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

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Overview

- **Why include owner occupied housing (OOH) in the CPI?**

- **Available methods for including OOH in the CPI**
  - Acquisition Approach
  - Rental Equivalence
  - User Cost approach
  - User Cost-Rental Equivalence Hybrid

- **Empirical comparison of methods using Sydney data.**

- **Implications of different methods for**
  - inflation rate
  - disinflation puzzle
  - monetary policy

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
(e.g. 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 use.

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

• For indexation purposes, may be OOH should not be included in the CPI. Owner-occupiers pay imputed rent to themselves and hence 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.

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

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

- Acquisitions approach
- Rental equivalence approach
- User cost approach

Different versions exist for each of these methods.

No consensus on which is best.

What we need to include OOH in the CPI is:
- OOH **expenditure share** of total consumption and
- an OOH **price index**.

Which methods are applied empirically?

- **Acquisitions**:

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

- **Rental equivalence**:

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

- **User cost:**

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.

• 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 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 – 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.

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
– Hedonic estimation

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

Problems with the Rental Equivalence Approach

• Services from renting are not the same as services from owner occupying (e.g., maintenance and improvements may be valued more by owner occupiers)

• Rental housing may differ from OOH in:
– location
– size
– quality (including location)

• Rental equivalence may be infeasible if there is rent control or the share of the rental market is small.

• Survey estimates are generally higher than hedonic estimates (see Katz 2017 and Aten 2018). Is this due to omitted variables in the hedonic model or survey respondents being over optimistic?

• Rental indices are often based on smallish samples of existing rather than new contracts. Ambrose, Coulson and Yoshida for example criticize the owner equivalent rent (OER) series in the US.

• Rent indices and price indices can be very different 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.

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)

• Measurement of service flow versus equilibrium condition

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 the service flow is different.

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

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

• Including ex post or expected capital gains can cause a downward bias in the CPI.

Some examples of this bias are provided in the Appendix. When expectations are extrapolated from past performance, the weight of OOH in the CPI is lower when houses prices are rising and higher when house prices are falling.

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.

The outcome is 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 will not cause the CPI to jump when the central bank changes interest rates (unlike other user cost methods).

(iii) 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).

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

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

• 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.

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

$$\text{Törnqvist Imputation}: \; P^{TI}_{t,t+1} = \sqrt{P^{PI}_{t,t+1} \times P^{LI}_{t,t+1}} \tag{1}$$

$$\text{Paasche Imputation}: \; P^{PI}_{t,t+1} = \prod_{h=1}^{H_{t+1}} \left[\left(\frac{\hat{p}_{t+1,h}(z_{t+1,h})}{\hat{p}_{t,h}(z_{t+1,h})} \right)^{1/H_{t+1}} \right] \tag{2}$$

$$\text{Laspeyres Imputation}: \; P^{LI}_{t,t+1} = \prod_{h=1}^{H_t} \left[\left(\frac{\hat{p}_{t+1,h}(z_{t,h})}{\hat{p}_{t,h}(z_{t,h})} \right)^{1/H_t} \right] \tag{3}$$

