Aggregate shocks and house prices fluctuations

José-Víctor Ríos-Rull Virginia Sánchez-Marcos

U of Minnesota, Mpls Fed, CAERP, U Cantabria, Fedea

Friday, March 23rd, 2012
HULM, Boston

What moves housing prices?

- What moves asset prices?

During a recession, households need to be convinced to reduce their consumption. Essentially the drop in asset prices is σ (the coefficient of risk aversion) times the required drop in consumption. (Glover et al. (2011)).

- But the return of houses does not change.

Still, if Cobb-Douglas (in cons and housing services) the same thing applies to houses. (with iid aggregate shocks the elasticity of prices to changes in income is given by $1 + \nu(\sigma - 1)$).

- Over the recent downturn stock prices (and debt) have recovered but houses have not.

- So what makes houses different?

What makes houses different than other assets

- They are big (in relation to the wealth and income of the purchaser).

- They are distributed very differently than other assets: Two thirds of households own a house and a mortgage. Their net asset position is lower than the value of the house.

- There are large transaction costs every time houses are transacted, about 10%.

- Their purchase involves the financial system directly. The glitches of the financial system may affect prices.

- There are large moral hazard problems that prevent hedging and other ways to share risk.

Our paper

- We Explore how these features explicitly modeled account simultaneously for housing and other asset prices.

- We ask the extent to which real and financial shocks with real meaning can be behind the observed price movements.

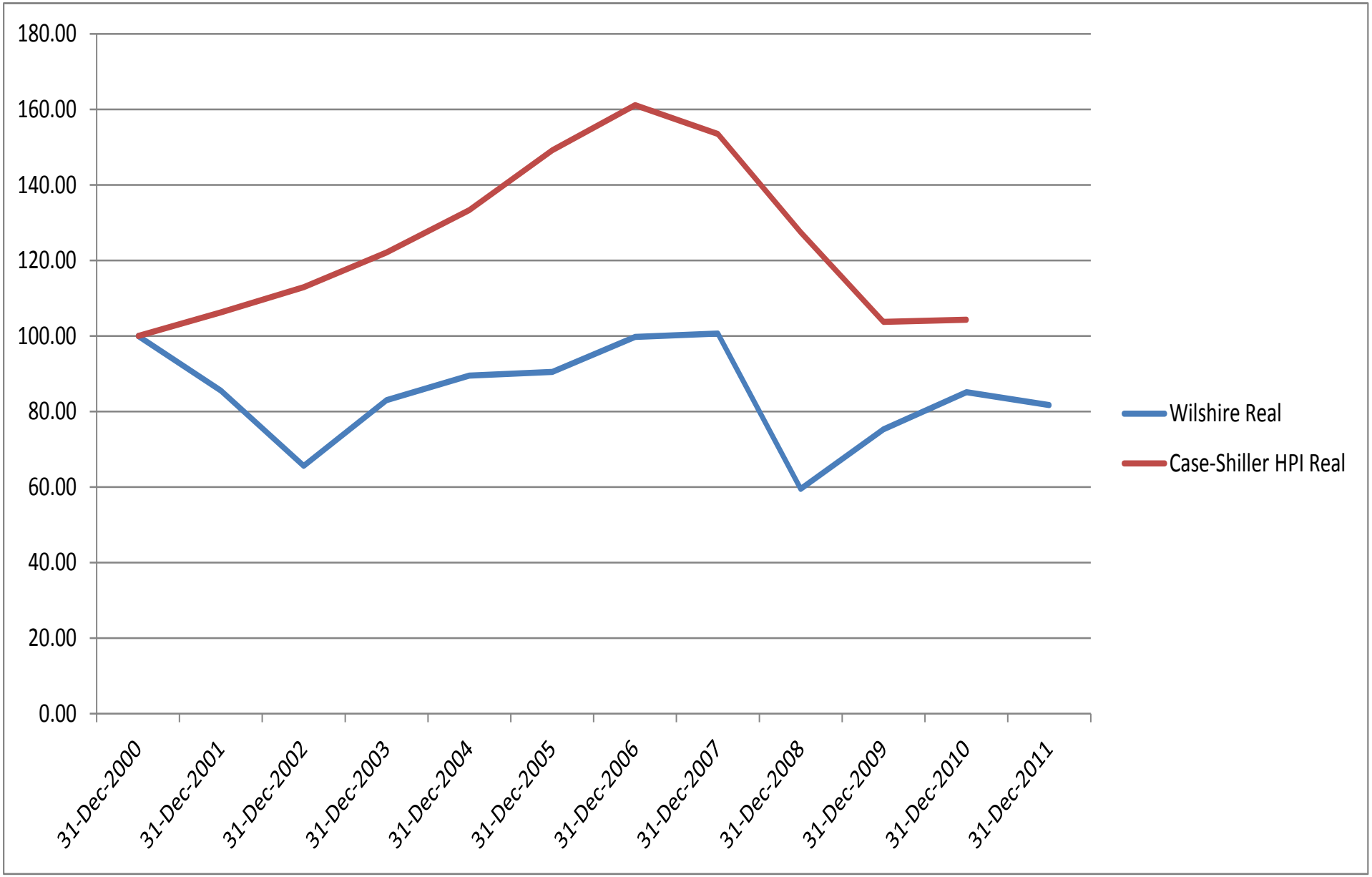
- We develop quantitative methods to analyze stochastic housing prices.

Asset prices and financial markets

Big increase and fall. No recovery for houses

- Houses: In the period 2000-2011 a boom-bust in housing market took place. The Composite-US-SA Case-Shiller House Price index went from 100.8 in 2000-I to 180.8 in 2006-I to 125.7 in 2011-IV.

- Stocks: couple of clashes and then recovery: Market capitalization to GDP was 153 in 2000, 105 2002, 146 2006, 82 in 2008 but back to 125 now.


180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
31-Dec-2000
31-Dec-2001
31-Dec-2002
31-Dec-2003
31-Dec-2004
31-Dec-2005
31-Dec-2006
31-Dec-2007
31-Dec-2008
31-Dec-2009
31-Dec-2010
31-Dec-2011
Wilshire Real
Case-Shiller HPI Real

Asset prices and financial markets II

Credit Expansion

- Outstanding home mortgage debt to GDP: some increase 53.6% in 2000-I while in 2006-I was 71.8% and in 2011-II 68.8%.

- Loan to value ratio: Big increase (About 84% during the mid-nineties for first time home buyers and about 95% at the peak).

- Mortgage interest rate went down. ()8.05 in 2000 to 6.3 in 2007 to 4.5 in 2011).

Asset prices and financial markets III

Transactions and Foreclosures

- Housing Transactions. About a third of the amount at the peak (double-check)

- Mortgage Foreclosures. 0.36% in the first three months of 2000 to 0.41% in the same period of 2006 to 1.01% in April-June of 2011.

- Mortgage Foreclosure Inventory 1.17% in 2000-I and it went to 0.98% in 2006-I and is 4.43 in 2011-II.

- To summarize. All went up and down: Prices, (more houses than stocks), transactions and financial ease.

Our Target

- To have a model economy with suitable chosen frictions that resembles the data in certain dimensions: home-ownership distribution, wealth distribution and some macroeconomic aggregates, including features of the mortgage issuing sector.

- To explore the ability of the model to deliver movements in prices and transactions that we observe as a response to different type of aggregate shocks.

- Finally, to answer the question of whether we can understand the movements observed with only attention to fundamentals or not.

- And the answer is.... Sort of, almost, ... , perhaps not quite.

Literature on House Prices

Theoretical

- Stein (1995) develops a static model of the housing market that focus on the role of the downpayment constrains. First, he argues that in order to support a strong housing demand, it is required a widespread distribution of liquidity across households: diminishing returns to ownership are pronounce in the case of housing in contrast with other type of assets. Second, he notes that house prices affect household liquidity and then its ability to make the downpayment to move up in the property ladder. This also suggests that both sales and prices may be positively correlated.

