Is the ECB's monetary policy doomed to overshoot? Consequences of omitting owner-occupied housing from the $HICP$

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Abstract

The European Union has been debating for over 20 years how to bring owner occupied housing (OOH) into the Harmonized Index of Consumer Prices ($HICP$) – the flagship measure of inflation used by the European Central Bank (ECB) to set monetary policy. We provide a solution to this problem based on a smoothed version of the user-cost method that has desirable properties and does not destabilize the $HICP$. We then show how our extended $HICP$ would have helped the ECB better anticipate shocks such as the 2022 inflation by causing measured inflation to rise above the 2% target sooner. Also, our measure aligns better with the inflation experienced by households. (*JEL Codes: C31; C43; E01; E31; E52; R31*)

Keywords: Inflation measurement; Owner-occupied housing; Harmonized Index of Consumer Prices ($HICP$); Housing booms and busts; Inflation targeting; Leaning against the wind

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1 Introduction

Owner occupied housing (OOH) is one of the most important and complex elements of a consumer price index (CPI). While most countries include OOH in their official CPIs, one notable exception is the European Union (EU). Since the euro's inception in 1999, OOH has been omitted from the Harmonized Index of Consumer Prices (HICP) -– the flagship CPI of the EU which is used by the European Central Bank (ECB) in its inflation target.[1]

In this article, we show how OOH could be included in the HICP using a version of the user-cost method that has desirable properties and does not destabilize the HICP. We then consider how monetary policy in the euro area (EA) could have been different if it had been informed by a measure of inflation that takes OOH into account.[2]

The omission of OOH from the HICP creates three main problems. First, the share of households that are owner occupiers varies significantly across euro area countries. In particular, the share is smaller for some richer countries, e.g., Germany (49%), Austria (54%) and France (65%), and higher for eastern European countries, most notably Slovakia (93%), Croatia (91%) and Lithuania (90%).[3] Given that rents paid are included in the HICP, it follows that country weights, and therefore also monetary policy, are currently tilted towards richer countries with larger rental markets.[4]

The second problem is that, to the extent that OOH behaves differently from other consumer prices, the $HICP$ may fail to reflect the perceived inflation experience of residents. For both these reasons, measured inflation may become misaligned with market conditions and public perceptions, which could undermine the credibility of the $HICP$ and distort monetary policy.

[1] This was not by design. Eurostat has been exploring how to bring OOH into the HICP since 2000 (European Commission, 2018).

[2] We focus on the composition of the euro area as of 2022 and we hold this composition constant throughout our analysis. Croatia adopted the euro as of 1 January 2023. Before that, the last member states joining the euro area were Slovenia in 2007, Cyprus in 2008, Malta in 2008, Slovakia in 2009, Estonia in 2011, Latvia in 2014 and Lithuania in 2015. Our definition of the EA thus includes Belgium (BE), Germany (DE), Estonia (EE), Ireland (IE), Greece (EL), Spain (ES), France (FR), Italy (IT), Cyprus (CY), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), The Netherlands (NL), Austria (AT), Portugal (PT), Slovenia (SI), Slovakia (SK) and Finland (FI).

[3] These numbers refer to the year 2021, see https://ec.europa.eu/eurostat/cache/digpub/housing/bloc-1a.html?lang=en (accessed on November 11, 2023)

[4] While the treatment of rents is less controversial, there is an ongoing debate over whether the focus should be on continuing or new rental contracts. New rents are more responsive to current market conditions than continuing rents. Some authors thus argue strongly in favor of focusing on new rents in a CPI (Ambrose et al., 2015, 2018; Adams et al., 2024). Nevertheless, most countries focus on continuing rents in their CPIs.

The third problem concerns timeliness. A number of recent studies have found that house prices are often a leading indicator of the broader market trend (Leamer, 2007; Hadi, 2011; Kydland et al., 2016; Huang et al., 2020). Hence, a CPI that includes OOH may provide more timely signals of current market trends, allowing a central bank to intervene sooner – and by that potentially with less extreme interventions – to smooth out booms and busts.

The three main methods for including OOH in a CPI are the net acquisitions, rental equivalence and user cost methods (Diewert, 2002, 2009; Hill et al., 2025). Eurostat (the statistical office of the EU) and the ECB have focused their attention thus far mainly on the net acquisitions method, although without reaching a resolution (European Commission, 2018; Eiglsperger et al., 2024). In this article, we focus on the third of the three main methods, the user cost approach. While there are some potential problems associated with this approach, we show how each of these can be resolved and argue that the resulting HICP would help the ECB better maintain both price stability and financial stability in the euro area.

Our empirical findings, which cover the period from 2007 to 2022, support these arguments. The impact of including OOH is strongest in 2007 and 2022, coinciding with the peaks of housing booms in several EU member states.

The topics addressed in this article relate to a number of current debates in the macro/monetary literature. First, the global financial crisis (GFC) demonstrated that price stability does not by itself guarantee financial stability. Asset markets can experience unsustainable booms while, at the same time, inflation is low and stable (as happened in Japan in the 1980s and in the US leading up to 2006). There is an ongoing debate in the literature over whether asset market booms can be dealt with by macroprudential regulations alone, or whether monetary policy is sometimes also needed (Cecchetti, 2006; Mishkin, 2011; Vollmer, 2021; Chen and Phelan, 2023). To the extent that the asset market in question is housing, our findings are relevant to this debate.

A second debate is over how monetary policy could be used to intervene in asset markets. One strand of the literature has explored how asset prices could be added to a Taylor rule (Chadha et al., 2004; Bofinger et al., 2013). Another strand considers how a broader measure of inflation could be constructed that combines goods and services with assets (Alchian and Klein, 1973; Goodhart, 2001). Neither approach has gained much traction in practice. With regard to housing, a more fruitful direction is to focus on how OOH is included in a CPI.

A third debate focuses on "leaning against the wind." This refers to a situation

where an inflation-targeting central bank sometimes raises interest rates to lean on asset market booms. Some prominent economists (Bernanke and Gertler, 2001; Gali, 2014; Svensson, 2017) have argued strongly against this, saying that it interferes with the goal of achieving price stability by undermining the coherence of inflation targeting, potentially causing damage to the economy. Others disagree: Gourio et al. (2018) and Miao et al. (2019) question the way these authors model asset market booms, while Jordà et al. (2015), Richter et al. (2021) and Mian and Sufi (2022) argue that housing booms are almost always credit-driven and hence more likely to end in a systemic banking crisis. This potentially strengthens the case for leaning against housing booms.

A key insight of this article is that the inclusion of OOH in a CPI, when done in the right way, can make some of these debates moot. There would be less need to include housing in the Taylor rule or broaden the measure of inflation or to explicitly lean against the wind, since when house prices rise, this would already be factored into the CPI. During a housing boom, measured inflation would rise, which would trigger an immediate response from an inflation-targeting central bank.