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

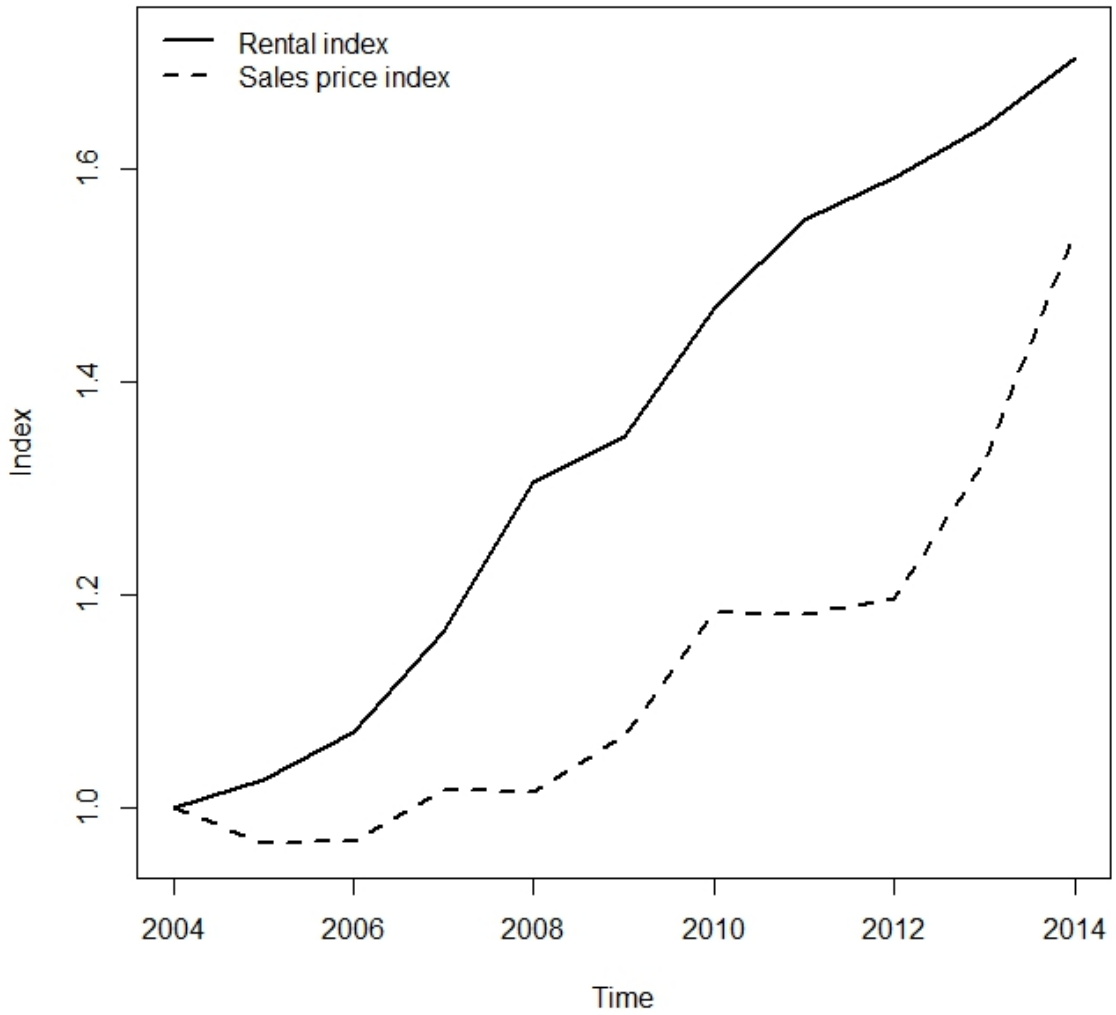

Figure 1: Price and rent indexes

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 and 30 year horizons.

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

	g(0)	g(10)	g(30)	r	u(0)	u(10)	u(20)	u(30)
2004	0.0000	0.0660	0.0331	0.0585	0.0635	0.0000	0.0133	0.0303
2005	0.0000	0.0591	0.0335	0.0514	0.0564	0.0000	0.0088	0.0229
2006	0.0000	0.0555	0.0328	0.0574	0.0624	0.0069	0.0188	0.0295
2007	0.0000	0.0533	0.0345	0.0620	0.0670	0.0138	0.0221	0.0326
2008	0.0000	0.0481	0.0354	0.0659	0.0709	0.0228	0.0293	0.0355
2009	0.0000	0.0338	0.0301	0.0556	0.0606	0.0268	0.0422	0.0305
2010	0.0000	0.0393	0.0293	0.0533	0.0583	0.0190	0.0271	0.0290
2011	0.0000	0.0400	0.0262	0.0516	0.0566	0.0166	0.0239	0.0304
2012	0.0000	0.0217	0.0274	0.0300	0.0350	0.0132	0.0050	0.0075
2013	0.0000	0.0071	0.0312	0.0354	0.0404	0.0333	0.0099	0.0092
2014	0.0000	0.0067	0.0354	0.0370	0.0420	0.0353	0.0061	0.0066
Average	0.0000	0.0391	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: $u_t = r_t + \delta_t + \omega_t + \gamma_t - \pi_t - g_t$.

