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Working Paper No. 676

September 2020

Estimating the cost of Irish housing for the CPI: A rental equivalence approach

*Matthew Allen-Coghlan^a, Cathal Coffey^a, Maria Martinez-Cillero^a, Ilias Kostarakos^a,
Kieran McQuinn^a and Conor O'Toole^a*

Abstract: In this paper, we implement a new measure, the rental equivalence approach, in estimating the cost of Irish housing for the purposes of the consumer price index (CPI). The cost of housing composes both the cost of owner occupier housing (OOH) as well as the cost of renting. This work, which is in conjunction with the Central Statistics Office (CSO), follows earlier work, which reviewed the different, existing approaches taken by the CSO in estimating the cost of housing. The rental equivalence approach - used to calculate the cost of OOH - seeks to isolate the consumption element of owning a home, which is consistent with its usage in the CPI. The proposed approach also benefits from the usage of existing rental indices, which are compiled and estimated by researchers in the Economic and Social Research Institute (ESRI) for the Rental Tenancy Board (RTB).

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*Keywords: Housing, Inflation, Rental Equivalence, CPI.
JEL codes: E31, R20 and P44.*

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Introduction

The estimation of the cost of housing for inclusion in the calculation of the consumer price index (CPI) is a complex task which, while always important, has become even more critical given the increase observed in house prices and rents both domestically and internationally over the past 30 years. When considering the cost of housing, it is important to distinguish between costs faced by renters and the cost of owner-occupied housing (OOH), defined as those who own their residence outright or with a mortgage. The estimation of this second housing cost is particularly challenging with statistical agencies in several countries including Spain, France and Portugal choosing to exclude OOH from the national CPI altogether. In April 2019 researchers at the Economic and Social Research Institute (ESRI) commenced a project with the Central Statistics Office (CSO) reviewing different approaches to measuring the cost of housing in the CPI for Ireland. In this paper we examine the implementation of the rental equivalence approach in an Irish context. Theoretically the rental equivalence approach involves matching the owner occupier home with a similar property that is on the rental market. The rent of that property is then taken to be the value of consumption of the owner-occupied property.

We propose a novel method for calculating the cost of OOH in Ireland by combining rent price data with data on the stock of owner-occupied housing in the country. Initially, using rental data from the Residential Tenancy Board (RTB), we estimate several rent indices for groups of properties with the same characteristics, using hedonic regression methods. We then compute the weight of these indexes based off the frequency with which property types with the same characteristics appear in the owner-occupied data in the 2016 census. Finally, these weights are applied to each of the individual rent indices and summed together to arrive at one final index of OOH.

Using this method, we find there are significant increases in the level of the owner-occupied index over the last five years. We also find there to be significant volatility in both the level and growth rate of the index from month to month. The level and growth rates are shown to vary significantly depending on whether a stock or flow measure of rents are used. We then integrate this measure of OOH into the Irish CPI to see what the resulting impact is on the overall price level. For the period 2017 to 2019, this alternative CPI is shown to be significantly higher than the published CPI.

We also compute an index for the cost of housing for private renters utilizing the RTB dataset. As with the cost of OOH we find there to be a significant increase in rent levels over the last five years. The index and growth rates are also shown to be sensitive to the choice of whether to use a stock or flow measure.

The manner in which housing costs are included in the CPI has a number of significant implications. As noted by Rognlie (2015) amongst others, in large developed countries increased housing costs are

one of the main reasons behind the increase in capital's net share of income. In Ireland this is particularly relevant as a number of studies (Kelly and McQuinn (2014) and McQuinn (2017)) highlight the particularly strong rate of house price inflation vis-à-vis other western economies. Consequently, it is imperative that official measures of inflation accurately capture the changing nature of housing costs. Possibly reflecting the sense that housing costs are not accurately captured in such a manner, the chief economist of the European Central Bank (ECB), recently suggested that housing costs could be given more weight in the way in which inflation is measured in the Eurozone.¹

The rest of the paper is divided into two parts: in part A we examine the issue of owner-occupied housing and in part B we estimate the cost for private renters. In section two we outline the background of the 'use approach' to measuring the cost of OOH, while a subsequent section looks at the strengths and weaknesses of the rental equivalence approach in the literature. The data used in the study is then discussed while subsequent sections present an overview of the methodology used and the results. A following section discusses how the proposed approach is integrated into the CPI with the cost of private renting then assessed. A final section offers some conclusions and areas for future work.

A. Estimating the costs for owner occupied housing

2. Background

The inclusion of owner-occupied housing services in the CPI is arguably one of the most complex issues faced by national statistical agencies, with little consensus among statisticians and economists regarding the most appropriate methodology for producing accurate measurements of such services. This complexity is highlighted by the fact that the European Commission (in agreement with the ECB) concluded that the currently produced owner-occupied housing indices are not suitable for inclusion in the HICP (see European Commission (2018) for more details).

There are three main approaches that have been utilized for the measurement of owner-occupied housing inflation:

the payments approach

the net acquisitions approach and

the rental equivalence approach, which is the main focus of this paper.

¹ See interview with ECB chief economist Philip Lane: <https://www.ft.com/content/16ef35f2-4389-11ea-abea-0c7a29cd66fe>

The first two approaches have been presented in detail in Ahrens et al. (2020). In this section we provide a short description, in order to facilitate the comparison with the proposed implementation of the rental equivalence for Ireland.

The ‘Payments’ Approach

The payments approach focuses on capturing the ongoing costs of living in an owner-occupied dwelling. In particular, it focuses on the actual cash flows related to the purchase of housing goods and services, irrespective of when these services are actually being consumed or acquired. These services are related to mortgage interest payments, property taxes and insurance, among others. The inclusion of the interest payments has raised a number of concerns regarding the suitability of such an index for the measurement of OOH costs, given that such payments do not represent consumption and are potentially sensitive to changes in the interest rates. It should be noted here that the payments approach is utilized only by Ireland and Austria (see Hill et al. (2018)).

The ‘Net Acquisitions’ Approach

The net acquisitions approach focuses on the change in the purchase price of dwellings that are new to the household sector; that is, it is only concerned with dwelling purchases that occur between the household sector and the other sectors of the economy, excluding any between-households’ transactions. The total value of the acquisition is allocated to the time of the purchase, irrespective of when consumption starts and when and how it is paid for. The dwelling itself is assumed to comprise of two components, the structure (which is the consumable part) and the land (which is an asset).

Given the lack of data on land prices, a number of approaches have been proposed in order to be able to separate the price of the structure from that of the land (e.g. Eurostat recommended the ‘gross price, net weight’ approach – see Eurostat (2017)). The net acquisitions approach is not extensively used by national statistical agencies for the compilation of the national headline inflation index. Indicatively, a study by the ONS (see Johnson (2015)) found that only 3 out of 29 countries used this approach. However, it should also be noted that all EU member-states, following the guidelines set by the European Commission, produce a quarterly owner-occupied housing index following the net acquisitions approach.

The ‘Use Approach’

The use approach treats the cost of owner-occupied housing services as the opportunity cost of occupying a dwelling. It comprises two sub-approaches, the rental equivalence and user cost approach. The rental equivalence approach calculates the cost of OOH services as the forgone rental income due to occupancy. While this can be based off an owners’ own estimates, a more robust approach utilises hedonic methods to estimate this cost, usually based on rental data. The second sub-approach is the user cost method which treats the cost of housing services as the cost of holding a house as an asset. This

encompasses the cost of finance, forgone investment income, depreciation, maintenance and includes expected capital gains.

Arbitrage pricing suggests that in the absence of transaction cost and bubbles, rental equivalence and user costs should produce the same level of costs. The fact that this does not frequently happen in empirical applications has been addressed by Verbrugge (2008), who largely attributes this discrepancy to transaction costs, and the lagged response of supply in housing. A drawback of user cost metrics of house prices is that they are found to be extremely volatile when standard methods of forecasting are used to measure expectations of prices. In practice, it is difficult to estimate how expectations of price changes are formed, meaning that few if any statistical agencies have adopted the approach in measuring housing costs. Verbrugge (2008) recommends the rental equivalence approach to compute the cost of OOH services, as the user cost approach is unsuitable as a metric for these reasons.