A fourth debate relates to the *way* OOH should be included in a CPI. As noted above, attention at Eurostat and the ECB has thus far focused primarily on the net-acquisitions method. The only countries currently using versions of the user-cost method – our preferred method – are Canada, Iceland and Sweden. We propose a version of the user-cost method that we argue is preferable to both the main alternatives – net-acquisitions and rental-equivalence – for use in the HICP.

The remainder of this paper is structured as follows. Section 2 explains why excluding OOH from the HICP is a problem. Section 3 explains the different ways of including OOH in the HICP and evaluates each method according to a series of criteria. Section 4 explains the particular version of the user-cost method that we then apply to euro area data. The impact and consequences of including OOH in the HICP is explored in Section 5. Finally, Section 6 concludes.

2 Why Excluding OOH from the HICP is a Problem

2.1 The Asymmetric Treatment of Housing Costs in the HICP

Figure 1a illustrates how the share of owner-occupiers varies considerably across euro-area countries: while in some countries almost half of all households rent, in others, almost all are owner-occupiers. At present, however, rents paid are included in the

$HICP$, while costs incurred by owner-occupiers are disregarded, leading to an imbalance in the weights for total housing costs in the $HICP$. Consequently, any monetary policy based on the $HICP$ will be relatively biased towards countries with a higher rental share. As indicated in Figure 1a, this implies that changes in housing costs in Germany and Austria receive larger weights relative to their GDP shares than changes in housing costs in Eastern and Southern European countries. This is particularly problematic, as the share of owner-occupiers in a country seems to be negatively correlated with GDP per capita (see also Figure 1a).

2.2 Divergence in Rent and Price Developments

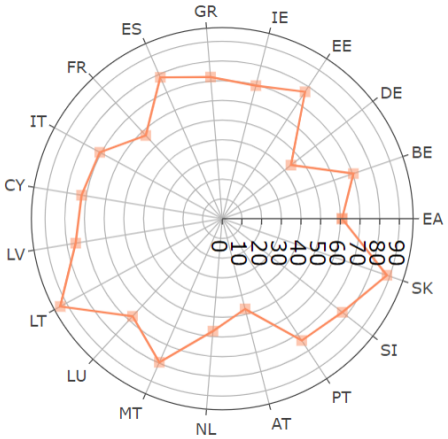
Another dimension of misalignment is that trends in prices and rents often diverge over the housing cycle. This misalignment is particularly striking for continuing rental contracts, which tend to be quite sticky. For example, the Owner Equivalent Rent index in the US does not at all follow the boom and bust in US house prices between 2000 and 2012, as shown in Figure 1b.

Misalignments also arise between prices and new rental contracts. In other words, even when harmonizing the measurement concept by evaluating both costs at current market prices they are no valid substitutes. In particular, a decrease in the user-cost of owner-occupying tends to lead to an increased spread between prices and rents. Such a situation can be triggered by falling interest rates, a decreasing risk premium of owning, or by increases in expected real capital gains or expected inflation (Amaral et al., 2024; Hill et al., 2025). Figure 1c shows that trends in prices and new rental contracts in the UK were quite different over the 2015-2024 period, particularly during the COVID-19 pandemic.[6] This indicates that the quality of measurement of OOH costs would vary over the business cycle when relying on rental equivalence approaches.

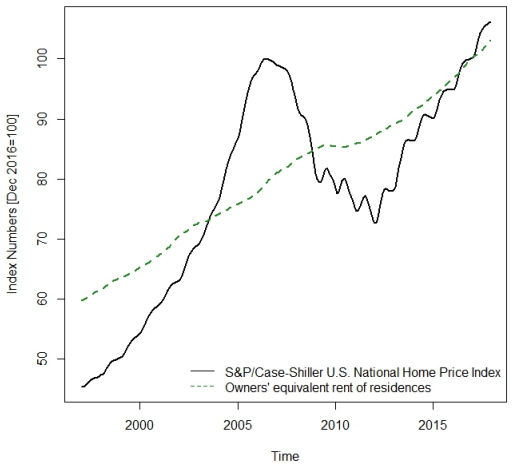
These observations fundamentally question the substitutability between OOH costs and both continuing and new rents. This seems to be particularly violated during times of crisis. This divergence directly undermines the empirical validity of using rents as a

[6]Calculating a Pearson correlation coefficient over the entire period (January 2016 to December 2023) yields $\rho = -0.148$ with a 95% confidence interval of $(-0.338; 0.0545)$. Thus, numerically there is no correlation at all. This result is driven by the strong misalignment towards the end of the period: splitting the series into a pre-COVID19 (January 2016 to February 2020) and a post-COVID19 (March 2020 to December 2023) period yields the Pearson correlations $\rho_{pre} = 0.799$ and $\rho_{post} = -0.528$, respectively. Both coefficients are significantly different from zero at the 5% level. This means there is at least some co-movement during the pre-COVID19 period, but opposing trends in price and rent developments thereafter. A similar lack of cointegration between price and rent developments was illustrated by Gallin (2006).

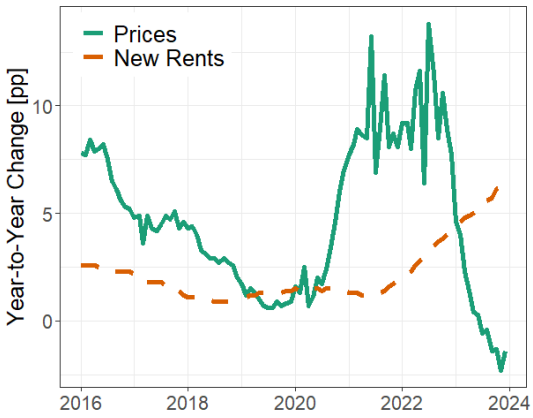
Figure 1: Misalignments Supporting the Inclusion of OOH in the *HICP*



(a) Share of Owner-Occupiers



(b) Prices and OER (US)



(c) Prices and New Rents (UK)

Note: Figure 1a shows the shares [%] of owner-occupiers per country and the euro area as a whole. The shares are computed from weighted Household Finance and Consumption Survey (HFCS) data and averaged over all existing survey years between 2010 and 2021.[5] Figure 1b contrasts Owners Equivalent Rent and CoreLogic SPCS indexes for the US. Figure 1c shows the Index of Private Housing Rental Prices (percentage change over 12 months) and Annual House Price Rates of Change for All Dwellings for the UK.

Source: ECB, Office of National Statistics.

proxy for OOH costs.

2.3 Loss of Credibility

The difference between official and perceived inflation is another reason why the exclusion of OOH from the HICP is of concern for the ECB. This view is voiced by Yves Mersch, a member of the Executive Board of the ECB:

> "At present, owner-occupied housing costs are not included in the Harmonised Index of Consumer Prices (HICP). [$\cdots$] There are a number of technical explanations for this exclusion, but it is clear that households view the cost of housing as an important part of their lifetime expenditure. [$\cdots$] So there may be a significant gap between what households perceive to be the increase in their cost of living and what is measured by the HICP. The gap between perceptions and official measures of inflation can complicate the communication of policy decisions. If households believe that inflation is rampant then they will see little justification for unconventional measures, in particular negative interest rates." (Mersch, 2020)

This view is also reiterated by stated concerns of consumers across OECD countries as reveled by the *Gallup World Poll*:[7] discontent over housing affordability in OECD countries has been a major source of discontent – particularly driven by responses of younger people (Bolhuis et al., 2022).

