House Prices and Credit Constraints: Making Sense of the U.S. Experience

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In a Nutshell

- Standard house price models for the US do not work well in sample (….so not very useful for policy analysis or simulation).
- Why?
- Econometric answer – (mainly) structural break, due to classic omitted variable bias.
- Economic answer – models do not take account of changing credit conditions / standards.

In a Nutshell (Cont'd)

- Easier credit drives up the house price to income and house price to rent ratios, ceteris paribus.
- Proxy credit conditions using the cyclically adjusted trend in the loan to value ratio (LTV) for first time buyers. Source: American Housing Survey.
- The adjusted LTV data are consistent with standard accounts of lax credit conditions and the growth in sub-prime lending etc.

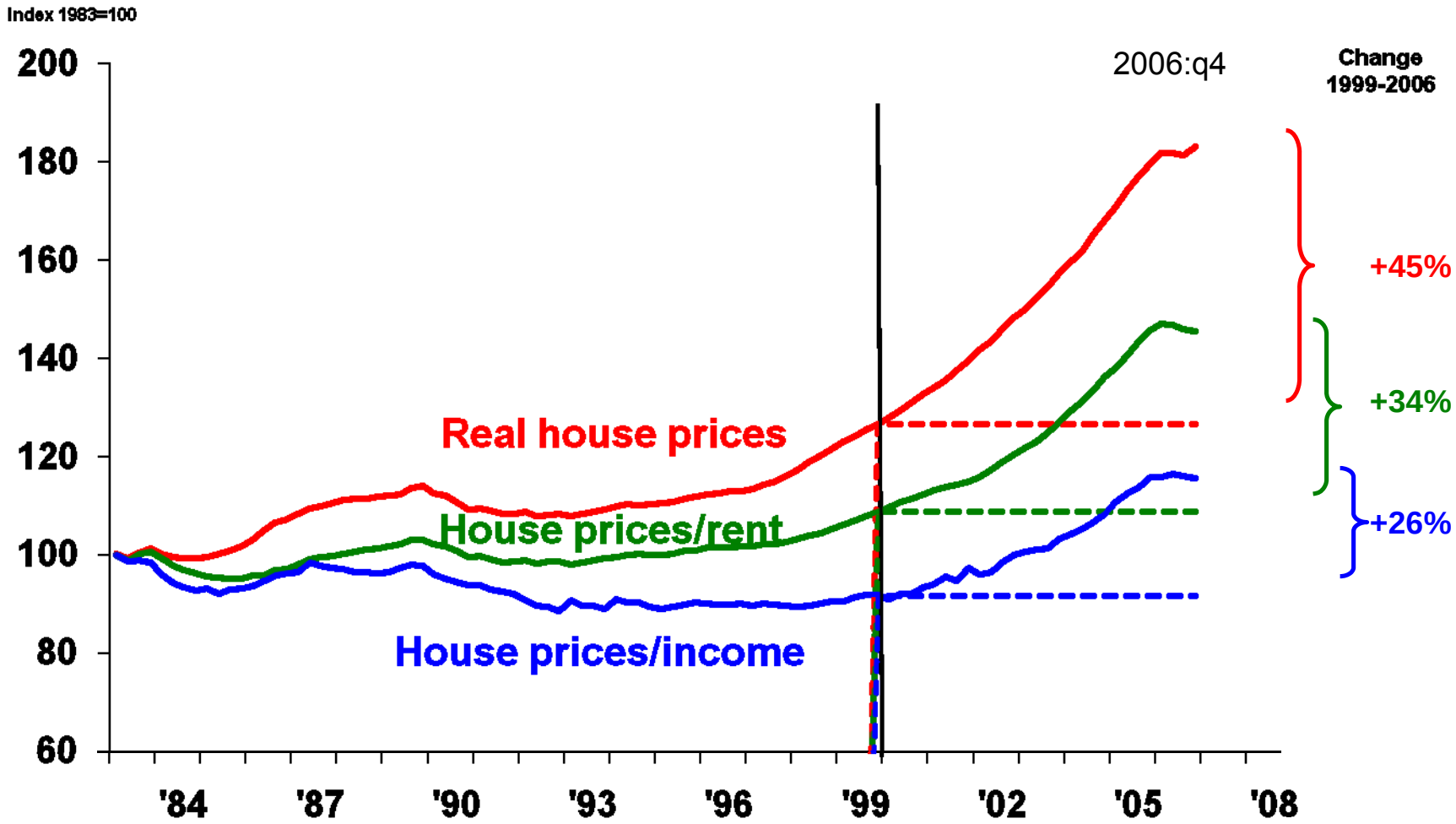
Aside: The US Housing Bust
(A Scary Bedtime Story for Central Bankers)

