

What Do VAR and DSGE Models Tell Us About the Current Business Cycle?

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A Real Time Exercise

1. I use results of ongoing work on a DSGE Model of the housing market with nominal and real frictions to focus on some questions related to the current outlook for the U.S. Economy
2. Using the an estimated Model of the Housing Market (data until 2009Q1), I ask what the model predicts for housing and non-housing variables.
3. To check the plausibility of my predictions, I compare the predictive ability of the model with VAR Models and with forecasts from CBO. The model does just as well (if not better) than these models, so if you believe those models, you should believe this one too.

The Bottom Line

- Model predicts a long recession: real GDP to fall by 4.7% in 2009 and 1.4% in 2010, before growth resumes at 4.4% in 2011
(key to this result is the persistence in business fixed investment that fell 12% qoq in 2009Q1)
- Housing Investment growth should become positive in 2010
- Inflation-Adjusted House Prices have bottomed out, but will return to their 2006 value in 2022 (yes, 2022).

A Model of the Housing Market

- The model adds a rich housing sector to a well-established framework that is increasingly used in quantitative monetary policy analysis
- Model described in Iacoviello and Neri (2009) and Iacoviello, Kamenik, Kumhof and Laxton (in progress)

Main model features

- Technology: Multi-sector structure with housing
- Collateral effects on spending for a fraction of households:

$$b_t = m \frac{V_t}{\text{value of the house}}$$

mortgage debt loan-to-value (85%)

- Model contains several sources of inertia (nominal rigidities, habits, investment adjustment costs) that allow a good fit to the data

2. The Model

- Sectors with different rates of technological progress
 - Y -sector produces consumption, business investment, intermediate goods (using K and N)
 - IH -sector produces homes (using K , N , land, intermediate goods)

$$Y_t = (A_{ct} N_{ct})^{1-\mu_c} (z_{ct} k_{ct-1})^{\mu_c}$$

$$IH_t = (A_{ht} N_{ht})^{1-\mu_h-\mu_b-\mu_l} (z_{ht} k_{ht-1})^{\mu_h} k_{bt}^{\mu_b} l_{t-1}^{\mu_l}$$

- Two Types of Households
 - Patients work, consume, buy homes, rent capital and land to firms and lend to impatient households
 - Impatients/Credit Constrained work, consume, buy homes and borrow against their home (wage share $1 - \alpha$)

$$u_t = z_t (\log \tilde{c}_t + j_t \log h_t - \tau_t g(n_{ct}, n_{ht}))$$

- Sticky prices in the non-housing sector, Sticky wages in both sectors
- Central Bank follows Taylor rule

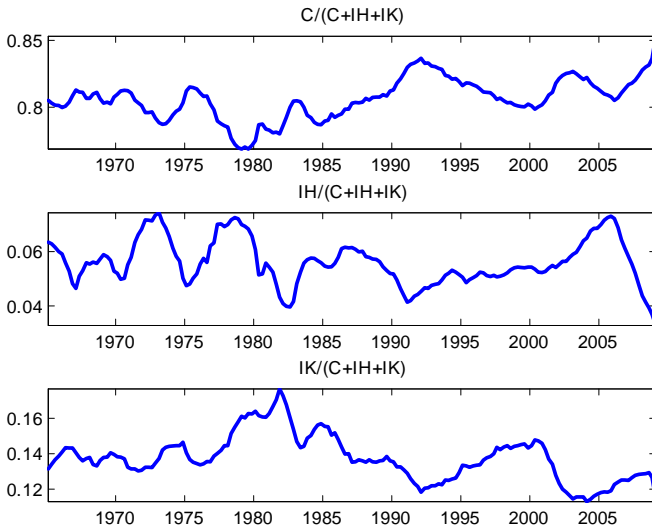
2. The Model

- Investment Adjustment Costs
- Trend-stationary and unit-root shocks to technologies for producing consumption goods, business investment goods, houses
- Log preferences over housing and consumption imply that expenditure shares are constant in the long run

