# Why are house prices so high and Does it Matter?

Causes, Consequences, Measurement Issues, and Future Prospects

Gwilym Pryce

### Plan

- 1. The obvious answer
- 2. Do house price indices mean what we think they mean?
  - Does it matter?
    - (i) macro policy
    - (ii) estimating the impact of new supply
    - (iii) landlords and investors
    - (iv) lenders
    - (v) estimation of wealth inequality
- 3. Orson Wells and his time machine: class reproduction implications of:
  - (a) The Density Divide
  - (b) Rising Sea Levels
  - (c) Demographics
  - (d) Long term interest rates

### 1. The obvious answer:

• Rising demand (due to rising income) and unresponsive supply.

# 2. Do house price indices mean what we think they mean?:

• Sample selection bias and all that.

- But what do house price indices really tell us?
- Can we trust them?
- Does it matter?

- Already know that forecasting is a lost cause:
  - "Even a stopped clock gives the right time twice a day... We have been predicting the end of the housing boom for so long that, sooner or later, one of us must get it right" (Jim Pickard, FT)
    - E.g <u>A.Oswald (Nov 02)</u> "I think we are about to go through the great housing crash of 2003 to 2005... I advise you to sell your house, and move into rented acommodation... Panic will then set in..."
    - Even a website: <a href="http://www.housepricecrash.co.uk">www.housepricecrash.co.uk</a> (15 million hits every month)
- But do HP indices even give us a reliable account of past HP movements?
- What do they really mean?

Does it matter whether HP indices are reliable & meaningful?

- (i) macro policy
- (ii) estimating the impact of new supply
- (iii) landlords and investors

(iv) lenders

(v) estimation of wealth inequality

### (i) It matters for macro policy

- sensitivity of HPs to interest rate changes
  - Asymmetric HP response to r change.
  - single currency?

# (ii) It matters for estimating the where to locate new supply

- Planning system is based on a "predict and provide" system:
  - Price trends in an area indicate whether demand exceeds supply
    - $D = S \implies HP \text{ constant}$
    - $D < S \implies HP \downarrow$
    - $D > S \implies HP \uparrow$
  - Developers: don't want to build houses where no-one wants to live
- Unreliable house price indices ⇒ poor planning & development decisions.

# (iii) It matters for landlords & investors

- Asset buy & sell decisions depend crucially on the cycle
  - Buy low, sell high
- ... and on long term trends in asset values
  - Diversification decisions based on correlation of movements in property returns relative to other assets
- Reliable property price indices essential for forecasting & efficient asset allocation decisions.

### (iv) It matters for Lenders

- Macro models of possessions ⇒ huge equity effect
  - Fall in current LTV has a large impact on the probability of mortgage default

# (v) It matters for estimation of wealth inequality

- Tenure and Class Reproduction
  - OO as a means of wealth accumulation => passed onto next generation.
  - => gulf between people in rented accommodation and OO
  - gulf widens down generations as cost of OO rises.
  - Effect on education, health care, quality of life in old age.

### Shelter Report:

- housing is now the single greatest repository of wealth held by individuals in Britain.
  - Over the last 30 years levels of housing wealth
    - (1) have grown from £44bn in 1971 to £2.4trillion in 2002, double that of pensions and life assurance put together
    - (2) Ten years ago the price of an average house in Kensington (the best off area) would buy two houses in Leven, Fife (the worst-off area). Today it would buy 24.

## Misguided British Preoccupation with Housing

- month on month and place by place reporting of house prices disguises an increasingly inequitable housing market.
- Professor Danny Dorling:
  - "We have been labouring under the misapprehension that the housing boom has been providing an easier way up the social ladder. However, our research reveals that children born into the poorest households in 2004 are now far less able than previous generations to escape poverty. In other words housing is taking us back towards the deep social divisions of Victorian society a moment in history than no-one wants to see repeated."

