Owner Occupied Housing in the CPI and its Impact on Monetary Policy During Housing Booms and Busts

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Overview

1. Why include owner occupied housing (OOH) in the CPI?

2. Discussion on available methods for including OOH in the CPI
– Acquisition Approach
– Rental Equivalence
– User Cost approach
– A User Cost-Rental Equivalence Hybrid

3. Empirical comparison of methods using hedonic quantile regression applied to Sydney.

4. Discussion of implications of different methods for
– the inflation rate
– the disinflation puzzle
– monetary policy

1.1 Why Include OOH in the CPI?

• The consumer price index (CPI) measures the price of goods and services consumed by households.

• The CPI is used for
– monetary policy,
– indexation of public sector wages, other government expenditure, and legal contracts,
– benchmark in private sector wage negotiations, price setting, etc.

• The focus here is on monetary policy

• The expenditure share of owner-occupied housing in the CPI, when included, typically ranges between 10-20 percent.

• For indexation purposes, OOH should probably not be included in CPI. Since owner-occupiers pay imputed rent to themselves, they are automatically compensated for any rise in the cost of owner-occupied housing services.

• For monetary policy the focus is on measuring changes in the purchasing power of money.

• Housing is an important part of consumer expenditure.
– Should we focus on the purchase price of new housing or the flow of services provided by owner-occupied housing?

• The share of owner-occupier households differs considerably across Europe.

⇒ Excluding OOH means that the share of housing in the CPI differs a lot across the EU. (Note: All countries include rents in the CPI).

2. What are the available methods for including OOH in the CPI?

The three main methods are:

- Acquisitions approach
- Rental equivalence approach
- User cost approach

No consensus on which is best.
Different versions exist for each of these methods.

To include OOH in the CPI we need:

- OOH **expenditure share** of total consumption and
- an OOH **price index**.

Which methods are applied empirically?

• In the EU, Eurostat requires countries to use the acquisitions method on an experimental basis. But OOH is currently excluded from the official harmonized index of consumer prices (HICP).

• Australia and NZ also use acquisitions - but differently

• Outside Europe, most countries use rental equivalence.
e.g. USA

• Canada, Sweden and Iceland use versions of the user cost approach.

2.1 The Acquisitions Approach

- Treat housing like consumer durables.
– But a house consists of a structure and land.

- For OOH per-capita expenditure share
– Focus only on newly built housing.
– Land should be excluded since it is not produced.
– Expenditure share for residential construction obtained from national accounts.

- OOH price index
– price index for residential building materials (Australia and New Zealand)
– Price index for new residential housing (Eurostat)

Problems with the Acquisitions Approach

• Land is the main driver of house price changes. When it is excluded we miss most of what is going on in the market.

• New residential construction is a volatile component of GDP, rising strongly during housing booms and falling again once the boom ends.

• The proportion of new houses that are self-builds can vary enormously across countries, as can the ability of NSIs to record self-building activity.

• The Eurostat version of acquisitions requires a price index for new-built housing. Such an index could be unreliable in smaller countries or those with a high proportion of self-builds.

• Australian version of acquisitions misses most of what is going on in market.

2.2 The Rental Equivalence Approach

• **For OOH expenditure share**
use average imputed rent of OOH
(adjusted by share of owner-occupiers to renters)

• Question: how to impute rents?
– Survey
– econometric estimation

• **For OOH price index**
use a rent index.
Ideally this should be for **new** rental contracts.

Problems with the Rental Equivalence Approach

• The services from renting are not the same as the services from owner occupying.
For example, maintenance and improvements may be valued more by owner occupiers

• Rental housing may not be representative of OOH. Differences exist in:
– location
– size
– quality (Hill and Syed, 2016: quality differences are not stable over time)
– Also: rental equivalence may be infeasible if there is rent control or the share of the rental market is small.

• Estimating the price-rent ratio using hedonic methods is quite complex. For example, the price-rent ratio is higher at the upper end of the market. See Bracke (2013), and Hill and Syed (2016).

• If imputed rents are obtained from a survey of owner-occupiers, they may be too high.
Owners are overly optimistic or value the particular features of their property more than the average renter (see Heston 2009).

• Rent indices and price indices can follow very different paths over the short to medium term.
– in the years leading up to 2006, house prices rose much faster than rents in some OECD countries.
– during financial crisis house prices dropped dramatically in some countries while rents stayed flat.
– this problem is made worse when the rent index is based on surveys of existing renters, rather than current market rents (i.e., new rental contracts).

