Lecture 6: Asset Pricing

UCLA - Econ 221 - Fall 2018

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Outline

1. Equities
   - Equity Premium
   - Cross-section of stock returns
   - Time series variation of Expected returns
2. Issues with Credit Spreads
   - Asset Pricing
   - Credit spreads as predictors
   - Bond's market Q
3. Issues with the Term Structure (Liquidity related)
4. Introduction: Production Based Asset Pricing

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Investor's Problem

$$\max_{\xi} \quad u(c_t) + \mathrm{E}_t\left[\beta u(c_{t+1})\right]$$

$$\text{s.t.} \quad \begin{cases} c_t = e_t - \xi p_t \\ c_{t+1} = e_{t+1} + \xi x_{t+1} \end{cases} \quad \Rightarrow \quad p_t = \mathrm{E}_t\left[\underbrace{\beta \frac{u'(c_{t+1})}{u'(c_t)}}_{m_t} x_{t+1}\right]$$

- An investor's first-order conditions give the basic consumption-based model:

$$p_t = E_t\left[\beta \frac{u'\left(c_{t+1}\right)}{u'\left(c_t\right)} x_{t+1}\right]$$

- Because consumption based CAPM does not work, we typically want to use "another" stochastic discount factor:

$$p = \mathbb{E}(mx),$$

$$m = \beta \frac{u'\left(c_{t+1}\right)}{u'\left(c_t\right)}.$$

Prices / Payoffs

	Price p_t	Payoff x_{t+1}
Stock	p_t	$p_{t+1} + d_{t+1}$
Return	1	R_{t+1}
Price-dividend ratio	$\frac{p_t}{d_t}$	$\left(\frac{p_{t+1}}{d_{t+1}} + 1\right)\frac{d_{t+1}}{d_t}$
Excess return	0	$R^e_{t+1} = R^a_{t+1} - R^b_{t+1}$
Managed portfolio	z_t	$z_t R_{t+1}$
Moment condition	$E(p_t z_t)$	$x_{t+1} z_t$
One-period bond	p_t	1
Risk-free rate	1	R^f
Option	C	$\max(S_T - K, 0)$

Mean-Variance Frontier

- For a given asset return R^i:

$$1 = E\left(mR^i\right) = E(m)E\left(R^i\right) + \rho_{m,R^i}\sigma\left(R^i\right)\sigma(m)$$

- Therefore:

$$E\left(R^i\right) = R^f - \rho_{m,R^i}\frac{\sigma(m)}{E(m)}\sigma\left(R^i\right)$$