### Spatial variation

- Dorling seems to suggest that house prices have not risen at the same rate everywhere:
  - But variations are not just regional even at relatively small spatial scales
    - Social cohesion & neighbourhood implications
    - House price measurement issues
      - Are regional or LA averages meaningful?
  - inflation surfaces & hedonic estimates

### Maps of house prices in Glasgow:

what is the location value of a house? *Gwilym Pryce, 12th May 2005* 

- <u>Map 1:</u> raw selling price
  - Large & complex variation
  - partly due to attribute differences
  - Difficult to identify submarkets
- <u>Map 2:</u> Price per room:
  - no. rooms & size not the only attribute that matters, so the pattern is still overly complex
- Map 3: MFPCQP
  - Fik et al "Location Value Signature"
  - Controls for property attributes
  - Emphasises spatial drivers of house price differences





#### How do we solve the attribute effect?

- Repeat sales:
  - Major problems with sample selection bias
- Hedonic:
  - P = f(house type, size, features, quality)
  - but if predict from standard hedonic model, no spatial variation
    - (major problem of Chesire & Sheppard approach)
- Location Value Signature (LVS)
  - Fik et al: include non-linear x,y interactions
    - Predict with constant attributes but variable x,y values.
    - => observe the unexplained spatial variation in P
- <u>MAP 3:</u>
  - Pryce 2005: extends Fik et al to include time (TLVS) and use Fractional Polynomial estimation (FPTLVS).



- <u>MAP 4:</u>
  - Perhaps it is the dynamics of housing markets that should be used to define submarket boundaries?
    - if two houses in the same market, their prices will rise at the same rate
    - So differences in price changes at the local level indicate diffferent submarkets
  - By adding <u>time</u> to the Location Value Signature model, we can use the model to predict the *inflation trajectory* of every point in space
    - Measuring Housing Equity using the Time-Location-Value-Signature model:
    - Estimates the rise in house price of every single property

       (30,000+ observations)
    - Much more precise than usual method of computing inflation:
      - Average for a particular region => slave to administrative boundaries.



#### **Constant Quality Prices (Smoothed)**



#### Have Rich or Poor Areas Done Best?

Cumulative % House Price Increase Since 1999q1 (as at 2004q4)



#### Perhaps school performance is a factor?

- If so, then profound implications...
  - Is comprehensive education really free?
     (Dennis Leech and Erick Campos)
    - Free-market housing
    - + comprehensive system
    - + variation in school performance
    - = house-price premium to attend good schools

#### • Map 5: Nearest School

- This is <u>not</u> performance by school catchments but by performance of nearest school
- Interesting that this more closely matches the house price *inflation* map more than any of the others
  - I.e. periphery schools seem to perform best
  - And it is on the periphery of the city where house price inflation is the highest

#### Performance of Nearest Local Authority School

(% Gaining 5 or more grades at level 5, 3 year average for 2000-2002)

Drumchapel High School Boclair Academy

**eshirton** 

-11

John Paul Academy

Turnbull High School Bishopbriggs nigh School

Stonelaw High School

St Margaret Mary's Secondary School Castlemilk High School Chryston High School

Knightswood Secondary School

Cleveden Secondary School
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Shawlands Ac Holyrood Secondary School

Hillhead High School

Bellahouston Academy

Renfrew High School

Drumchau

Drumity

School

Govan High School

Paisley Grammar School

Rosshall /Lourdes Secondary School

St Andrew's Academy

ool

head High School

St Paul's High School

Hillpark Secondary Sching SIPark Secondary School

Barrhead High School

Woodfarm High School

St Ninian's High School

St Luke's High School Eastwood High School

Mearne Castle High School Pheringha

Whitehill Secondary School St Andrew's Secondary Schoolenous

Smithycroft Secondary School

St Mungo's-Academy

Eastbank.Academy Bannerman High School

Ro

64

50

42

38

35

31 27 24

Trinity High School Newton (Lanark

Cathkin High School

Uddingston Grammar Scho

Lochend Community High School

MAP/5

Blantyre-High School

John Ogilvie Hillol

as Illigh Cohool

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	for Dwellings Transacted in Each Submarket:							
Variables:	West End	East End	South Side	North Side	Total			
Performance <sup>®</sup> of Nearest State								
School	44.85%	15.91%	26.98%	20.51%	31.56%			
Price:								
Selling Price	£89,835	£48,327	£62,498	£50,703	£69,225			
Price per Room (Flats)	£30,181	£13,774	£18,855	£13,224	£22,263			
Price per Room (Houses)	£25,115	£17,989	£20,940	£17,965	£21,044			
Location:								
Has Notable Views	5.73%	2.25%	4.37%	5.43%	4.58%			
Km to Glasgow City Centre	4.68	5.27	4.75	3.84	4.75			
Marketing:								
ТОМ	56.32	118.37	76.19	101.29	77.98			
% Offers Over sales	84.08%	65.82%	77.37%	60.27%	76.67%			
% Fixed Price sales	15.86%	33.11%	22.37%	39.38%	23.06%			
Number of Observations	4,154	1,953	4,365	810	11,282			
<sup>k</sup>			•	I	•			

<sup>\*</sup>Number of rooms other than bedrooms, bathrooms and kitchens.

