

# House Prices, Credit Growth, and Excess Volatility: Implications for Monetary and Macroprudential Policy

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## **Reserve Requirements and Other Macroprudential Policies: Experiences in Emerging Economies**

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All opinions expressed are personal and do not necessarily reflect the views of either the Norges Bank, or The Federal Reserve System or the Bank of Portugal.

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- This Paper: DSGE model of housing with excess volatility. Subset of agents employ moving-average forecast rules.

## Policy experiments:

- Interest-rate response to house price growth or credit growth.
- Tightening of lending standards (lower LTV).
- Weight on wage income in borrowing constraint. (best).

## Related literature (partial list)

- Interest rate response to asset prices or credit in RE models
  - Dupor (2005)
  - Gilchrist and Saito (2008)
  - Christiano, Ilut, Motto and Rostagno (2010)
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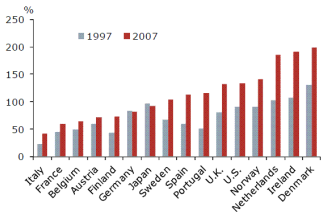
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- Countercyclical tax on debt in RE Model
  - Bianchi and Mendoza (2010).

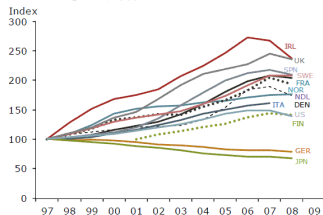
# Household leverage, house prices, and consumption

From Glick and Lansing (2010), FRBSF Economic Letter 2010-01.

Household leverage ratios: Debt to disposable income

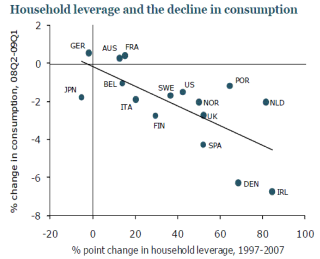
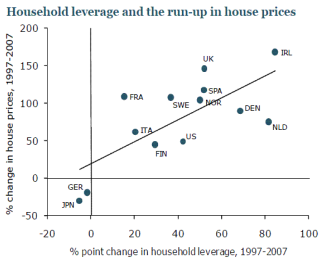


Real house prices, 1997-2008



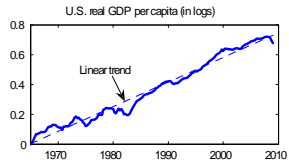
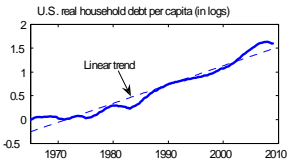
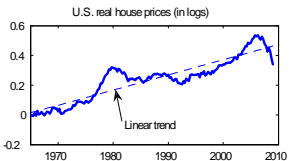
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# U.S. Housing Boom of the mid-2000s

New buyers with access to easy credit helped fuel an excessive run-up in house prices.



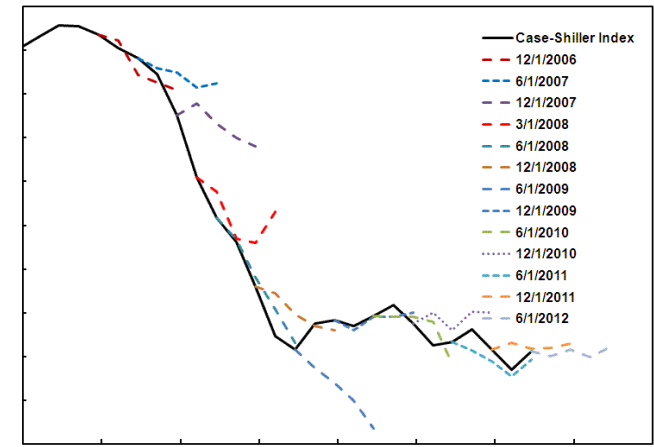
# Housing Market Expectations

Futures tend to overpredict prices when prices are falling (moving average forecast rule).