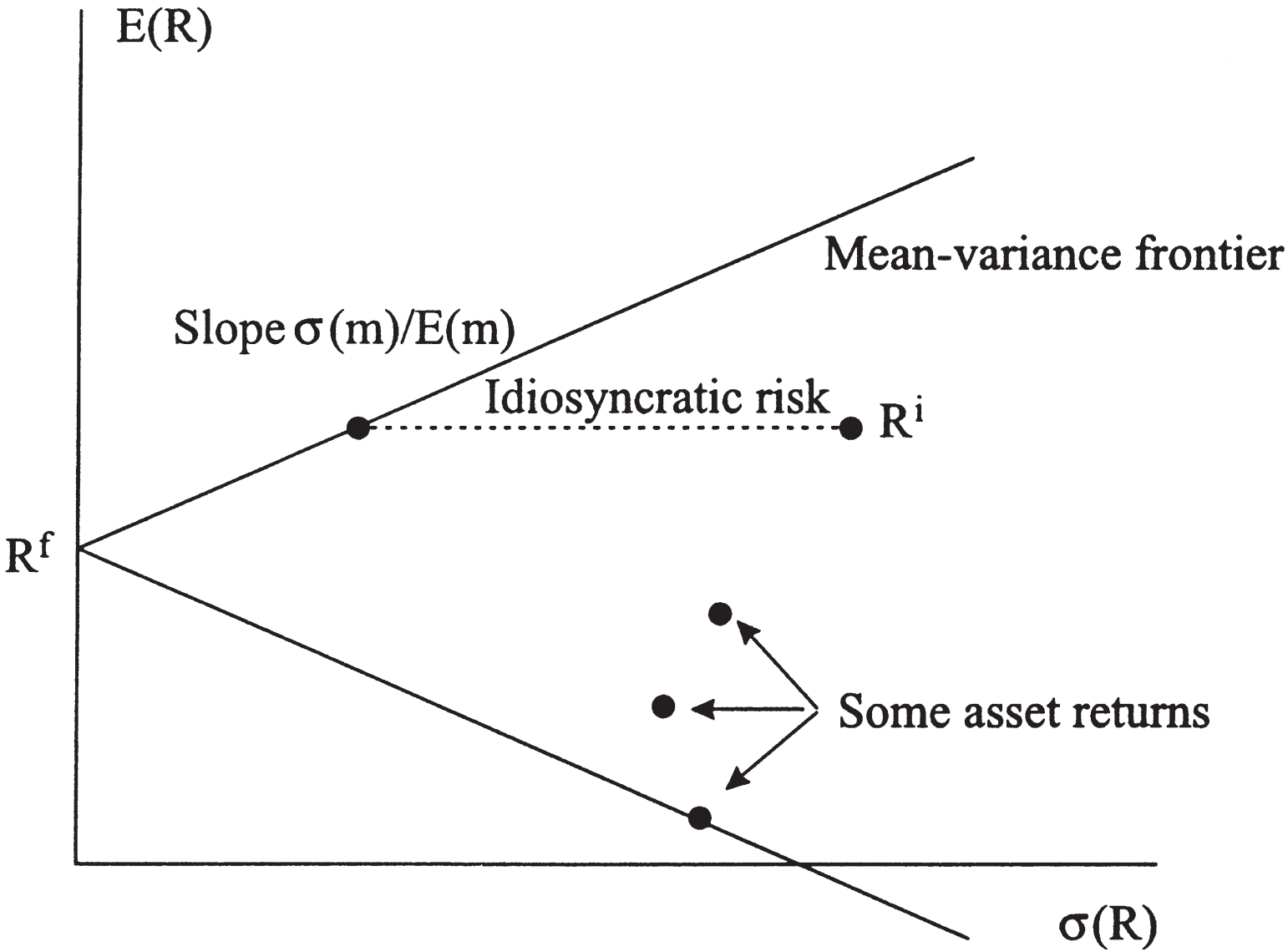
- Thus (mean-variance frontier):

$$\left|E\left(R^i\right) - R^f\right| \leq \frac{\sigma(m)}{E(m)}\sigma\left(R^i\right)$$

- Denote R^{mv} the return of a portfolio n the frontier. Therefore:

$$\left|\frac{E\left(R^{mv}\right) - R^f}{\sigma\left(R^{mv}\right)}\right| = \frac{\sigma(m)}{E(m)} = \sigma(m)R^f$$

Mean-Variance Frontier



Power utility

- With power utility: $u'(c) = c^{-\gamma}$,

$$\left|\frac{E\left(R^{mv}\right) - R^f}{\sigma\left(R^{mv}\right)}\right| = \frac{\sigma\left[\left(c_{t+1}/c_t\right)^{-\gamma}\right]}{E\left[\left(c_{t+1}/c_t\right)^{-\gamma}\right]}$$

- Therefore:

$$\left|\frac{E\left(R^{mv}\right) - R^f}{\sigma\left(R^{mv}\right)}\right| = \sqrt{e^{\gamma^2\sigma^2(\Delta \ln c_{t+1})} - 1} \approx \gamma\sigma(\Delta \ln c)$$

- Slope of the mean-standard deviation frontier is higher:
  - if the economy is riskier: if consumption is more volatile
  - or if investors are more risk averse.
- Real stock return: 9%, standard deviation about 16%, while real return on Treasury bills has been about 1%. Sharpe ratio = 0.5.
- Aggregate non durable and services consumption growth: mean and standard deviation of about 1%. **Therefore** $\gamma \approx 50$. **This is crazy.**