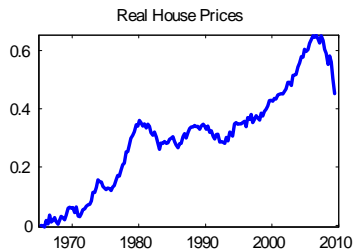
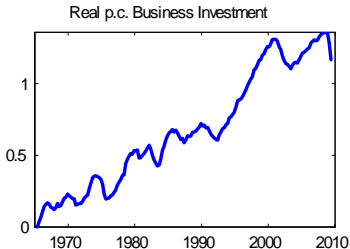
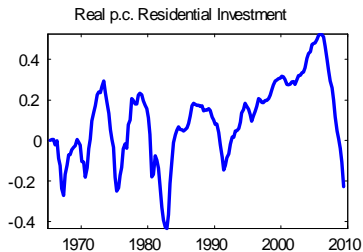
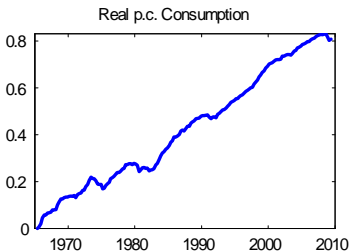
$$\log q_t + \log IH_t = \log \text{constant} + \log C_t$$

- Shocks to technology, preferences, monetary policy and inflation

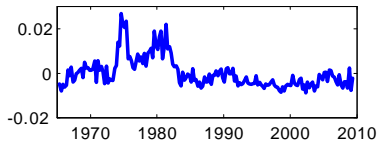
Nominal shares



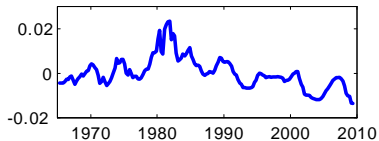
Model Estimated on 10 U.S. time series using Bayesian techniques



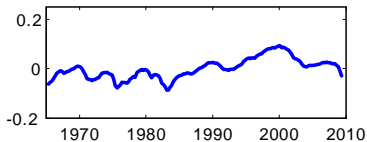
Inflation



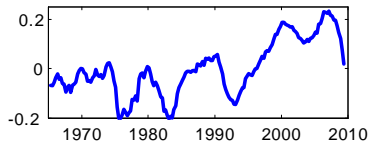
Nominal Interest Rate



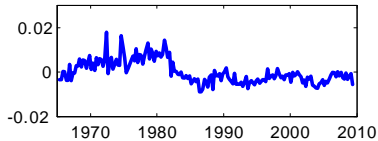
Hours Worked, Consumption Sector



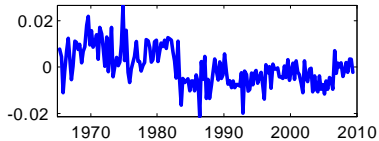
Hours Worked, Housing Sector

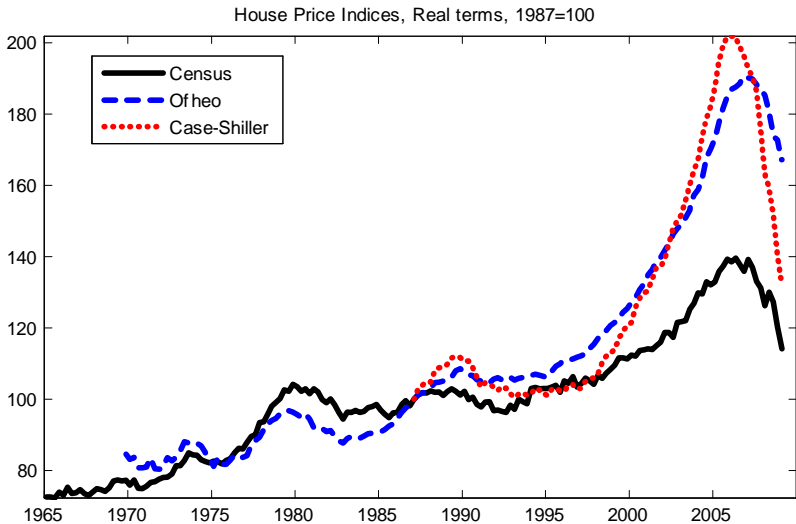


Wage Inflation, Consumption Sector



Wage Inflation, Housing Sector





For house prices, I use the Census Bureau Constant Quality Index of New One-Family Homes Sold