<sup>\*\*</sup> % of pupils gaining 5 or more awards at level 5 or above (three year average for the period 2000-002).

*Source*: School Data were obtained from the Scottish Executive; all other results are from our GSPC dataset.

Hedonic Regression Estimate of the Value Placed on School Performance

Number of obs		33485	Adj R-squared		0.5988
School performance	£	337			
bundet_d	£	39,673	Spring	£	3,277
bunsd_d	£	21,965	Summer	£	5,972
vildet_d	£	27,724	Autumn	£	7,119
vilsd_d	£	4,323			
hous_VicTrad	£	7,577	y2001	£	6,076
vict_trad	£	7,450	y2002	£	17,192
fltmdr_d	£	9,217	y2003	£	32,324
bedrooms	£	16,834	y2004	£	51,983
publicro	£	27,183	cbdglas_km	-£	532
nbathrms	£	34,564	SM3	-£	18,549
spacious	-£	1,439	SM4	-£	19,497
conservy	£	8,492	SM5	-£	21,020
needsupg	-£	9,456	SM6	-£	4,316
luxury	£	15,976	SM7	-£	13,922
views	£	6,309	SM8	-£	15,235
bay	£	12,422	SM9	-£	11,731
ensuite	£	19,465	SM10	-£	15,838
garage_d	£	12,076	SM11	£	14,253
parking	£	5,603	_cons	-£	66,226

- School performance measured as:
  - % of pupils gaining 5 or more awards at level 5 or above (three year average for the period 2000-002).
- So, holding everything else constant, on average, people are willing to pay £340 for every 1% increase exam pass performance of their nearest school
  - So willing to pay 50x£340 = £17,000 to live near a school with 50% pass rates
  - So willing to pay 70x£340 = £23,800 to live near a school with 50% pass rates
    - I.e. an extra **£6,800** for the same house

# Effect not as strong as you might think

• Why?

# But are these estimates of wealth inequality reliable?

• Depends crucially on the reliability of house price indices

# 2. Three questions we need to ask:

- (i) Where does the sample come from?
- (ii) What is the mix adjustment?
- (iii) What about properties that have not recently sold?

# (i) Where does the sample come from?

- Land Registry
- ODPM/SML
- Nationwide
- Halifax
- RICS
- Hometrack
- Rightmove

## (ii) What is the mix adjustment?

- Particularly important when looking at price movements for a small area
- Changes in the type of dwellings coming onto the market can have a big impact on average price
  - E.g. mansion comes onto the market pulls up the average price in that month for that area, even if prices have not really changed
- Solution?
  - Hedonics
  - Repeat sales

# (iii) What about properties that have not recently sold?

- (a) US method
  - Logit/Probit
- We have tried to improve/adapt the US method to UK data using two different approaches

(b) Method 1:

- Duration analysis
- (c) Method 2:
  - Spatial variation in the proportion of dwellings that trade in a given time period
# Impact of Unsampled Properties on Hedonics:

• If properties that do not sell are on average similar to those that do,

– then hedonic estimation will be unbiased

- If, however, properties that do not sell are different,
  - then hedonic estimation may be biased
    - Particularly if marginal price of attributes is different for untraded properties

– E.g. high quality properties in desirable surroundings

#### Regression Line: Traded properties only $slope = \pounds 100$ (I.e. cost of extra m<sup>2</sup> = \pounds 100)



**Floor Area** 



#### Suppose Untraded Properties have different rates of inflation?

Price change dummy not pick this up  $\Rightarrow$  underestimate HP inflation



## Impact of Bias

- Barker Review of Housing Supply Interim Report (2003) estimates that:
  - the current number of new homes per annum would need to be doubled in order to "achieve the European trend rate", and "more than double to get real price stability". (p.58)
- But it also acknowledges that,
  - "the impact of additional housebuilding on house prices will depend on where, and what type, of houses are built" (p.59)
  - But why is location and type important?...
    - This paper looks at particular aspect to that question: that the house price measure you use may distort policy targets...