2.3 The User Cost Approach

OOH expenditure $= P_t u_t$ (adjusted by share of owner-occupiers)

where P_t is the average price of a dwelling

u_t is the per dollar user cost

$$u_t = r_t + \delta_t + \omega_t + \gamma_t - \pi_t - g_t$$

r is the interest rate
δ is depreciation
ω is running and average transaction costs
γ is the risk premium
π is the expected rate of inflation
g is the expected real capital gain on housing

The OOH price index is simply a house price index

The Case for Excluding Capital Gains from User Cost

• The inclusion of capital gains can make user cost expenditures very volatile. See Verbrugge (2008), Garner and Verbrugge (2009), and Hill and Syed (2016)

• Households are indifferent between owner occupying and renting if:

$$u_t P_t = R_t.$$

For this equilibrium condition expected capital gains should be included in the user cost.

• But measuring OOH expenditure in the CPI is different.

• If included, positive capital gains would be treated as negative consumption expenditure, which seems dubious.

• Capital gains relate to the investment part of housing rather than consumption.

• When capital gains are included in the user cost of OOH and households form their expectations by extrapolating from past performance, the weight of OOH in the CPI is lower when houses prices are rising and higher when house prices are falling. This causes a downward bias in the CPI.

Some examples of this bias are provided in the Appendix.

2.4 A User Cost-Rental Equivalence Hybrid

We have thus far considered either excluding expected capital gains or assuming expectations are based on past performance.

An alternative is to assume that expectations are always at the break-even level (i.e., they adjust so that in each period $R_t = u_t P_t$).

Under this assumption, the rental equivalence and user cost expenditure shares are always equal.

Hence we have a user cost method that uses rental equivalence expenditure shares, but a house price index instead of a rent index to measure price changes from one period to the next.

We refer to this method as the user-cost break-even method, u(be).

u(be) has three advantages:

(i) It is more sensitive to price trends than rental equivalence.

(ii) It does not directly depend on the interest rate, and hence unlike other user cost methods will not cause the CPI to jump when the central bank changes interest rates.

(iii) The expenditure shares will be more stable than under a standard user cost approach.

Conclusion:
• for countries with a big enough rental market we recommend including OOH in the CPI using u(be).
• For countries where the rental market is too small and unrepresentative we recommend using u(0).

3. Empirical Analysis

• Micro-level data for Sydney, Australia from Australian Property Monitors: 2004 - 2014

• Prices:
340 362 usable observations (for houses)
216 148 usable observations (for apartments)

• Rents:
311 105 usable observations (for houses)
480 578 usable observations (for apartments)

• Characteristics: bedrooms, bathrooms, land area, longitude, latitude

Land area cannot be used for apartments.

Hedonic Estimation

• We use quantile regression hedonic methods to impute prices and rents for every dwellings in every year of the data set (2004-2014).

• Hedonic model for house prices for quantile range θ:

$$Q_\theta(\log p|X) = \beta_0 + \beta_1 \log(area) + \sum_{j=2}^{4} \beta_j^{bed} d_{\{j\}}(bed)$$

$$+ \sum_{j=2}^{4} \beta_j^{bath} d_{\{j\}}(bath) + f(long, lat)$$

• Estimate equivalent models for apartment prices, house rents and apartment rents.

• We impute rents from the rent equations and prices from the price equations.

• We designate every dwelling as owner-occupied or rented in every period.

• We remove OOH from the Sydney CPI, and then put it back in using different methods.

• Like this we can compare the official Sydney CPI with:
– user cost (various treatments of expected capital gains)
– rental equivalence
– acquisitions (Eurostat method)
– excluding OOH

• The user cost method and the Eurostat acquisitions methods require a house price index.

• The rental equivalence method requires a rental index.

• We construct these indexes using hedonic methods.

We compute rental and sales price indices using a Törnqvist hedonic imputation approach.

$$\text{Paasche Imputation}: \quad P_{t,t+1}^{PI} = \prod_{h=1}^{H_{t+1}} \left[\left(\frac{\hat{p}_{t+1,h}(z_{t+1,h})}{\hat{p}_{t,h}(z_{t+1,h})} \right)^{1/H_{t+1}} \right] \tag{1}$$

$$\text{Laspeyres Imputation}: \quad P_{t,t+1}^{LI} = \prod_{h=1}^{H_t} \left[\left(\frac{\hat{p}_{t+1,h}(z_{t,h})}{\hat{p}_{t,h}(z_{t,h})} \right)^{1/H_t} \right] \tag{2}$$

$$\text{Törnqvist Imputation}: \quad P_{t,t+1}^{TI} = \sqrt{P_{t,t+1}^{PI} \times P_{t,t+1}^{LI}} \tag{3}$$

The price (rent) index is calculated over all houses sold (rented) in periods t and $t+1$.