Aside from these practical limitations, there are also theoretical arguments to suggest the rental equivalence is a more appropriate method. Much of the issues in the treatment of OOH in the CPI are a consequence of the simultaneous existence of OOH as both an asset and a consumption good. The primary goal of any approach to measure the cost of housing is to quantify the rise in price of the consumption services derived from housing. The user cost measures the cost of holding a durable good (asset), rather than the cost of consumption services derived from this asset. Rental equivalence on the other hand quantifies the rent which would be charged on the dwelling were it to be rented. Renting essentially involves the purchase of the consumption services derived from occupancy. Therefore, the rental equivalence approach is a more appropriate measure of the price of consumption service.

Rental Equivalence

The rental equivalence approach calculates the cost of consumption services derived from OOH to be the same as the cost of services from an equivalent dwelling on the rental market. The standard assumption is that the consumption services from owner occupied and rented dwellings are the same. It should be noted that there is also an asset component to owning a home but this is not included in the rental equivalence approach. The rental equivalence approach is used in the UN system of national accounts to account for the consumption of OOH services. Under this system owner occupiers are seen as unincorporated businesses who invest in housing stock and then implicitly rent these services to themselves.

3. Evaluation of Approach in the Literature

Theoretical aspects

One key advantage of the rental equivalence approach is its theoretical consistency with the stated goals of the CPI. As discussed above, rental expenditure involves the purchase of the services related to occupancy of a dwelling. Therefore, the rental equivalence approach computes the price of consumption services related to a dwelling as being equivalent to the rent which would be charged for a comparable dwelling.

Diaz (2008) constructed a model in which owning a house is distinct from renting, in that ownership provides a sure stream of services, while renting allows for greater choice in the composition of consumption. However, this greater choice is subject to the risk of future price and consumption changes. These trade-offs are essentially choices upon which modern asset pricing theory is based, with the most noteworthy example being the CCAPM introduced by Breeden (1989). Clearly the discrepancy between renting and ownership, derived from transaction costs, uncertainty, etc. are a result of a dwelling being an asset which is owned, while simultaneously providing consumption services. Hill et al. (2019) documented that rental and house prices can follow divergent paths over the medium term due to a range of factors, including for example “bubbles” or periods of overvaluation in house prices. While Hill et al. (2019) highlight this as a potential weakness of the rental equivalence approach we actually see this as a positive in the Irish case. In the past the Irish housing market has experienced a high level of volatility due to speculation on house prices. The advantage of the rental equivalence approach is that it isolates the consumption element of owning a home and ignores the investment element. As we are only interested in the consumption element we don’t want to include changes in the cost of housing which may result from speculation.

Iacoviello (2005) argues that the CPI is a measure concerned with the cost of consumption goods, rather than the cost of holding assets so monetary policy should not be based on house price movements. Therefore, according to Iacoviello (2005), it should account for the changing prices of consumption services, i.e. rent prices, rather than asset prices, which implies the rental equivalence approach is indeed the appropriate metric.

On a theoretical level, the inclusion of financing costs (such as mortgage and insurance costs) in the CPI is inconsistent with both the scope of the index and its measurement of other prices. For example in the payments index of the ONS, the largest positive contributor to the quarterly changes were changes in the interest rates (almost 2 per cent year-on-year), while factors directly related to housing (major repairs and maintenance, stamp duty) contributed less than 0.3 per cent. The CPI captures the price of consumption, not the costs associated with financing such consumption, or indeed the management of risk in consumption. If the measure of prices for OOH includes financing costs, by consistency this implies the index should include the costs of credit cards, overdrafts and other types of credit used to finance general consumption. For these reasons, either direct or indirect impacts of interest rates on the metric of OOH costs are inappropriate. This argues in favour of the rental equivalence approach over

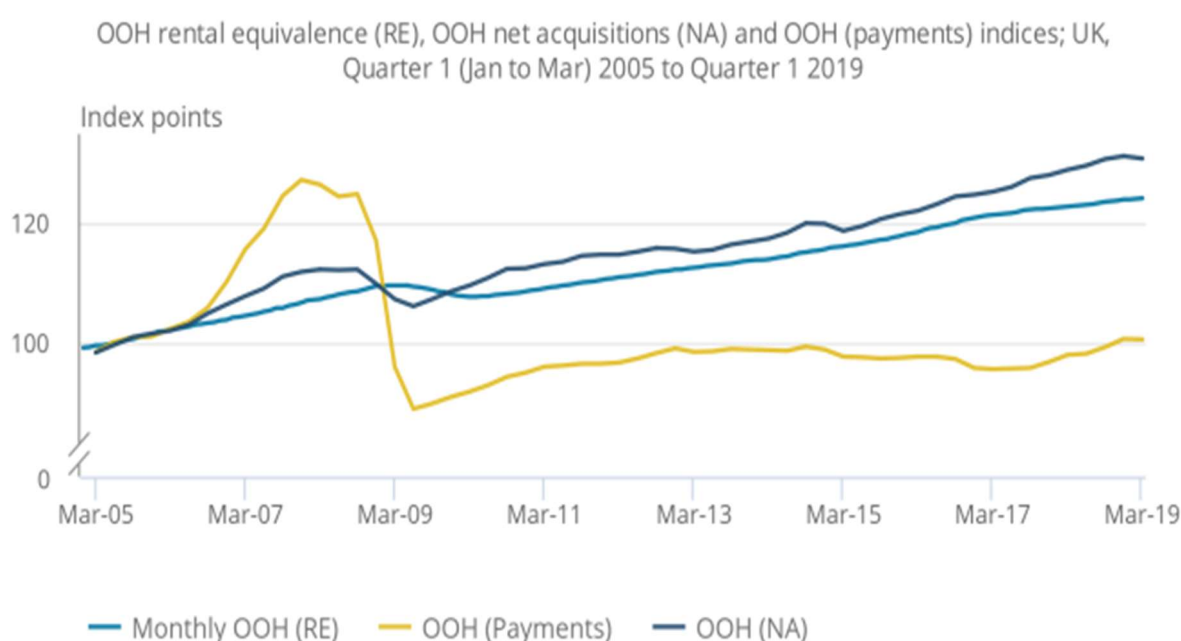
the alternative methods. Another advantage of the rental equivalence approach is its consistency with certain aspects of the national accounts. Imputed rents for OOH are estimated under the income method for computing GDP. As the CPI is used for deflating the national accounts, using a consistent approach in both the CPI and national accounts is particularly attractive.

One limitation of the rental equivalence approach in Ireland however is the introduction of regulations limiting price inflation (See O'Toole et al., 2019). The introduction and prevalence of rent controls across certain geographical areas since 2016 limit the extent to which rental prices reflect the economic conditions in these areas as increases in rents are restricted on an administrative basis. For example, O'Toole et al. (2019) find that rental inflation was between 2 and 3 percentage points lower than that which otherwise would have been the case following the introduction of rent controls.

Practical aspects

On a practical level, the rental equivalence approach is the most appropriate alternative for inclusion in the CPI. One key requirement of the CPI is that the approach should be relatively stable. The rental equivalence approach is found to be the most stable measure of OOH costs in the literature (Verbugge, 2004). Figure 1 gives the ONS estimate of the OOH component of CPI for the UK from 2005 to 2019 based on the rental equivalence approach, the payments approach and the net acquisitions approach. The rental equivalence approach clearly produces the least volatile estimate. This is certainly advantageous from a policy perspective, as volatile measures of prices are unsuitable for inclusion in the headline measure of inflation.