## Case Shiller Index and Futures

Indexed to 100 in January 2000

Index



2006 2007 2008 2009 2010 2011 2012 2013  
Source: Bloomberg

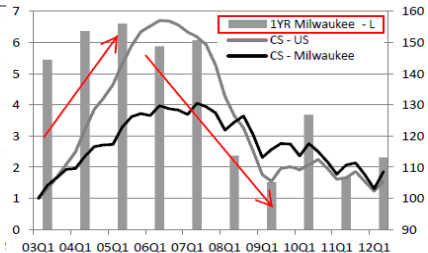
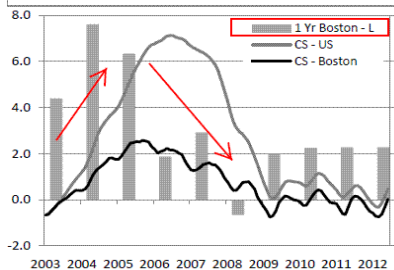
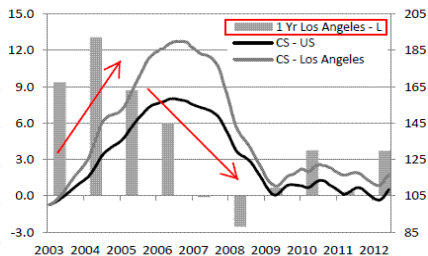
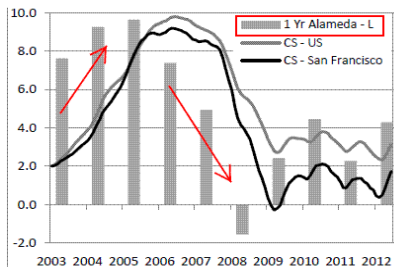
# Survey Expectations about U.S. House Prices

Survey expectations are well-described by moving average of past price changes.

- Case and Shiller (2003): Surveys in 2002-3. 90% of survey respondents expect house prices to increase over the next several years. Over the next 10 years, respondents expect annual price appreciation in the range of 12 to 16% per year.
- Piazzesi and Schneider (2009): “Starting in 2004, more and more households became optimistic after having watched house prices increase for several years.”
- Shiller (2007): Surveys in 2006-7. Places with high recent house price growth exhibited high expectations of future price appreciation, while places with slowing price growth exhibited downward shifts in expected appreciation.
- Case, Shiller and Thompson (2012): Survey in 2008. Respondents in prior boom areas now mostly expect declines in future house prices.

# House Prices and Their Expectations in Four Cities

From Case, Shiller, and Thompson (2012), NBER Working Paper 18400.

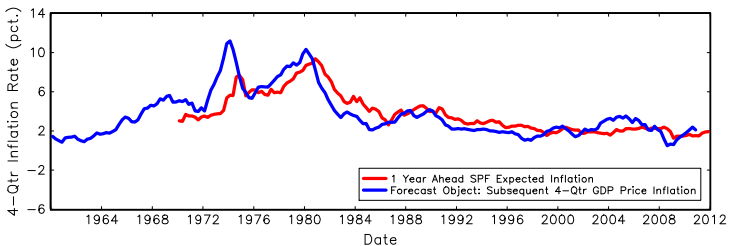




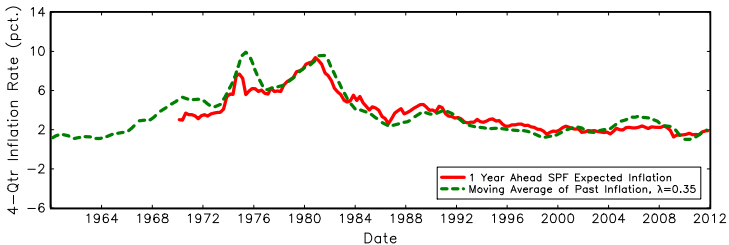
# Survey-Based Inflation Expectations

Survey forecasts exhibit 1-sided forecast errors, resemble moving-average of past inflation.

