International Capital Flows and House Prices: Theory and Evidence

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Motivation

- Dramatic boom-bust cycle in real estate prices

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- Large fluctuations in international capital flows

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- Financial market liberalization(FML) vs. international capital flows

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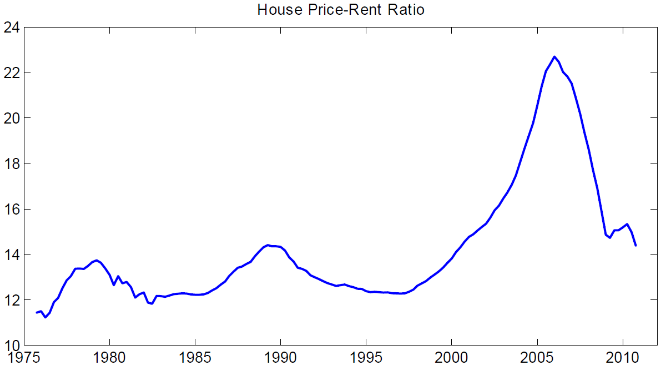
House Price-Rent Ratio
24
22
20
18
16
14
12
10
1975
1980
1985
1990
1995
2000
2005
2010

Theory

- *Global savings glut hypothesis* (Bernanke (2005); Mendoza, Quadrini and Rios-Rull (2007); Bernanke (2008); Caballero, Fahri and Gourinchas (2008); Caballero and Krishnamurthy (2009))

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  - Savings from China and East Asia found their way to U.S.
  - Interest rates $\downarrow$
  - House prices $\uparrow$

Hence, capital inflow $\uparrow \Longrightarrow$ interest rates $\downarrow \Longrightarrow$ house prices $\uparrow$

Alternatives

- *Laibson and Mollerstrom (2010):*
  Bubble in the housing market $\Longrightarrow$ Housing wealth $\uparrow$ $\Longrightarrow$ Consumption $\uparrow$ $\Longrightarrow$ Borrowing from abroad $\uparrow$ $\Longrightarrow$ Net capital inflow $\uparrow$

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  lower collateral requirements facilitate access to external funding
- *Gete (2010)*:
  consumption smoothing between tradeable and nontradable(housing) goods $\Longrightarrow$ positive correlation between housing prices and current account deficits

Empirical Counter-Evidence

- While interest rates were low throughout the boom period, they have remained low and even fallen further in the bust period

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- While interest rates were low throughout the boom period, they have remained low and even fallen further in the bust period
- While capital flowed into countries like the U.S. during the boom, there is no evidence of a clear reversal in this trend during the bust period

Setup

- Two-sector GE model: housing and non-housing production

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- Heterogenous households
- Incomplete financial markets
- A house is durable illiquid asset which can be used as collateral
- Large number of overlapping generations of households with stochastic life-cycle earnings profile

Factors of Interest

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- The impact of changes in housing transaction costs

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- The impact of changes in housing collateral requirements
- The impact of changes in housing transaction costs
- The impact of an influx of foreign capital into the domestic bond market

Dynamics

- Simultaneous occurrence of positive economic shocks and FML

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- Risk premia on housing and equity assets $\downarrow$
  - lower collateral requirements
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- Simultaneous occurrence of positive economic shocks and FML
- Risk premia on housing and equity assets $\downarrow$
  - lower collateral requirements
  - lower transaction costs
- "Implied Rent" $\downarrow \Longrightarrow$ price/"rent" $\uparrow$

▸ Model

Mechanism

- Financial market liberalization:
  - Endogenous interest rate $\uparrow$
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- Financial market liberalization:
  - Endogenous interest rate $\uparrow$
  - Risk premium $\downarrow$
- International Capital Flow:
  - Endogenous interest rate $\downarrow$
  - Risk premium $\uparrow$