It is therefore important that OOH is brought into the HICP in a way that is perceived as legitimate by users. And it seems that users' inflation perceptions are indeed sensitive to changes in house prices as discussed in subsection 5.3.

2.4 The Link Between Price Stability and Financial Stability

Since the GFC, there has been a growing recognition that price stability does not guarantee financial stability. Central banks need to focus on more than inflation targeting alone. To ensure the stability of the financial system, they sometimes need to intervene with prudential regulations or interest rate changes to manage asset market booms/bubbles. In some situations, the two objectives of price stability and financial stability pull in

[7] See https://www.ft.com/content/f206f6f1-1536-4b29-ad8d-2421fadfc64b, last accessed in December 2024.

opposite directions. This can happen during periods of secular stagnation, such as between the end of the euro-area financial crisis and the start of the COVID-19 pandemic. Summers (2016) describes a secular stagnation environment as follows:

> "Real interest rates are very low, demand has been sluggish, and inflation is low, just as one would expect in the presence of excess saving. Absent many good new investment opportunities, savings have tended to flow into existing assets, causing asset price inflation." (Summers, 2016, p. 3)

In the aftermath of the euro-area financial crisis, the ECB pursued a very loose monetary policy to counter the effects of secular stagnation. However, the zero lower bound constraint forced the ECB to resort to unconventional measures as part of this strategy.

One possible response to secular stagnation and the zero lower bound constraint discussed during this period was to raise the inflation target to, say, 4 percent (Blanchard et al., 2010; Ball, 2013; Krugman, 2014). This proposal was met with strong resistance from central bankers and many macroeconomists, who argued that the distortions of 4 percent inflation would outweigh the benefits and that changing the target would undermine central bank credibility (Mishkin, 2011; Bernanke, 2016). Furthermore, if central banks were already struggling to reach 2 percent targets, adopting a 4 percent target risked further increasing the gap between target and reality.

The inclusion of OOH into the $HICP$ has the potential to mitigate the conflict between price and financial stability. Depending on how OOH is included, it could make measured inflation more sensitive to movements in house prices. For example, a sharp increase in house prices could, depending on the treatment of OOH, push up measured inflation and trigger an automatic rise in interest rates by an inflation-targeting central bank. In other words, in its pursuit of price stability, the central bank would automatically respond to housing market booms, thereby helping to maintain both price and financial stability.

3 The Challenge Presented by OOH

3.1 The Three Main Methods of Including OOH in a CPI

Three main approaches for including OOH in a CPI discussed in the literature are the net-acquisitions approach, the rental-equivalence approach and the user-cost method.[8] While the net-acquisitions approach focuses on the transaction prices that households pay for the acquisition of homes, the rental-equivalence and the user-cost methods both focus on the service flow provided by housing.

The net acquisitions approach is currently the preferred method of Eurostat and the ECB.[9] Australia and New Zealand use a version of net acquisitions in their CPIs (Hill et al., 2025). Net acquisitions attempts to treat OOH in the same way as consumer durables such as cars and refrigerators are treated in a CPI. This implies that only new-built properties and existing properties that are new to the residential sector are included in the HICP.[10]

The main reason why OOH based on the net acquisitions method has not been included in the HICP thus far is due to its use of a house price index as the main part of the OOH price index. Some National Statistical Institutes raised concerns that OOH thus measured therefore includes both consumption and an investment component (Whelan, 2021). This is problematic as the HICP is supposed to focus only on consumption.

The rental equivalence method measures the service flow of OOH using imputed rents derived by matching owner-occupied properties with equivalent rental properties. In practice, owner-occupied dwellings are usually not matched on a one-to-one basis, yet some imputation techniques are adopted to come up with a rental value – sometimes relying even on owners' estimated rental value. It is the most widely used method for including OOH in a CPI (Hill et al., 2025), and is currently used by the US, Japan, Denmark, Norway, Switzerland, Czech Republic, Mexico and South Africa (OECD, 2015). However, it is unlikely to be suitable for use in the euro area as a whole, as the rental markets in some eastern and southern member countries are too small and often strongly price-regulated to accurately match OOH properties with similar rental

[8] A fourth approach – the payments method – is sometimes also discussed, but we do not consider it here since it lacks sufficient theoretical foundations (Diewert, 2009).

[9] However, so far, no formal decision has been taken on whether to include OOH into the HICP based on the net-acquisitions method (European Commission, 2018; Eurostat, 2023).

[10] The overall OOH price index combines price indices for new housing, major renovations, maintenance and repair of dwellings, and property rates and charges, although the new housing component has by far the largest weight (Hill et al., 2025).

properties.[11, 12]

The user-cost method focuses on measuring the costs actually incurred by owner-occupiers (Diewert, 2003, 2009; Hill et al., 2025). The basic idea dates back at least to Keynes (1936) and was more fully developed by Jorgenson (1967). Its first applications were for measuring the cost of capital for macro modeling of production functions and investment behavior. The first applications of the method to housing were by Blinder (1980) and Poterba (1984). Versions of the user-cost method are used by Canada, Iceland and Sweden in their CPIs (Hill et al., 2025).

3.2 The Standard User-Cost Method

We believe the user-cost method deserves serious consideration for use in the HICP. here we outline the standard version of the user-cost method. In the next section we show how the method can be refined to make it suitable for use in the HICP.

The user-cost consists of the product of the current average market price of owner-occupied properties in period t and country c (denoted by $P_{c,t}$) and the per-euro user-cost (denoted by $u_{c,t}$). There are multiple versions of the per-euro user-cost formula (Poterba, 1984; Himmelberg et al., 2005; Diewert et al., 2009; Hill et al., 2025). The different formulations relate to approximation assumptions and whether mortgage interest payments are tax deductible. Here, we make use of the following formulation outlined in Diewert (2009), which ignores mortgage interest payment deductions[13]

$$u_{c,t} = (1 + r_{c,t}) + \omega_{c,t} - (1 - \delta_t)(1 + g^e_{c,t} + \pi^e_{c,t} - \gamma_{c,t}), \tag{1}$$

where $r_{c,t}$ is the nominal interest rate, δ_t is depreciation, $\omega_{c,t}$ is running- and average transaction costs (including taxes), $\gamma_{c,t}$ is the risk premium for owner-occupying rather than renting, $g^e_{c,t}$ is the expected real capital gain on housing and $\pi^e_{c,t}$ is the expected rate of inflation.

Some authors – such as Himmelberg et al. (2005) – use a simplified version of (1) which assumes $\delta_t(g^e_{c,t} + \pi^e_{c,t} - \gamma_{c,t}) = 0$. In this case, again ignoring mortgage interest deductions, the user cost formula reduces to $u_{c,t} = r_{c,t} + \delta_t + \omega_{c,t} + \gamma_{c,t} - g^e_{c,t} - \pi^e_{c,t}$.