• Also, the user cost and rental equivalence methods require estimates of the average price and rent (P_t and R_t) each period.

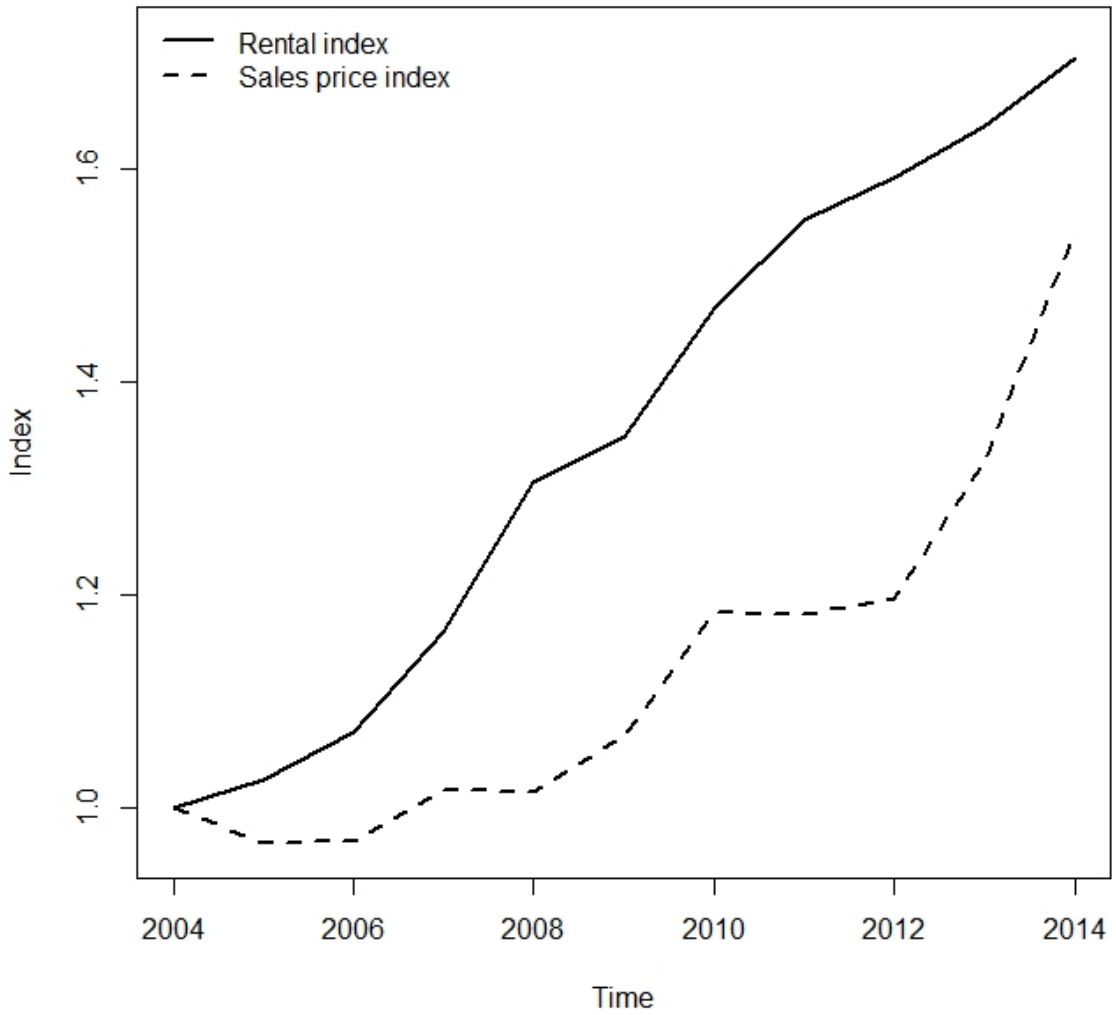

Figure 1 : Price and rent indexes.

Calculating Per Dollar User Cost u_t

$$u_t = r_t + \delta_t + \omega_t + \gamma_t - \pi_t - g_t$$

r_t is the 10-year interest rate on Australian government bonds.

$\delta_t = 1.1\%$ (from Fox and Tulip, 2014)

$\omega_t = 1.9\%$ (from Fox and Tulip, 2014)

$\gamma_t = 0$ (i.e., set risk premium to zero)

$\pi_t = 2.5\%$ (RBA inflation target is 2-3%. Average inflation over this period was 2.6%)

g_t: annualized expected real capital gains obtained by extrapolating past real capital gains over 10, 20 and 30 year horizons.