- Financial innovations in securitization and changes in procedures by rating agencies, inter alia, resulted in the sub-prime revolution.
- Loans were extended to borrowers with poor credit histories, previously denied loans.
- Many of the loans were for adjustable rate mortgages which particularly benefited from the lowest interest rates for decades in 2001–2003.
- The house-price rises, set in train by these credit-supply and interest-rate changes, fooled many people into thinking that such rises would be sustained.
- Fundamentals changed in 2003 as interest rates returned to more ‘normal’ levels, and high rates of building expanded the housing stock, while house prices became increasingly overvalued.
- As the extent of bad loans gradually became clear, the fundamentals changed again, as the supply of credit for all types of mortgages contracted.

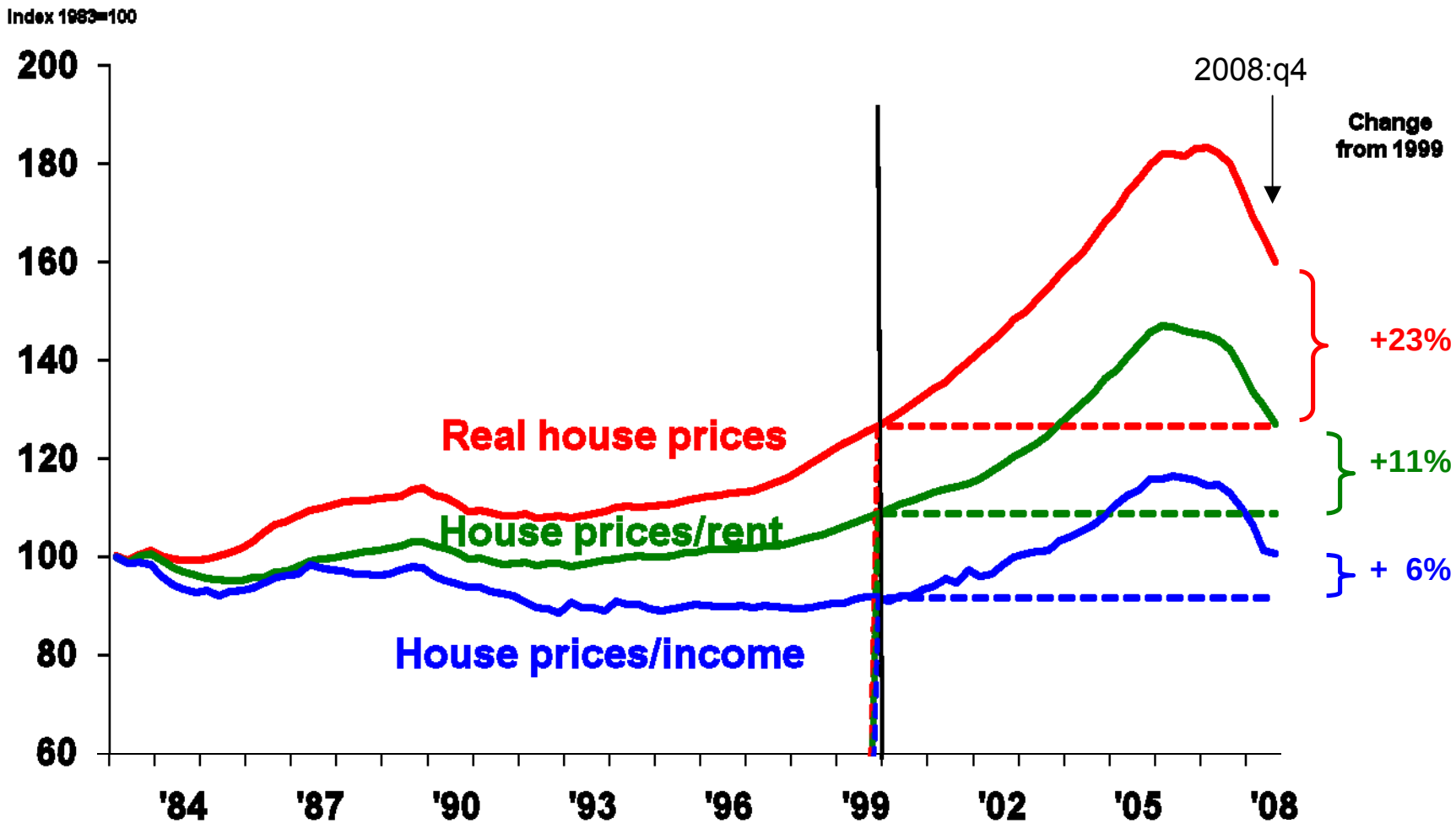
In a Nutshell (Cont'd)