[11] For example, in Slovakia, only 7.1% of households rent, and available rental accommodations differ from the typical owner-occupier properties in location, size, and quality.

[12] https://ec.europa.eu/eurostat/cache/digpub/housing/bloc-1a.html

[13] Unlike in the US, these deductions are (not any more) very relevant in Europe: Fatica and Prammer (2018) provide an overview of the status quo in 2017, ever since then several of these policies have been abolished or adapted (Vangeel et al., 2022). To simplify a multi-year and pan-European assessment, we leave out the impact of these policy changes.

Once the per-euro user cost formula ($u_{c,t}$) has been specified, OOH expenditure is then given by

$$\text{OOH expenditure}_{c,t} = u_{c,t} P_{c,t} \tag{2}$$

and the OOH price index by

$$\text{OOH price index} = \frac{u_{c,t} P_{c,t}}{u_{c,t-1} P_{c,t-1}}. \tag{3}$$

It is theoretically possible that u could equal zero or be negative during periods of high expected capital gains. We return to this issue in section 4.

While the user cost method is often framed within a rational expectations and no-arbitrage asset-pricing framework, our approach departs from this view. Empirical studies show that transaction costs, credit constraints, and differences in housing tenure choices prevent arbitrage in practice (see Duca et al., 2021, for further details and references). Moreover, observed price-to-rent ratios and expectations typically diverge from no-arbitrage predictions (see, e.g., Schreyer, 2009; Duca et al., 2016, and Figure 1c). Therefore, we use the user cost formula not as an equilibrium asset-pricing condition, but as a practical tool for measuring the actual costs faced by owner-occupiers—consistent with CPI measurement principles. This distinction is crucial because the asset-pricing framework assumes seamless substitution between owning and renting, which rarely holds—especially in Europe, where rental markets are heavily regulated while owner-occupied markets are not (Kholodilin, 2020). We thus focus on capturing owner-occupiers' real costs, rather than enforcing theoretical equivalence across tenure types. These choices inform both our formulation of the user-cost measure and the measurement strategies discussed in subsection 3.3 and section 4.

3.3 Criteria for Including OOH in the $HICP$

In our opinion, the debate over the relative merits of alternative ways of including OOH in the HICP rests on six main criteria.

C1: **The OOH price index should measure changes in OOH prices not changes in house prices.**

The $HICP$ is a *consumer* price index and hence should focus exclusively on measuring the inflation rate of consumer expenditure.

C2: **The inclusion of OOH should not substantially increase period-to-period volatility in the $HICP$.**

The main use of the $HICP$ is for monetary policy within the euro area. Hence, it is essential that noise distortions in the $HICP$ are kept to a minimum.

C3: **The inclusion of OOH should not cause an immediate rise in measured inflation when interest rates rise.**

The ECB sets interest rates to achieve its inflation target. It is problematic for the ECB if the immediate impact of a contractionary monetary policy (i.e., raising interest rates) is to increase inflation.

C4: **The inclusion of OOH should help the $HICP$ reflect the inflation experience of euro-area residents more accurately.**

C5: **The method used for including OOH in the $HICP$ should be implementable by all member countries.**

The criteria deserve some comments as no single method proposed fulfills all of them simultaneously.

The net-acquisitions method fails C1, while rental equivalence fails C5. The failure of C1 and C5, respectively, effectively rules them out as candidate methods for including OOH in the $HICP$. To the extent that rents diverge from prices, rental equivalence may also violate C4.

The user-cost method is generally perceived as failing C2 and C3. We will explain in section 4 how it can be modified to satisfy both these criteria.

4 A User-Cost Method Suitable for the $HICP$

4.1 A Smoothed User-Cost Method

The two main weaknesses of the traditional user-cost method relate to criteria C2 and C3. We develop here a smoothed version of the user-cost method that solves both these problems. In other words, the inclusion of OOH in the $HICP$ based on our smoothed version of the user-cost method will *not* destabilize the $HICP$ and the $HICP$ will *not* jump in response to monetary policy changes.

A key component of our user cost specification is the expected real capital gain, which we calculate using historical averages. This choice is supported by extensive evidence that households form their expectations by extrapolating from past house price increases rather than economic fundamentals (De Stefani, 2021; Armona et al., 2019). Duca et al. (2021) show that this extrapolative behavior is widespread and that housing demand models often perform better when using multi-year averages of past appreciation than fundamentals (e.g., Duca, Muellbauer, and Murphy 2011, and (e.g., Duca et al., 2016). Consequently, our use of historical capital gains data corresponds to households' behavior in how they estimate expected capital gains in reality. We also apply a smoothing method similar to that used by Duca et al. (2021) to avoid unrealistic spikes in implied utilization costs during boom or bust periods in property prices.

The per euro user-cost formula for u in (1) contains six elements. Two of these, depreciation ($\delta_{c,t}$) and running/average transaction costs including taxes ($\omega_{c,t}$) generally vary little over time.[14] Also, in the European context, we can assume that expected inflation ($\pi^e_{c,t}$) remains anchored close to the ECB's inflation target of 2%.[15]

We do not adjust here for mortgage interest tax relief (MITR), which was available in 2017 in six euro-area countries (Belgium, Estonia, Finland, Italy, Luxembourg and the Netherlands) albeit at a much lower level than, for example, in the US. (see Barrios et al., 2019).[16] In the Supplemental Appendix we show how the user-cost method can be extended to include MITR.

Most of the existing literature on the user-cost method typically assumes that the risk premium of owner-occupying (as opposed to renting) (γ_t) is constant. However, we specify a version of the risk premium that evolves over time for each country depending on how high the price-rent ratio is relative to its average level. A higher than normal price-rent ratio implies higher risk for owner occupiers.

This leaves us with two potentially problematic terms in the user-cost formula: the expected real capital gain ($g^e_{c,t}$) and the nominal interest rate ($r_{c,t}$). Sudden changes in expected capital gains could destabilize a CPI (criterion C2) (Gillingham, 1983; Verbrugge, 2008; Hill et al., 2025). The same is true for changes in the included nominal

[14] These terms can be adjusted if needed. For example, $\omega_{c,t}$ would need to be updated if the tax rate on housing in a country is changed. However, such changes are rare.

[15] The professional forecasters' inflation expectations for five years ahead in the euro area, as conducted quarterly by the ECB, have remained relatively stable around the ECB inflation target of 2% over the period from 2002 to 2023 with the mean of 1.9% and standard deviation of 0.1%. Even during the recent surge in inflation in the euro area from Q3/2021 to Q4/2023, the mean professional forecasters' inflation expectations for five years ahead remain at 2.1%. For more information, see: ecb.europa.eu

[16] See OECD.org and OECD.ilibrary.org

interest rate (Hill et al., 2025). Specifically, if a short-term nominal interest rate is included in the user-cost formula, interest rate increases (set by the ECB to counter inflationary pressures) could have a perverse initial effect of increasing rather than decreasing measured inflation (violating criterion C3).