Figure 1: ONS estimates of OOH



4. Data

In order to estimate the value of OOH using the rental equivalence approach, the two main data sources we use are the RTB rental dataset and Census 2016. The RTB data contains information on new tenancies registered with the RTB each quarter, as well as renewals for tenancies which have had the same lease for 4/6 years. Contained in this dataset is information on various characteristics of each tenancy, including the location of the property, type of property, number of bedrooms and the length of tenancy. This dataset starts in Q3 2007 with the latest data available being Q3 2019². Since 2013, researchers at the ESRI have been estimating and maintaining several rental indicators as part of an ongoing collaboration with the RTB. Moreover, in 2017 the number of indicators produced increased significantly as a result of the introduction of rent pressure zone legislation for the Irish rental market (see Lawless et al. (2018) for more details).

The other main dataset utilised is the housing profile in Census 2016. This dataset provides information on the number of households in the country by nature of occupancy. This allows us to find the number of households which are owner occupied. Like the RTB dataset, the Census data includes information on various characteristics of the property, including the type of property and the region in which the property is located. The Household Budget Survey (HBS) 2015/2016 is also used in this paper. It contains information on the characteristics and expenditure of Irish households.

Timeliness Issues

In order to produce an appropriate measure of consumer prices, the calculation of the index should be such that it is readily available in a timely manner each month. The CSO quality report stipulates that:

CPI and HICP data is published nationally four weeks and two days following the second Tuesday of the reference month with the exception of the December and January data. The December data is published five weeks and two days following the second Tuesday of the reference month. The January data is usually published 5-6 weeks and two days following the second Tuesday of the reference month due to the annual updating of weights and/or five yearly full rebase.

The Eurostat website indicates that the Harmonised Indices of Consumer Prices (HICP) is published as a flash estimate at the end of each month, and approximately two weeks later the official series is

² As of December 2019 when the analysis was undertaken.

published. Figure A.1 in the appendix indicates the predicted dates of publications for the relevant indices for the 13 months following December 2019, along with the predicted dates of availability for the RTB data. Figure A.2 gives the predicted delay between the earliest due date of either index being published and the predicted date of receipt of RTB data for each of the 13 months following December 2019. Due to these timeliness concerns, when calculating the rent indices presented below we only use tenancies which have been registered within the first 20 days of the month.

Stock vs. flow measures of rents

Two main types of rental data can be considered when estimating any rental index, being the flow and the stock of rents. The flow of rents contains information on the market rent level at a given moment in time. The RTB dataset used to estimate the cost of OOH in Ireland contains mainly flow data, since it compiles primarily new tenancies (i.e. defined as registered tenancies of those who begin a new lease at any given quarter). On the other hand, the stock of rents measures the pool of rents paid for ongoing tenancies by tenants who began their lease in the past. The RTB dataset also contains a small proportion of renewed tenancies, which correspond to tenants who hold the same lease continuously for 4/6 years, at which point the tenancy agreement must be legally re-registered. As a result of the different type of information the stock and flow of rents capture, rental indices computed using each of the two measures could behave differently. Rental indices based on stock rents can be expected to be more stable, therefore providing a better representation of the owner-occupied sector (International Monetary Fund, 2020).

Due to these potential differences, we will compute OOH indices using both types of rental data. First, we will compute an OOH index series based on the flow of rents information captured by the new tenancies registered in the RTB dataset. Second, we will exploit the two types of registrations, new and renewals, in the RTB dataset in order to approximate a “stock” measure of rents and estimate an OOH index series based on the stock of rents. Approximately 13 per cent of observations are classified as renewed tenancies each month. The table below displays selected tenancy characteristics for the new and renewal tenancies sub-samples between 2015 and 2019:

Table 1: Select tenancy characteristics for new and renewal tenancies subsamples between 2015 and 2019

	New tenancies	Renewed tenancies
Average monthly rent (€)	1,115	895
% by category:		
No. tenants: 1	45.6	50.3
No. tenants: 2	39.4	27.9

No. tenants: 3	7.7	9.2
No. tenants: 4+	7.3	12.6
No. bedrooms: 1	17.7	13
No. bedrooms: 2	37.8	31.5
No. bedrooms: 3	29.8	38.8
No. bedrooms: 4+	14.8	16.8
Dwelling type: Detached	10.9	13.2
Dwelling type: Semi-detached	22.5	31.8
Dwelling type: Terrace	14.2	17.8
Dwelling type: Apartment	46	32.1
Dwelling type: Other	6.4	5.1

The average monthly rent is higher for new tenancies. 46 per cent of new tenancies correspond to apartments, which represent the most frequent type of dwelling in this category of agreement. In contrast, although apartment was also the most frequent type of dwelling among renewed tenancies, it is very closely followed by semi-detached houses. The two sub-samples are similar in terms of number of bedrooms and tenants.

Flow measure

The RTB dataset is already a measure of the flow of rents, since it mostly includes new tenancy registrations. Following Bentley (2019), the rent amount paid in each registered tenancy agreement is imputed each month for each tenancy by carrying forward the rent recorded at the beginning of the tenancy. This is done for a maximum of 14 months, or until the tenancy ends (this approach implies that each tenancy is only observed for the duration of the tenancy, or for a maximum of 14 months if the tenancy is longer than that). This process includes the following steps:

1. We start by re-calculating the tenancy end date, using the variables tenancy start date and tenancy length (in months):
 - a. Limit the tenancy length to be no more than 14 months.
 - b. Add capped tenancy length to the tenancy start date variable in the dataset to recalculate the tenancy end date.
 - c. Recover the new (i.e. capped) tenancy end month and year.
2. A series of dummies which equal one if a given year/month (from 2015M01 to 2019M09) is between each tenancy start and (capped) end dates are generated.

3. Rent recorded at the beginning of the tenancy is imputed for each month in which these dummies equal 1.

Stock measure

A dataset containing an accurate representation of the stock of rents in Ireland is currently not available, therefore we approximate this measure as follows. Again, we start by imputing the rent amount paid in each registered tenancy agreement by carrying forward the rent recorded at the beginning of the tenancy for a maximum of 14 months or until the tenancy ends. But as opposed to the flow measure described above, we use both tenancies registered as new and as renewals. The RTB dataset includes a variable which indicates whether an existing tenancy has been re-registered after 4/6 years (4 years if the tenancy commenced before December 2016 and 6 years thereafter). To approximate the stock of rents, we re-weight the RTB dataset exploiting the distinction between new and renewed tenancies it contains. We use this indicator to approximate a “stock” measure by giving tenants in existing tenancies (renewals) a higher weight than tenancies which have been in the dataset for less than 12 months.

We calculate separate index series for further tenancy renewals and for new registrations, and then weight these two using weights taken from the 2015/2016 Household Budget Survey. This survey shows that 40.5 per cent of renters reported living in their rented accommodation for one year or less. This weight is applied to new tenancies in the RTB dataset. A higher weight of 59.5 per cent, for those who reported living in their property for a period of greater than a year, is applied to renewed tenancies in the RTB dataset, therefore approximating what the stock of rents in Ireland might look like.

5. Methodology

Hedonic Regression

The rental equivalence approach involves the estimation of the rent which would be charged on an OOH, were it available on the rental market. In order to estimate the rents which are representative of owner-occupied properties, we estimate the rents of properties which have similar characteristics as the owner-occupied stock.

This imputed rent is calculated as the rent accruing to a dwelling of given characteristics, according to a hedonic model of rents. The hedonic model exploits a rolling time dummy method in order to estimate price changes. This is equivalent to assuming the price of each of the explanatory characteristics are constant over the estimation period. The data are organised into a set of 32 separate groups, indexed by j . These groups contain rent quotes for four property type categories (detached, semi-detached, terraces and apartments), in eight NUTS3 regions (Border, West, Mid-West, South-East, South-West, Dublin, Mid-East, Midlands). In addition, we have data on other property characteristics (tenancy length, rent

frequency, number of tenants, number of bedrooms) indexed by i with a set of fixed coefficients measuring the impact of these characteristics on rent levels. The regression specification that we run is of the form

$$\ln(R_{t,i,j}) = D_{t,j} + \mathbf{x}'_{t,i,j}\beta + \varepsilon_{t,i,j} \quad (1)$$

Where D_{jt} is a set of dummies varying over for each of the 32 groups and $\mathbf{x}'_{ijt}$ is a vector of additional unit characteristics.]