U.S. Survey Expected Inflation versus Subsequent Actual Inflation

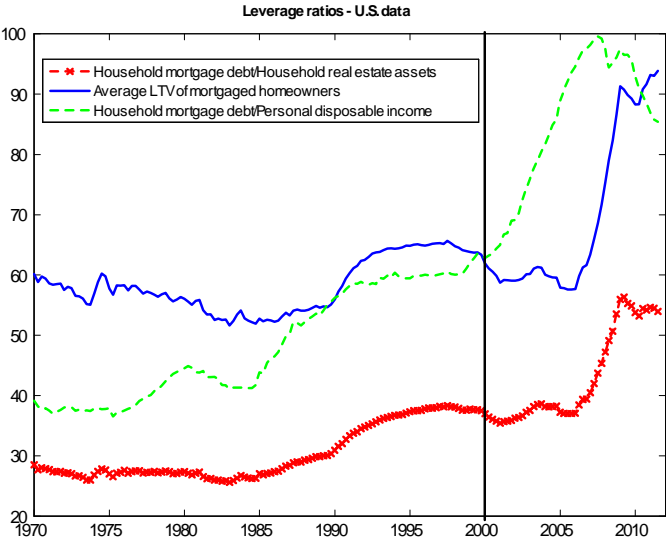


U.S. Survey Expected Inflation versus Moving Average of Past Inflation



# Loan-to-Value (LTV) versus Loan-to-Income (LTI) Ratios

LTI provided a much earlier warning signal of rising household leverage.



# “Understanding Household Debt Obligations”

Remarks at Credit Union National Association Governmental Affairs Conference (2004)

“Overall, **the household sector seems to be in good shape**, and much of the apparent increase in the household sector’s debt ratios over the past decade reflects factors that **do not suggest increasing household financial stress.**”

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Fed Chairman Alan Greenspan, February 23, 2004.



# Households: Patient-lenders and Impatient-borrowers

Basic setup is similar to Iacoviello (2005, AER).

$$\max \widehat{E}_{1,t} \sum_{t=0}^{\infty} \beta_1^t \left\{ \log(c_{1,t} - bc_{1,t-1}) + v_{1,h} \log(h_{1,t}) - v_{1,L} \frac{L_{1,t}^{1+\varphi_L}}{1+\varphi_L} \right\},$$

$$c_{1,t} + l_t + q_t(h_{1,t} - h_{1,t-1}) + \frac{b_{1,t-1}R_{t-1}}{\pi_t} = b_{1,t} + w_t L_{1,t} + r_t^k k_{t-1} + \phi_t.$$

$$k_t = (1 - \delta)k_{t-1} + \left[ 1 - \frac{\psi}{2} \left( \frac{l_t}{l_{t-1}} - 1 \right)^2 \right] l_t,$$

$$\max \widehat{E}_{2,t} \sum_{t=0}^{\infty} \beta_2^t \left\{ \log(c_{2,t} - bc_{2,t-1}) + v_{2,h} \log(h_{2,t}) - v_{2,L} \frac{L_{2,t}^{1+\varphi_L}}{1+\varphi_L} \right\},$$

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$$b_{2,t} \leq \frac{\gamma}{R_t} \left[ \widehat{E}_{1,t} q_{t+1} \pi_{t+1} \right] h_{2,t},$$

$$\beta_2 < \beta_1 \quad (\text{Incentive to borrow})$$

# Household Expectations

Subset employ moving-average forecast rules. Remainder employ rational forecast rules.

$$\begin{aligned} \underbrace{F_t X_{t+1}}_{\text{Current forecast}} &= \underbrace{F_{t-1} X_t}_{\text{Previous forecast}} + \lambda \underbrace{(X_t - F_{t-1} X_t)}_{\text{Previous forecast error}}, \quad 0 < \lambda \leq 1, \\ &= \lambda \left[ X_t + (1 - \lambda) X_{t-1} + (1 - \lambda)^2 X_{t-2} + \dots \right], \end{aligned}$$

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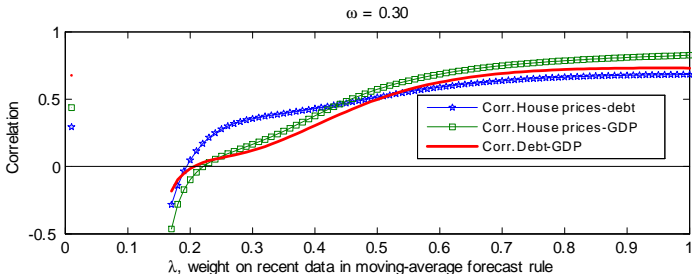
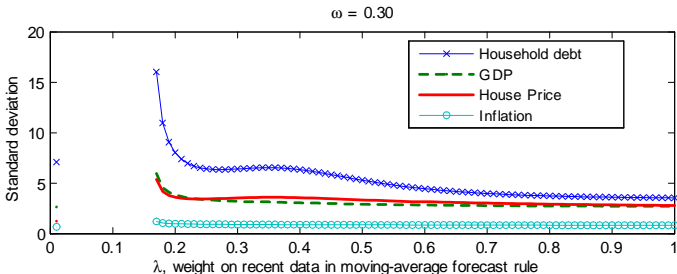
$$\hat{E}_t X_{t+1} = \omega F_t X_{t+1} + (1 - \omega) E_t X_{t+1}, \quad 0 \leq \omega \leq 1$$

where  $\omega$  = fraction who employ moving-average forecast rule.