- ... this is because macro house price indices are dominated by high turnover properties.
  - Whether or not a new dwelling enters the set of high turnover properties will determine its impact on the price index
  - Higher turnover properties are over-represented
- This can distort policy outcomes:
  - E.g. Suppose policy goal is to reduce house price inflation
  - Building more high turnover properties will increase supply of that type/location of property
    - Apparent impact on reducing rising value of stock of houses is greater than actual, because they are over-represented
    - Particularly problematic if high turnover partly due to low satisfaction.

=> over production of low quality properties

- Q1/ Is there evidence that frequently traded dwellings have different economic & geographic attributes?
  - a. is there variation in frequency of sale across space?
  - b. do price levels differ by frequency of sale?
  - c. do inflation levels differ by frequency of sale?
- Q2/ How can we correct for bias when data on the population of properties are not available?

Q1a/ Is there Variation in I	Frequency of Sale				
Across space	ce?				
Table 1	Table 1				
Variation in the Frequ	ency of Sale of				
Properties in the We	Properties in the West of Scotland				
% No Repeat Sales in the 1991-2000 period					
City of Glasgow	59.0%				
East Dunbartonshire	59.9%				
South Lanarkshire	60.0%				
West Dumbartonshire	60.8%				
East Renfrewshire	61.5%				
North Lanarkshire	63.4%				
West Dunbartonshire	64.6%				
Renfrewshire	64.9%				
South Ayrshire	68.3%				
Inverclyde	68.5%				
East Ayrshire	68.9%				
North Ayrshire	70.9%				
Argyll & Bute	77.6%				

### Q1b/ Do Price Levels differ by FoS?

East Renfrewshire		
Mean	SD	n
£ 65,173	£ 42,210	1235
£61,638	£ 35,940	607
£ 57,829	£28,508	221
£ 53,135	£24,692	54
£ 38,345	£ 18,689	15
£62,912	£ 38,900	2132

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#### Q1c/ Does Price Inflation Differ by FoS 1991-2000 Period

Mean	min n	
	50.8%	1235
	34.5%	579
	40.6%	173
	21.0%	47
	40.2%	15
	46.5%	2132



#### Median House Prices in N.Lanarkshire: Repeat Sales vs Non Repeats

## Need to understand more about:

- The variation in frequency of sale of:
  - different property types
  - different household groups
  - different areas
- How to correct any biases caused by nonrandom variation in the frequency of sale...

## (a) US Literature on Correcting for sample selection Bias

- Gatzlaff and Haurin (1998)
  - Use Heckman correction
  - But this incorporates a simple probit estimate of the prob(sale)
  - Assumes **no duration dependence**:
    - I.e. a house is equally likely to be resold the day after it has just been purchased as it is a year or two later

### Why might we expect duration dependency?

- Unpacking takes time:
  - can't consume durable goods while they are still in boxes!
- Customisation takes time:
  - Properties often bought for their potential, so optimal consumption of housing not achieved immediately.
- Social Capital:
  - takes time to establish good relationships
- Schooling:
  - Frequent moves disrupt human capital accumulation

- Employment:
  - Frequent moves a negative signal?
- Equity:
  - Stein/Genesove & Mayer argument
- Liquidity:
  - Length of stay = ToffM + TOM
  - Is TOM really constant over time/space?
- Minimize transaction costs over lifetime:
  - sum of moving costs over lifetime are lower if fewer moves.

## **Duration Dependence:**



## (b) Method 1:

Estimated Hazard Function for Time to Resale

- Problems with US method:
  - Does not account for duration dependence
  - Cannot be applied to the UK because we don't have a database of the total housing stock.
- Can we learn anything from repeat sales over a long period?
  - SASINES data allows us to do that
  - "Solve" the data availability and duration dependence problem at the same time

## Is there duration dependence in the probability of sale?

- If not:
  - our results will offer no improvement on the Haurin method,
  - but will still offer us a way round the UK data problem

## **Duration Dependent?**

#### **Gompertz Distribution:**

if gamma > 0 then positive duration dependence; if gamma = zero then no duration dependence; if gamma < 0 then negative duration dependence.