- Aoki et al. (2004) shows that if houses serve as collateral to lower the agency costs related to borrowing, the effect of monetary policy shocks on housing investment, house prices and consumption may be amplified.

- Ortalo-Magne and Rady (2006) pose a model economy with different size houses where households are willing to go up in the property ladder. They find that a positive income shock to first time-buyers may be propagated due to the capital gain of partially small-size owners wishing to up-size.

- Burnside et al. (2011) propose a model in which agents have heterogenous expectations about long-run fundamentals and social interactions can generate temporary increases in the fraction of agents who hold a particular view. The resulting dynamics can produce boom-bust cycles as well as protracted booms that are not followed by busts, independently of fundamentals.

Literature on House Prices

Quantitative

- Martin (2005) explores the effect of the baby boom in the U.S. on interest rates and housing prices trends over the period 1963-2003 within a Lucas tree economy without frictions and uncertainty .

- Garriga et al. (2012) build a RA model with production and segmented markets for investment and borrowing. Households can borrow at an exogenous foreign interest rate to invest in domestic markets. Houses serve as collateral and they are a composite good produced of land (in fixed supply) and structures. In this context there is a new component in the housing price equation: collateral value. In this context they show that changes in interest rates and credit conditions that are viewed as permanent have a large impact on house prices.

- Adam et al. (2011) pose a simple open economy asset pricing model with rational households that, however, entertain subjective beliefs about price behavior and update these using Bayes rule. They show that the latter is important to account for the house price and current account dynamics in the G7 over the years 2001-2008 as a response to changes in foreign interest rates.

- Kiyotaki-Michaelides-Nikolov-11 (2011) build an OLG heterogenous agent model with idiosyncratic uncertainty and a careful modeling of the production sectors. House prices overreact to exogenous irreversible changes in productivity and interest rates, in contrast with the limited effect of changing financing constrains. They focus is on welfare analysis.

Literature on House Prices

Quantitative and Empirical

- Favilukis et al. (2010) formulate a two-sector GE model of housing and non-housing production where heterogenous agents face idiosyncratic risk and markets are incomplete. They show that the price-rent ratio is 23.4% higher in an economy with a degree of financial liberalization similar to the one that characterizes the US economy over the period 2000 to 2006, than in an economy with credit constraints similar to the previous period.The driven force of the relative higher price-rent ratio is the endogenous fluctuation of the risk premia: financial market liberalization reduces risk premia as it enhances the ability of agents to insure against idiosyncratic risks.

- Chatterjee and Eyigungor (2009) build a model that accounts for the home-ownership rate, the average foreclosure rate, and the distribution of home-equity ratios across homeowners prior to the recent boom and bust in the housing market. They investigate the effect of an unanticipated increase in the supply of housing (overbuilding shock) together with the tightening of credit constraints in the market for new mortgages and the lengthening of the time to complete a foreclosure. Their model can account for the observed recent decline in house prices and much of the increase in the foreclosure rate.

- Del Negro and Otrok (2007) find small impact of monetary polity on house prices over the period 1986 to 2005 (VAR analysis)

- Mian et al. (2011) use state law requiring judicial foreclosure as an instrument to actual foreclosure and find that foreclosure has a large negative impact on house prices.

The Model Economies

- We pose a model of the Bewley-Imrohoroglu-Huggett-Aiyagari variety with houses and aggregate fluctuations to study housing market dynamics.

- Exponential population to get poor people who need to save to buy houses.

- There is a large advantage to own the dwelling you live in.

- Uninsurable shocks to earnings and to the suitability of the house.

- Flats and houses (differ in size) (Ortalo and Rady (2006)).

- Proportional adjustments costs to the price when buying a dwelling.

- Households make decisions about consumption savings and trading in the housing market.

Decisions and Markets

- Markets:
  1. Lucas tree (no frictions, dividends).
  2. A measure of flats (give some utility).
  3. A measure of houses (give more utility).
  4. Mortgages lent at an exogenous interest rate by foreigners.

- The first three are in fixed supply. (Davis and Heathcote (2007)).

- Mortgages are offered inelastically. The economy can have external deficits. Not in steady state.

Mortgage market and Foreclosure

- Households can borrow some to buy the house. Borrowing commands a premium (i.e. typically higher than average rate of return but less volatile).

- Loans are really home equity lines of credit.

- The initial loan requires a minimum down payment so the maximum loan to value (current price) ratio is $1 - \alpha$.

- Not all households have access to credit. Among those with low earnings, there are some with full have access to credit in the same circumstances that higher earners, some that require a higher down payment and some that do not have access to credit whatsoever. This circumstance follows a Markov process.

Mortgage market and Foreclosure II

- Households have an absolute debt limit B_d (so they can be under but not too much).

- Households choose to sell their dwelling and pay or to foreclose when (they lose the house and consume a set amount): Whatever is more financially attractive. The exact amounts matter.

- Upon foreclosure the household stands with zero assets and no scar from the process. Its ability to borrow depends only in whether it has access to credit and in having enough assets to get a new down payment. It takes a few periods to accumulate such amount (a low class earner's mean earnings is one third of the value of the flat).

The Steady State Household Problem

The household's objective

$$W^{e,\eta,d}[y\ R(y)+\varepsilon)] = \max_{d',y',c'\in B_{d,\eta_1,y}} u^{\eta_2,d'}(c) + V^{e,\eta,d'}(y')$$

where the evolution of the value function is

$$V^{e,\eta,d'}(y') = \sum_{e',\eta'} \Gamma_{e,e'}\ \Gamma_{\eta,\eta'} \int_{\underline{\varepsilon}}^{\overline{\varepsilon}} W^{e',\eta',d'}[y'\ R(y')+\varepsilon]\ \ F(d\varepsilon, e')$$

Here, $R(y)$ is the gross return on financial liquid assets, e is the Markovian earnings class, ε is earnings, η_1 is the ability to borrow shock, η_2 is the suitability of the home shock. A bad η_2 makes the existing home useless and the household needs to sell.

The Steady State Household Problem

The budget constraints (do not worry about π)

- If no change of dwelling $d' = d$

$$c + p_\ell \, \pi \, y' = y \, R(y) + \varepsilon$$

- However, if a household trades dwellings there are transaction costs

$$c + p_\ell \, \pi \, y' + \phi(d, d') = y$$

$\phi(d, d') = p_{d'}(1 + \delta)$ if $d = 0$ and $\phi(d, d') = p_{d'}(1 + \delta) - p_d$ otherwise.

- A household can only purchase if it has a down payment that is large enough (depends on ε and η_1).

- The foreclosure is not triggered in steady state.

Equilibrium in St St

(and in the version with Aggregate Shocks)

- Agents optimize given prices. (or a reasonable forecast of those prices).

- A measure of agents over characteristics x that repeats itself. (A law of motion of such object in the Stoch version).

- Market clearing of assets: Flats, Houses, and Financial Assets. Samo with shocks

$$\int dx(f,.) = \mu_f, \qquad \int dx(h,.) = \mu_h \qquad \int_0^\infty y\, dx(.,y) = \mu_\ell.$$

Calibration

Easy, set ex-ante

- Demographics and preferences
  - Population turnover, 1.5%, (adult life expectancy of 67)
  - Risk aversion set to 2
- Some features of the financial system
  - 1.% mortgage premium
  - 5.% minimum down payment
  - 10.% cost of buying a dwelling

Calibration II

Hard, It requires estimation

- Preferences: discount rate β, utility function $u_d(c,\eta) = \frac{c^{1-\sigma}}{1-\sigma}\,\gamma^{d,\eta}$ and probability of getting a flat suitability shock.

- Earnings Shocks: $e \in E = \{e^1, e^2, e^3\}$, $e \sim \Gamma_{ee'}$ and $F(\epsilon(e), e) = \left[\frac{\epsilon(e) - \underline{\epsilon}(e)}{\bar{\epsilon}(e) - \underline{\epsilon}(e)}\right]^{\chi}$

- Access to mortgage market: For the poorest class, very persistent with a third each type of access.