$$\omega = 0.3, \quad \lambda = 0.35 \quad (\text{hybrid expectations}).$$

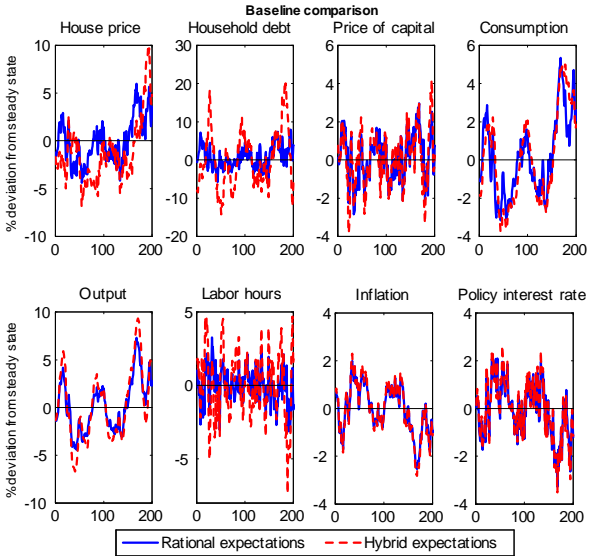


# Calibration of adaptive expectations parameters



# Hybrid Expectations Model Exhibits Excess Volatility

Moving-average forecast rule embeds a unit root which magnifies volatility.



# Monetary Policy and Macroprudential Policy

What policy actions are effective in dampening excess volatility in credit, output, etc.?

Interest-rate response to house price growth or credit growth:

$$R_t = (1 + r) \left(\frac{\pi_t}{1}\right)^{1.5} \left(\frac{y_t}{y}\right)^{0.125} \left(\frac{q_t}{q_{t-4}}\right)^{\alpha_q} \left(\frac{b_{2,t}}{b_{2,t-4}}\right)^{\alpha_b} \zeta_t,$$

$$\alpha_q \text{ or } \alpha_b \in [0, 0.4], \quad (\text{baseline} = 0)$$

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$$\alpha_q \text{ or } \alpha_b \in [0, 0.4], \quad (\text{baseline} = 0)$$

Lower LTV or move towards LTI constraint:

$$b_{2,t} \leq \frac{\gamma}{R_t} \left[ \hat{E}_{1,t} q_{t+1} \pi_{t+1} \right] h_{2,t}$$

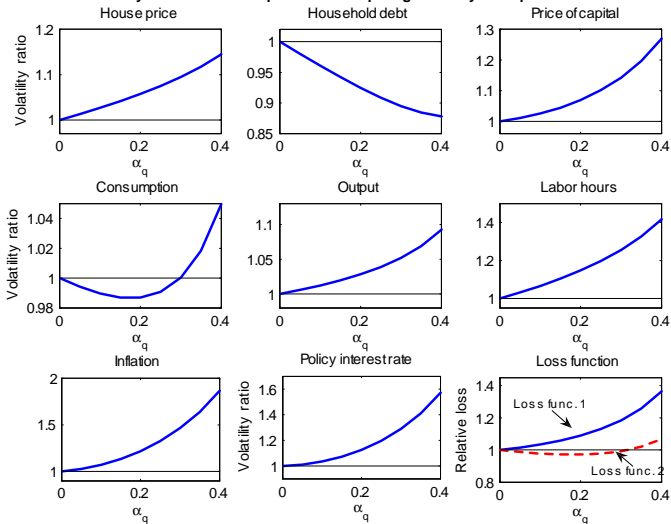
$$\gamma \in [0.2, 1.0], \quad (\text{baseline} = 0.7)$$

$$b_{2,t} \leq \frac{\hat{\gamma}}{R_t} \left\{ m \underbrace{w_t L_{2,t}}_{\text{wage income}} + (1-m) \underbrace{\left[ \hat{E}_{1,t} q_{t+1} \pi_{t+1} \right] h_{2,t}}_{\text{collateral}} \right\}$$

# Interest Rate Response to House Price Growth

Reduces volatility of household debt but magnifies volatility of output and inflation.