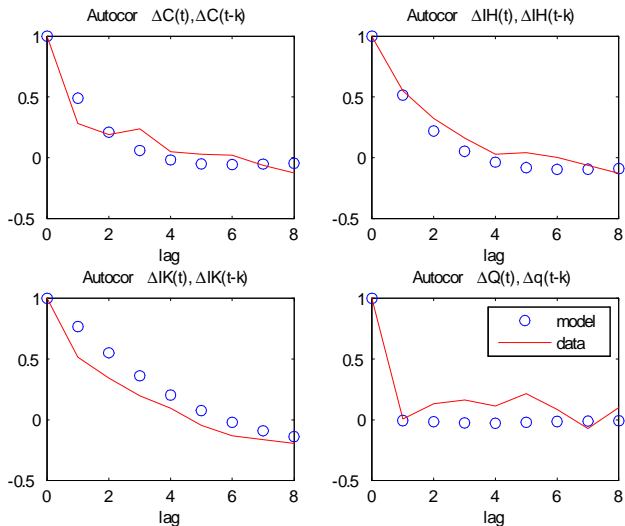
- **Why the Census?**

1. CENSUS: Only regularly published hedonic house price series (but only for new houses; new construction often occurs at the edge; downward bias?)
2. OFHEO: Repeat-sales, poor adjustment for quality improvements (upward bias?)
3. CS: Repeat-sales, value-weighting, poor adjustment for quality improvements (unless some transactions are deemed suspicious...)

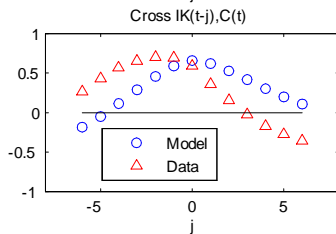
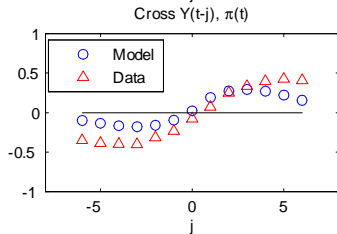
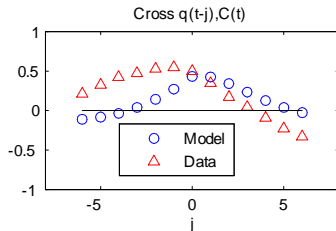
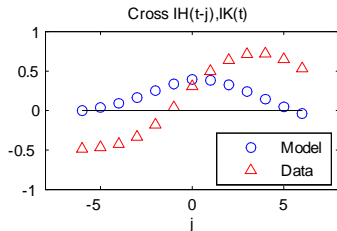
3. ESTIMATION RESULTS

1. Slow rate of technological progress in housing construction explains upward trend in housing values of the last decades.
Part of the trend growth reflects supply constraints from land, but their contribution is small (10% of the trend)
2. Wage share of credit constrained households estimated around 20 percent
These are the households who suffer the most from drops in housing values
This fraction is large enough to amplify effects on consumption from fluctuations in housing values (especially for high values of the loan-to-value ratio)
3. Model finds substantial investment adjustment costs, which explain the persistence of investment growth found in the data

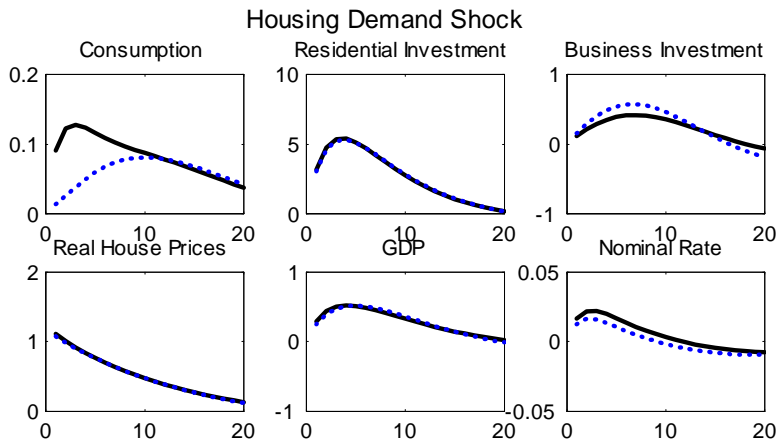
Properties of Estimated Model: Autocorrelations (growth rates)



Properties of Estimated Model: Cross-correlations (HP-filtered level)