Model Prediction

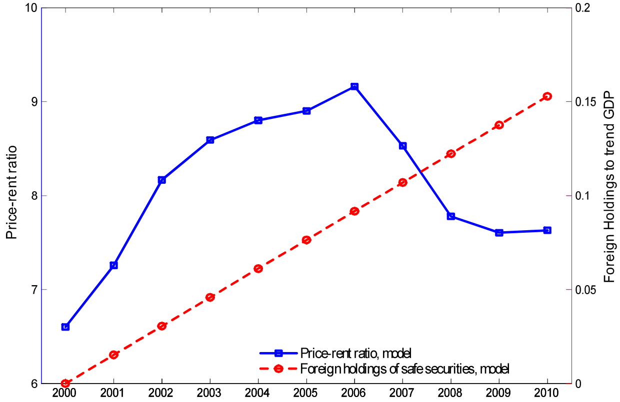

Figure : Price-"Implicit Rent" Ratio and Foreign Holdings

Data

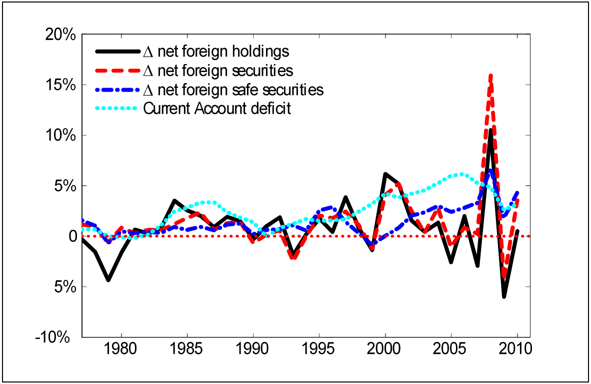

Figure : Measures of U.S. Capital Flows

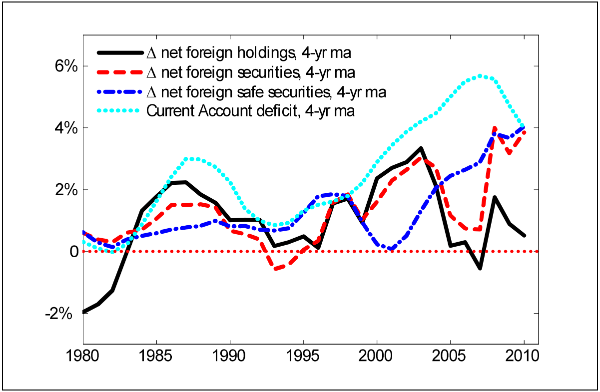

Figure : Measures of U.S. Capital Flows (4 year MA)