The key variables of interest are the monthly dummy variables, which allow us to estimate rent indexes for tenancies which exhibit specific characteristics and, in turn, match these rent indices with owner-occupied properties which have the same characteristics. Indices are estimated from January 2015 to September 2019 for both new and renewed tenancy arrangements. The results are presented in Table 2.

Where $\mathbf{x}_{t,i}$ is the vector of characteristics, and $R_{t,i}$ is the rental cost (unobserved for OOH) of dwelling i . The control variables in $\mathbf{x}_{t,i}$ include the length of tenancy, number of tenants and the number of bedrooms. The variables of interest are a series of monthly dummy variables interacted with specific characteristics of the tenancy, namely the type of property and the region in which the property is located. These variables allow us to estimate rent indexes for tenancies which exhibit specific characteristics and, in turn, match these rent indices with owner-occupied properties which have the same characteristics. Indices are estimated from January 2015 to September 2019 for both new and renewed tenancy arrangements. The results are presented in Table 2.

Table 2: Model estimates for new and renew tenancies

Dependent variable: ln(Monthly rent)		
	Renew	New
	Coefficients	Coefficients
Tenancy length: 1-6 months	-0.023	-0.054
Tenancy length: 7-9 months	0.077	0.022
Tenancy length: 12+ months	-0.037	-0.092
No. tenants: 2	0.079	0.086
No. tenants: 3	0.079	0.128
No. tenants: 4+	0.122	0.164

Rent freq.: Fortnight	-0.009	0.011
Rent freq.: Yearly	-0.217	-0.248
Rent freq.: Quarterly	-0.081	0.532
No. bedrooms: 1	-0.290	-0.276
No. bedrooms: 3	0.123	0.118
No. bedrooms: 4	0.258	0.267
No. bedrooms: 5+	0.389	0.395
Month*NUTS3*Dwelling type dummies	Yes	Yes
Constant	5.858	6.040
Observations	430,969	2,922,607
R-squared	0.607	0.597

Note: Tenancy length: 10-11 months, No. tenants: 1, Rent freq.: Monthly, No. bedrooms: 2 are the base categories.

Calculating weights

Using the coefficients from the interacted variables in the above regression, we construct a unique rent index for each of our 32 groups. We then turn to the owner occupier data in order to estimate the appropriate weight for each of these indices. The owner occupier weights are calculated from the Census 2016 data. The Census contains information on the region and the property type of owner-occupied dwellings. The weights are presented in Table 3. They can be interpreted as the percentages of each type of housing present in each region. For example, the largest concentration of semi-detached and terraced houses, and apartments is in Dublin (11.6 per cent, 7.5 per cent and 2.2 per cent, respectively), while the largest concentration of detached houses is in the South-West region (9.2 per cent).

Table 3: Weights of property type by region in owner occupier data

	Detached house	Semi- detached house	Terraced house	Apartment
Border	0.071	0.013	0.005	0.001
West	0.08	0.015	0.005	0.001

Mid-West	0.07	0.023	0.012	0.001
South-East	0.063	0.02	0.01	0.001
South-West	0.092	0.034	0.02	0.002
Dublin	0.038	0.116	0.075	0.022
Mid-East	0.079	0.046	0.017	0.004
Midlands	0.044	0.014	0.005	0.001
<i>Total:</i>				<i>1</i>

Source: Central Statistics Office

When we apply these weights to each index and sum them together, we are left with one final index for all OOH. Applying these weights to the corresponding rent indices ensures that the final rent index is representative of the stock of OOH.

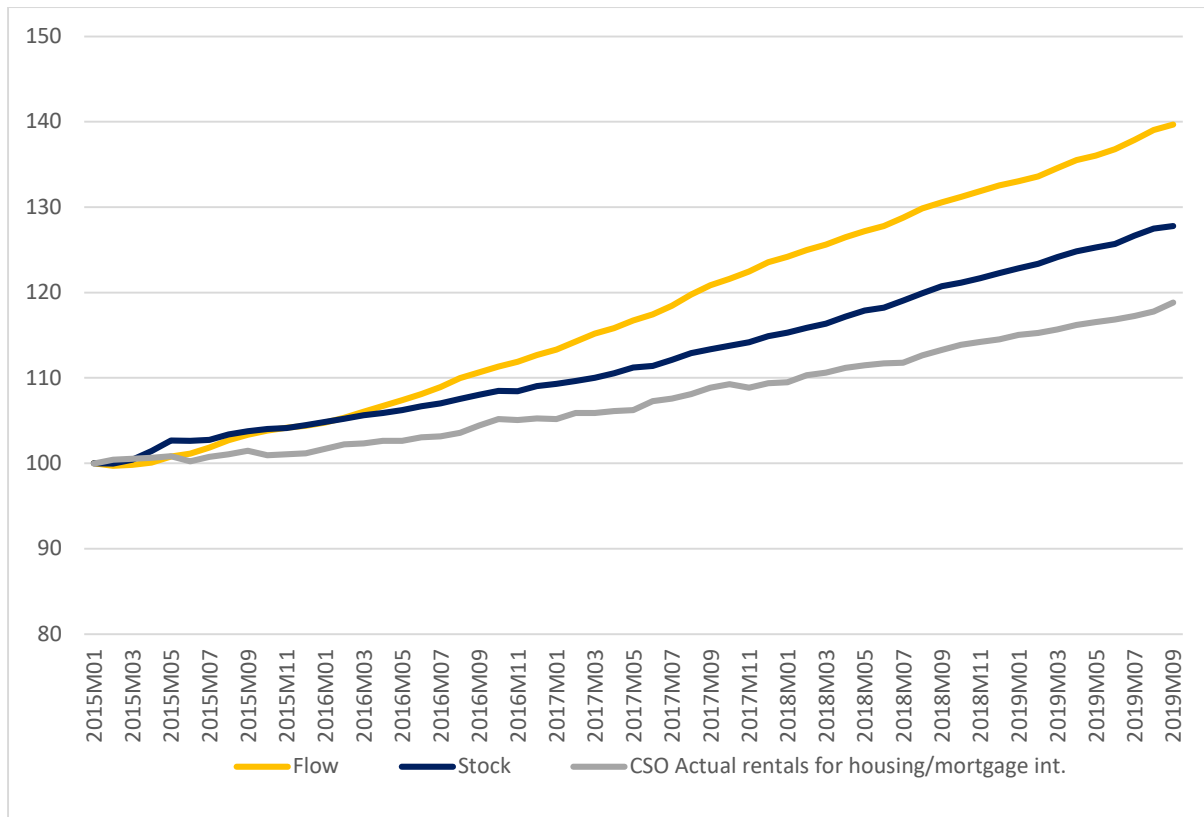
6. Results

After estimating the rent indexes for each of the 32 groups of property type in each region and combining these using the weights estimated from Census data, we get the total measure of OOH using the rental equivalence approach.

Two different owner-occupied indices are displayed in Figure 2, one using the flow of rents and the other using our estimated series for the stock of rents. In addition, the index for actual rentals for housing and mortgage interests computed by the CSO is also displayed for comparison.

Both computed series are shown to be quite stable over time. They also both show a sustained and significant growth in OOH costs since the beginning of 2015. However, the increase measured by the index computed using the flow of rents is larger when compared with the increase measured by the index computed using the “stock” of rents. The index based on the stock of rents is almost 30 points greater in September of 2019 when compared to January of 2015, while the index based on the flow of rents is roughly 40 points greater. This finding is not surprising, since the flow of rents includes new tenancies which have higher rents than existing ones.