Our solution to ensure that C2 and C3 are satisfied is to smooth the user-cost term by building a convex combination of the user-cost in the preceding period and the update yielding

$$\tilde{u}_{c,t} = \alpha u_{c,t} + (1-\alpha)\tilde{u}_{c,t-1}. \tag{4}$$

The term $\tilde{u}$ in (4) refers to the smoothed user-cost while u refers to the original unsmoothed user cost. The parameter $\alpha \in [0;1]$ determines the degree of smoothing. For each period, the updated $\tilde{u}_{c,t}$ is therefore a convex combination of its past value $\tilde{u}_{c,t-1}$ and the newly computed $u_{c,t}$. If $\alpha = 1$ there is no smoothing, while $\alpha = 0$ refers to perfect smoothing, that is, keeping the user-cost constant over time.[17]

Hence, OOH expenditure takes the form

$$\text{OOH expenditure}_{c,t} = \tilde{u}_{c,t}P_{c,t} = [\alpha u_{c,t} + (1-\alpha)\tilde{u}_{c,t-1}]P_{c,t}$$

and the OOH price index

$$\text{OOH price index}_{c,t} = \frac{\tilde{u}_{c,t}P_{c,t}}{\tilde{u}_{c,t-1}P_{c,t-1}} = \left[\alpha\left(\frac{u_{c,t}}{\tilde{u}_{c,t-1}}\right) + (1-\alpha)\right]\frac{P_{c,t}}{P_{c,t-1}}.$$

When $\alpha = 0$, the user-cost price index reduces to a house price index, implying a violation of C1 just like with the net-acquisitions method. To avoid this, α must be set to a positive value. The index provider can set α as low as needed (as long as it is still positive) to ensure that C2 and C3 are satisfied. For illustration, we present results for a sequence of choices: $\alpha \in \{0, 0.25, 0.5, 0.75, 1\}$. Even for the most extreme case – $\alpha = 0$ – the inclusion of OOH does not increase the measured volatility as demonstrated in subsection 5.1.

4.2 Implementation of the User-Cost Method in the *HICP*

In addition to choosing the parameter α, we need to compute $P_{c,t}$ and $u_{c,t}$ for each country c in each period t (here quarters) to compute OOH expenditure and the OOH

[17] Canada, Iceland and Sweden follow a different approach. Rather than smoothing the per-euro user-cost, they smooth the house price index (Hill et al., 2025). However, this approach risks reducing the market relevance of the CPI.

price index. To then include OOH in the HICP, we also need the total $HICP$ expenditure for each country in each period. We compute the necessary items as follows:

For our estimates of the **current price of owner-occupied dwellings** ($P_{c,t}$), we take owner-estimated prices reported in the EU-harmonized *Household Finance and Consumption Survey* (HFCS) for 2017 for each country.[18] Respecting survey weights in this context guarantees that $P_{c,t}$ is indeed representative for the stock of owner-occupied dwellings but not dwellings observed on the market in a specific period. Hence, these values come closer to the envisioned measurement concept.

We then uprate them to all other years in our sample using the official House Price Indices (HPIs) of each country.[19] This yields

$$\bar{P}_{c,t} = \bar{P}_{c,2017} \times \frac{HPI_{c,t}}{HPI_{c,2017}},$$

where HPI denotes the official House Price Index.

The **nominal interest rate (r_t)** here is the 10-year government bond rate (updated each quarter).

The **depreciation rate (δ_t)** should refer to the the whole property, consisting of the structure and the associated land, but excluding any maintenance costs. Most estimates of depreciation in the literature focus on the structure part only and range from 2% to 2.5% annually (Himmelberg et al., 2005; Harding et al., 2007; Poterba and Sinai, 2008). However, from a user-cost perspective, these estimates are too high as they ignore the land component which generally does not depreciate (Diewert, 2013; Svensson, 2022). Hence we set the depreciation rate to 1%, which is close to the 1.1% rate used by Fox and Tulip (2014) and between the estimates of 0.77% and 1.1% used by Svensson (2022).

We estimate **running and average transaction costs** (ω_t) by combining two elements, maintenance costs m and recurrent property/land taxes τ. The latter consists of fees payable upon transaction (and thus need to be amortized over a typical holding period) while recurrent taxes are payable annually. Following Barrios et al. (2019), we set the maintenance cost equal to 1.5% for all countries in all years. We also take property/land taxes from Barrios et al. (2019). These vary by country but are assumed to be fixed over time. We denote recurrent property/land taxes by τ_c. Transaction costs

[18] The HFCS values for the 2017 wave we use here come from the 2019 wave fielded between November 2016 and January 2019, which was the first one to include all the euro-area countries we use for this study (see HFCN, 2020, for details). At the same time, it was the last survey conducted in-person and without any COVID19-related disruptions (some countries subsequently switched to an online survey-mode which likely had a negative impact on data quality).

[19] The HPIs are available from Eurostat via the following link: data.europa.eu.

consist of real estate agent fees and stamp duties. We amortize these costs over the typical holding period. Also, both agents' fees and stamp duties vary by country but are fixed over time. See the Supplemental Appendix for further details.

To estimate the **risk premium** ($\gamma_{c,t}$) compensating owner-occupiers for the higher risk of owner-occupying as opposed to renting we use a general 1% level and add the country-specific deviation of its price-rent ratio (relying on currently owner-occupied dwellings for price estimates and currently paid rents for rental units for rent estimates) from the average ratio observed across all euro area countries.

Hence, we compute

$$\gamma_{c,t} = 0.01 + \frac{1}{100} \frac{P_{c,t}/R_{c,t}}{\text{Avg}_{c,t}\left(P_{c,t}/R_{c,t}\right)}.$$

We operationalize the computation relying on HFCS data. Again for the year 2017, we obtain mix-adjusted price-to-rent ratios by country by computing the weighted median price per square meter for owner-occupiers and the weighted median annual rent paid per square meter for renting households separately for sub-regions (whenever available, see HFCN, 2020, for details) and achieve country aggregates by taking again a weighted median over subregions. Survey weights ensure representativeness of measured price and rent levels for the respective country-specific owner-occupying and renting population. Further, we make use of the multi-imputed nature of the HFCS to obtain correct point estimates.

We then bring this ratio forward and backward in time using the HPIs for $HPI_{c,t}$ and the HICP rent indices $R^{HICP}_{c,t}$ for $R_{c,t}$:

$$\frac{P_{c,t}}{R_{c,t}} = \frac{HPI_{c,t}}{\text{Median}_{q\in\{Q1,\dots Q4\}}\left[HPI_{c,2017_q}\right]} \times \frac{\text{Median}_{q\in\{Q1,\dots Q4\}}\left[R^{HICP}_{c,2017_q}\right]}{R^{HICP}_{c,t}} \times \frac{P_{c,2017}}{R_{c,2017}}. \quad (5)$$

Computing these components separately by country ensures that the heterogeneity in housing market developments across Europe (see Hill et al., 2025) are well reflected in the risk premium.