- Asset parameters : number of dwellings μ^f, μ^h (the size of the Lucas tree is normalized to 1 plus total mortgages). Dividends r

Targets

1. Labor share out of income (not gdp) of 0.84.
2. Financial asset wealth relative to income: 2.24.
3. Owner occupied housing wealth relative to income: 2.87.
4. Fraction of households that own a house: 0.40.
5. Fraction of people with flat: 0.25.
6. House prices relative to flat prices $\frac{p_h}{p_f}$: 1.8.
7. Annual turnover 6.3%.
8. Average earnings life-time growth: 1.5.
9. Log earnings autocorrelation*: 0.68.
10. Log earnings variance*: 0.86.
11. General Properties of the Lorenz Curve of earnings.
12. General Properties of the Lorenz Curve of assets.

Other Statistics: Dwelling Purchase

Other Statistics of Interest

	Model	U.S.
Ratio of Debt to GDP	74.0%	65.0%
Fraction of Households with active Mortgage	41.2%	45.9%
Down Payment first-time buyers	27%	24%
Down Payment repeat buyers*	40%	30%
Buyers paying all in cash	4%	5%

Other Statistics: Cross-Sectional Distributions

Wealth Distribution in Model and Data (1998 SCF)

		Quintiles					
		1st	**2nd**	**3rd**	**4th**	**5th**	**Gini**
Total	Model	0.05	2.00	5.79	15.59	76.17	0.747
Assets	U.S.	-0.29	1.35	5.14	12.38	81.42	0.796
Financial	Model	-22.80	-8.69	0.69	3.70	127.11	1.439
Assets	U.S.	-7.27	-0.25	1.14	6.92	99.45	0.953
Housing	Model	0.00	4.28	21.06	37.10	37.57	0.439
Wealth	U.S.	0.00	1.40	12.31	22.08	64.21	0.656

So what are aggregate shocks?

- All experiments.
  - Some financial tolerance: Penalization of low assets. (if asset position goes to a financial liability between 0 and 15% above the steady state price in good times is OK, in bad times generates a 4% interest penalty (only for flats).)
- Various Experiments.
  - Income Shocks.
    - Total Income: Labor earnings and Dividends.
  - Financial Conditions Shocks
    - Size of minimum down payment.
    - Fraction of households with access to credit.
    - Mortgage premium.

How do we deal computationally with Aggregate Uncertainty?

- We assume limited rationality following Krusell and Smith (1997).

- As states we use the shocks and the minimum states required, the prices themselves. This requires a costly two stage process. Households react to prices not to forecasted prices.

- We use as forecasting function of prices the best linear predictor.

- We estimate using OLS the following regression

$$p^{j\prime} = \Psi_{z,z'}(p) = \alpha_0^j + \alpha_1^j 1_{\{z=1,z'=2\}} + \alpha_2^j 1_{\{z=2,z'=1\}} + \alpha_3^j 1_{\{z=2,z'=2\}} + \alpha_4^j p^j$$

What is an experiment?

- There is an aggregate shock that takes two values.
- The persistence of the shock is 95%
- We populate the economy with 200,000 households and let it run
  - 16 periods with the first state
  - 10 periods with the second state.
  - 25 more periods in the first state.
- We show the implications

What type of aggregate shocks?

- Income shock
  - Earnings and dividends move up and down $+/-5\%$.
- Three Types of Financial shocks
  - Downpayment from 10% to 0% to 10%
  - Changes in access to credit for poor households.
  - Mortgage premium
    - ⋆ From 2% to 0% to 2%: (mortgage interest rates bw 9%-7%), or
    - ⋆ From 4% to -2% to 4%: (mortgage interest rates go from 11% to 5%).

What happens in the RA frictionless economy?

Only for Income expansions

	$\triangle p_h$	$\triangle p_\ell$
Income $+/-5\%$ (iid Aggregate Shock)	1.20	1.20
Income $+/-5\%$ (Persistent Aggregate Shock)	**1.17**	**1.17**
Income $+/-5\%$ (Irreversible Aggregate Shock)	1.11	1.11

Table: Representative Agent Economy, Cobb-Douglas with $\nu = 0.86$

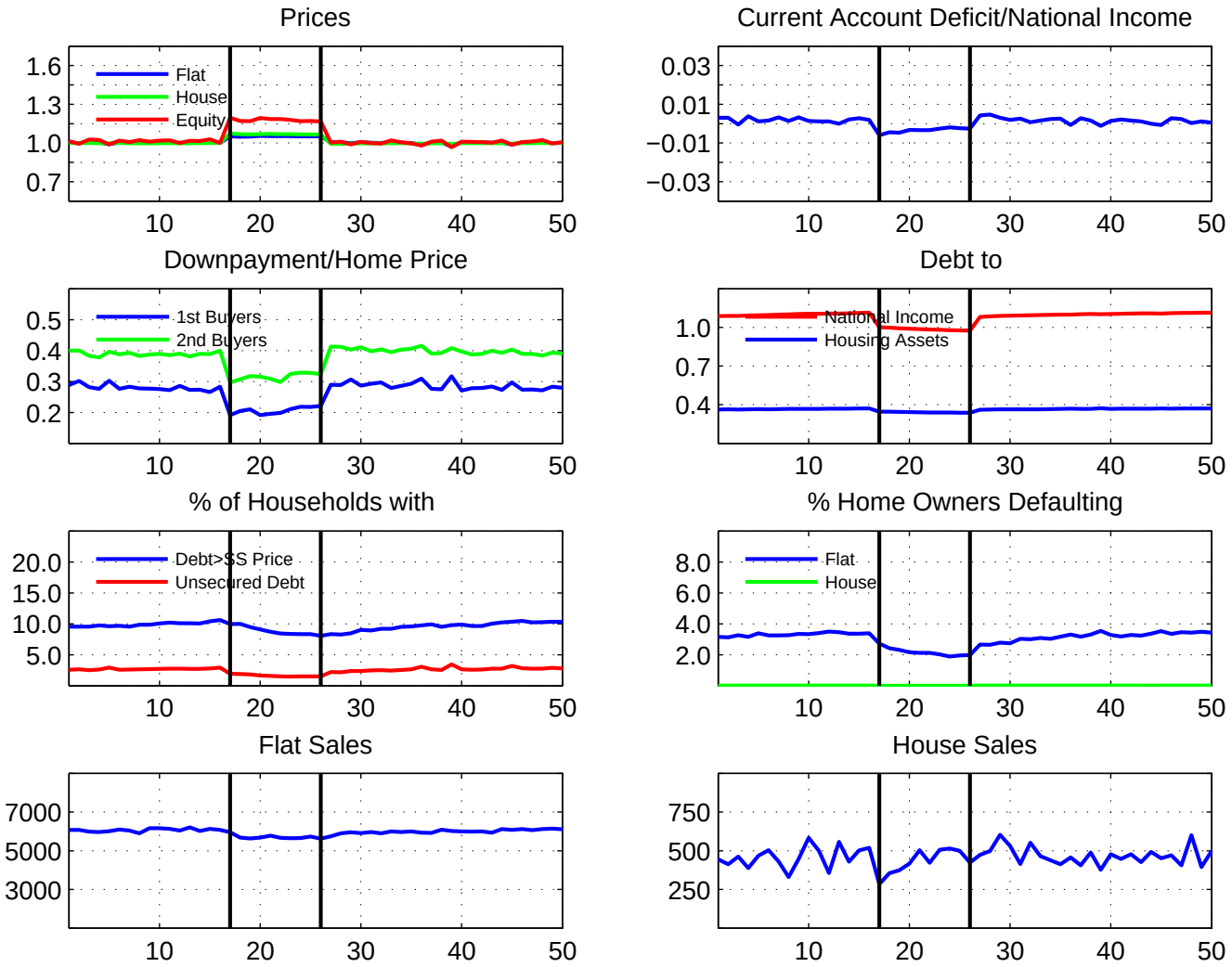
Main Results

RA is 17% for all

Type of Shock	$\triangle p_f$	$\triangle p_h$	$\triangle p_\ell$	$\triangle E\{r_\ell\}$
Income	1.07	1.06	1.22	2.3%

Table: Heterogeneous Agents Eco with Frictions

- Housing Prices move a lot less than financial assets that move a tiny bit more than in the RA economy. Note the lack of movement in the mortgage interest rates.