Data

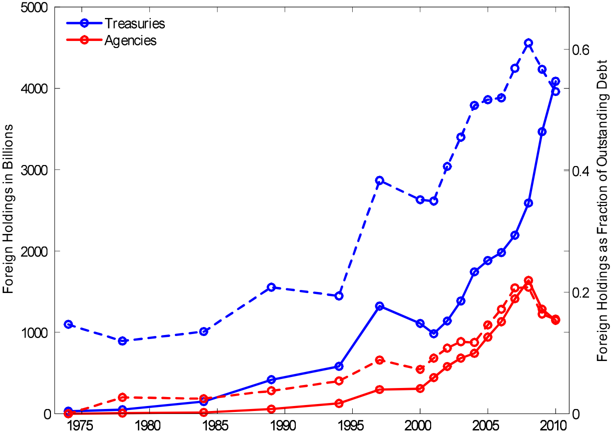

Figure : Foreign Holdings of U.S. Safe Assets

Data

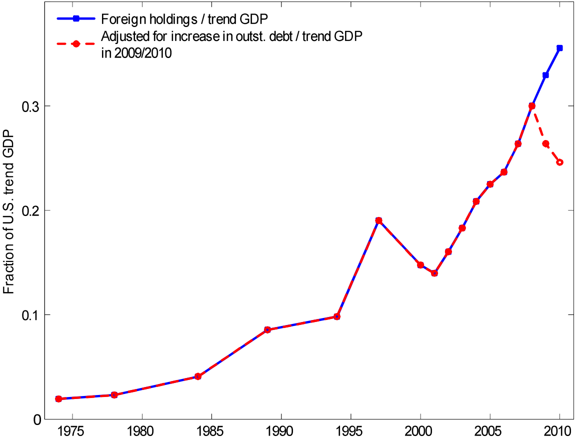

Figure : Foreign Holdings relative to U.S. GDP

Data

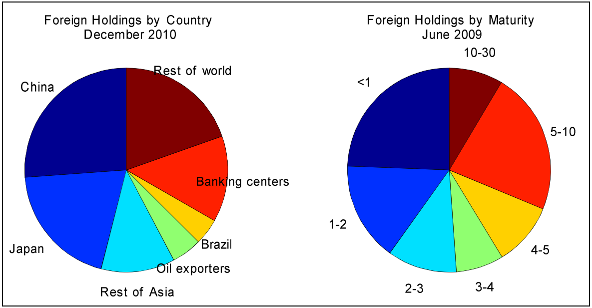

Figure : Foreign Holdings by Maturity and by Country

Data

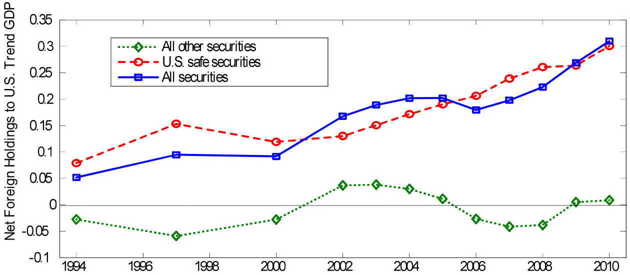

Figure : Net Foreign Holdings relative to U.S. Trend GDP

Data

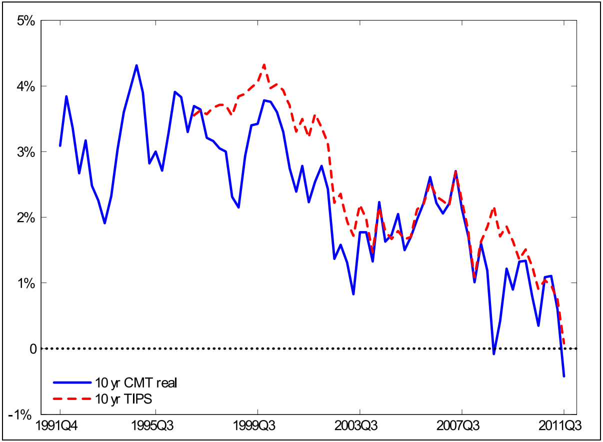

Figure : U.S Real Interest Rates

Data

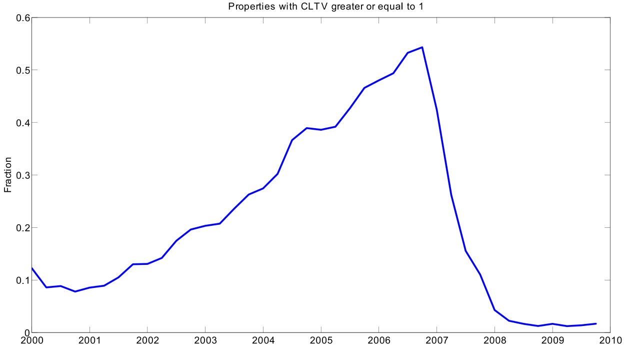

Figure : Fraction of Properties in L.A. County with cumulative LTV ratios $\geq$ 100%