- Two basic (theoretical) approaches to modelling house prices – the inverted housing demand and house price to rent approaches.
- Our LTV based measure of credit conditions work well in both econometric models:
  - LTV highly significant;
  - Obtain plausible and (more) stable long run equilibrium parameters and adjustment speeds;
  - Models track well in pseudo out of sample forecasts.
- Can use models to examine various interesting scenarios.

What Do We Want To Explain?
US House Prices Gains 1999-2006



What Do We Want To Explain (Cont'd)?
Recent US House Prices Falls



Source: Freddie Mac, Bureau of Economic Analysis, Federal Reserve Board.

Average LTVs for First-Time Home-Buyers Using Non-Gov't Mortgages

Source: American Housing Survey, calculations from Duca, Johnson, and Muellbauer (2008, in process). Non-gov't mortgages exclude FHA & VA insured mortgages and other gov't insured or direct mortgage loans that are generally limited in their individual size. 3-quarter moving average.

Econ 101 – What Determines House Prices? Two Models.

- The most basic theory of what determines house prices is just a story of supply and demand, where the supply - the stock of houses - is given in the short run.
- Then house prices depend on the stock of housing and the factors driving demand.
- This is our inverted housing demand model.
- In the US, where rental markets are well-developed and rents are generally market determined, the most popular model of house prices is the house price to rent model.

The Inverted Housing Demand Model

- The inverted demand equation is obtained by considering the demand for housing services:

$$\ln h = -\alpha \ln hp + \beta \ln y + z$$

  where hp = real house price, y = real income, and z = other demand shifters.

- Own-price and income elasticities are $-\alpha$ and β.
- Inverting yields: $\ln hp = (\beta \ln y - \ln h + z) / \alpha$

Demand Shifters (z's) in the Inverted Demand House Price Model

- Housing is a durable good (with an investment component) $\Rightarrow$ expected or 'permanent' income and 'user cost' should be important drivers.
- User cost = after-tax interest rate + property tax rate + depreciation rate - expected rate of house price appreciation (less transactions costs).
- Expected capital gains seldom observed so must be proxied by past capital gains, a reduced form model etc.

Bubble ‘Builder’ and ‘Burster’ Dynamics

- Housing market not efficient, so systematic mispricing (over or under shooting) can persist for quite a while.
- There is also a large extrapolative element in expectations.
- A series of positive shocks to fundamentals can lead to rising prices and the expectation of further appreciation, leading to greater and greater overvaluation. In due course, the increasing negative pull from fundamentals and increased supply reduce the rate of appreciation.
- Lagged house price capital gains or losses are an important determinant of current house prices, termed the ‘bubble-builder’ by Abraham and Hendershott (1996).
- The deviation of prices from long-run ‘fundamentals’ is then the ‘bubble-burster’.

Yet More Explanatory Variables!