Table 2: Average Monthly OOH Expenditure Shares: Sydney 2004-2014

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

Table 3: 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, real house prices rose on average by 2.32 percent per year.

• Given that real house prices are rising in most countries, it follows that the exclusion of OOH generally causes a downward bias in the CPI.

Table 4: 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 5: 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.

5. The Disinflation Puzzle in the US

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

Why did inflation not fall more as unemployment rose from 4 to 10 percent from 2007 to 2010?

Why has inflation not risen much since 2010 as unemployment fell from 10 percent back to 4 percent?

Is the Phillips curve dead?

A number of attempts have been made in the literature to explain the disinflation puzzle (see for example Ball and Mazumder 2011 and Coibion and Gorodnichenko 2015).

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

To check this we can recompute the US CPI using u(be) and u(0), and then re-estimate the following version of the Phillips curve used by Ball and Mazumder (2011):

$$\pi_t = \pi_t^e + \alpha(u - u^*)_t + \varepsilon_t,$$

where π_t is inflation in quarter t, u unemployment, u^* the natural rate of unemployment, and expected inflation π_t^e is computed as follows:

$$\pi_t^e = \frac{1}{4}(\pi_{t-1} + \pi_{t-2} + \pi_{t-3} + \pi_{t-4}).$$

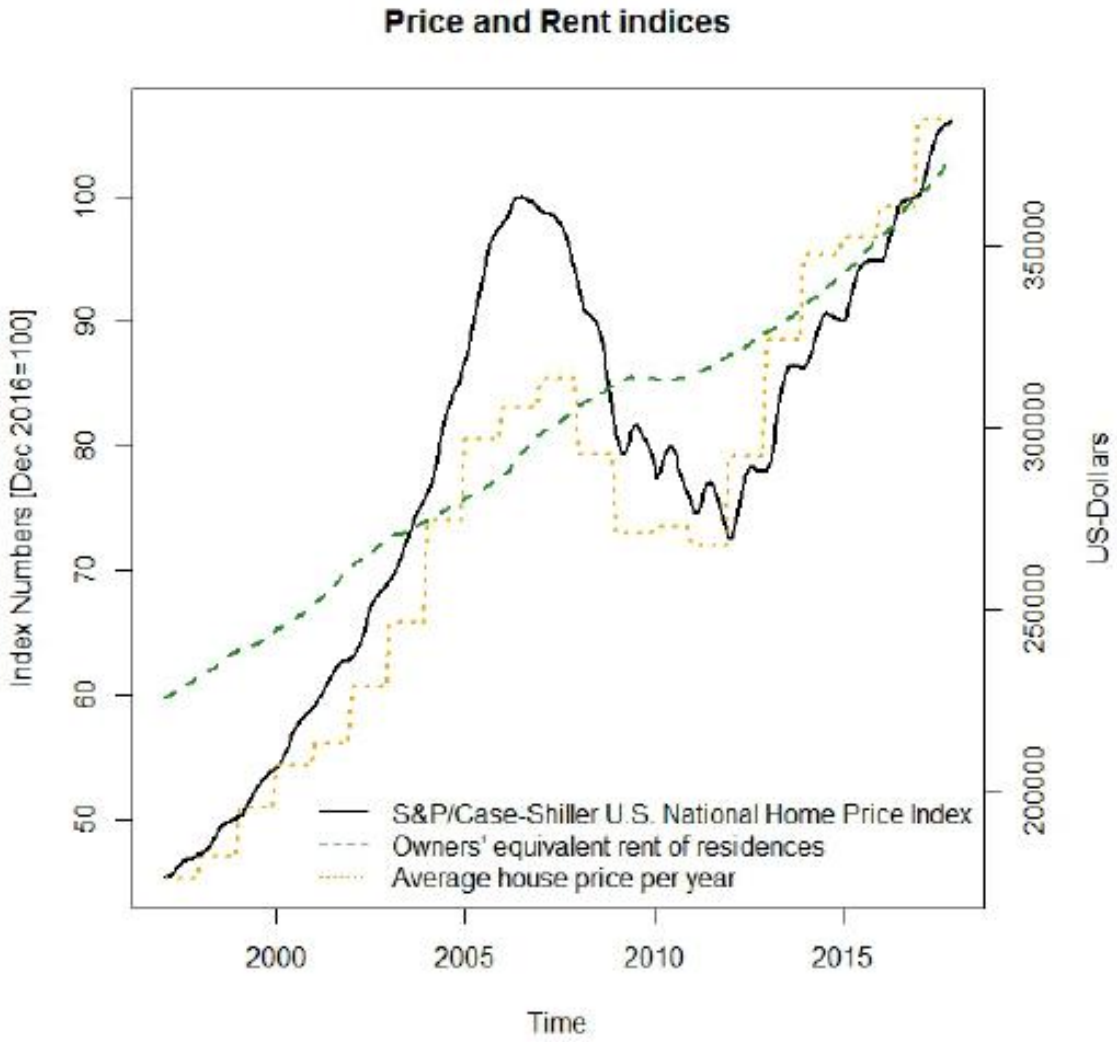

Figure 2: Price and rent indexes

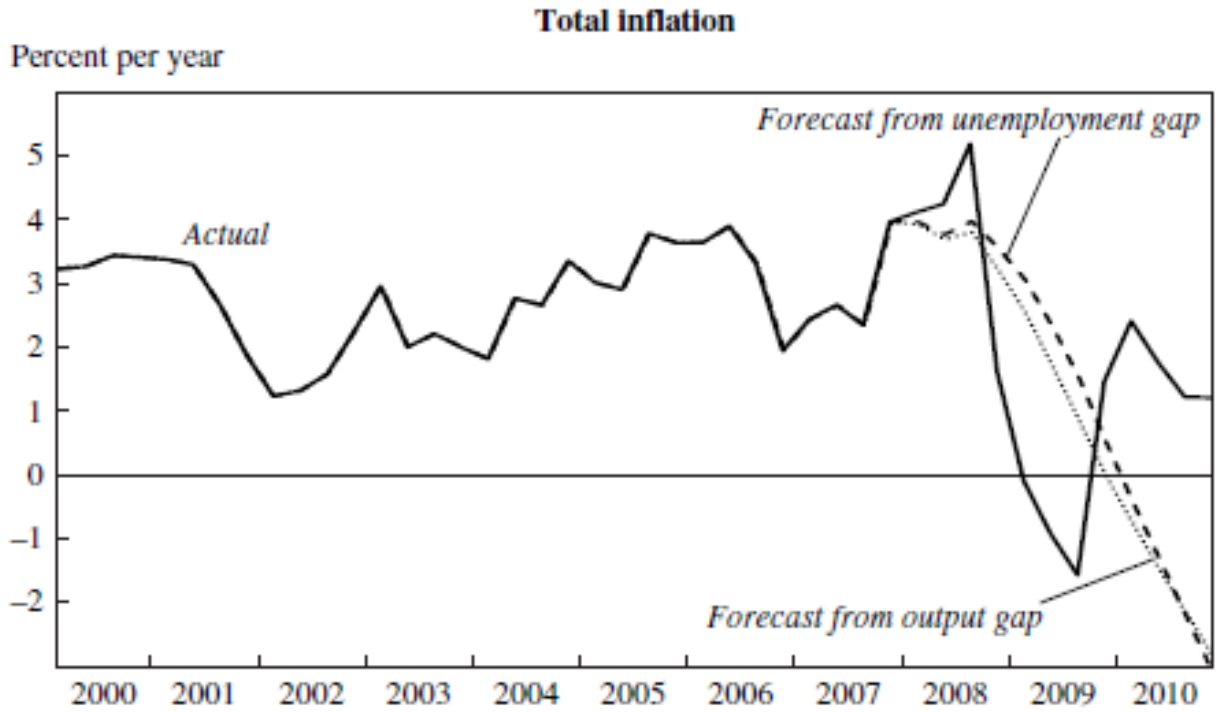

Figure 3: Ball-Mazumder (2011) - Figure 1

Re-Computing the Phillips Curve

Let $\hat{\pi}_t$ denote the imputed inflation rate obtained from a Ball-Mazumder type Phillips curve:

$$\hat{\pi}_t = \pi_t^e + \hat{\alpha}(u - u^*)_t.$$

where α is estimated over the period 1960-2007 using the official inflation rate and corresponding expected inflation.