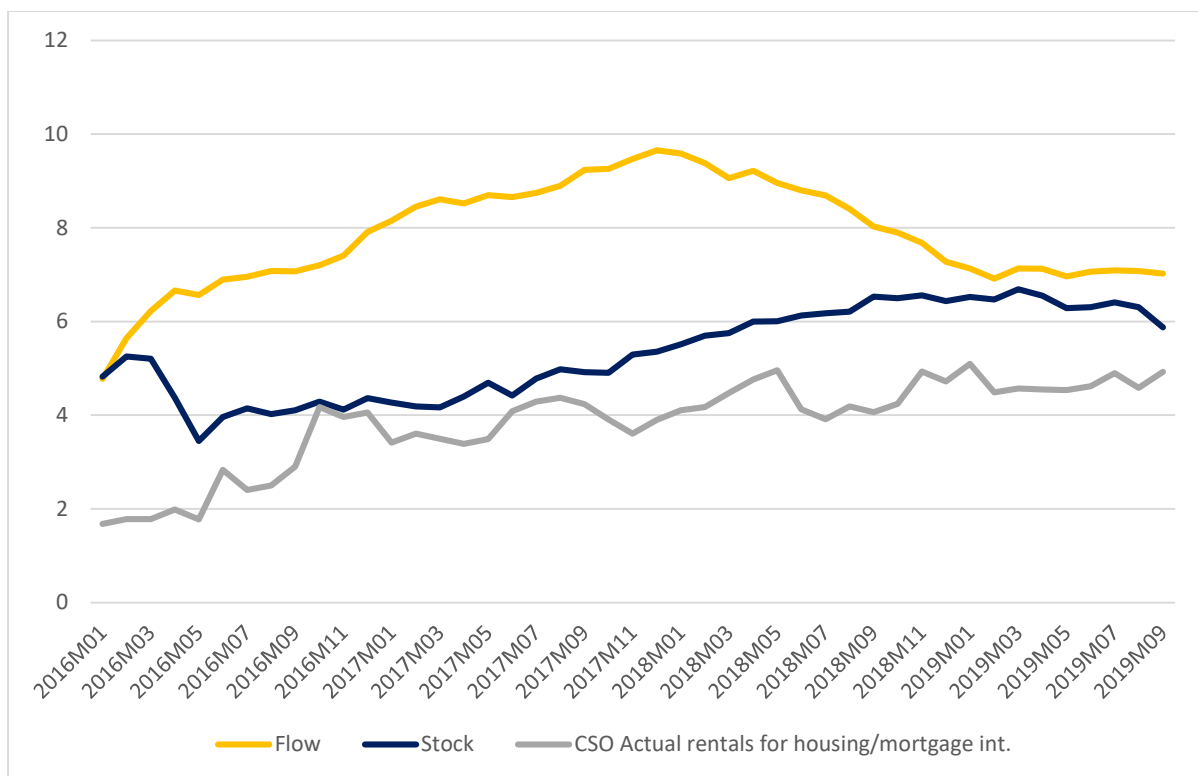
Figure 2: Owner-occupied index series (2015M01 = 100)



Source: Authors' Calculations

In Figure 3, the annual inflation for the three indices is presented. The annual growth of the owner-occupied index computed using the flow of rents range from 6 per cent to nearly 10 per cent increases. The rate of growth of this index was higher between January 2015 and December of 2017, and annual growth stabilised in 2019 at roughly 7 per cent. The annual inflation of the owner-occupied index computed using the “stock” of rents is more stable, showing increases ranging from 4 to 6.5 per cent annually between 2015 and 2019. As a robustness check, we estimated the indices using both those observations registered within the first 20 days of the month and with all observations. We found there to be no significant difference between both indexes.

Figure 3: Owner occupied growth year on year (%)



Source: Authors' Calculations

7. Integration into the Consumer Price Index

Having generated our estimate of the cost of OOH under the rental equivalence approach, the next step is to incorporate this proposed new measure of housing cost into the CPI. This allows us to assess the impact of using the rental equivalence approach on the overall rate of inflation. The CPI is made up of a basket of goods and services, with each item having its own unique price index. These individual price indices are brought together by assigning each item a weight. To carry out this next step we must first remove the items specific to the payments approach and then replace them with an index based on the rental equivalence approach. We use the stock estimate in Figure 2 as the rental equivalence index in the CPI.

At its core, the rental equivalence approach attempts to measure the cost of housing for owner-occupiers by estimating/imputing how much those same owner-occupiers would have to pay to rent their dwellings. As a result, we exclude costs normally borne by landlords, as this would lead to a degree of double counting if we were to include them with a rental equivalent approach (International Monetary Fund 2020). The items which are associated with the payments approach (and consequently excluded

from the CPI) are the items that Ahrens et al. (2020) use to generate an owner-occupied housing cost index based on the payments approach. The full list of items that we remove are displayed in the Appendix in table A.1.

In order to accurately integrate the rental equivalence index into the CPI, we must first determine its appropriate weight. Generally, the weights within the CPI associated with a given sub-index or elementary aggregate (the lowest level of calculation within the CPI) should correspond to the share of total household expenditure that spending on those items accounts for. Goods and services included in the CPI consumption basket are classified using the COICOP³ classification system which groups items into various divisions and sub-divisions. The weights at a 4-digit COICOP level are updated annually using national accounts data. The proportion of this weight allocated to the items within each of the 4-digit COICOP groupings are set using the most recent Household Budget Survey (HBS). These are only updated when the results from a new HBS are available.

Therefore, the weights used by the CSO for the CPI in year t are set in December of year $t-1$ using the most recent national accounts data available at that time (the national accounts from year $t-2$). In order to ensure that the weights approximate as closely as possible the consumers' expenditure pattern of the previous calendar year, the national accounts figures for year $t-2$ are updated to December of year $t-1$ with relevant price data before they are used to calculate the weights used for the CPI in year t .⁴

To calculate the appropriate weight within the CPI for our rental equivalence index we use national accounts data which contains an estimate of the aggregate value of imputed rents in the country for a given year. The value of imputed rents in the national accounts is calculated using Census data. This then is used to apply the rents associated with various property types to owner-occupied dwellings with the same characteristics. For intercensal years the CSO grow this figure forward using an indicator of the stock of quality adjusted housing and a price index.

To generate a CPI weight for our rental equivalence approach, we use the national accounts to compare the total value of expenditure on imputed rents and the total value of expenditure on another item (or group of items) that also derive their CPI weight from the national accounts. In our application, we compare the value of imputed rents with the value of bread and cereals in the national accounts and we use this relationship to scale up the existing CPI weight of bread and cereals to generate a weight for our rental equivalence index. The logic here is that if the value of imputed rents is 10 times greater than the value of bread and cereals in the national account data then its CPI weight should also be 10 times greater than the CPI weight of bread and cereals. We then reweight all remaining goods and services in

³ COICOP stands for 'Classification of Individual Consumption by Purpose' see CSO (2016c) for more details.

⁴ For more detail on how the CPI weights are computed see CSO (2016b) and CSO (2016c).

the CPI to take into account the removal of the payment approach items and the introduction of the rental equivalence index.

In practical terms, having removed the payments approach items, we take the 2016 (Census year) national accounts figures for imputed rents and for bread and cereals and uprate these to December 2017 using relevant information on prices. We use the relationship between these to generate a December 2017 weight for the rental equivalence index and reweight the other items in the CPI. Due to the annual reweighting there is an extra step when using national accounts data based on intercensal years. In order to generate a CPI weight for our rental equivalence index for December 2018, we grow the 2016 (census year) national account figure for imputed rents forward to 2017 using our rental equivalence index.⁵ This ensures consistency between the approaches used to give our rental equivalence index its weight and its inflation rate. As before, this, together with the value of expenditure on bread and cereals in the 2017 national accounts, is then uprated with price data to December 2018 and the size of one relative to the other is used to generate a CPI weight for our rental equivalence index for December 2018. The other items in the CPI are again reweighted. The national accounts figures provided by the CSO are listed in Table A.2 in the appendix. The owner-occupied index series shown in Figure 2 is used to capture the cost of OOH over this time while the other goods and services in the CPI basket derive their inflation rates from the same price indices as before.