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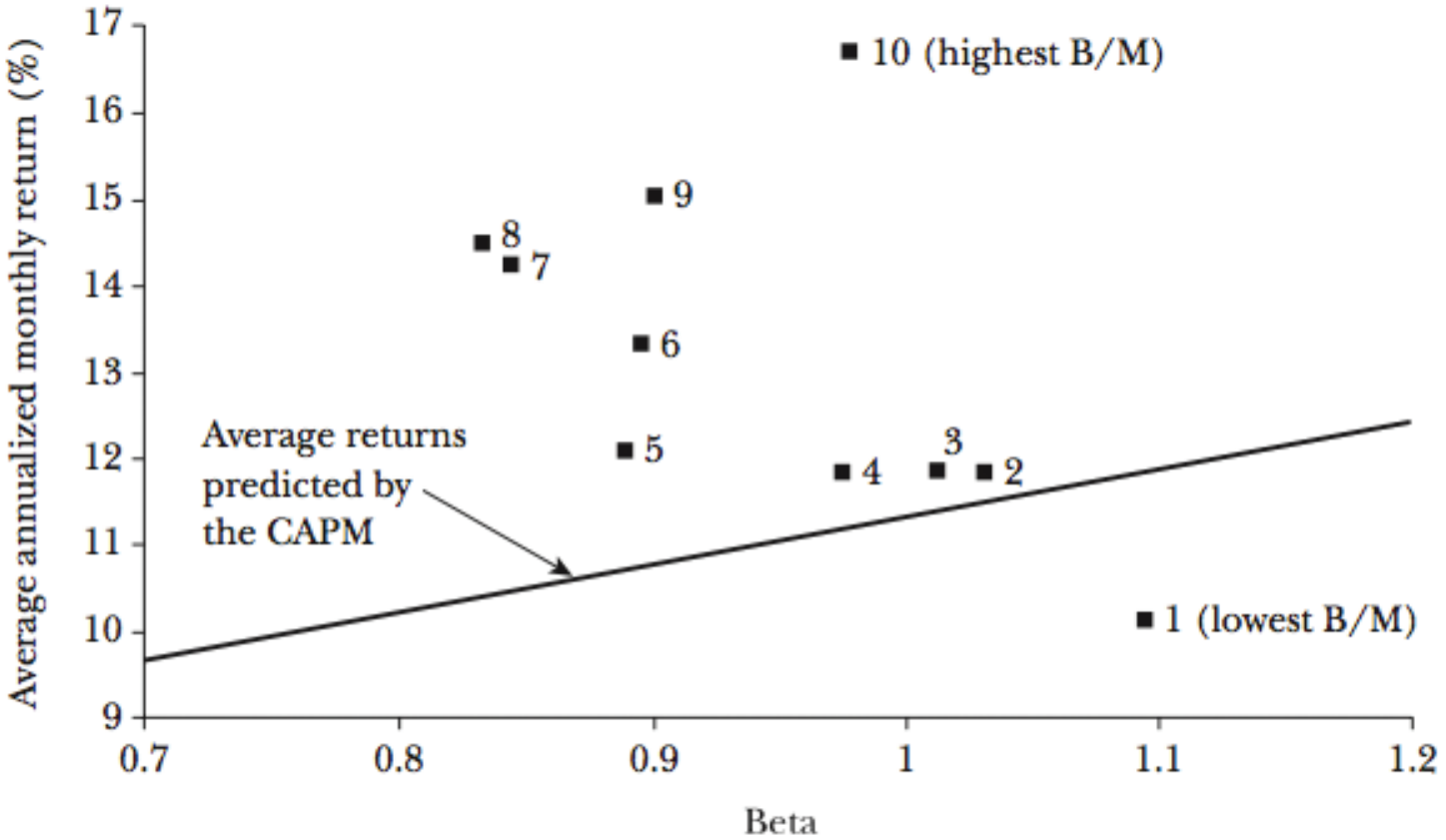
"Distress" or Value Premium

Average Annualized Monthly Return versus Beta for Value Weight Portfolios Formed on B/M, 1963–2003