Income shocks

What do we learn?

Income Expansion

- Income shocks look like a standard Aiyagari economy. Financial prices go up, storage (home equity) goes up, current account goes up.

- What about housing?

  - Small action in prices.

  - Foreclosures move the right way.

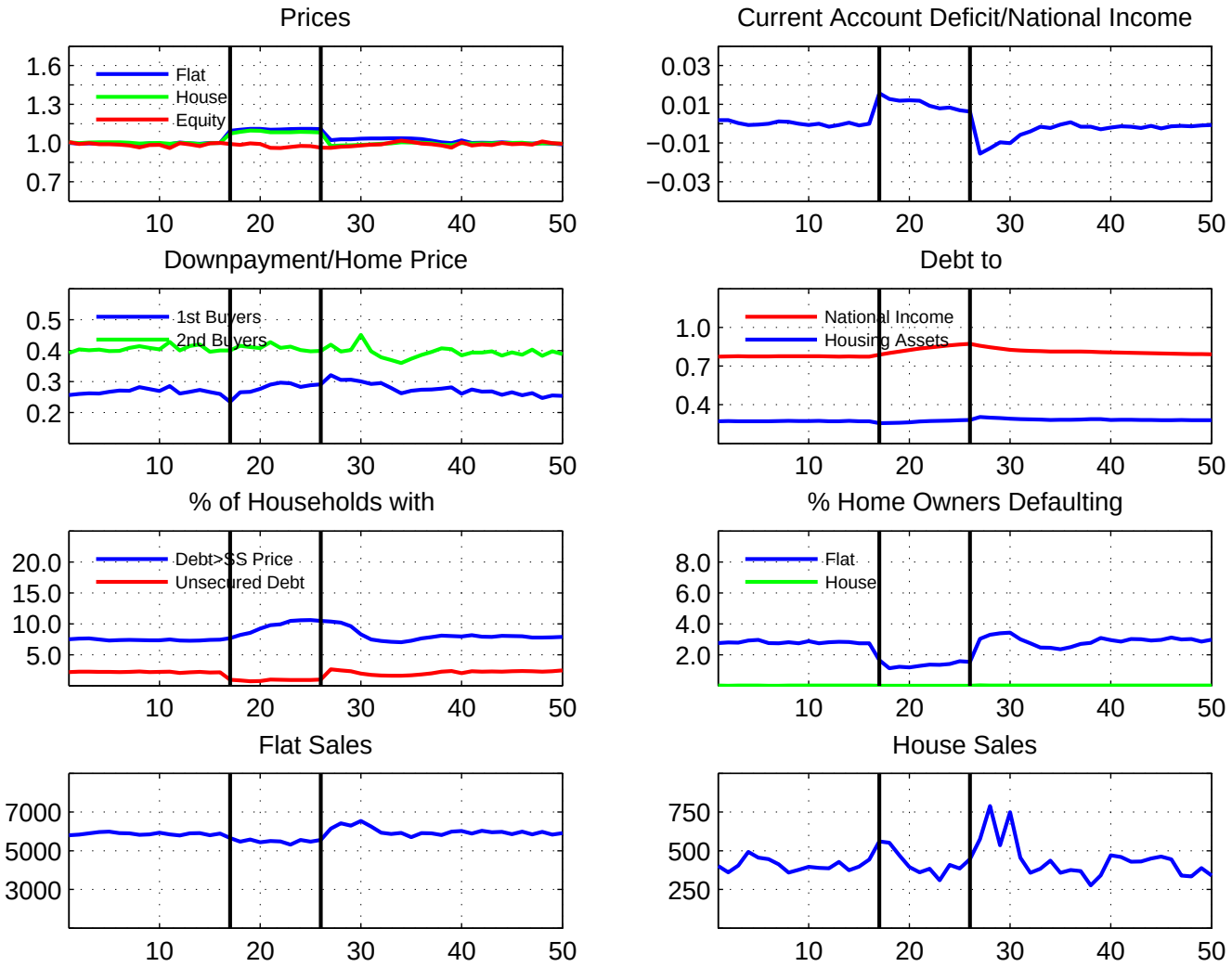
  - Flat sales are flat: House transactions do not move. There is no change in the relative performance of households which is what triggers sales.

Main Results

Type of Shock	$\triangle p_f$	$\triangle p_h$	$\triangle p_\ell$	$\triangle E\{r_\ell\}$
Income	1.07	1.03	1.22	2.3%
Financial:(Down+Aces+Mort)	1.11	1.10	1.00	0.0%

Table: Heterogeneous Agents Economy with Frictions

- No effects on financial asset prices, but sizeable effects on house prices.



Financial expansion

What do we learn?

Financial Expansion

- The new borrowing opportunities generate a large current account deficit, in addition to the housing boom.

- There is no change in down payments despite the price hike.

- There is a temporary drop in defaults.

- Again, no change in flats transactions but some in houses. There is a change in the ease at which high earners may buy houses.

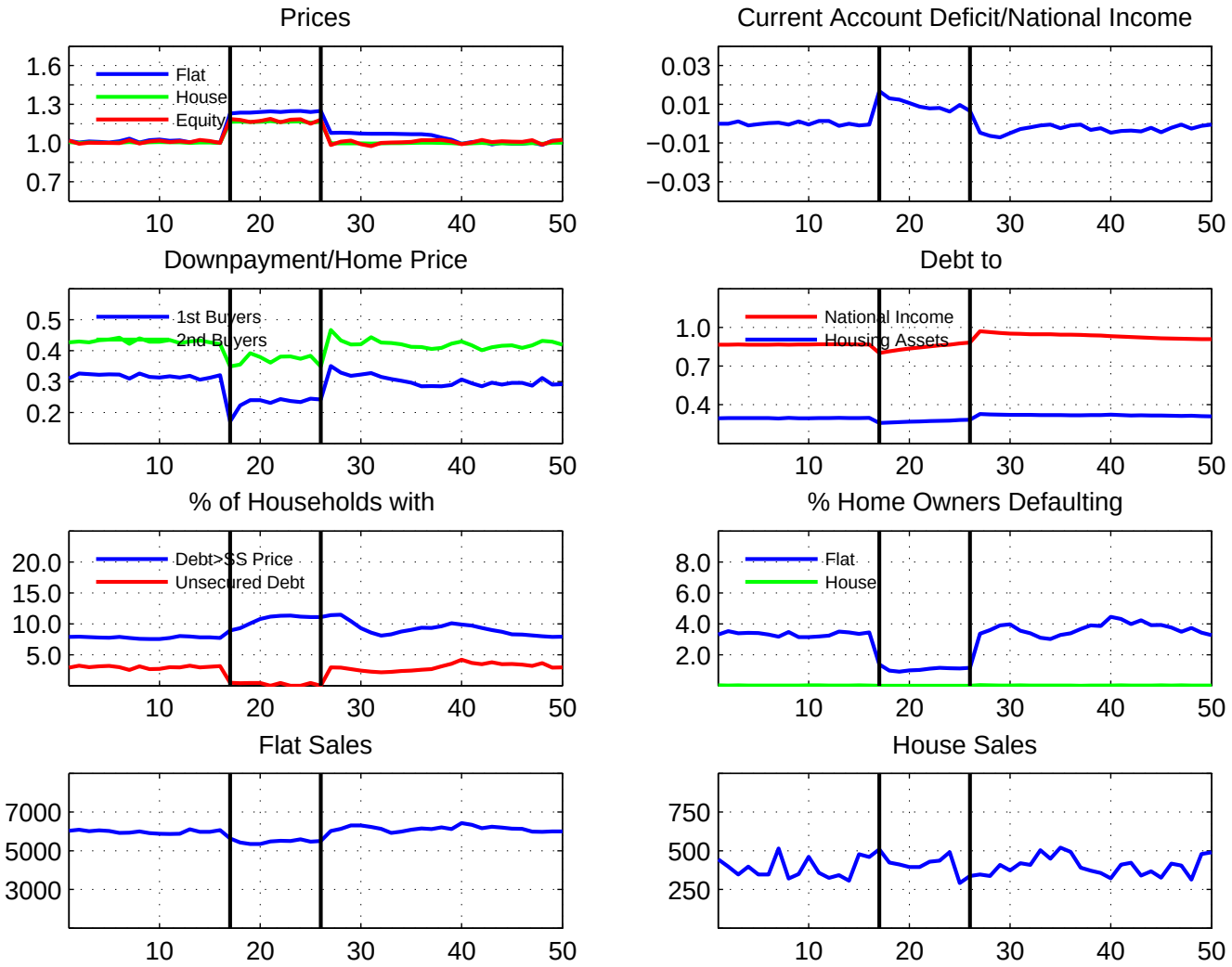
- Fast speed of adjustment.