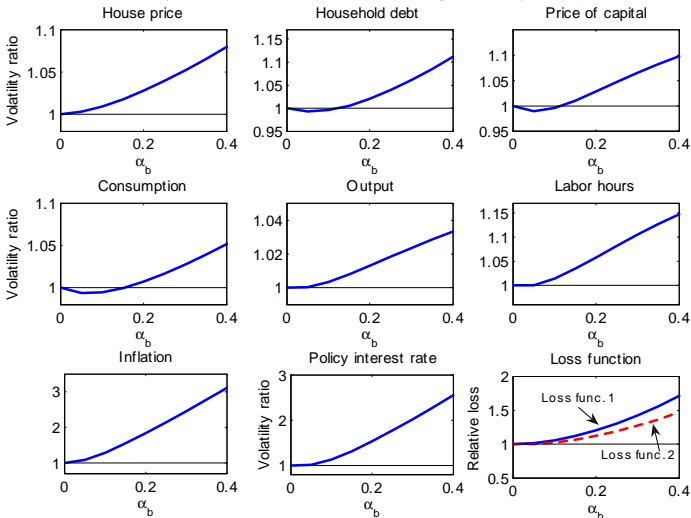
Sensitivity to interest rate response to house price growth - Hybrid expectations



# Interest Rate Response to Credit Growth

Tends to magnify volatility of household debt and other macro variables.

## Sensitivity to interest rate response to credit growth - Hybrid expectations



# Monetary policy results depend on expectations

Previous results obtained from rational expectations models may not be robust.

## Interest rate response to credit growth ( $\alpha_b = 0.2$ )

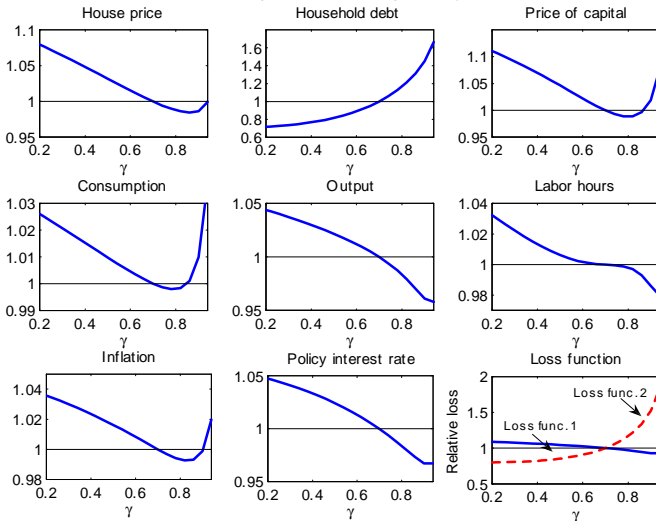
	Standard deviations			
	House price	HH debt	Output	Inflation
<b>Rational Expectations</b>				
Not responding	2.08	3.17	2.31	0.81
Responding	2.14	2.00	2.34	0.84
Volatility Ratio	1.03	0.63	1.01	1.04
<b>Hybrid Expectations</b>				
Not responding	3.62	6.55	3.14	0.90
Responding	3.72	6.68	3.18	1.65
Volatility Ratio	1.03	1.02	1.01	1.83

Standard deviations expressed as percent deviations from steady state.

# Tighten Lending Standards: Lower LTV

Reduces volatility of household debt but magnifies volatility of other macro variables.

**Sensitivity to LTV ratio - Hybrid expectations**





# Generalized constraint maths

$$b_{2,t} \leq \frac{\gamma}{R_t} \left[ \hat{E}_{1,t} q_{t+1} \pi_{t+1} \right] h_{2,t}$$