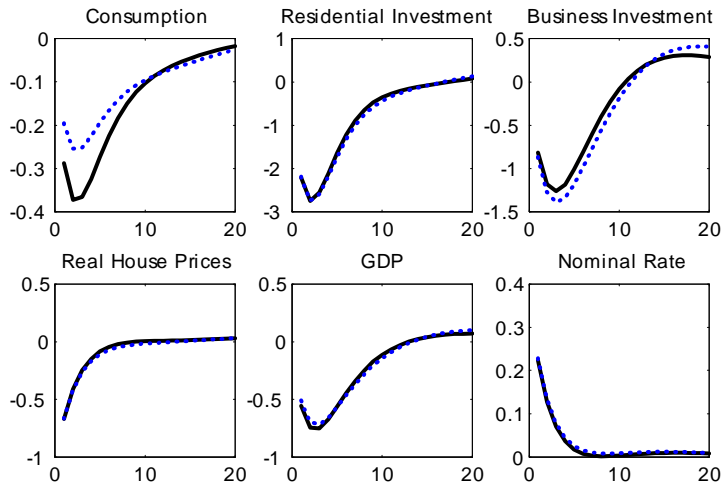
Properties of Estimated Model: Impulse Responses



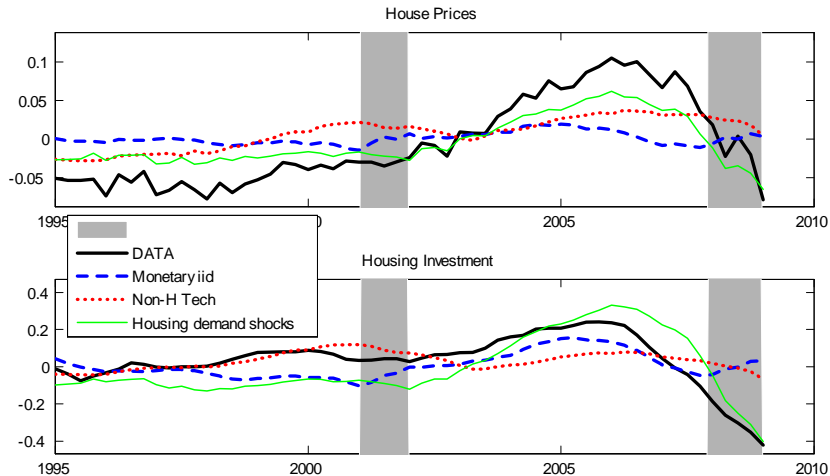
Dashed lines (no collateral effects)

Properties of Estimated Model: Impulse Responses

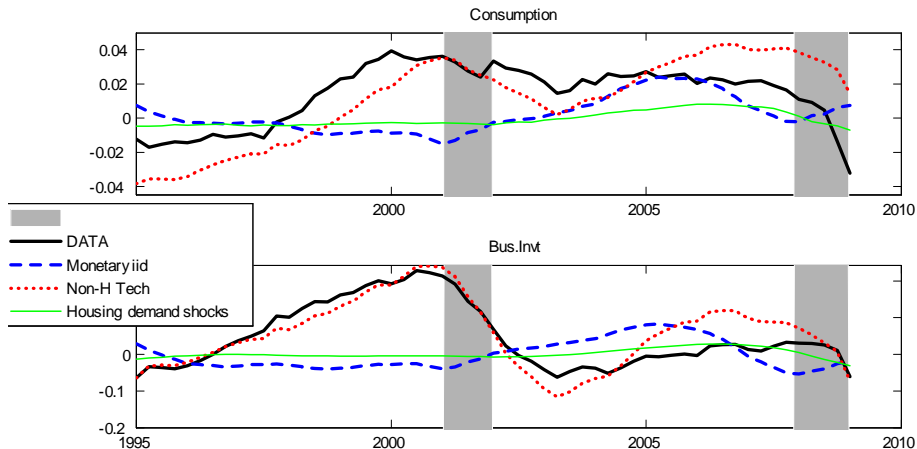
Monetary Shock



4.1. The Recent Cycle: What were the causes?



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4.2 How Did the Housing Cycle Feed into Consumption Spending?

In the model, house price increases relax collateral constraints allowing households to borrow and spend more.

Effect is larger the larger the share of credit constrained households

How Much Did the Housing Cycle Feed Consumption Spending?