Main Results

Type of Shock	$\triangle p_f$	$\triangle p_h$	$\triangle p_\ell$	$\triangle E\{r_\ell\}$
Income	1.07	1.03	1.22	2.3%
Financial:(Down+Aces+Mort)	1.11	1.10	1.00	0.0%
Inc+Fin(Down+Aces+Mort)	1.25	1.17	1.19	2.0%

Table: Heterogeneous Agents Eco with Frictions,

- Financial affects are unaffected but housing prices compound, especially flats.



Income + Financial expansion

What do we learn?

Income and Financial Expansion

- Houses become more attractive as it is easier to forego consumption given the higher rate of return.

- The conflict between more and less savings results in less savings with a current account deficit.

- Down payments become smaller.

- Debt increase and high prices slow down foreclosures.

- But sales are flat.

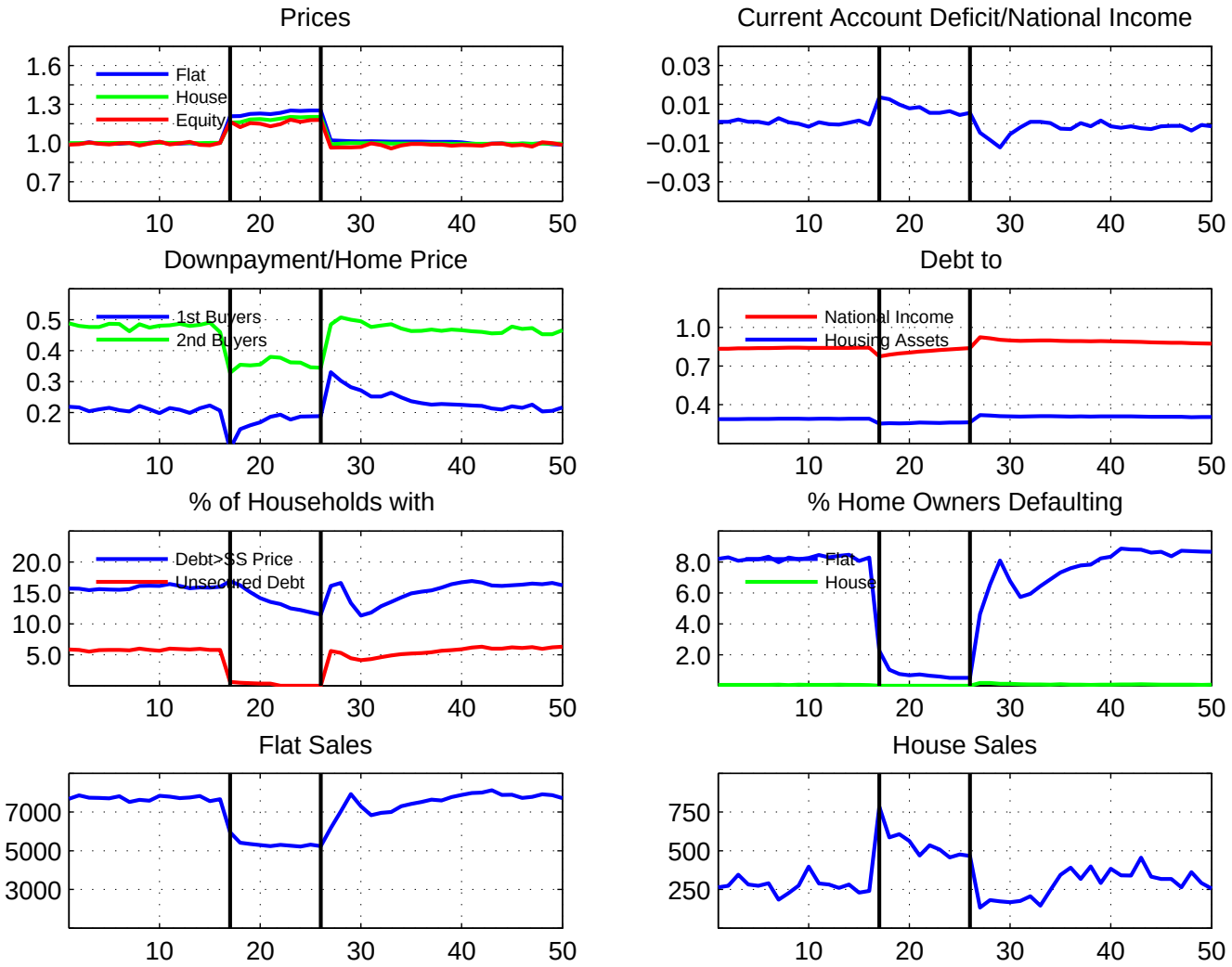
- Fast speed of adjustment.

Main Results

Type of Shock	$\triangle p_f$	$\triangle p_h$	$\triangle p_\ell$	$\triangle E\{r_\ell\}$
Income	1.07	1.03	1.22	2.3%
Financial:(Down+Aces+Mort)	1.11	1.10	1.00	0.0%
Inc+Fin(Down+Aces+Mort)	1.25	1.17	1.19	2.0%
Inc+Mort-L	1.25	1.20	1.18	2.0%

Table: Heterogeneous Agents Eco with Frictions

- Similar outcomes Substiting Credit Expansion and Lower down payment with larger interest rates drops



Income + Large drop in mortgage rate premium: from 4% to -2%

What do we learn?

Income and Large drop in mortgage rate

- Similar effects on prices but shorter effects on the current account.

Large drop in the down payment an

- Down payments become smaller.

- Debt increase and high prices slow down foreclosures.

- But sales are countercyclical for flats and not for houses. Seems the opposite that the data.