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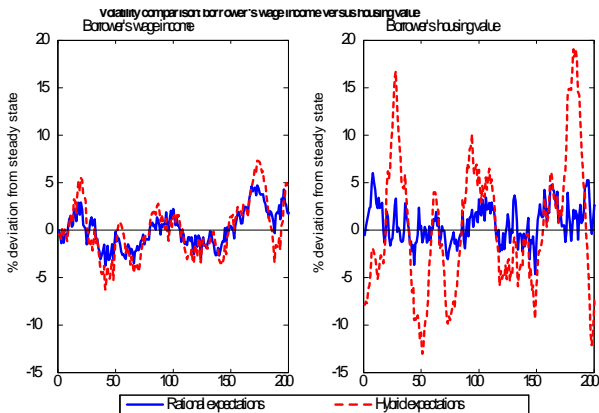
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$$\underbrace{\frac{b_{2,t} R_t}{\left[ \hat{E}_{1,t} q_{t+1} \pi_{t+1} \right] h_{2,t}}}_{LTV_t} \leq \hat{\gamma} \left\{ m \frac{w_t L_{2,t}}{\left[ \hat{E}_{1,t} q_{t+1} \pi_{t+1} \right] h_{2,t}} + (1-m) \right\}$$

# Volatility Comparison: Wage Income versus Housing Value

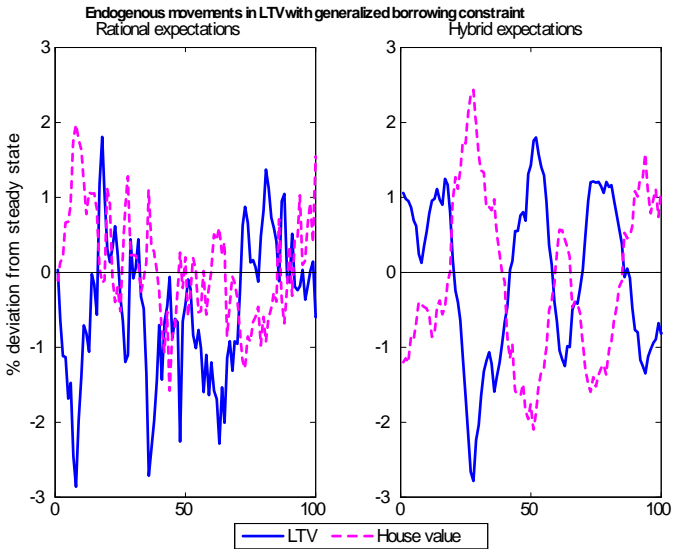
Wage income is less subject to bubble-induced distortions.



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# Endogenous LTV acts like an automatic stabilizer

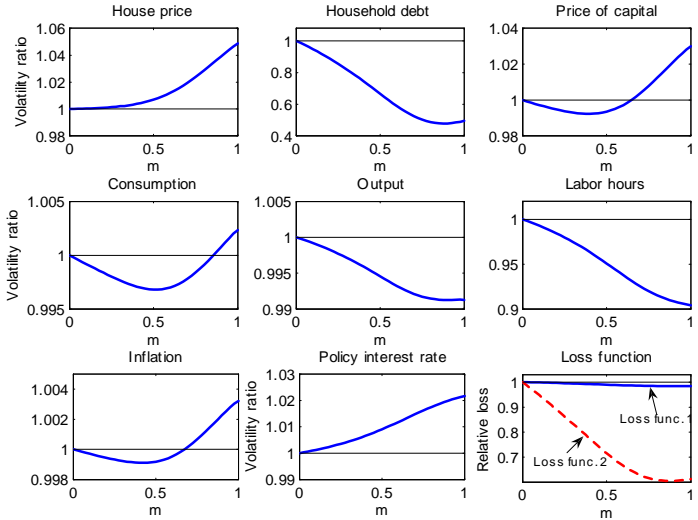
Weight on wage income in borrowing constraint induces countercyclical LTV ratio.



# Move Towards Loan-to-Income Constraint (Best)

Reduces volatility of household debt as well other economic variables.

**Sensitivity to weight on wage income in borrowing constraint - Hybrid expectations**



# Conclusion

No policy was perfect but some did better than others.

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- Best-performing policy: Require lenders to put substantial weight on wage income in the borrowing constraint. Promotes both economic and financial stability (automatic stabilizer).

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- Best-performing policy: Require lenders to put substantial weight on wage income in the borrowing constraint. Promotes both economic and financial stability (automatic stabilizer).
- Best performing policy calls for lending behavior that is basically the opposite of what U.S. lenders did during housing boom of the mid-2000s. **By 2006, 27 percent of all new mortgages were “no-doc” and “low-doc” loans.**