Table 4 shows the weight given to the cost of owner occupied housing in the CPI under the two approaches for December 2017 and December 2018. The weights sum to 1 for all the items in the CPI basket of goods and services. The weight ascribed to the cost of owner-occupied housing increases dramatically under the rental equivalence approach when compared to the payments approach.

Table 4: CPI weight of owner-occupied housing

	Weights set December 2017	Weights set December 2018
Payments Approach Items*	0.045	0.045
Rental Equivalence Index	0.173	0.166

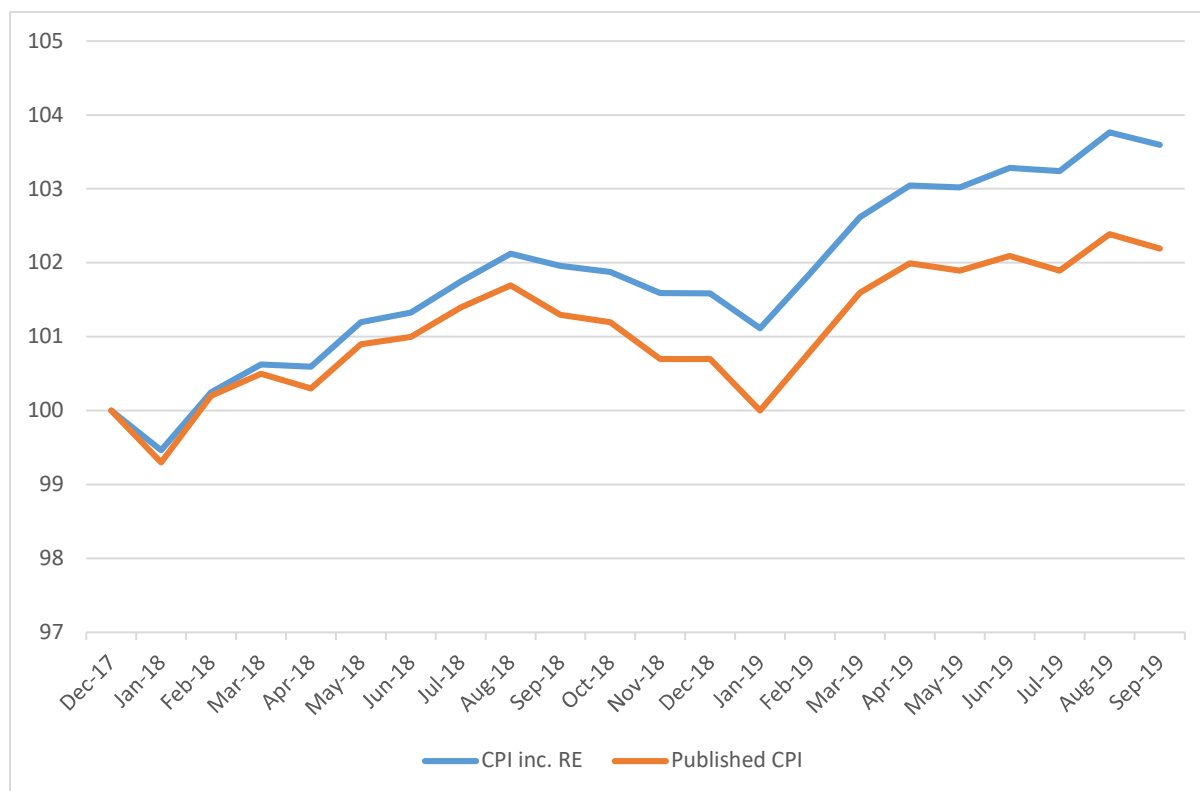
Source: Authors' Calculations

⁵ By doing this we implicitly assume that there was no change in the composition of owner-occupied housing between 2016 and 2017.

* Payments Approach Items are those specified by Ahrens et al. (2020) as listed in table A.1 in the Appendix.

We calculate a new CPI under the rental equivalence approach for the period December 2017 to September 2019. Figure 4 shows this new index along with the actual published CPI for comparison.

Figure 4: CPI (December 2017 = 100)



Source: Authors' Calculations

The CPI including the rental equivalence measure of OOH is shown to be significantly higher than the published CPI. The difference between the two indexes increases across time. This is due to the cumulative effect of replacing the payments approach items with an index that has a much larger rate of inflation and the fact that the rental equivalent approach has a relatively higher weight in the CPI basket than the payments approach. As of September 2019, the overall price level is 1.4 per cent higher. This illustrates the potentially significant impact of integrating the rental equivalence approach into CPI. However, it must also be noted that this result may be dependent on the sample period used in the analysis. The results above show that over this period, using rental equivalence to measure the cost of OOH leads to a higher inflation rate when compared to the payments approach. This is due to the significant increase in rental prices over this time period. Over a period in which rental prices were

declining on a substantial basis, the opposite would likely be observed; the payment approach would more than likely result in a higher inflation rate than that based on rental equivalence.

B. Estimating the cost of housing for private renters

8. Background and Issues

When estimating the cost of housing for inclusion in the calculation of the CPI, in addition to the cost of housing for owner occupiers, the cost of housing for renters needs to be estimated as well. This exercise is more straightforward than estimating the cost of OOH, since the cost of renting is observable (i.e. the rent charged to tenants). The CSO already publishes a monthly index for private rents which is included in the existing CPI figures. However, here we will attempt to improve on this measure by exploiting alternative data sources (i.e. the RTB dataset). In particular, the existing CSO measure includes a mixture of the stock and the flow of rents⁶. However, as in the case of OOH costs, there are also different costs faced by those renting at current market prices and those who began their tenancies some time ago. Therefore, the same issue of estimating these costs using the flow versus the stock of rents is also relevant here.

Index computation

In order to estimate rent indices for private renters, we again follow the hedonic regression approach. As in the case of OOH, we run a series of hedonic regressions, where the dependent variable is the log of monthly rent paid and where we control for several dwelling and tenancy characteristics (i.e. number of bedrooms, number of tenants, tenancy length, etc.). In order to construct the indices, we include a set of time monthly dummies in the regressions. Again, RTB data between January of 2015 and September 2019 is used to estimate the hedonic regressions. Only observations registered with the RTB within the first 20 days of the month are used.

Stock vs. Flow of rents

⁶ The CSO carries out a survey where each respondent is asked to provide four prices each month (for a 1 bed apartment, 2 bed apartment, 3 bed and 4 bed semi-detached house). Using this data, the CSO calculates first the geometric mean of the monthly relatives for each respondent, and second the geometric mean of these means for each county. Finally, a Laspeyres index of the county relatives is built, using weights taken from the latest census data on the number of rented households in each county.

The measure of the flow of rents and the approximation of a “stock” of rents is identical as in the estimation of the OOH costs.

The RTB data is already a measure of the flow of rents. The rent amount paid in each registered tenancy agreement is imputed each month for each tenancy by carrying forward the rent recorded at the beginning of the tenancy, for a maximum of 14 months or until the tenancy ends. Only tenancies registered as new are used to estimate the flow measure.

To approximate the stock of rents, we again re-weight the RTB dataset exploiting the distinction between new and renewed tenancies. We approximate a “*stock*” measure by giving tenants in existing tenancies (renewals) a higher weight than tenancies which have been in the dataset for less than 12 months using the HBS weights.