Year	Model (Actual) Consumption Growth	Counterfactual Consumption Growth w/o Collateral Effect	Contribution of housing to C
1999	4.9%	4.5%	0.4%
2000	4.4%	4.5%	-0.1%
2001	2.4%	2.4%	0.0%
2002	2.7%	2.1%	0.6%
2003	2.7%	2.2%	0.5%
2004	3.6%	3.1%	0.5%
2005	2.9%	3.0%	-0.1%
2006	2.9%	3.4%	-0.5%
2007	2.7%	3.5%	-0.8%
2008	0.2%	0.5%	-0.3%
2009 (forec.)	-0.7%	-0.3%	-0.4%

5. Preliminaries

Model

$$Y = C + IH + IK$$

Data

$$GDP = Y + G + \Delta Inventories + NX$$

I use the coefficient of a regression of

$$\Delta GDP = \beta_0 + \beta_1 \Delta Y$$

to map model predictions on Y into data predictions for GDP
($\beta_0 = 0.0029, \beta_1 = 0.5497$)

5.1. Basic Overview of the Forecasting Properties: VAR

In forecasting GDP, housing prices and investment, model better than a VAR(2) (GDP, q, IH, R, π)

GDP

Hor.	RMSE		
	DSGE	VAR(2)	DSGE gain
1 q	0.0057	0.0094	39%
4 q	0.0235	0.0405	42%
8 q	0.0318	0.0360	12%
12 q	0.0322	0.0273	-18%

House Prices

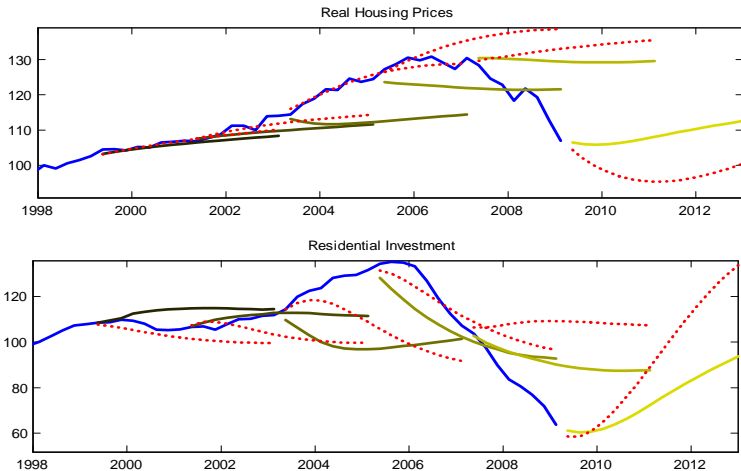
Hor.	RMSE		
	DSGE	VAR(2)	DSGE gain
1 q	0.0160	0.0139	-15%
4 q	0.0580	0.0655	11%
8 q	0.0928	0.0958	3%
12 q	0.1013	0.0971	-4%

Housing Investment

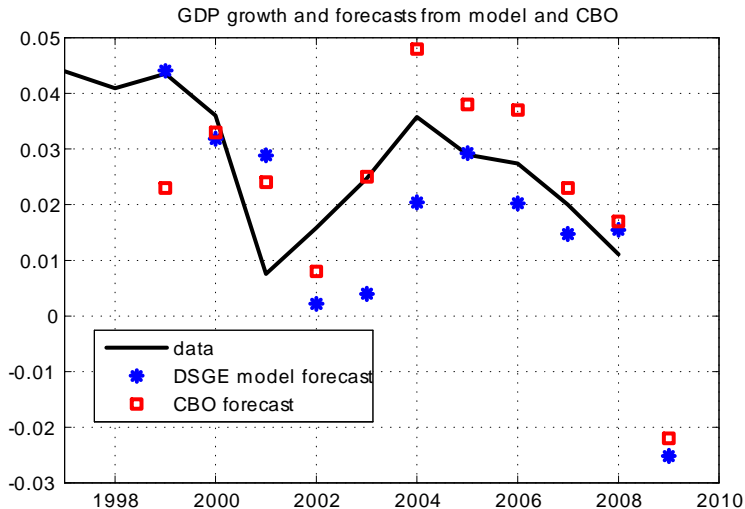
Hor.	RMSE		
	DSGE	VAR(2)	DSGEgain
1 q	0.0340	0.0357	5%
4 q	0.1491	0.1806	17%
8 q	0.2186	0.2071	-6%
12 q	0.2152	0.2389	10%

5.1.a Forecasting Properties vs VAR(2)