**Estimated** *γ*:

Cl 95% (.3046027, .3086786) => Clearly greater than zero => duration dependence

#### Weibull Distribution:

if p > 1 then positive duration dependence;

- if p = one then no duration dependence;
- if p < 0 then negative duration dependence.

Estimated p:

**Cl 95%** 4.735841, 4.800477**)** 

=> Clearly greater than one
=> duration dependence

## Non-Monotonic?

#### Log-logistic Distribution:

- if **g** = 1 then the hazard is monotonic and negative duration dependence
- if 0.5 < **g** < 1 then the hazard rises steeply but declines shallowly indicating highly positive duration dependence at the outset, gradually becoming slightly negative duration dependent.
- if **g** < 0.25 then the hazard initially rises but declines steeply indicating gradually increasing duration dependence, which at some point rapidly becomes highly negatively duration dependent.
  - Estimated γ:CI 95% (.183254 .1857785)=> Clearly less than one=> non-monotonic duration dependence

### Cox Semi-Parametric







## Hazard Adjusted Mean



- Could also be used to correct hedonic regression:
  - Use hazard function to predict hazard of sale by economic factors (1989-2004).
  - Correct hedonic price regression by using hazard of sale
    - rather than hazard of non selection so use bootstrapped standard errors.
  - Create hazard-adjusted hedonic price indices:
    - for 1989-2004 for major Scottish Cities using CML data
    - For 1999-2004 for Glasgow submarkets

## (c) Method 2:

Spatial variation in the proportion of dwellings that

trade in a given time period

- Problems with Method 1:
  - What about properties that very rarely sell?
    - I.e. not included in the 16 year period
  - Cannot be applied to England and Wales
    - Land Registry data only been properly spatial coded for last 18 months or so.
    - Impossible to identify repeat sales  $\Rightarrow$  cannot compute ToffM
  - What about spatial spillover effects?
    - G&H & Pryce (M1) assumes no social or economic interactions

## Spatial Interactions:

- Relationships and family ties:
  - Reason for staying = f(friends/relatives)
    - If friends/relatives in adjacent post codes move, then less reason to stay
- Unmeasured factors drive Pr(move) affect adjacent areas:
  - New amenities
    - E.g. relocation of school; closure of train station
  - Crime
    - not measured at a small spatial scale, but potentially important
    - E.g. problem family moves into adjacent street.

- Many moves are local:
  - So if someone puts their house on the market in an adjacent post code, that gives you the opportunity to move there, which allows someone else who may well live locally to move in etc.
- Equity gains by submarket:
  - US research (Genesove & Mayer; Stein) suggests:
    - Pr(move) = f(equity)
      - need to cover transactions costs
  - Properties in the same or similar submarket likely to appreciate at the same rate
  - Need to include a measure of similarity.

- Q1/ Does the probability of sale vary across submarkets?
- Q2/ Are there spatial spillover effects?
- Q3/ Are there density & size effects?
- Q4/ How can we correct indices to take into account spatial variation in Pr(sale)?

# Q1/ Does Pr(Sale) vary systematically across space?

- Observed variation could be purely random with no systematic element
  - So, first way to test this is to look at whether the relationships with possible determinants are significant.
- Model:

 $S_i = f([+] S_w, [-] densityi_t, [-] Elevn, [-] Footprint, [-] SocialHousing$ 

 $[-] \Delta \text{ unemp}_{pt}, [+] \Delta \text{ pop}_{pt}, [-] \text{ distLondon}, [-] \text{ age}$ 

- Where,
  - PNDA = proportion of non-domestic in p
  - EASL = elevation above sea level
  - $w_{pq}$  = spatial weight matrix

## Fractional Logit Regression

- OLS: dependent variable is assumed to be unbounded:
  - So predicted values can fall below zero or could exceed one.
  - Meaningless in terms of proportions which are strictly bound at zero and one.
- So we use FLR which allows the dependent variable (and predicted values) to vary continuously between zero and one.
  - FLR devised by Papke and Wooldridge (1996, *Jnl Applied Econometrics*, vol 11)