- Demography e.g. the proportion of households in the under-35 age group where many first-time buyers are to be found.
- Many mortgage borrowers face limits on their borrowing and may be risk averse $\Rightarrow$ nominal interest rates and proxies for downside risk or mortgage default may be important. (Cameron et al., 2006).
- Changes in credit conditions matter for house prices (and savings), particularly in the US and UK.

The Ratio of House Price to Rents (Model 2)

- Ceteris paribus, arbitrage between owner-occupied and rental housing markets implies the house rent-to-price ratio equals the real user cost of housing.
- Hence, the log house price-to-rent ratio equals the log of the inverse of real user cost:

$$\ln\left(hp/rent\right) = -\ln\left(uc\right)$$

- Very simple and attractive model….
- But misleading if credit conditions vary etc.

The Inverted Demand Model - Data

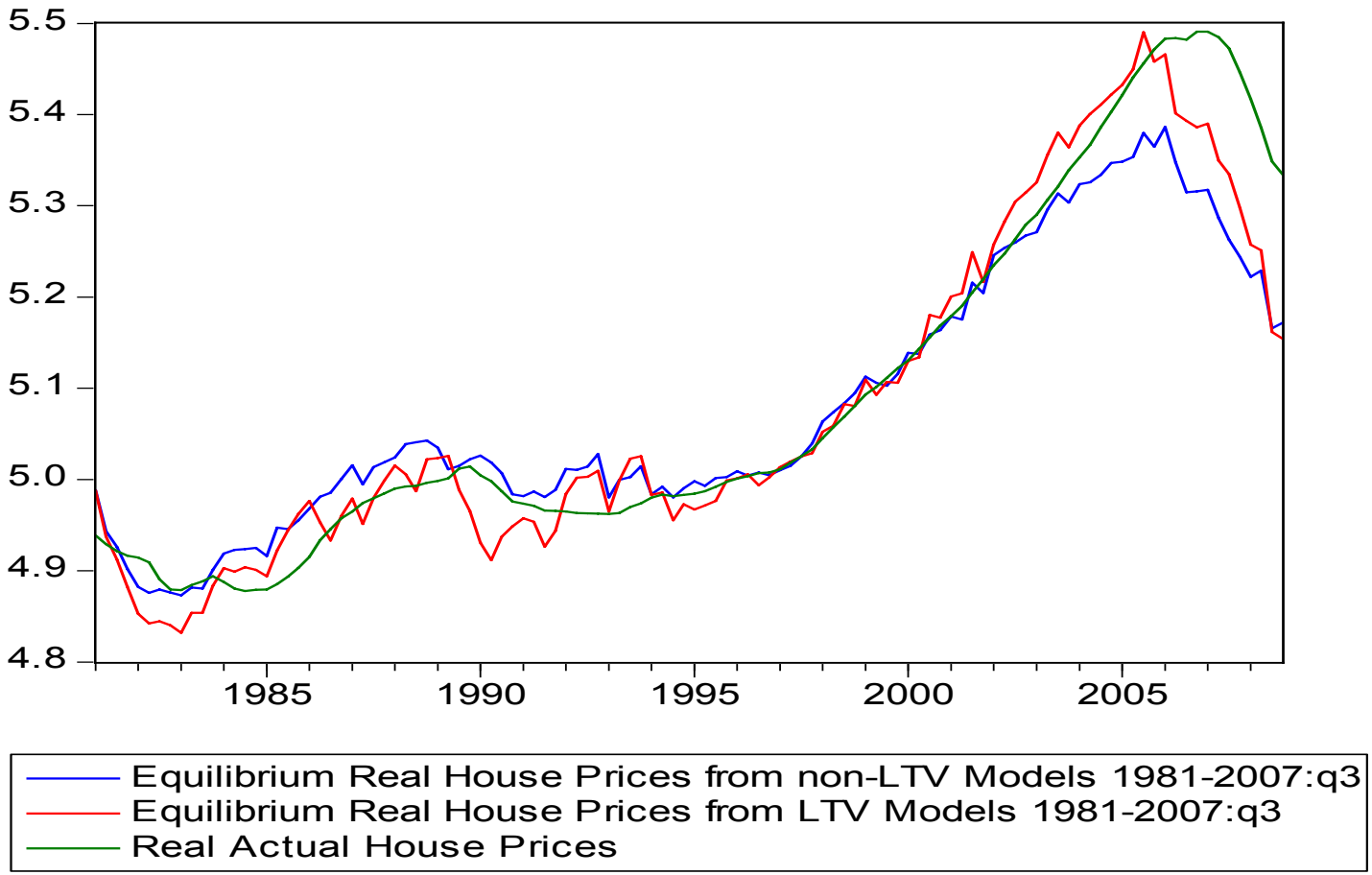
- **Home Prices:** Freddie Mac repeat sales of homes purchased with conforming mortgages. Deflated using PCE index.
- **Income**: Real per capita labor plus transfer income.
- **Real Mortgage Rate:** After tax and depreciation adjusted nominal mortgage rate, minus 16 quarter annualized appreciation (adjusted for home selling costs).
- **Real Housing Stock:** Fed's Flow of Funds estimate of the replacement cost of housing structures, deflated by housing construction price index.
- **Monetary Target Regime:** Dummy for monetary targets that boosted interest rate volatility (1979 Q4 to 1982 Q3)
- **Deposit Regulations:** Two quarter change in effect of Regulation Q (REGQ**)** disintermediation policy.
- **Tax Variable:**Tax advantage to housing capital gains since 1998 Q1