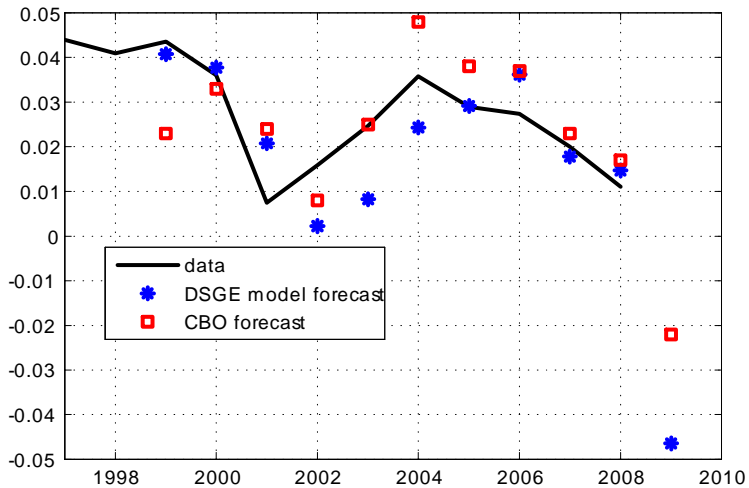
Blue: data, green: DSGE, red: VAR



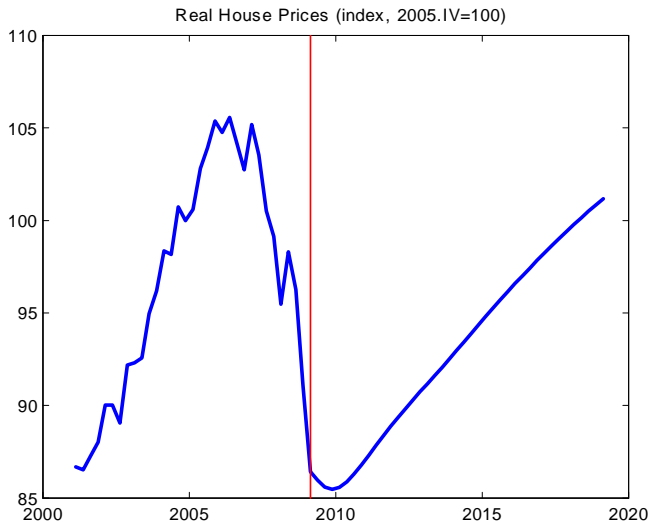
5.2.a Forecasting Properties vs CBO (data until 08Q4)



5.2.b Forecasting Properties vs CBO (data until 09Q1)

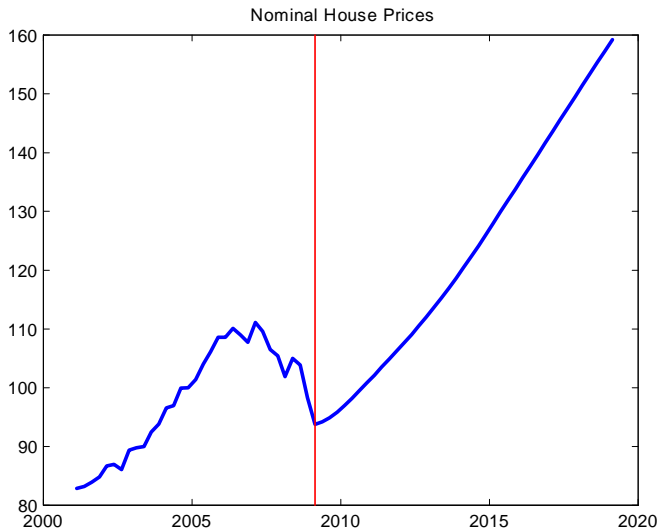


5.3. Housing Market Projections: Real Prices



5.4. Housing Market Projections: Nominal Prices

Assuming 3% (2%) inflation, nominal house prices return to the peak in 2013 (2014)



5.5. Where is the Economy Headed?

Year	ΔC	ΔIH	ΔIK	$\Delta \text{Real hp}$	$\Delta \text{Nm. hp}$	ΔGDP
2008	0.2%	-23.1%	1.6%	-6.9%	-5.6%	0.4%
2009	-0.7%	-23.4%	-30.6%	-10.4%	-7.7%	-4.8%
2010	-0.4%	6.0%	-17.6%	0.3%	4.3%	-1.3%
2011	1.8%	16.5%	11.6%	2.3%	5.2%	4.4%
2012	3.3%	14.0%	21.6%	2.2%	5.2%	6.3%
long-run	3.4%	2.2%	4.9%	1.2%	4.2%	3.3%

Conclusions

1. If persistence is a key defining property of macro time series, the outlook for the US economy from DSGE models suggests a longer than expected recession
2. Model forecast for GDP is -4.6% in 2009, -1.3% in 2010, 4.4% in 2011 (with qoq growth resuming in 2010Q2)
3. House prices seem to have bottomed out, but the recovery to the previous levels will occur at a slow pace.