Data

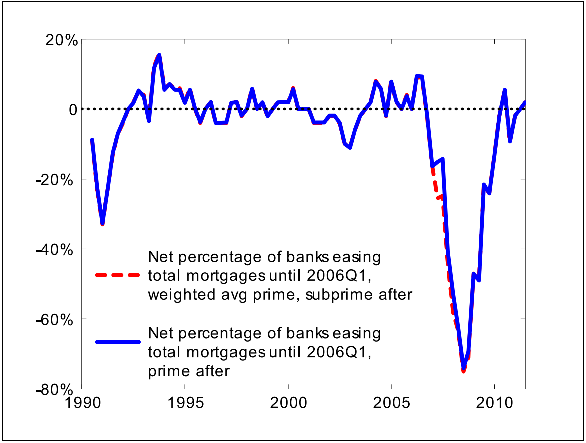

Figure : Net Percentage of U.S. Banks Reporting Easier Credit Standards

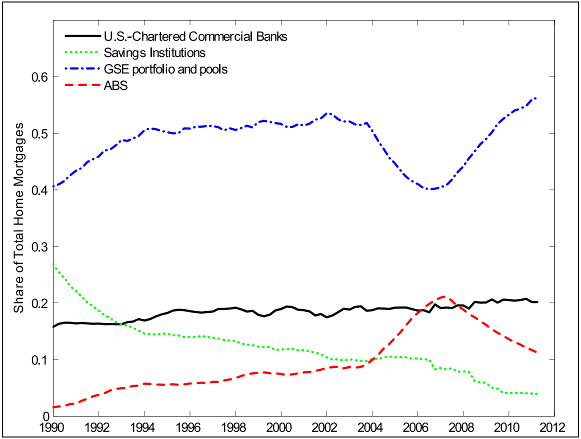

Figure : Mortgage Shares by Holder over Time

Data

Table 1: Regression of Mortgage Growth by Holder on Credit Standards

Mortgage Holder	1991Q1-2010Q4	2000Q1-2006Q1	2000Q1-2010Q4	1991Q1-1999Q4
All	0.024	0.000	0.033	-0.006
	(3.73)**	(0.00)	(4.86)**	(-1.41)
	[0.24]	[-0.04]	[0.40]	[0.00]
ABS	0.097	0.356	0.125	-0.259
	(3.91)**	(2.00)	(4.65)**	(-4.69)**
	[0.20]	[0.24]	[0.44]	[0.38]
Banks	0.019	-0.022	0.025	0.014
	(3.82)**	(-0.26)	(4.25)**	(0.92)
	[0.10]	[-0.03]	[0.17]	[0.01]
Savings	0.088	0.160	0.101	0.070
	(3.50)**	(1.95)	(3.72)**	(2.22)*
	[0.39]	[0.29]	[0.45]	[0.19]
GSE	-0.013	-0.146	-0.014	-0.036
	(-2.37)*	(-3.30)**	(-2.26)*	(-3.60)**
	[0.11]	[0.53]	[0.15]	[0.25]
ABS/GSE	0.110	0.50	0.140	-0.217
	(4.76)**	(2.41)*	(4.78)**	(-4.68)**
	[0.26]	[0.34]	[0.48]	[0.37]

Data

Table 2						
	Panel A 2000Q1-2006Q4			Panel B 2006Q4-2010Q4		
	real HP gr. (% change)	CA def. (cum.) / GDP2006	Res. Inv. (cum.) /GDP2006	real HP gr. (% change)	CA def. (cum.) / GDP2006	Res. Inv. (cum.) /GDP2006
Australia	55%	24%	35%	17%	23%	27%
Austria	1%	-8%	29%	20%	-17%	19%
Belgium	18%	-17%	32%	10%	-1%	26%
Canada	46%	-10%	35%	10%	6%	30%
Czech Republic	20%	19%	18%	4%	14%	16%
Denmark	64%	-16%	32%	-20%	-15%	22%
Estonia	387%	47%	19%	-47%	26%	21%
Finland	37%	-35%	39%	8%	-15%	28%
France	85%	-3%	36%	1%	7%	22%
Germany	-16%	-17%	38%	-3%	-29%	23%
Greece	50%	39%	42%	-22%	62%	23%
Hungary	40%	39%	25%	-27%	15%	14%
Iceland	64%	57%	28%	-28%	62%	21%
Ireland	60%	8%	57%	-40%	15%	26%
Israel	-16%	-6%	27%	34%	-14%	22%
Italy	35%	7%	29%	-2%	12%	21%
Korea	25%	-12%	29%	-4%	-9%	20%
Luxembourg	71%	-51%	13%	-3%	-38%	14%
Netherlands	28%	-31%	37%	-7%	-27%	26%
New Zealand	73%	30%	35%	-10%	29%	23%
Norway	46%	-73%	21%	9%	-68%	16%
Poland	-2%	18%	16%	33%	29%	11%
Portugal	-6%	51%	42%	2%	51%	18%
Slovenia	46%	8%	11%	1%	18%	10%
Spain	87%	28%	45%	-16%	35%	30%
Sweden	61%	-35%	17%	15%	-36%	15%
Switzerland	12%	-75%	28%	13%	-40%	15%
United Kingdom	78%	13%	21%	-6%	9%	14%
United States	64%	30%	32%	-36%	17%	13%
Russia	157%	-39%	8%	10%	-30%	12%
China	-1%	-22%	38%	-6%	-50%	63%
Euro Area	32%	0.04%		-3%	2.4%	
Corr. CAdef	0.23	1.00	0.22	-0.38	1.00	-0.14
Corr. HP gr.	1.00	0.23	-0.25	1.00	-0.38	-0.09