As a grand-average to which we benchmark ratios, $\text{Avg}_{c,t}\left(P_{c,t}/R_{c,t}\right)$, we rely on a rolling-median over the past 10 years for each quarter-country combination,

$$\text{Avg}_{c,t}\left(\frac{P_{c,t}}{R_{c,t}}\right) = \text{Median}_{q\in\{t-4\cdot10,\dots,t\}}\left[\frac{P_{c,q}}{R_{c,q}}\right].$$

We set **expected inflation** (π_t^e) to 2%. This is the ECB's inflation target and expected inflation stayed close to this level during our sample period (Bankowska et al., 2021).

For the **expected real capital gain** (g_t), we use the 10-year average real capital gain as an empirical proxy to measure households' extrapolative behavior in forming expectations (see subsection 4.1 for a discussion and further references).

4.3 Preventing Negative User Costs

Negative user costs can occur during housing booms when expected real capital gains are large. For example, Chen et al. (2022) claim that the user-cost in Shanghai was negative for many years. A negative value of u in one period would imply negative OOH expenditure and a negative price index – which would be nonsensical in a CPI context. In all periods, u must therefore be constrained to be strictly positive. Even that is not quite enough, because a positive but very small value of u can cause the OOH price index to behave erratically. For example, suppose $u_t = 0.001$. Then the OOH price for a comparison between $t-1$ and t will be very close to zero, while the OOH price index between t and $t+1$ could be extremely (and implausibly) large.

Hence we set a lower bound on u of 0.1 as follows:

$$\hat{u}_{c,t} = \max(0.01, \tilde{u}_{c,t}),$$

where $\hat{u}$ denotes the final version of u that is used in the OOH expenditure and OOH price index formulas.

4.4 Aggregating Across Countries

Taking the above estimates of the user-cost components, we calculate the weight for OOH in each country as follows. First, total expenditure (excluding OOH) is given by the Household Final Monetary Consumption Expenditure (HFMCE). HFMCE is calculated from the National Accounts by deducting imputed rent from Household Final Consumption Expenditure (HFCE).[20]

The weight for each country c in the $HICP$ with OOH included is then calculated

[20] OOH is included in GDP in euro area countries using the rental equivalence method in spite of the problem of small rental markets in some countries.

as follows:

$$w_{c,t}^{HICP+OOH} = \frac{HFMCE_{c,t} + N_{c,t}^{OOH} u_{c,t} P_{c,t}}{\sum_{c=1}^{C} (HFMCE_{c,t} + N_{c,t}^{OOH} u_{c,t} P_{c,t})},$$

where $N_{c,t}^{OOH}$ is the number of owner occupier households in country c in year-quarter t.[21]

The overall $HICP$ inclusive of OOH is then calculated as follows:

$$\frac{HICP_t^{+OOH}}{HICP_{t-1}^{+OOH}} = \sum_{c=1}^{C} w_{t-1,c}^{HICP+OOH} \left(\frac{HICP_{t,c}^{+OOH}}{HICP_{t-1,c}^{+OOH}} \right).$$

Once again, we want to emphasize that, while our user-cost formulation adopts observational data (e.g., historic realized capital gains and smoothed interest rates), we do not interpret these inputs as reflecting perfectly rational or no-arbitrage expectations. Instead, in line with the behavioral and empirical evidence summarized by Duca et al. (2021), we view these as reflecting the backward-looking nature of households' inflation and capital gain expectations. Our method thus remains valid for the conceptual requirements of the CPI, that is, measuring *actual* costs as experienced by consumers, while avoiding unrealistic assumptions.

5 The Implications of Including OOH in the $HICP$

5.1 How the Inclusion of OOH Changes the $HICP$

Now, having computed country-specific and an aggregate $HICP^{OOH}$, we can compare it to the original series to detect any systematic changes. We first do so by simply plotting the two series on top of each other together with the euro area HPI in Figure 2a.

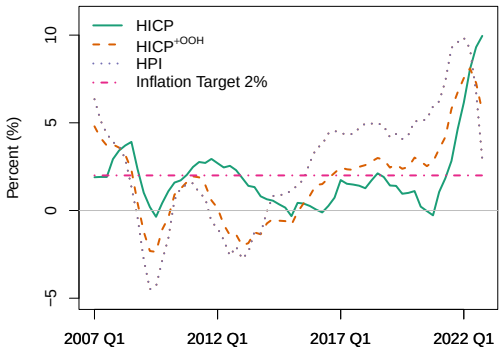
It becomes evident that during the most recent inflationary period, house price inflation started before general inflation, and thus, including OOH pushes up $\Delta HICP^{OOH}$ in comparison to the $\Delta HICP$. According to $\Delta HICP^{OOH}$, there was no drop in inflation towards the end of 2020 and thus there would have been no incentive to reduce interest rates to the low levels observed during this period: Between September 2019 and July 2022, the deposit facility was set at -0.5%, the lowest level ever. These two findings suggest that interest rates were likely too low for too long.

When looking at the GFC between mid 2007 and early 2009, we find also for this

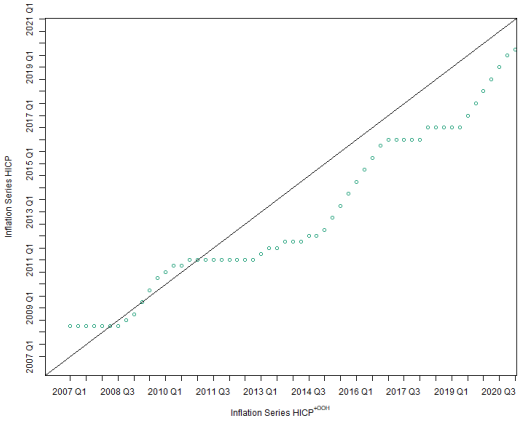
[21] The total number of households and the share of renters and owner occupiers are available from the Eurostat Data Browser: ec.europa.eu/eurostat.a , ec.europa.eu/eurostat.b .

Figure 2: Implications: Comparisons between $\Delta HICP$ and $\Delta HICP^{OOH}$

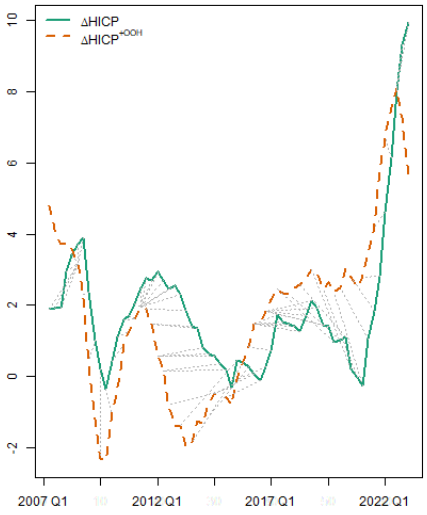
(a) Inflation Rates and House Prices



(b) $\Delta HICP$ vs. $\Delta HICP^{OOH}$.



