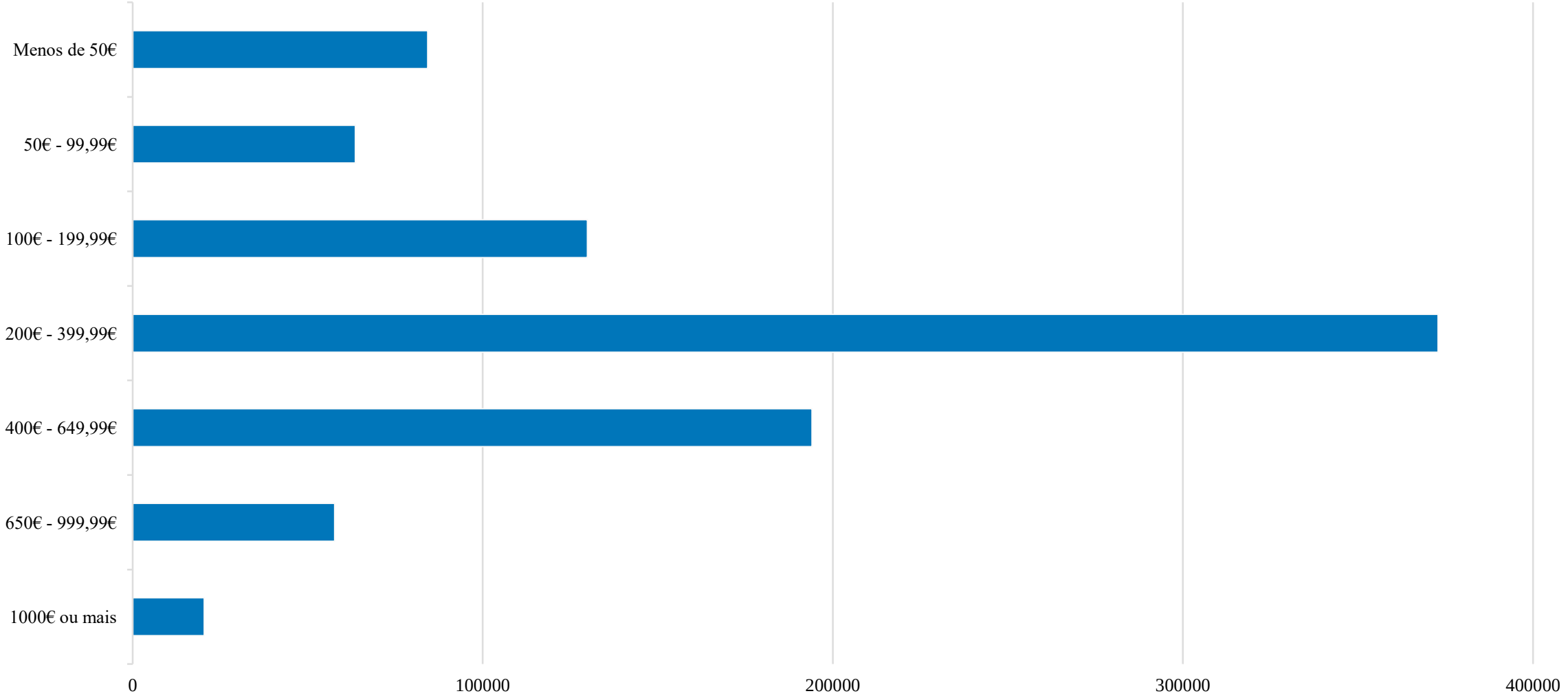
- In this equation, HCOP represents the predicted percentage of housing cost overburden.

- For instance, ***for 2022, the model predicts a 0.27% reduction in housing cost overburden compared to the previous year (2021)***.