Regression Analysis

Table 3: Quarterly Panel Regressions (2002Q4-2010Q4)
11 Countries

Regression	Real House price growth on				
	$Cons$	$CAdef/GDP$	CS	$(CAdef/GDP)xCS$	R^2
1	0.005	-0.055			0.01
	(1.52)	(-0.73)			
2	0.005		0.005		0.06
	(1.69)		(3.24)**		
3	0.005	-0.018	0.005		0.07
	(1.62)	(-0.29)	(3.26)**		
4	0.005	-0.009		0.083	0.05
	(1.58)	(-0.14)		(5.34)**	
5	0.005		0.004	0.060	0.09
	(1.96)		(3.20)**	(6.61)**	

Regression Analysis

Table 4: Quarterly Regressions for US (1990Q2-2010Q4)

	Real house price growth on				
Regression	Cons.	$CAdef/GDP$	CS	$(CAdef/GDP)^*\ CS$	Adj. R^2
1	-0.006	0.207			0.02
	(-1.35)	(0.92)			
2	0.001		0.016		0.53
	(0.27)		(9.94)**		
3	-0.011	0.365	0.017		0.62
	(-2.68)**	(2.54)*	(10.32)**		
4	-0.008	0.322		0.385	0.61
	(-2.33)*	(2.31)*		(10.74)**	
5	0.001		0.007	0.221	0.55
	(0.52)		(1.26)	(0.88)	

Regression Analysis

Table 5: Quarterly Regressions for US (2000:Q1-2010:Q4)

	Real house price growth on				
Regression	*Cons*	*CAdef/GDP*	*CS*	*(CAdef/GDP)* CS*	Adj. R^2
1	-0.018	0.435			0.01
	(-0.96)	(1.02)			
2	0.002		0.023		0.66
	(0.43)		(11.43)**		
3	-0.008	0.214	0.023		0.66
	(-0.48)	(0.57)	(11.89)**		
4	-0.008	0.189		0.465	0.62
	(-0.40)	(0.45)		(10.60)**	
5	0.002		0.031	-0.162	0.65
	(0.46)		(1.84)	(-0.46)	

Regression Analysis

Table 6: Quarterly Regressions for US (1990Q2-2010Q4)

Regression	Real house price growth on *Cons*	ΔNFL_t	CS	ΔNFL_txCS	Adj. R^2
1	0.003	-0.142			0.06
	(0.76)	(-1.46)			
2	0.001		0.016		0.53
	(0.27)		(9.94)**		
3	0.000	0.036	0.016		0.53
	(0.06)	(0.89)	(8.75)**		
4	0.001	0.143		0.135	0.25
	(0.18)	(1.54)		(4.94)**	
5	0.001		0.016	0.002	0.53
	(0.28)		(5.99)**	(0.15)	

Regression Analysis

Table 7: Regressions of $\Delta\ln(P_{t+H})$ on CS, covariates (1991Q4-2010Q4)
U.S. Data