(c) DTW



Note: Figure 2a depicts quarterly time series of inflation rates for the Euro Area computed as annual percentage changes of the $HICP$ and the $HICP^{OOH}$, as well as of the House Price Index (HPI), respectively. Figure 2b plots $HICP$- against $HICP^{+OOH}$-implied inflation rates. Figure 2c depicts the dynamic time warping (DTW) alignment that minimizes the distances between the two series. The best overlap between the two series is indicated by the dotted lines connecting the series at different points in time.

Source: Eurostat; authors' calculations.

period that an inflation measure inclusive of OOH would have suggested contractionary monetary policy prior to the crisis meaning some leaning against the wind via conventional monetary policy. Further, the following downturn appears to have been much more severe, heralding a longer and more pronounced period of deflation.

Furthermore, gradually falling inflation rates were observed from mid-2011 onward. Again, if OOH had been included in the $HICP$, the downturn would have been visible earlier and thus potentially less severe. Between 2012 and 2015, inflation rates where not only low, but even negative, implying increased pressures for conventional and unconventional monetary policy actions.

A priori, it is not clear whether accounting for OOH costs in the $HICP$ would increase its volatility or not. Ideally, however, volatility would not be increased. We therefore test whether volatility differs between $HICP$ and $HICP^{OOH}$ (here measured as variances) using a two-sided F-test with $H_0 : \sigma^2(HICP) = \sigma^2(HICP^{OOH})$. The test does not reject H_0 (p-value = 0.863) and so we find no evidence for excess volatility in inflation rates when accounting for OOH. Thus, we do not find any evidence that our method would violate criteria C2.

5.2 More Timely Monetary Policy

Although overall volatility is not increased, it seems as if over the entire period $HICP^{+OOH}$ had the tendency to lead inflation rates based on the official $HICP$. We investigate this aspect by first plotting the two measures against each other as shown in Figure 2b. Whenever the inflation rate derived from $HICP^{OOH}$ is larger than that derived from $HICP$, the dots would be below the 45°-line. Of the 64 quarters investigated, in 13 periods the $HICP$-imposed inflation rate was lower than that calculated from $HICP^{OOH}$, i.e., in roughly 20% of the time only. On average, we find over the entire time period that

$$\frac{1}{64}\sum_{t=1}^{64}\frac{\Delta HICP_t}{\Delta HICP_t^{OOH}} = 0.6268 < 1$$

is below unity and thus that $HICP^{OOH}$-implied inflation is on average larger in magnitude.

Next, to formally test the alignment of the two series, we adopt the concept of dynamic time warping (DTW), which measures the similarity between two time series that may differ in speed. DTW was originally developed by Vintsyuk (1968) and Sakoe and Chiba (1978) to compare the similarity between speech patterns. It is now widely used

in machine learning circles to estimate the similarity between data sequences (Shokoohi-Yekta et al., 2015). DTW can also be used to assess lead-lag relationships and temporal similarities in time series (Franses and Wiemann, 2020). Figure 2c illustrates the optimal alignment according to the DTW algorithm. The optimal alignment between the two series varies somewhat over time, but typically, the $HICP^{+OOH}$ leads the $HICP$ series over this period.

5.3 Enhancing Credibility: Alignment of the HICP with Inflation Perceptions and Expectations

So far we have focused on enhancing the comprehensiveness of the $HICP$ mainly arguing on conceptual grounds. Another argument in favor of an extended view on consumer prices is of empirical nature as already highlighted in subsection 2.3: the success of the monetary policy transmission process initiated by an inflation-targeting central bank will depend on whether consumers' current perceptions and future expectations are aligned with impulses set by policy actions.

Thus, we test whether our extended inflation measure based on the $HICP^{+OOH}$ comes closer to consumers' stated perceptions and expectations than the currently used $HICP$. This can be seen as an indication that changes in house prices may be part of the missing link between officially measured and perceived inflation.

Further, we can also test whether house prices are factored in when forming inflation expectations. By assuming that consumers on average form expectations by extrapolating past experiences, we can explicitly test for alignment between expected inflation rates constructed from the $HICP$ or $HICP^{OOH}$, and stated house price expectations. If the latter yields better alignment between $HICP^{OOH}$ and stated expectations, we add strong empirical support for the notion that people already now factor in house prices in the $HICP$.

For our test, we use stated inflation perceptions, expectations, and home price expectations elicited within the *ECB Consumer Expectations Survey (CES)*.[22] The exact wording of our three outcome variables is as follows:

[22]This survey has been conducted online monthly by the ECB with data available since April 2020, providing high-frequency data on euro area consumers' perceptions and expectations regarding the economy, as well as their economic decisions. Initially, the survey covered the six largest economies in the euro area: Belgium, Germany, Spain, France, Italy, and the Netherlands. In April 2022, the sample was extended to include five additional countries: Ireland, Greece, Austria, Portugal, and Finland. As our estimated $HICP^{OOH}$ data extends until the end of 2022, the following analysis uses the ECB survey data from the six original countries, covering from April 2020 to December 2022.

- **Inflation perceptions:** How much higher (lower) do you think prices in general are now compared with 12 months ago in the country you currently live in? Please give your best guess of the change in percentage terms. You can provide a number up to one decimal place. ...%
- **Inflation expectations:** How much higher (lower) do you think prices in general will be 12 months from now in the country you currently live in? Please give your best guess of the change in percentage terms. You can provide a number up to one decimal place. ...%
- **Home price expectations:** In 12 months from now, by about what percent do you expect the price of your current home to be higher (lower)? Please give your best guess of the expected change in percentage terms. You can provide a number up to one decimal place. In 12 months from now, I expect the price of my current home to be ...% higher (lower).

To mitigate the influence of outliers, we exclude the upper and lower 2.5% of observations for each country and survey year in the variables related to perceptions and expectations.

We use the following general equation to estimate the effect of $\Delta HICP$ and $\Delta HICP^{OOH}$ on inflation perceptions and expectations:

$$Y_{it} \propto \alpha + \beta \Delta HICP_t^{(OOH)} + \mu_i + \gamma X_{it}, \tag{6}$$

where Y_{it} represents one of our three outcome variables. $\Delta HICP^{(OOH)}$ represents inflation rates compiled from either the $HICP$ or $HICP^{OOH}$ index. We estimate the models once for country-level data and once for aggregate Euro Area data. In the former case, the models thus include country-fixed effects μ_i. Further, X_{it} is a vector of control variables, including income, age, gender, education, household size, number of children, and partnership. We estimate the regression using two different estimation techniques: First, we follow the standard approach and estimate a linear regression model, i.e., we model $\mathbb{E}(Y|X)$ and model parametrically specified errors $\varepsilon_{it} \sim \mathcal{N}(0, \sigma^2)$. Second, we acknowledge the deviation of the distributions of our outcome variables from normality, and thus re-estimate the equations as quantile regressions (QR) which we evaluate at the median level. Thus, we model $\mathbb{Q}_{Y|X}(\vartheta = 0.5)$ and refrain from a parametrically specified error distribution. QR is further beneficial as it allows us to explicitly model the median of the distribution, which yields a more democratic centrality measure than the mean. This is relevant because of the asymmetry of survey responses which are

clearly right-skewed.