Table 1 : Expected Real Capital Gains and Per Dollar User Costs: Sydney 2004-2014

	g(0)	g(10)	g(20)	g(30)	r	u(0)	u(10)	u(20)	u(30)
2004	0.0000	0.0660	0.0501	0.0331	0.0585	0.0635	0.0000	0.0133	0.0303
2005	0.0000	0.0591	0.0476	0.0335	0.0514	0.0564	0.0000	0.0088	0.0229
2006	0.0000	0.0555	0.0436	0.0328	0.0574	0.0624	0.0069	0.0188	0.0295
2007	0.0000	0.0533	0.0449	0.0345	0.0620	0.0670	0.0138	0.0221	0.0326
2008	0.0000	0.0481	0.0415	0.0354	0.0659	0.0709	0.0228	0.0293	0.0355
2009	0.0000	0.0338	0.0184	0.0301	0.0556	0.0606	0.0268	0.0422	0.0305
2010	0.0000	0.0393	0.0312	0.0293	0.0533	0.0583	0.0190	0.0271	0.0290
2011	0.0000	0.0400	0.0327	0.0262	0.0516	0.0566	0.0166	0.0239	0.0304
2012	0.0000	0.0217	0.0300	0.0274	0.0300	0.0350	0.0132	0.0050	0.0075
2013	0.0000	0.0071	0.0305	0.0312	0.0354	0.0404	0.0333	0.0099	0.0092
2014	0.0000	0.0067	0.0359	0.0354	0.0370	0.0420	0.0353	0.0061	0.0066
Average	0.0000	0.0391	0.0369	0.0317	0.0507	0.0557	0.0171	0.0188	0.0240

Note: Here depreciation is fixed at $\delta = 0.011$, running and average transaction costs is fixed at $\omega = 0.019$, and expected inflation is fixed at $\pi = 0.025$. r is the yield on 10-year government bonds. $g(x)$ is the expected real capital gain. The per dollar user cost is calculated as follows: $u_t = r_t + \delta_t + \omega_t + \gamma_t - \pi_t - g_t$.

Average OOH Expenditures

Table 2 : Average Monthly OOH Expenditures in Dollars: Sydney 2004-2014

	$u(0)$	$u(10)$	$u(20)$	$u(30)$	Rental Equiv.	Acquis.
2004	2 140.9	0.0	450.6	1 024.2	1 016.9	606.2
2005	1 857.4	0.0	289.9	754.2	1 046.6	629.4
2006	2 077.0	229.0	625.3	984.8	1 094.7	637.8
2007	2 364.4	484.8	781.0	1 147.8	1 194.4	646.2
2008	2 494.1	801.3	1 033.6	1 248.2	1 339.4	672.6
2009	2 207.9	975.8	1 537.1	1 110.6	1 354.7	689.9
2010	2 348.2	764.6	1 091.0	1 167.5	1 462.1	711.2
2011	2 273.2	666.7	959.9	1 220.9	1 549.4	732.7
2012	1 411.0	534.9	199.8	304.8	1 585.8	744.9
2013	1 802.2	1485.4	441.6	410.4	1 625.6	770.8
2014	2 165.2	1820.0	315.6	341.3	1 676.8	802.3
Average	2 103.8	705.7	702.3	883.2	1 358.8	694.9

Table 3 : Average Monthly OOH Expenditure Shares: Sydney 2004-2014

	$u(0)$	$u(10)$	$u(20)$	$u(30)$	Rental Equiv.	Acquis.
2004	0.3246	0.0000	0.0919	0.1870	0.1859	0.1198
2005	0.2866	0.0000	0.0590	0.1402	0.1846	0.1198
2006	0.3071	0.0466	0.1177	0.1737	0.1894	0.1198
2007	0.3324	0.0926	0.1413	0.1947	0.2010	0.1198
2008	0.3354	0.1395	0.1730	0.2016	0.2132	0.1198
2009	0.3034	0.1614	0.2327	0.1797	0.2109	0.1198
2010	0.3100	0.1276	0.1727	0.1826	0.2186	0.1198
2011	0.2969	0.1102	0.1513	0.1849	0.2235	0.1198
2012	0.2050	0.0890	0.0352	0.0528	0.2247	0.1198
2013	0.2414	0.2078	0.0723	0.0676	0.2230	0.1198
2014	0.2686	0.2359	0.0508	0.0547	0.2215	0.1198
Average	0.2920	0.1101	0.1180	0.1472	0.2087	0.1198
CV	0.1370	0.6931	0.5254	0.4024	0.0758	0.0000