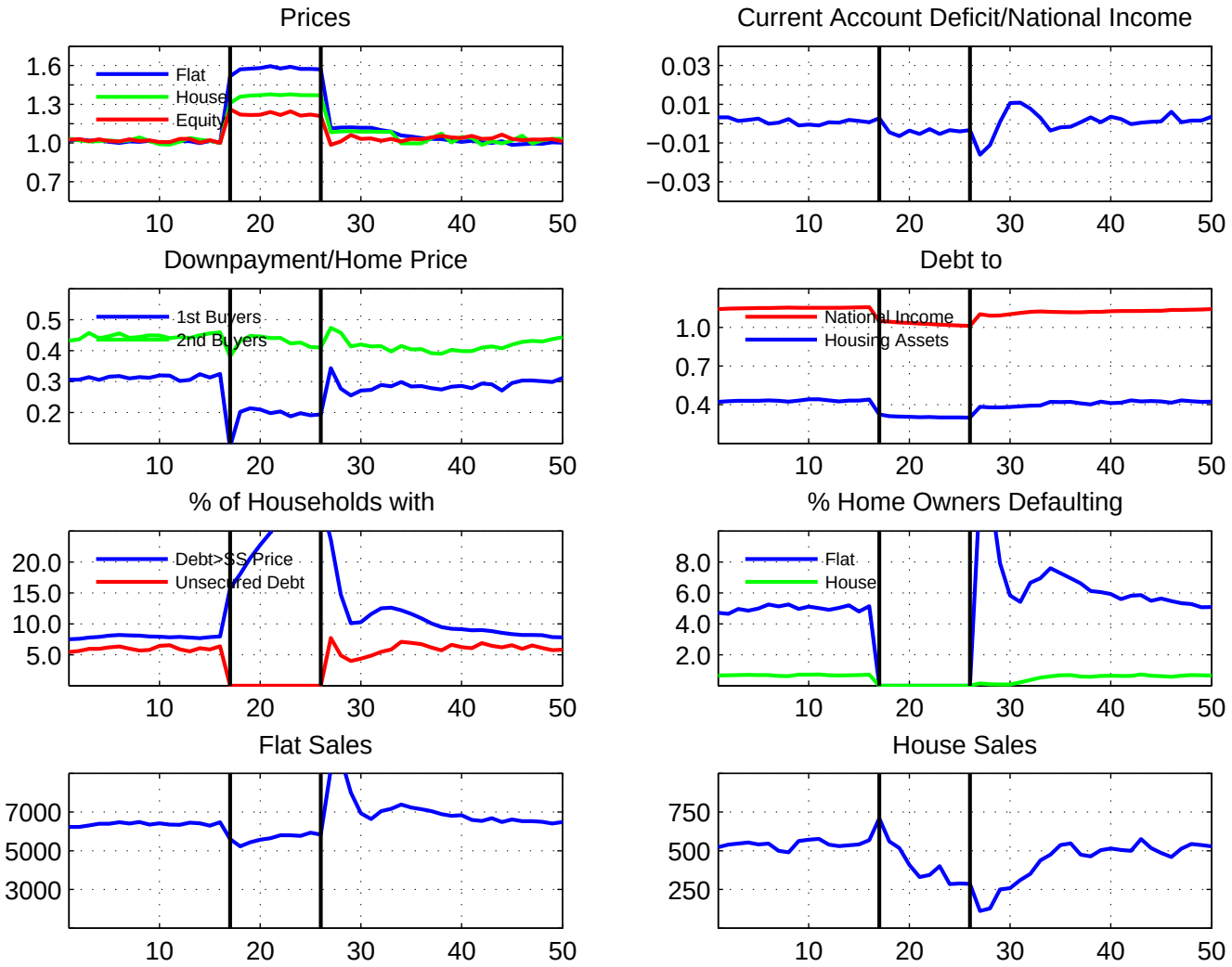
- Fast speed of adjustment.

Main Results

All together

Type of Shock	$\triangle p_f$	$\triangle p_h$	$\triangle p_\ell$	$\triangle E\{r_\ell\}$
Income	1.07	1.03	1.22	2.3%
Financial:(Down+Aces+Mort)	1.11	1.10	1.00	0.0%
Inc+Fin(Down+Aces+Mort)	1.25	1.17	1.19	2.0%
Inc+Mort-L	1.25	1.20	1.18	2.0%
Inc+Fin(Down+Aces+Mort-L)	1.60	1.38	1.26	2.5%

market price increase.



All together: Income + Finance Expansion + large change in mortgage rates

What do we learn?

Income and large drop in mortgage Expansion

- No steady effect on current account.

Other Things we learned

- Increasing the harshness of punishment changes things for the combination of shocks.

- Leniency in bankruptcy proceedings seems to be important for large price variations.

	$\triangle p_f$	$\triangle p_h$	$\triangle p_\ell$	$\triangle E\{r_\ell\}$
Income	1.09	1.08	1.18	2.2%
With weak punishement	1.07	1.03	1.22	2.3%
Financial:(Down+Aces+Mort)	1.08	1.11	1.02	0.0%
With weak punishement	1.11	1.10	1.00	0.0%
Inc+Fin(Down+Aces+Mort)	1.14	1.15	1.22	2.1%
With weak punishement	1.25	1.17	1.19	0.0%

Conclusions

- Price hikes in houses of 60% relative to stock prices of 25% are possible within economies with fully rational agents if
  - We jointly pose economic expansion with financial expansion.
  - Extension of the set of borrowers, large reduction of mortgage interest rates relative to other assets, reduction of down payments.
  - The price expansion is typically (but not always) accompanied by current account deficits.
  - The boom-bust cycle has the right implications for foreclosures.
- But
  - The procyclicality of transactions is hard to get. Perhaps there are insufficient housing types for people to move up and down. Here

References

Adam, K., A. Marcet, and P. Kuang, "House Price Booms and the Current Account," 2011. NBER Working Paper No. 17224.

Aoki, K., J. Proudman, and G. Vlieghe, "House prices, consumption, and monetary policy: a financial accelerator," *Journal of Financial Intermediation*, 2004, *13*, 414–435.

Burnside, C., M. Eichenbaum, and S.Rebelo, "Understanding Booms and Busts in Housing Markets," 2011. NBER Working Paper No. 16734.

Chatterjee, S. and Burcu Eyigungor, "Foreclosures and house price dynamics: a quantitative analysis of the mortgage crisis and the foreclosure prevention policy," 2009. Federal Reserve Bank of Philadelphia.

Favilukis, Jack, Sydney C. Ludvigson, and Stijn Van Nieuwerburgh, "The Macroecononomic Effects of Housing Wealth, Housing Finance, and Limited Risk Sharing in General Equilibrium," 2010. Mimeo, NYU.

Garriga, C., R. Manuelli, and Peralta-Alva, "Bubbles or Fundamentals? Understanding Boom and Bust Episodes in the Housing Market," 2012. Mimeo.

Glover, Andrew, Jonathan Heathcote, Dirk Krueger, and José-Víctor Ríos-Rull, "Inter-generational Redistribution in the Great Recession," 2011. NBER Working Paper No. 16924.

Kiyotaki-Michaelides-Nikolov-11, "Winners and Losers in Housing Markets," *Journal of Money, Credit, and Banking*, 2011, *43*, 255–296.

Krusell, Per and Anthony A. Smith, "Income and Wealth Heterogeneity, Portfolio Choice, and Equilibrium Asset Returns," *Macroeconomic Dynamics*, 1997, *1* (2), 387–422.

Martin, Fernando, "Optimal Taxation without Commitment," 2005. Mimeo, Simon Fraser University.

Mian, A., A. Sufi, and F. Trebbi, "Foreclosures, House Prices, and the Real Economy," 2011. NBER Working Paper No. 16685.

Negro, M. Del and C. Otrok, "99 Luftballons: Monetary Policy and the House Price Boom across U.S. States," *Journal of Monetary Economics*, 2007, *54*, 1962–1985.