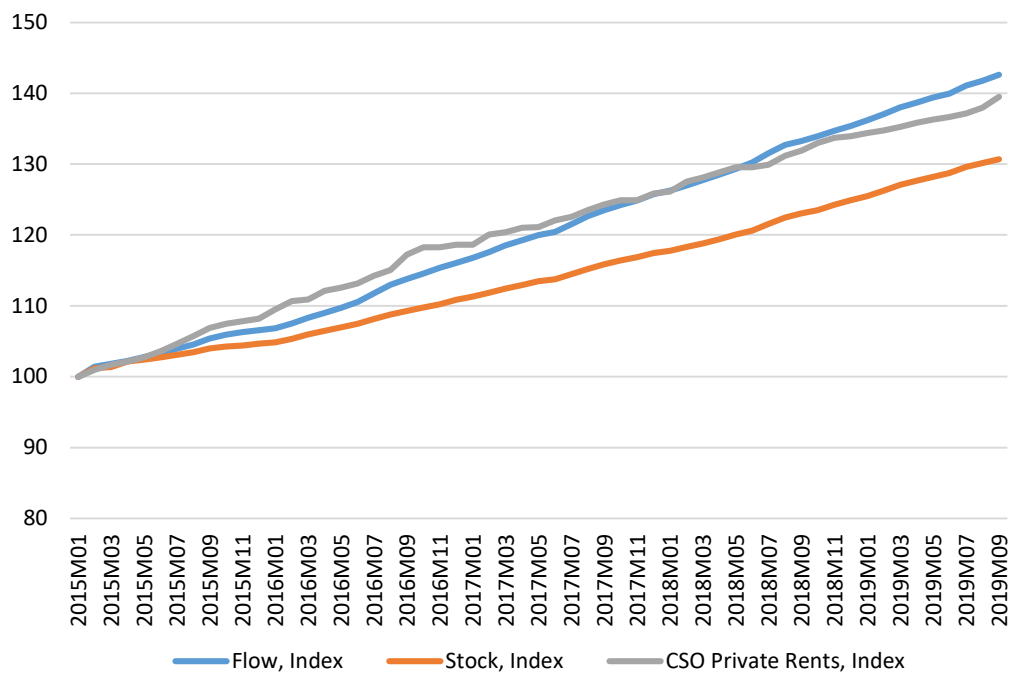
9. Results

Figure 5 presents the series of indices computed using the flow and our approximation to the “stock” of rents. In addition, the index for private rents computed by the CSO is also displayed for comparison. In Figure 6, the annual inflation for each of these three indices is displayed.

Both index series show sustained growth in rental costs since the beginning of 2015. However, the increase measured by the index computed using the flow of rents is over 10 points larger when compared with the increase measured by the index computed using the “stock” of rents. This finding is not surprising, since the flow of rents includes new tenancies which are higher than existing ones.

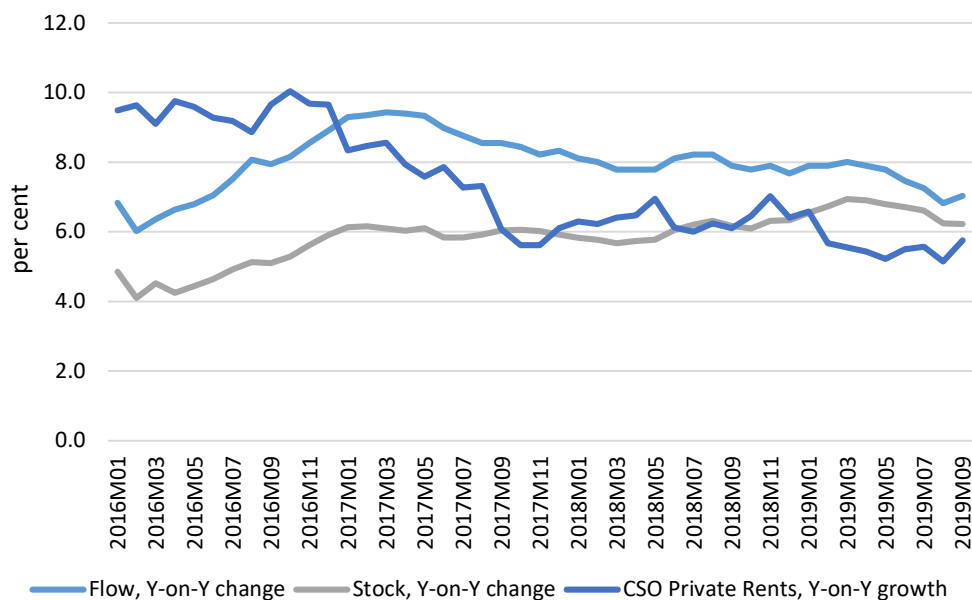
The annual growth of the rent indices computed using the flow of rents range from 6 per cent to nearly 10 per cent increases. The annual inflation of the rent indices computed using the “stock” of rents displays increases ranging from 4 to about 7 per cent annually between 2015 and 2019. The trends in annual growth of both indices based on the flow and the “stock” measures were somewhat similar in the period analysed (despite the annual growth of the index based on the “stock” of rents being consistently lower), and they appear to be converging since the beginning of 2017.

Figure 5: Private rents index series (2015M01=100)



Source: Authors' Calculations

Figure 6: Annual growth rate in private rents index series (%)



Source: Authors' Calculations

10. Conclusions and future work

In this paper we implement a new approach for estimating the cost of housing in Ireland for owner occupiers and private renters. The methodology used to estimate the cost of OOH is based on the rental equivalence approach. This approach is meant to complement the existing approaches used by the CSO in measuring the cost of housing. The rental equivalence approach has the distinct advantage of isolating the consumption element of owning a home, which is consistent with its usage in the CPI. Additionally, the rental equivalence approach is particularly tractable in the Irish case as a significant amount of rental data is available with rental indicators estimated at a regional level.

By including the OOH measure based on the rental equivalence approach, the alternative CPI is shown to be significantly higher than the actual index. By September 2019, the difference between both indices is 1.4 per cent. The possibility that official estimates of inflation have not fully captured the changes in housing costs has a number of significant implications, particularly in the context of the Irish economy. Domestic house prices, even by the significant changes observed across countries over the past 30 years, have displayed an exceptional degree of volatility. The implications of these changes on the official estimates of the cost of living may have been understated, with changes in prices possibly underestimated due to the measure of OOH used.

There are however some issues with the implementation of this approach to the estimation of OOH equivalent rent. On a practical level, the imputation of consumption services from data on rental transactions is reliant upon these transactions reflecting the true value of consumption services, as determined by the working of a functional market. This requirement is compromised by the fact that several areas in Ireland have been declared as “rent pressure zones”, where price rises for rental units are restricted to 4 per cent annually. Units which are designated as new to the market, including units which have undergone major renovation, are excluded from this regulation, as they do not have a base price. While a rental index aims to capture inflation of actual rental prices keeping quality constant, the hedonic index needed to calculate OOH costs should reflect market fundamental rents, rather than observed rents. Therefore, these rent controls present a challenge to the construction of such an index. Consequently, it may be desirable to estimate the underlying parameters for dwellings subject to these controls. Future research will look at addressing this issue.