			Forecast Horizon H			
Row	Regressors	Contemp.	1	2	3	4
1	CS_t	0.015	0.015	0.028	0.041	0.050
		(9.63)**	(7.00)**	(5.46)**	(4.76)**	(4.09)**
		[0.52]	[0.47]	[0.47]	[0.41]	[0.41]
2	CS_t	0.018	0.016	0.032	0.054	0.071
		(6.29)**	(4.11)**	(3.87)**	(4.71)**	(4.57)**
	ΔNFL_t	0.036	-0.026	0.018	0.218	0.435
		(0.79)	(-0.40)	(0.12)	(1.04)	(1.62)
	r_t^{10}	-0.004	-0.003	-0.009	-0.019	-0.027
		(-1.10)	(-0.72)	(-1.24)	(-2.33)*	(-2.31)*
		[0.53]	[0.48]	[0.49]	[0.53]	[0.50]
3	CS_t	0.017	0.016	0.033	0.054	0.070
		(6.19)**	(4.30)**	(4.25)**	(5.00)**	(4.67)**
	ΔNFL_t	0.058	-0.024	0.012	0.216	0.456
		(1.10)	(-0.36)	(0.07)	(0.87)	(1.37)
	r_t^{10}	-0.005	-0.003	-0.008	-0.019	-0.028
		(-1.23)	(-0.63)	(-0.99)	(-2.00)*	(-2.20)*
	ΔGDP_t	0.568	0.036	-0.153	-0.032	0.449
		(1.60)	(0.09)	(-0.19)	(-0.03)	(0.27)
		[0.54]	[0.47]	[0.48]	[0.53]	[0.49]

Regression Analysis

Table 8: Regressions of $\Delta \ln(P/R)_{t+H}$ on CS, covariates (1991Q4-2010Q4)
U.S. Data

		Forecast Horizon H				
Row	Regressors	contemp.	1	2	3	4
1	CS_t	0.015	0.015	0.043	0.055	0.064
		(8.36)**	(7.54)**	(7.38)**	(6.26)**	(5.08)**
		[0.49]	[0.46]	[0.52]	[0.51]	[0.46]
2	CS_t	0.017	0.015	0.049	0.070	0.087
		(6.08)**	(4.02)**	(5.46)**	(6.15)**	(5.49)**
	ΔNFL_t	0.013	-0.075	-0.056	0.097	0.312
		(0.29)	(-0.99)	(-0.31)	(0.46)	(1.14)
	r_t^{10}	-0.003	-0.003	-0.017	-0.029	-0.037
		(-0.95)	(-0.87)	(-1.80)	(-2.68)**	(-2.65)**
		[0.50]	[0.48]	[0.56]	[0.58]	[0.55]
3	CS_t	0.015	0.014	0.047	0.069	0.085
		(5.65)**	(4.04)**	(5.22)**	(5.93)**	(5.29)**
	ΔNFL_t	0.051	-0.068	-0.010	0.147	0.385
		(1.00)	(-0.83)	(-0.05)	(0.56)	(1.09)
	r_t^{10}	-0.006	-0.004	-0.019	-0.032	-0.041
		(-1.39)	(-0.85)	(-1.85)	(-2.79)**	(-2.90)**
	ΔGDP_t	0.977	0.181	1.088	1.142	1.601
		(2.36)*	(0.48)	(1.25)	(0.93)	(0.94)
		[0.54]	[0.48]	[0.57]	[0.58]	[0.55]

Regression Analysis

Table 9: Quarterly Long-Horizon Regressions

Panel A

		$\ln(P_{t+H}) - \ln(P_t)$ on Forecast Horizon H			
Row	Regressors	1	2	3	4
1	$\Delta \log(HP_t)$	0.96	1.58	2.35	2.95
		$(9.29)^{**}$	$(6.41)^{**}$	$(5.85)^{**}$	$(4.98)^{**}$
		[0.70]	[0.65]	[0.69]	[0.63]

Panel B

		$\ln(P_{t+H}) - \ln(P_t)$ on Forecast Horizon H			
Row	Regressors	1	2	3	4
1	e_{CS}	0.76	1.33	2.07	2.71
		$(5.01)^{**}$	$(4.08)^{**}$	$(4.59)^{**}$	$(4.42)^{**}$
		[0.23]	[0.19]	[0.22]	[0.22]

Regression Analysis

Table 10: Regressions of $\Delta\ln(P_{t+H})$ on CS, covariates (1991Q4-2010Q4)
U.S. Data