We test for the correlation between inflation rates and our outcome variables by assessing the parameter β. Positive estimates indicate co-movement between $Y_{i,t}$ and the respective inflation rates, while negative estimates indicate anti-movement, and insignificant estimates no correlation. The closer β is to one, the stronger is the co-movement.

Columns (1)-(4) using linear regression and (13)-(16) using quantile regression in Table 1 compare stated inflation perceptions to adjusted and unadjusted inflation rates. The association for $\Delta HICP - EA19$ intensifies significantly from 0.745 to 0.927 (QR: 0.7000 to 0.852) and similarly (yet to a smaller extend) when deriving it from country-specific rates. This supports the hypothesis that consumers indeed factor in changes in house prices when forming inflation perceptions. On top, we can deduct that using the adjusted $\Delta HICP^{OOH}$ means a measure more in-line with consumers' intuitive understanding of inflation measurement. This could also increase the ECB's credibility.

In a second step, we correlate again the adjusted and unadjusted inflation measures with stated inflation expectations. Results reported in columns (5)-(8) and (17)-(20) in Table 1 reveal again an increase in terms of alignment between measured inflation rates and stated expectations: the expected increases are again larger in magnitude when derived from the $\Delta HICP - EA19$ directly (LR: from 0.400 to 0.546; QR: from 0.348 to 0.482) as compared to the one derived from the $\Delta HICP - Country$ (LR: from 0.386 to 0.408; QR: from 0.336 to 0.358). This indicates that also expectations regarding overall price stability miss an element when relying on the current definition of the $HICP$ and this may partly be the developments in the housing market. This provides another credibility argument in favor of using OOH-sensitive inflation measures.

Finally, columns (9)-(12) and (21)-(24) derive the same measure for expected future changes in the value of consumers' own property. Assuming again that consumers tend to extrapolate past and present experiences to forecast the future would lead to the prediction that the increase in alignment should be strongest for this question. This is indeed what we find: correlations for both the $\Delta HICP - EA19$ and $\Delta HICP - Country$ roughly double when accounting for OOH costs. Thus, we can conclude that the gap between measured and perceived inflation could be decreased by including OOH costs to the $HICP$.

Table 1: Regression Results

	Inflation Perceptions				Inflation Expectations				Home Price Expectations			
Panel A: Linear Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\Delta HICP - EA19$	0.745***				0.399***				0.155***			
	(0.006)				(0.005)				(0.004)			
$\Delta HICP^{OOH} - EA19$		0.927***				0.548***				0.341***		
		(0.010)				(0.008)				(0.007)		
$\Delta HICP - Country$			0.720***				0.386***				0.147***	
			(0.006)				(0.005)				(0.004)	
$\Delta HICP^{OOH} - Country$				0.748***				0.408***				0.297***
				(0.008)				(0.007)				(0.006)
Adjusted R^2	0.218	0.142	0.220	0.141	0.112	0.086	0.112	0.081	0.024	0.029	0.024	0.031
Socio-Economic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N observations	388553	388553	388553	388553	393153	393153	393153	393153	393577	393577	393577	393577
Panel B: Quantile Regression	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
$\Delta HICP - EA19$	0.700***				0.348***				0.0983***			
	(0.002)				(0.002)				(0.002)			
$\Delta HICP^{OOH} - EA19$		0.852***				0.482***				0.196***		
		(0.006)				(0.004)				(0.003)		
$\Delta HICP - Country$			0.690***				0.336***				0.0935***	
			(0.002)				(0.002)				(0.002)	
$\Delta HICP^{OOH} - Country$				0.708***				0.358***				0.208***
				(0.004)				(0.003)				(0.003)
Pseudo Adj. R^2	0.147	0.085	0.149	0.084	0.062	0.043	0.061	0.039	0.037	0.038	0.036	0.041
Socio-Economic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N observations	388553	388553	388553	388553	393153	393153	393153	393153	393577	393577	393577	393577

Notes: The dependent variables are the respondent's inflation perceptions, inflation expectations, and home price expectations. Demographic controls include income, age, gender, education, household size, number of children, and partnership. Standard errors, clustered at the household level, are reported in parentheses. The sample period is 2020:04 – 2022:12. Data source: ECB Consumer Expectations Survey (CES). Standard errors in parentheses. Significance is indicated using standard notation: *p-value < 0.10, **p-value < 0.05, ***p-value < 0.01

These results are robust to the exclusion of socio-economic controls and so we conclude that three dimensions of credibility would increase when accounting for OOH costs in the measurement of the HICP. As the effectiveness of monetary policy actions strongly depends on consumers building expectations in-line with official statistics, focusing on the inclusion of OOH costs in the HICP appears to be of utmost urgency and importance.

6 Conclusions and Recommendations

In this study, we discuss the problems imposed by neglecting OOH costs in the $HICP$. We argue that accounting for OOH is important from a conceptual perspective to guarantee that the $HICP$ represents *all* types of households. This is particularly important in the case of a monetary union made up of countries with very different housing tenure compositions, asynchronous housing cycles and non-representative rental markets. This is to avoid biased monetary policy: As the share of renters is much higher in rich western countries than in Southern European or Eastern European countries, by omitting OOH currently the ECB probably under-serves the needs of these countries.

While it is generally agreed that OOH should form part of the $HICP$, there is no consensus on *how* it should be included. We propose a version of the user-cost approach that fulfills CPI measurement principles, is practically feasible to be implemented by all EU countries, and makes the HICP more responsive to developments in the housing market.

Further, we empirically show that the extended inflation measure leads the current one in times of housing market turmoil. Further, measured inflation would not have turned negative but would have been close to target discouraging loose monetary policy during and after the pandemic. This would have set other incentives and conventional monetary policy would have automatically led to a certain degree of leaning against the wind. We speculate that the recent inflationary period would have been less pronounced.

Additionally, we can show that consumers seem to intuitively factor in changes in house prices in their mental model leading to inflation perceptions and expectations. Thus, including OOH narrows the gap between perceived and expected inflation, and measured inflation rates. This may potentially also narrow the credibility gap.

Our results show that the adjusted $HICP^{OOH}$ is more consistent with consumers' stated inflation expectations than the current $HICP$ methodology. It is essential to understand that this alignment does not stem from the $HICP^{OOH}$ directly measuring expected future inflation. Rather, this outcome occurs because the $HICP^{OOH}$ reflects

the actual out-of-pocket expenses incurred by households. The close correspondence with expectations simply reflects that households' perceptions of inflation, including the role of housing costs, are more accurately captured by a CPI that takes account of owner-occupied housing expenditure. This result emphasizes the importance of including OOH to ensure that the $HICP$ remains a credible and practically relevant measure of inflation.

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Note: The Appendix is not yet included.