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Appendix A1

FIGURE A1: DATA AVAILABILITY DATES

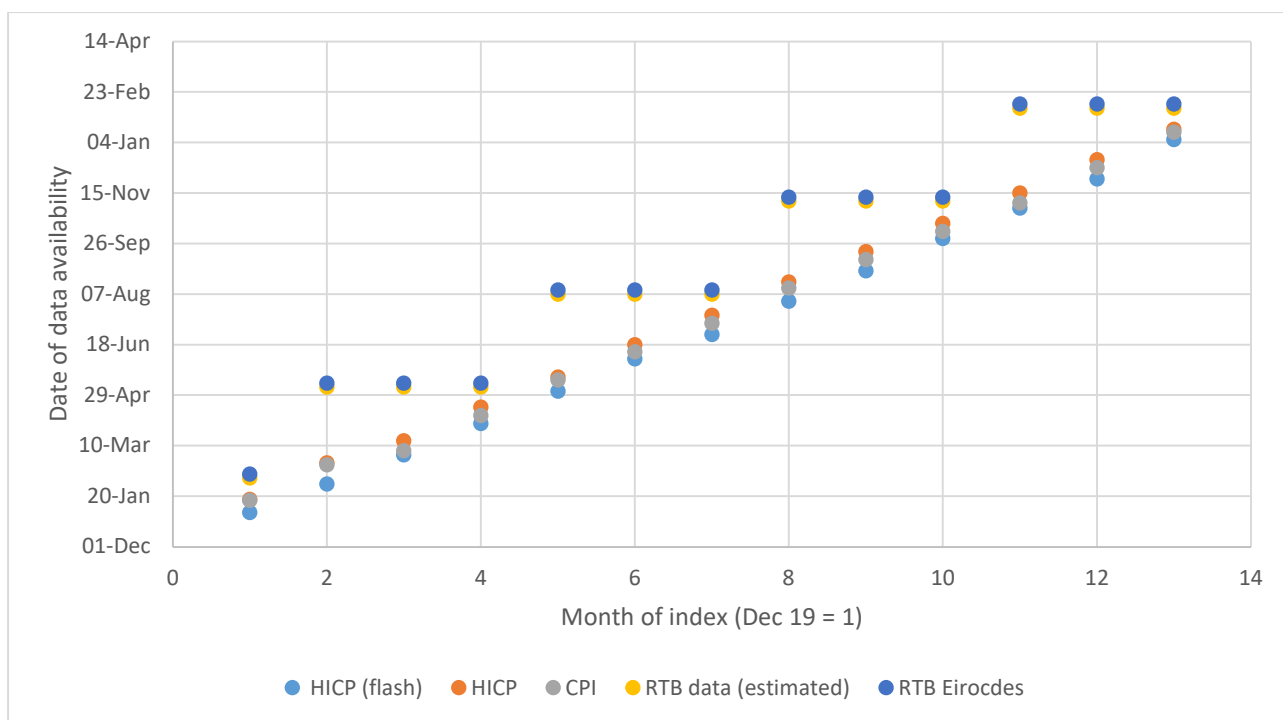


FIGURE A2

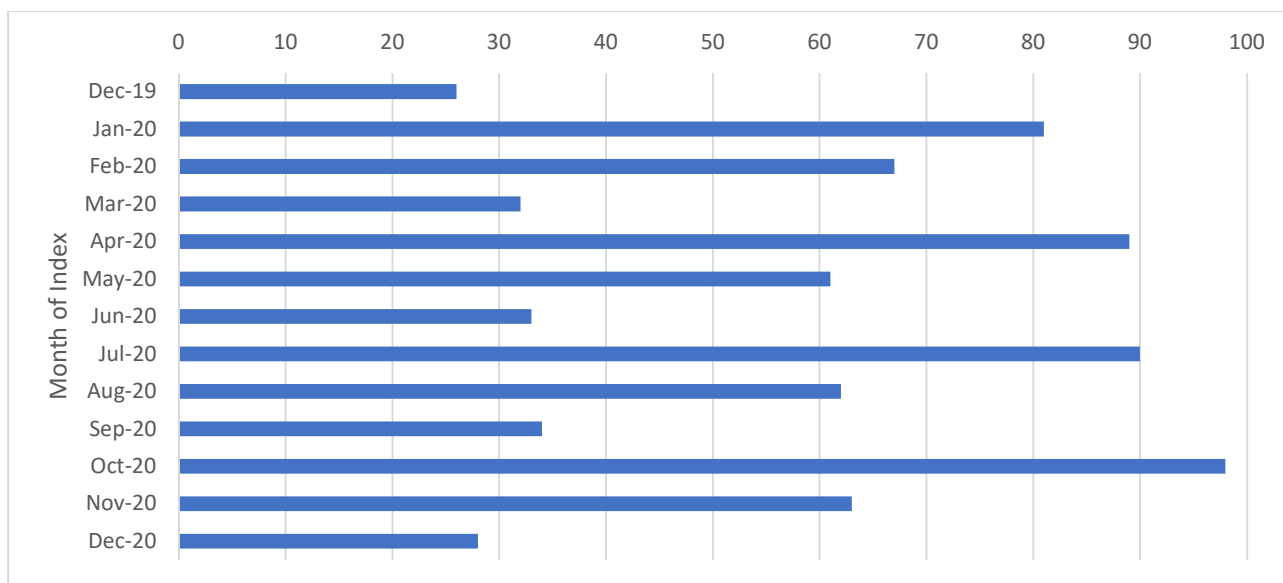


Figure A.2 gives the predicted delay between the earliest due date of either index being published and the predicted date of receipt of RTB data for each of the 13 months following December 2019.

TABLE A1

Mortgage interest
Floor Tiles
Paint
Paint Brush
Paint roller
Varnish
DIY household maintenance products
Taps/Mixer Taps
Building materials
Plumbers services
Electricians services
Services for maintenance of heating systems

Painters services
Carpenters services
Other house maintenance services
Solicitors' Fees

TABLE A2

GDP expenditure weights [€ millions]		
	2016	2017
Bread and cereals	1,166.46	1,176.97
Actual rentals for housing	4,202.86	4,532.88
Imputed rentals for housing	12,954.42	13,919.55

Source: CSO

Note that the figures listed here as those as calculated by the CSO.

The 2017 figure for imputed rents listed here is not used in this paper and is replaced by growing the 2016 figure forward as described in section 7.

Appendix A2

Derivation of User Cost Model

This appendix presents an outline of the derivation of the basic user cost model, following Diewert (2019) and focusing on the simple case of a durable good that remains the same over time.⁷

Start by assuming that one unit of a durable good is purchased at the beginning of period 0 at the price P^0 . The used durable good can be sold at the end of period 0 at the price P_s^1 . Then, the net cost for the use of the durable good will be equal to the difference between its price at the beginning of the period less its price at the end of the period; however, the end-of-the-period price needs to be discounted to its

⁷ The case of a unique durable good –such as a house– where a quality adjustment factor needs to be included in the user cost model is a simple extension of the model presented here – for more details, see Diewert (2019).

equivalent beginning-of-period price, which is equal to $\frac{P_s^1}{1+r^0}$, where r^0 is the beginning-of-the period nominal interest rate. Then, the period 0 user cost is simply:

$$u^0 = P^0 - \frac{P_s^1}{1+r^0} \quad (2)$$

The user cost equation can be rewritten in a more familiar context by using the economic depreciation rate, δ , defined as:

$$(1 - \delta) = \frac{P_s^1}{P^1} \quad (3)$$

and the period 0 inflation rate, i^0 , defined as:

$$1 + i^0 = \frac{P^1}{P^0} \quad (4)$$

Substituting equation (3) in equation (4) and re-arranging yields:

$$P_s^1 = (1 - \delta)(1 + i^0) P^0$$

which, when substituted back into equation (2) yields the following expression for the period 0 used cost:

$$u^0 = \frac{[(1 + r^0) - (1 - \delta)(1 + i^0)]P^0}{1 + r^0}$$

This expression for the user is based on prices that are discounted to the beginning of period 0. In order to express the user cost in terms of prices that are discounted to the end of period 0 we can rewrite equation as follows:

$$p^0 = (1 + r^0)u^0 = [(1 + r^0) - (1 - \delta)(1 + i^0)]P^0$$

which can be further simplified into:

$$p^0 = [r^{0*} + \delta]P^0$$

where r^{0*} is the real interest rate, defined as the difference between the nominal interest rate and the inflation rate of the asset.

Verbrugge (2008) employs a variant of the basic user cost formula, namely:

$$u_i^t = (i^t + \delta - E\pi_i^t)P_i^t$$

where i^t is the nominal interest rate, δ is the sum of annual depreciation, maintenance and repair, insurance, property taxes and a potential risk premium (assuming that the sum is equal to 7%), $E\pi_i^t$ is the expected annual constant- quality home appreciation rate and P_i^t is the price of the home. The resulting user cost can be viewed as the opportunity cost measure for the annual cost of owning a home. Then, by employing various forecasts for the price appreciation variable, Verbrugge (2008) shows that the ex-ante user cost is extremely volatile and, thus, unsuitable for a metric of the owner-occupied housing costs.