			Forecast Horizon H			
Row	Regressors	contemp.	1	2	3	4
1	$\epsilon_{CD,t}$	0.015	0.015	0.027	0.038	0.047
		(7.20)**	(5.50)**	(4.39)**	(3.94)**	(3.54)**
		[0.48]	[0.43]	[0.41]	[0.40]	[0.35]
2	$\epsilon_{CD,t}$	0.018	0.015	0.031	0.052	0.068
		(5.28)**	(3.50)**	(3.22)**	(3.67)**	(3.58)**
	ΔNFL_t	0.023	-0.038	-0.012	0.164	0.368
		(0.51)	(-0.55)	(-0.08)	(0.71)	(1.23)
	r_t^{10}	-0.004	-0.003	-0.009	-0.020	-0.028
		(-1.13)	(-0.76)	(-1.22)	(-2.10)*	(-2.08)*
		[0.50]	[0.44]	[0.43]	[0.46]	[0.43]
3	$\epsilon_{CD,t}$	0.013	0.012	0.028	0.051	0.070
		(2.95)**	(2.11)*	(2.30)*	(3.01)**	(3.10)**
	ΔNFL_t	0.017	-0.044	-0.019	0.162	0.372
		(0.38)	(-0.61)	(-0.12)	(0.70)	(1.24)
	r_t^{10}	-0.002	-0.002	-0.007	-0.019	-0.028
		(-0.51)	(-0.36)	(-0.95)	(-1.99)	(-2.11)*
	$\Delta GDP_{t\to t+4}$	0.011	0.008	0.008	0.002	-0.003
		(2.32)*	(1.33)	(0.69)	(0.15)	(-0.15)
		[0.55]	[0.46]	[0.43]	[0.45]	[0.42]

Regression Analysis

Table 11: Regressions Based On Model Simulated Data

Panel A				Panel B			
	$\Delta \ln (P_t)$ on				$\Delta \ln (P_t/R_t)$ on		
Regression	ΔNFL	CS	R^2	Regression	ΔNFL	CS	R^2
1	0.130		0.01	1	0.4177		0.07
	(0.291)				(0.748)		
2		0.063	0.37	2		0.095	0.63
		(2.21)				(3.62)	
3	-0.561	0.0875	0.48	3	-0.505	0.117	0.69
	(-6.01)	(3.60)			(-4.01)	(5.73)	

Conclusion

- Foreign capital flows into safe U.S. securities played an important role in lowering the interest rates

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- Capital flows have little if any explanatory power for residential real estate fluctuations in samples that include both the boom and the bust
- Variation in credit standards alone explains 53% of the quarterly variation in U.S.house price growth over the period of 1992-2010 and 66% over the boom-bust period from 2000-2010. The rest of variables explain only 5% of variation in quarterly U.S. house price growth.

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Thank you!

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- Individuals have a utility function given by:

$$U(C_{a,t}, H_{a,t}) = \frac{\tilde{C}_{a,t}^{1-\frac{1}{\delta}}}{1-\frac{1}{\delta}}$$

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$$C^i_{a,t} + B^i_{a+1,t+1}q_t + \theta^i_{a+1,t+1}(V^e_{C,t} + V^e_{H,t}) \leq$$

$$\Omega^i_{a,t} + (1-\tau)W_t L^i_{a,t} + p^H_t((1-\delta_H)H^i_{a,t} - H^i_{a+1,t+1}) - F^i_t$$

$$-B^i_{a+1,t+1} \leq (1-\bar{\omega})p^H_t H^i_{a,t+1}$$

$$F^i_t \equiv F^i_{H,t} + F_{K,t}$$

F.O.C.

- The first order condition for optimal housing choice:

$$\frac{\partial U}{\partial C^i_{a,t}} = \beta E_t \left[\frac{\partial U}{\partial C^i_{a+1,t+1}} \left(\frac{\frac{\partial U}{\partial H^i_{a+1,t+1}}}{\frac{\partial U}{\partial C^i_{a+1,t+1}}} + p^H_{t+1}(1-\delta_H) \right) \right]$$

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- "Rent" is defined as:

$$\frac{\frac{\partial U}{\partial H^i_{a+1,t+1}}}{\frac{\partial U}{\partial C^i_{a+1,t+1}}}$$

National Rental Index

- National Rental Index is defined as intertemporal marginal rate of substitution for a representative agent:

$$R_{H,t+1} = \frac{\frac{\partial U}{\partial H_{t+1}}}{\frac{\partial U}{\partial C_{t+1}}}$$

Back to Dynamics