Table 4 : CPI Annual Inflation for Sydney

	u(0)	u(10)	u(30)	u(be)	Rental Equiv	Acq(AUS)	Acq(EUR)	OOH Excl.
2004-05	0.617%	2.215%	1.295%	1.300%	2.298%	2.463%	1.820%	2.215%
2005-06	3.012%	4.146%	3.591%	3.415%	4.179%	3.846%	3.791%	4.146%
2006-07	2.709%	1.890%	2.289%	2.339%	3.166%	1.736%	2.078%	1.744%
2007-08	2.850%	3.873%	3.438%	3.411%	6.331%	4.323%	3.869%	4.269%
2008-09	2.785%	1.766%	2.089%	2.149%	1.300%	1.309%	1.600%	1.041%
2009-10	5.485%	4.249%	4.409%	4.680%	4.060%	2.906%	3.609%	2.845%
2010-11	3.106%	3.515%	3.392%	3.311%	4.398%	3.766%	3.604%	3.800%
2011-12	1.316%	1.284%	1.297%	1.303%	1.671%	1.310%	1.313%	1.266%
2012-13	4.046%	3.113%	2.821%	4.204%	2.585%	2.587%	3.149%	2.396%
2013-14	5.797%	5.349%	3.483%	5.552%	2.831%	2.813%	3.761%	2.538%
Average	3.172%	3.140%	2.810%	3.167%	3.282%	2.706%	2.859%	2.630%
CV	0.483	0.397	0.351	0.422	0.432	0.370	0.361	0.413

4. Implications for Other Countries

• We compute average annual rates of appreciation of real house prices over the periods 1950-2012, 1980-2012, and 2000-2012 for 14 OECD countries using data provided by Knoll, Schularick and Steger (2017).

• In every single country in each of these periods (with one exception) real house prices rose.

• In our Sydney data set, house prices rose on average by 4.95 percent, while the CPI excluding OOH rose by 2.63 percent per year.

• Therefore: the exclusion of OOH generally causes a downward bias in the CPI.

Table 5 : Average Annual Increase in Real House Prices

	1950-2012	1980-2012	2000-2012
AUS	2.35%	2.94%	4.45%
BEL	2.45%	2.03%	3.69%
CAN	2.71%	2.42%	5.00%
CHE	1.00%	1.20%	3.67%
DNK	1.75%	1.12%	1.32%
FIN	3.31%	2.45%	2.70%
FRA	5.08%	2.05%	4.78%
GBR	2.28%	2.78%	3.22%
NLD	2.61%	1.69%	-0.01%
NOR	2.39%	4.17%	5.51%
SWE	1.51%	2.16%	5.12%
USA	0.30%	0.28%	0.01%

The country codes here are as follows: AUS = Australia; BEL = Belgium; CAN = Canada; CHE = Switzerland; DNK = Denmark; FIN = Finland; FRA = France; GBR = Great Britain; NLD = the Netherlands; NOR = Norway; SWE = Sweden; USA = United States of America.

Table 6 : Impact of Including OOH in the CPI Using u(be) or u(0)

	1 year Difference	10 year Difference
λ=0%	0.000%	0.000%
λ=1%	0.221%	2.230%
λ=2%	0.456%	4.654%
λ=3%	0.706%	7.290%
λ=4%	0.972%	10.155%
λ=5%	1.254%	13.267%
λ=6%	1.552%	16.648%

Note: λ denotes the rate at which real house prices are rising.

The Disinflation Puzzle in the US

Williams (2010): "The surprise [about inflation] is that it's fallen so little, given the depth and duration of the recent downturn."

Krugman (2015): "If inflation had responded to the Great Recession and aftermath the way it did in previous slumps, we would be deep in deflation by now: we aren't."

Is the Phillips curve dead?

A number of attempts have been made in the literature to explain the disinflation puzzle.

Another possible explanation is the failure of the US CPI to properly capture the impact of OOH.

Implications for Monetary Policy

• Is the disinflation puzzle significantly reduced when OOH is included using u(be) or u(0)? If so, this means the treatment of OOH in the CPI is important to our understanding of the Phillips curve.

• Including OOH using u(be) or u(0) would in most years lead to a higher HICP than if OOH is excluded or included using the acquisitions method.

• If the inflation target remained fixed at 2 percent using u(be) or u(0) would on average lead to tighter monetary policy.

• Inclusion of OOH using u(be) or u(0) would cause an inflation targeting central bank to implicitly *lean against the wind*.

• There is an active ongoing debate on the merits of using interest rates to *lean* on a housing boom. Indeed Svensson (2016) argues for doing the opposite.

• Consideration of the treatment of OOH in the CPI is a prerequisite to this debate on *leaning*.