## Distance decay function:

• For area *i* the effect of % stock that sells in nearby areas is the weighted sum of % stock that sell in area *j* divided by the distance from *j* to *i* raised to the power of *m* 

$$S_{Wi} = \sum \frac{S_j}{d_{ij}^m}$$

## Fractional Logit Results

Variable	d	ď	ď
SW	1.607	7.633	3.739
	(55.201)	(15.959)	(3.445)
MPPD_p1518	-0.075	-0.095	-0.097
	(-9.15)	(-11.596)	(-11.836)
ht_elvn_1000	-0.031	-0.058	-0.059
	(-4.474)	(-8.564)	(-8.712)
aveFPA_1000	-0.003	-0.004	-0.004
	(-5.484)	(-6.63)	(-6.785)
aveNNm2_1000	-0.117	-0.143	-0.145
	(-20.708)	(-25.426)	(-25.684)
+ Mosaic cats			
Ν	193855	193855	193855
II	131529	130183.238	130069.381
chi2	11077.64	8253.53	8016.273
aic	-262934	-260276.476	-260046.762

#### Predicted values: strips out white noise component



- Q2/ Are there spatial spillover effects?
  Yes (t = 55)
- Q3/ Are there density & size effects?
  - %sell negatively correlated with both distance to nearest neighbour (t = -21) and footprint (t=-5).
  - So large, low density properties tend to sell less frequently and enter the indices less often.

Q4/ How can we correct indices to take into account spatial variation in Pr(sale)?

- Plan is to include in Hedonic regressions
   Pr(Sale) or some monotonic transformation of it
  - E.g. pseudo Inverse Mills
- Alternatively create sample weights.

# 5. Orson Wells and his time machine:

• Class reproduction implications of house price inflation:
# (a) The Density Divide

- low density housing is rising at a faster rate than high-density urban housing;
- Current Policy Measures
  - increasing the supply of high density urban housing will only exacerbate the divergence in house wealth trajectories;
  - White flight only exacerbated
  - Spatial concentration of low income ethnic minorities.
    - => social cohesion issues

#### How Policy and Selection Bias Can Reinforce Each Other



- The corollary of low-density dwellings increasing in value at a faster rate and also trading less frequently (box ①) is that unadjusted price indices will understate the true rate of house price inflation (box ②).
- This will give an exaggerated impression of the effectiveness of high-density new-build in reducing price inflation (box ③).
- This may encourage policy makers to continue with the policy of encouraging high-density construction, but even if it does not, there are other forces that will seek to maintain this policy (such as pressure from environmental groups).
- Consequently, high-density development rises still further as a proportion of all new construction (box ④), this then exacerbates the inflation differential between low- and highdensity properties (box ①), and the self-reinforcing cycle starts anew.

- we compared the unadjusted cumulative inflation results for Oxfordshire (231%) with those of Surrey (262%) over the period 1996-2004.
  - unadjusted indices: => rate of HP inflation in the two areas was fairly similar.
- bias-adjusted indicies: Oxfordshire, the *adjusted* rate = 230% (almost identical to the *un*adjusted estimate).
- In contrast, the adjusted figure for Surrey (407%) was massively greater than the unadjusted value.
  - These results were based on very large samples (sample sizes for the county-level regressions ranged from 31,000 to 326,000).
  - => HP appreciation of the housing stock in the two counties was in fact very different

- Profound implications for planners:
  - Based on the *unadjusted* estimates, planners might have concluded that both counties needed a similar proportionate increase in new-build to ameliorate house price inflation.
  - Using the *adjusted* series we would arrive at the very opposite conclusion: Surrey is likely to need a far more radical boost to housing supply if price stability is to be achieved.
- Conceivably, similar distortions could occur at other spatial scales, such as local authorities, postcode sectors or regions.
  - no reason to believe that systemic variation in frequency of sale will be precluded by changing the size of the spatial unit.

### (b) Rising Sea Levels

- what will the future house price map of Britain look like?
- only the rich will be high and dry.

# (c) Demographics

• falling/ageing population in Scotland and other low income regions.

# (d) Long Term Real Interest Rates

• An alternative explanation for rising house prices: – have risen for the same reason that the price of gold has

risen:

- because of falling long term real interest rates.
- House prices (& gold prices & bond prices) have doubled because real interest rates have halved.
- What happens when LT interest rates fall...?
  - LT interest rates are mean-reverting
- Catastrophic for those whose only pension is their house...
- Don't build any more houses!