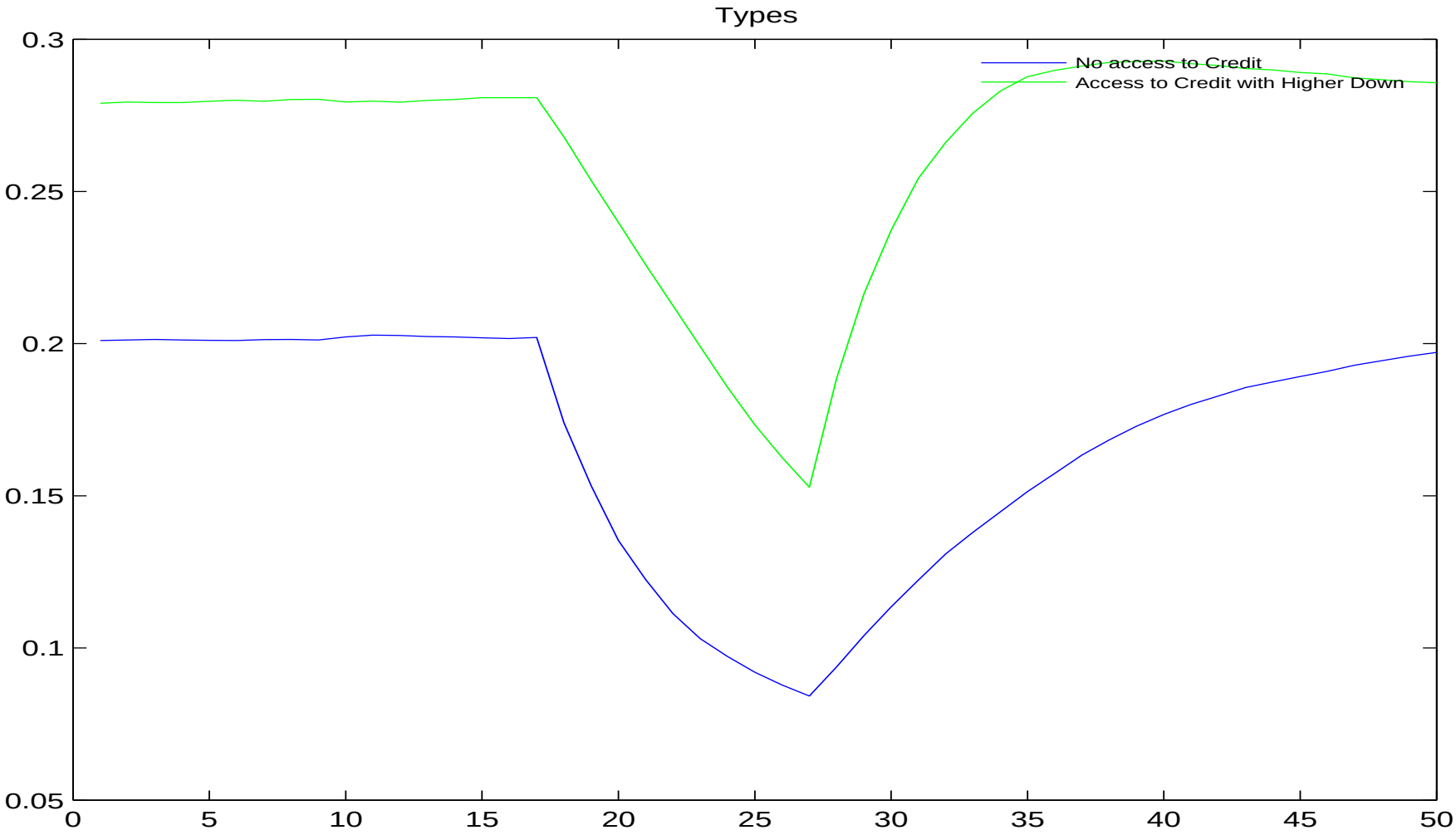
Ortalo-Magne, Francois and Sven Rady, "Housing Market Dynamics: On the Contribution of Income Shocks and Credit Constraints," *restud*, 2006, *73*, 459–485.

Stein, J.C., "Price and trading volume in the housing market: a model with down-payment effects," *Quarterly Journal of Economics*, 1995, *110*, 379–406.

Main Results

Type of Shock	$\triangle p_f$	$\triangle p_h$	$\triangle p_\ell$	$\triangle E\{r_\ell\}$
Income	1.07	1.03	1.22	2.3%
Financial:(Down+Aces+Mort)	1.11	1.10	1.00	0.0%
Inc+Fin(Down+Aces+Mort)	1.25	1.17	1.19	2.0%
Inc+Mort-L	1.25	1.20	1.18	2.0%
Inc+Fin(Down+Aces+Mort-L)	1.60	1.38	1.26	2.5%
Inc+Fin(Down+Aces+Mort) (Irreversible)	1.13	1.07	1.11	0.0%

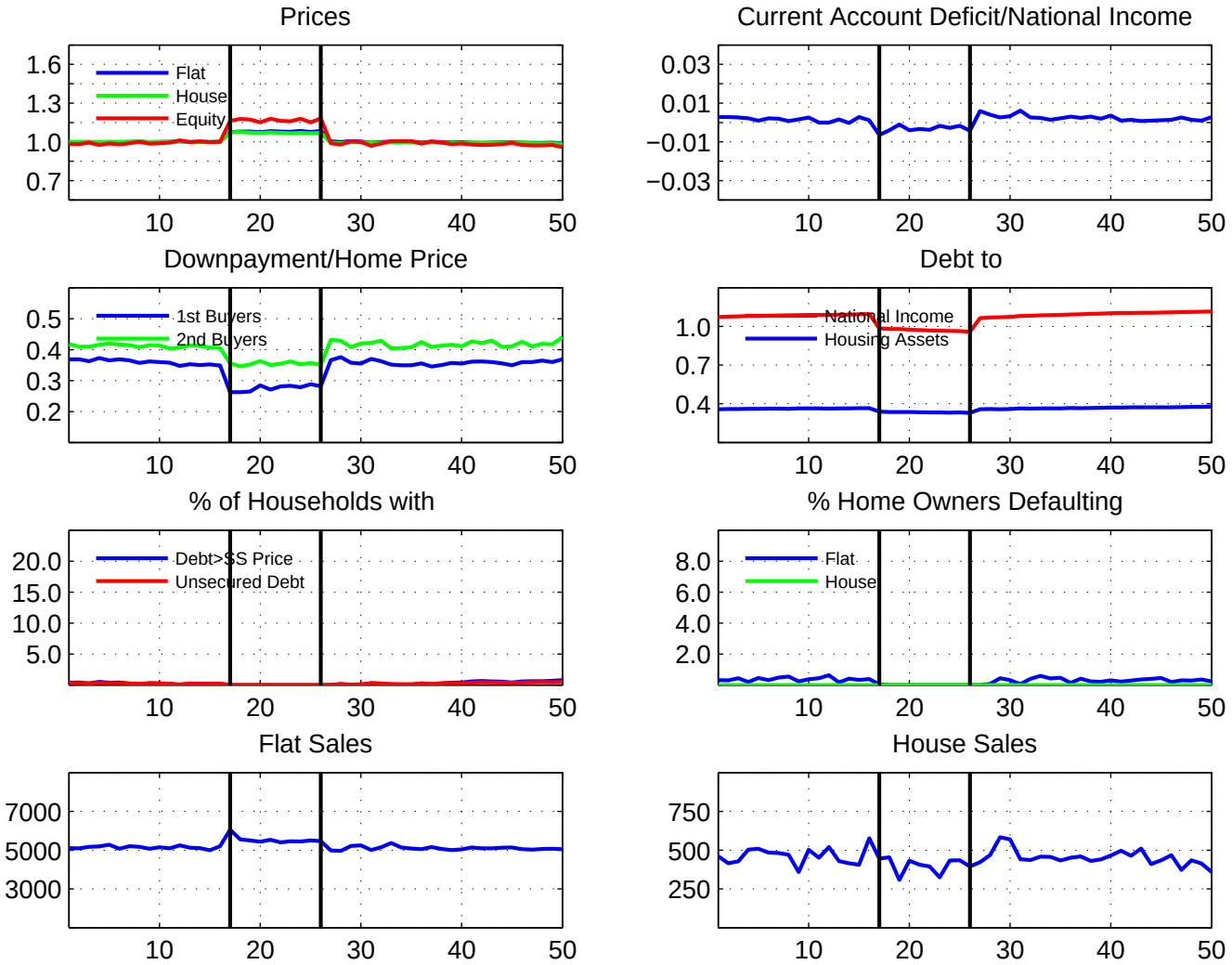
Table: Heterogeneous Agents Eco with Frictions, **Weak punishment**