# Table 5 - Most countries' change in Activity Rate (2021-2022)

| Country | 2021 (%) | 2022 (%) | Change (%) |
|---|---|---|---|
| *DE - Germany* | 60.0 | 61.0 | +1.0 |
| *AT - Austria* | 60.0 | 60.3 | +0.3 |
| *BE - Belgium* | 54.0 | 54.2 | +0.2 |
| *BG - Bulgaria* | 55.0 | 54.0 | -1.0 |
| *CY - Cyprus* | 62.0 | 63.1 | +1.1 |
| *HR - Croatia* | 54.0 | 56.0 | +2.0 |
| *DK - Denmark* | 62.0 | 63.2 | +1.2 |
| *SK - Slovakia* | 60.0 | 60.9 | +0.9 |
| *SI - Slovenia* | 57.0 | 57.3 | +0.3 |
| *ES - Spain* | 57.0 | 57.4 | +0.4 |
| *EE - Estonia* | 63.0 | 63.9 | +0.9 |
| *FI - Finland* | 60.0 | 60.1 | +0.1 |
| *FR - France* | 54.0 | 54.4 | +0.4 |
| *GR - Greece* | 51.0 | 52.0 | +1.0 |
| *HU - Hungary* | 58.0 | 59.0 | +1.0 |
| *IE - Ireland* | 64.0 | 65.3 | +1.3 |
| *IT - Italy* | 48.0 | 48.7 | +0.7 |
| *LV - Latvia* | 59.0 | 60.6 | +1.6 |
| *LT - Lithuania* | 62.0 | 62.7 | +0.7 |
| *LU - Luxembourg* | 60.0 | 59.5 | -0.5 |
| *MT - Malta* | 62.0 | 63.7 | +1.7 |
| *NL - Netherlands* | 65.0 | 66.3 | +1.3 |
| *PL - Poland* | 56.0 | 57.0 | +1.0 |
| *PT - Portugal* | 57.0 | 57.0 | 0.0 |
| *CZ - Czech Republic* | 61.0 | 59.1 | -1.9 |
| *RO - Romania* | 51.0 | 51.8 | +0.8 |
| *SE - Sweden* | 65.0 | 65.6 | +0.6 |
| *IS - Iceland* | 69.0 | 70.1 | +1.1 |
| *NO - Norway* | 65.0 | 65.1 | +0.1 |
| *UK - United Kingdom* | x0 | x0 | - |
| *CH - Switzerland* | 67.0 | 66.1 | -0.9 |

# Figure 1 - Number of Accommodations or Rented Dwellings (RD)



# Table 6 - The Official Benchmark Interest Rates (OBIR)

- The Official Benchmark Interest Rates (OBIR), is measured by the Marginal Lending Facility Rate (MLFR).
- The MLFR is the interest rate banks pay when borrowing overnight from the European Central Bank (ECB) (Table 6).
- To secure this borrowing, banks must provide collateral, such as securities, to guarantee repayment (ECB, 2018).
- ***This progressive growth indicates the central bank's tightening of monetary policy***.

| Period | Marginal Lending Facility |
|---|---|
| *2023-09-20* | 4.75 |
| *2023-08-02* | 4.50 |
| *2023-06-21* | 4.25 |
| *2023-05-10* | 4.00 |
| *2023-03-22* | 3.75 |
| *2023-02-08* | 3.25 |
| *2022-12-21* | 2.75 |
| *2022-11-02* | 2.25 |
| *2022-09-14* | 1.50 |
| *2022-07-27* | 0.75 |

# 5. Conclusions

- The HPI is a crucial metric for understanding trends and fluctuations in the housing market and rentals (2021-2023).

- We realized there has been a variation over time, exhibited by the variations in its maximum and minimum values, and this amplitude suggests a volatile dynamic in the market.

- Equations for the CI show that the variation exhibited in the HPI also exists in this variable with the fluctuations captured by the smoothing function, showing that changes in construction activity can directly influence the price of housing.

- FCA shows that households have been spending more than may be due to the increase in the cost of living.

# 5. Conclusions

- The values recorded for GDP and its variation show the same pattern as in the HPI, demonstrating that there is a relationship between both variables.

- The Housing Cost Overburden shows that there is a lot of variability among countries over these years.

- However, these discrepancies may be dependent on the variability of the housing market as well as the current economic situation.

- In short, following the methodology used, ***the relationship between the HPI and the 8 economic variables considered is complex and multifaceted***.

# Bedankt