We compute three alternative inflation residual series:

$$Res(\pi) = \pi_t - \hat{\pi}_t$$

for official US data and alternative series π_t with OOH included in the CPI using u(be) and u(0).

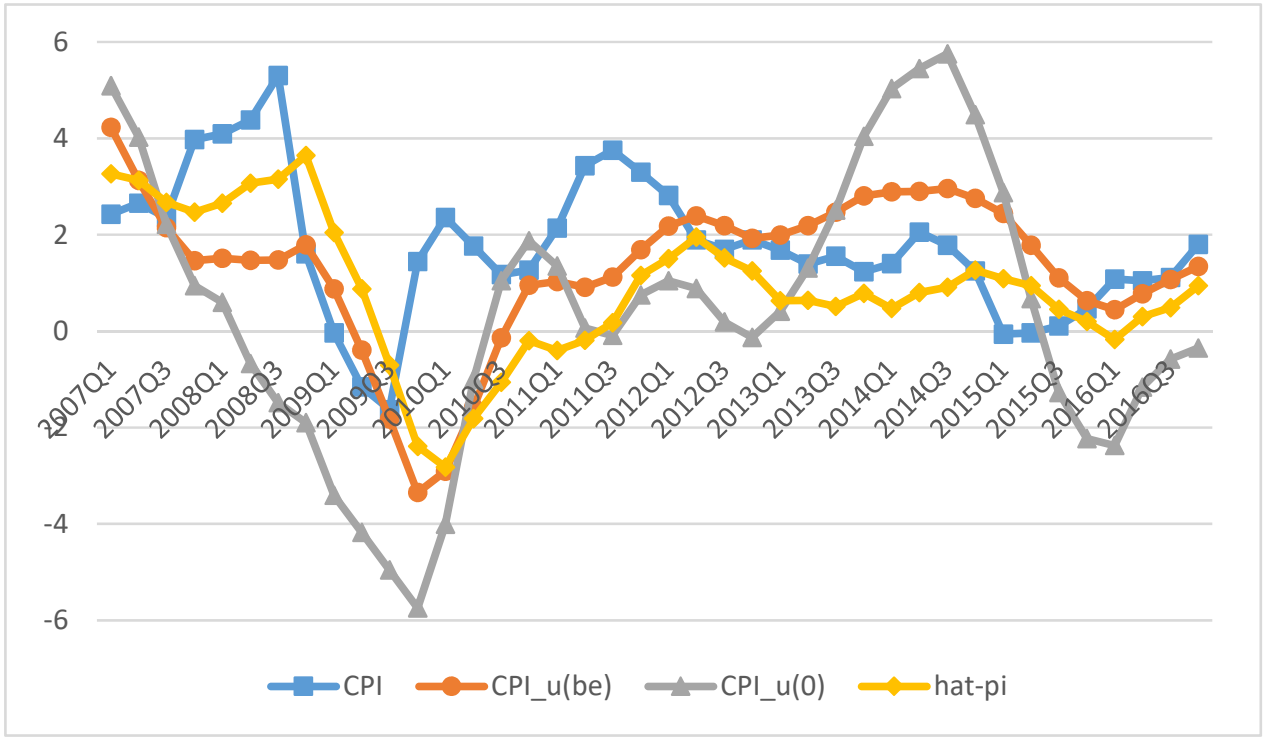

Figure 4: Inflation Rates in the US

Notes: CPI is the official CPI. CPI_u(be) and CPI_u(0) are alternative versions of the CPI that include owner occupied housing (OOH) using the u(be) and u(0) user cost methods, respectively. hat-pi is the expected rate of inflation.

Implications for Monetary Policy

• The extent of the disinflation puzzle is reduced when OOH is included in the CPI using u(be). The treatment of OOH in the CPI is maybe 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*.