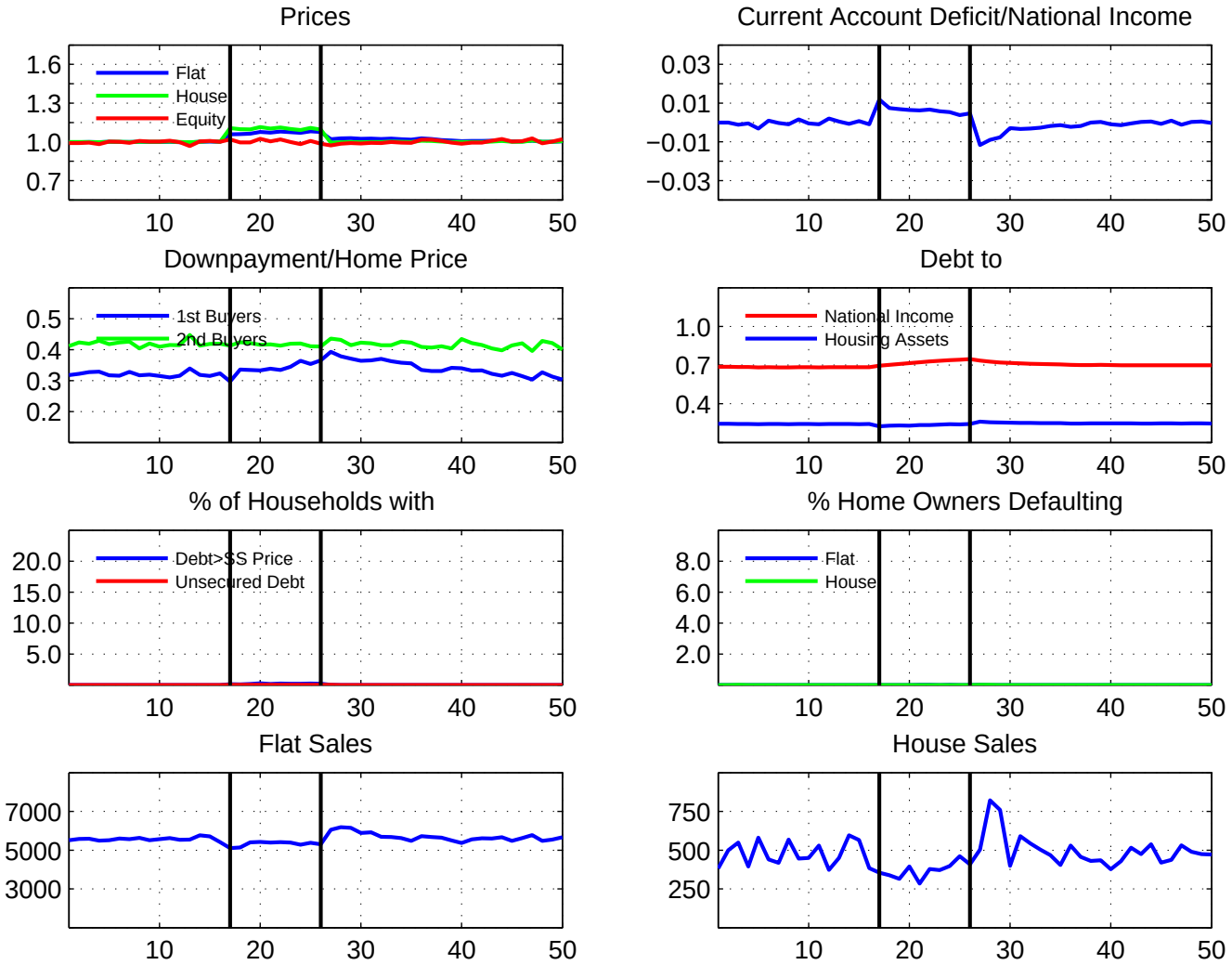
Access to credit distribution

What type of aggregate shocks?

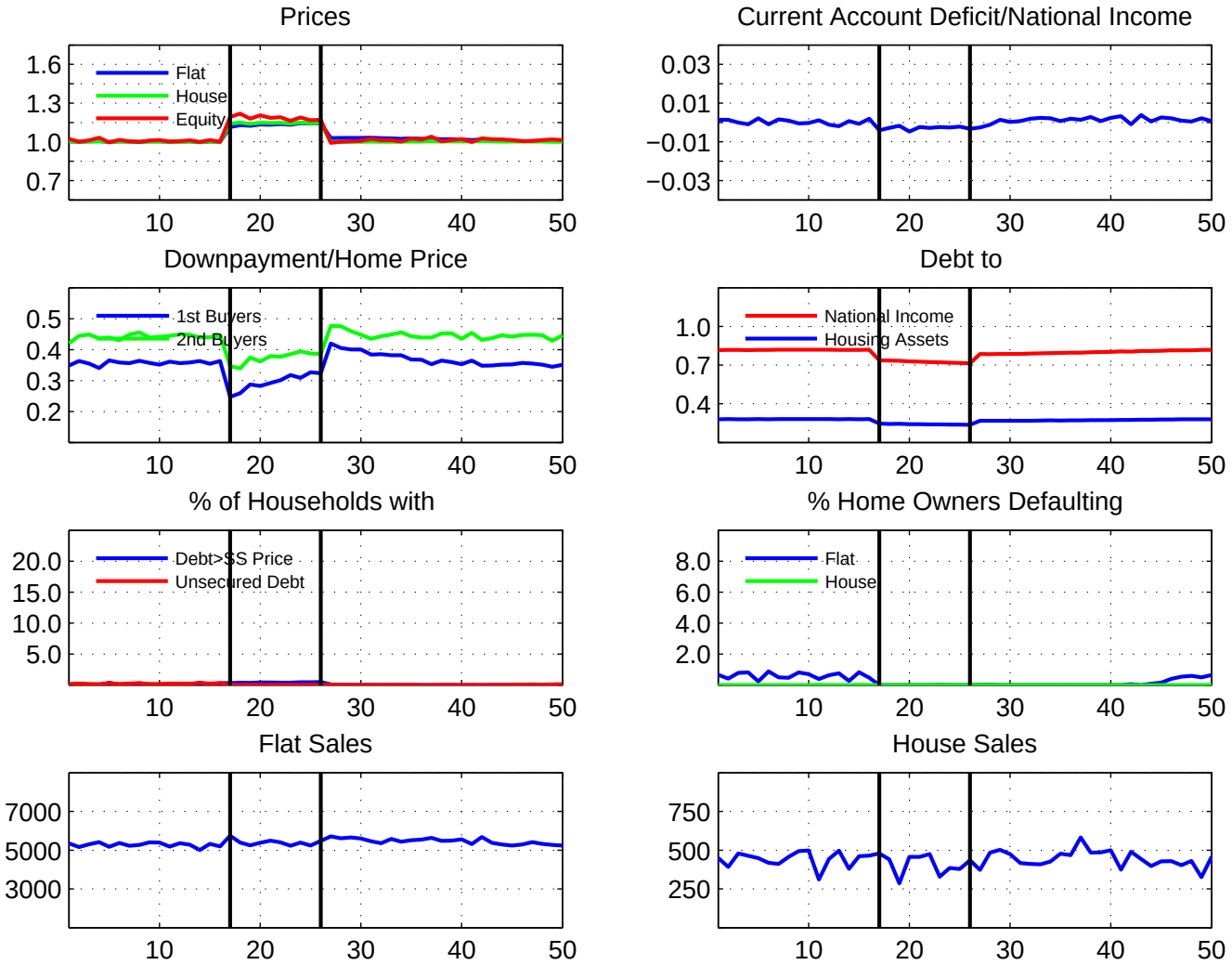
- **Financial expansion**
  - Downpayment from 10% to 0% to 10%
  - Changes in access to credit
  - Mortgage premium from 2% to 0% to 2%
- **Income expansion**
  - Earnings and dividends move up and down $+/-5\%$. This is 10.5% variation in income
- Furthermore, during expansion flat buyers/owners are allow to borrow 15% above the flat steady price at the mortgage rate, however, this entails an extra cost of 4% during recessions



Income, strong punishment



Financial expansion, strong punishment



Income + Financial expansion, strong punishment