VEC (Vector Error Correction) Inverted Demand Results

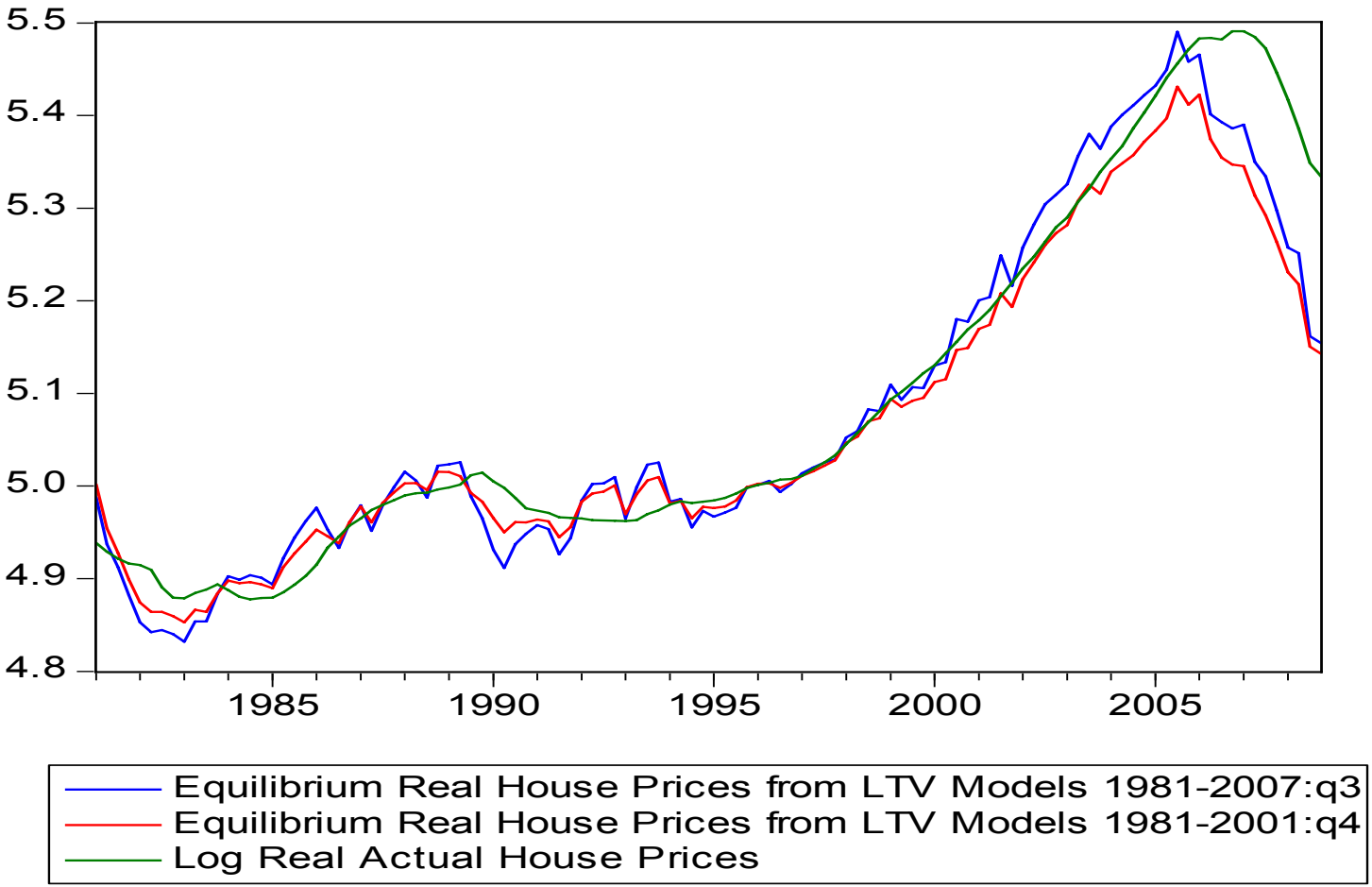
Long Run Coeffs	**No LTV 1980:3-2001**	**LTV 1980:3-2001**	**No LTV 1980:3-2007:2**	**LTV 1980:3-2007:2**
Ln Real Income$_{t-1}$	1.00** (5.3)	1.29** (7.0)	1.59** (3.0)	1.88** (5.4)
Ln Housing Stock$_{t-1}$	-0.40** (-3.0)	-0.72** (-5.1)	-0.89* (-2.3)	-1.23** (-7.5)
Ln First-Time Buyer LTV$_{t-2}$		0.71** (4.8)		1.33** (7.6)
Ln User Cost$_{t-1}$	-0.13** (-10.3)	-0.14** (-12.2)	-0.13** (-7.3)	-0.15** (-19.7)
Speed of Adjustment / EC$_{t-1}$ Term	-0.17** (-3.7)	-0.18** (-6.5)	-0.05** (-3.6)	-0.16** (-7.0)
Income Elasticity Price Elasticity	2.5 2.5	1.80 1.40	1.78 1.12	1.52 0.81
Unique Cointegrating Vector	Yes**	Yes**	Yes* (trace) No (max)	Yes**
R^2 S.E. * 100	0.78 0.35	0.82 0.32	0.79 0.39	0.85 0.32

Vectors allow trends in variables but not in the cointegrating relationship. Controls include 0-1 dummies for monetary targeting regime and 1998 capital gains tax relief, depreciation rate on rental properties, and consumer income/interest rate expectations. Statistics from Tables 1 and 2 from the paper.

Real House Prices Tracked Better by Long Run Equilibrium of LTV vs. Non-LTV Models



Long Run Equilibrium House Prices Similar for LTV Models Estimated With & Without 2002-2007



House Price to Rent Model Results

- Our findings are qualitatively similar when we model the house price to rent ratio.
- Models with our LTV based measure of credit conditions perform better.
- One specification of the estimated long run rent and house price to rent equations for the US is:

$$\ln(rent) = 0.3\ln(hp) + 0.02\,uc - 0.01\,ur$$

$$\ln(hp/rent) = 1.3\ln LTV - 0.02\ln uc$$

- The estimated speeds of adjustment to the long run equilibrium are very slow, since rents are very sticky.

A Hostage to Fortune – The Simulated path of Future US House Prices

- If our model is correct, the US house price bust may last quite a long time!
- The simulated path of future real US house prices, shown in next figure, assumes that:
  - The US economy recovers slowly;
  - Mortgage credit condition revert to their end 1999 value;
  - (Most importantly) our model is correct.

Real House Price Simulation Based on House Price-to-Rent Model (LTVs Revert to 1999 Q4 Level in 2008 Q4)