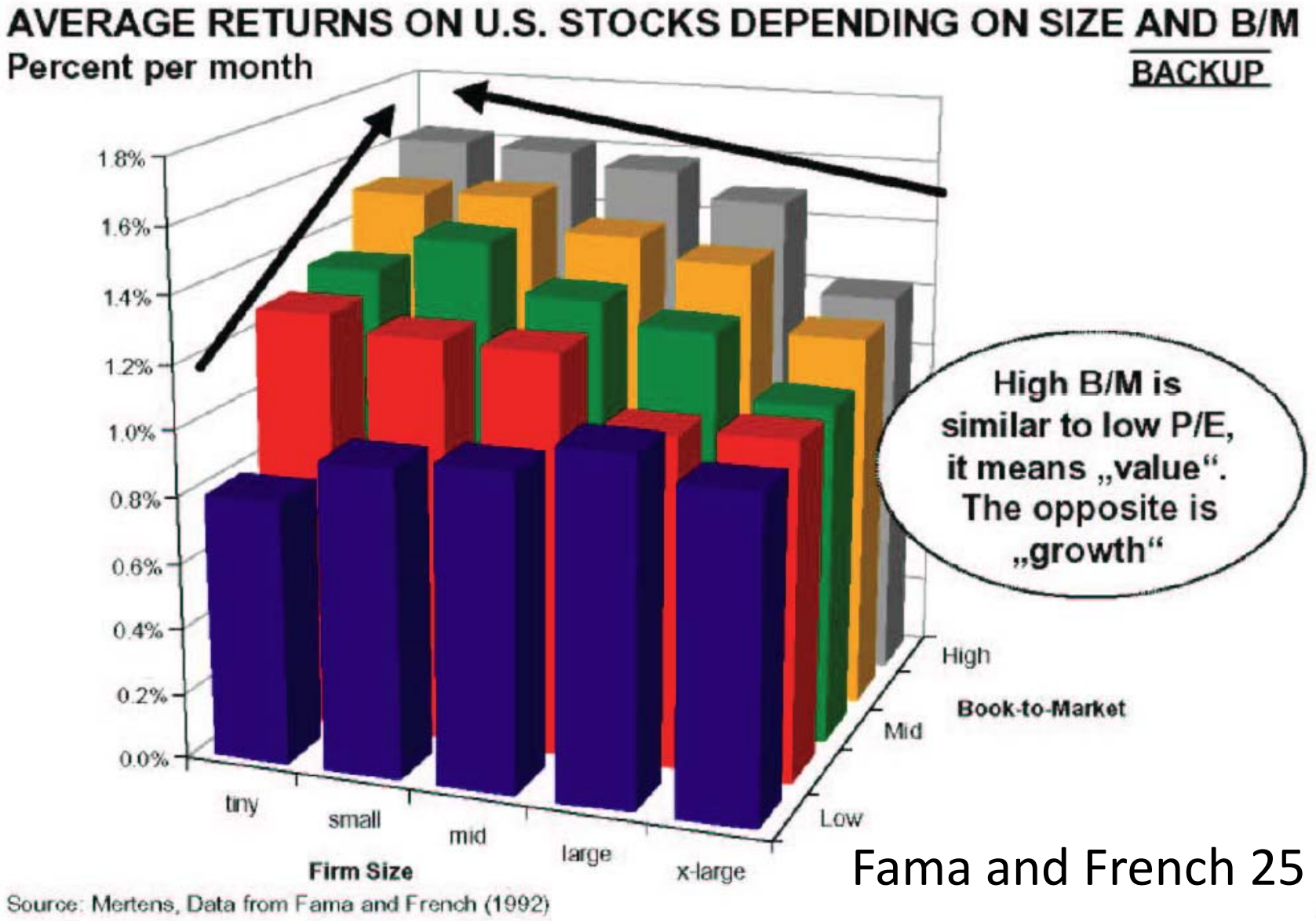
Fama, French (1996)

	Book-to-Market Equity (BE/ME) Quintiles									
Size	Low	2	3	4	High	Low	2	3	4	High
	Panel A: Summary Statistics									
	Means					Standard Deviations				
Small	0.31	0.70	0.82	0.95	1.08	7.67	6.74	6.14	5.85	6.14
2	0.48	0.71	0.91	0.93	1.09	7.13	6.25	5.71	5.23	5.94
3	0.44	0.68	0.75	0.86	1.05	6.52	5.53	5.11	4.79	5.48
4	0.51	0.39	0.64	0.80	1.04	5.86	5.28	4.97	4.81	5.67
Big	0.37	0.39	0.36	0.58	0.71	4.84	4.61	4.28	4.18	4.89

Fama, French (1996)

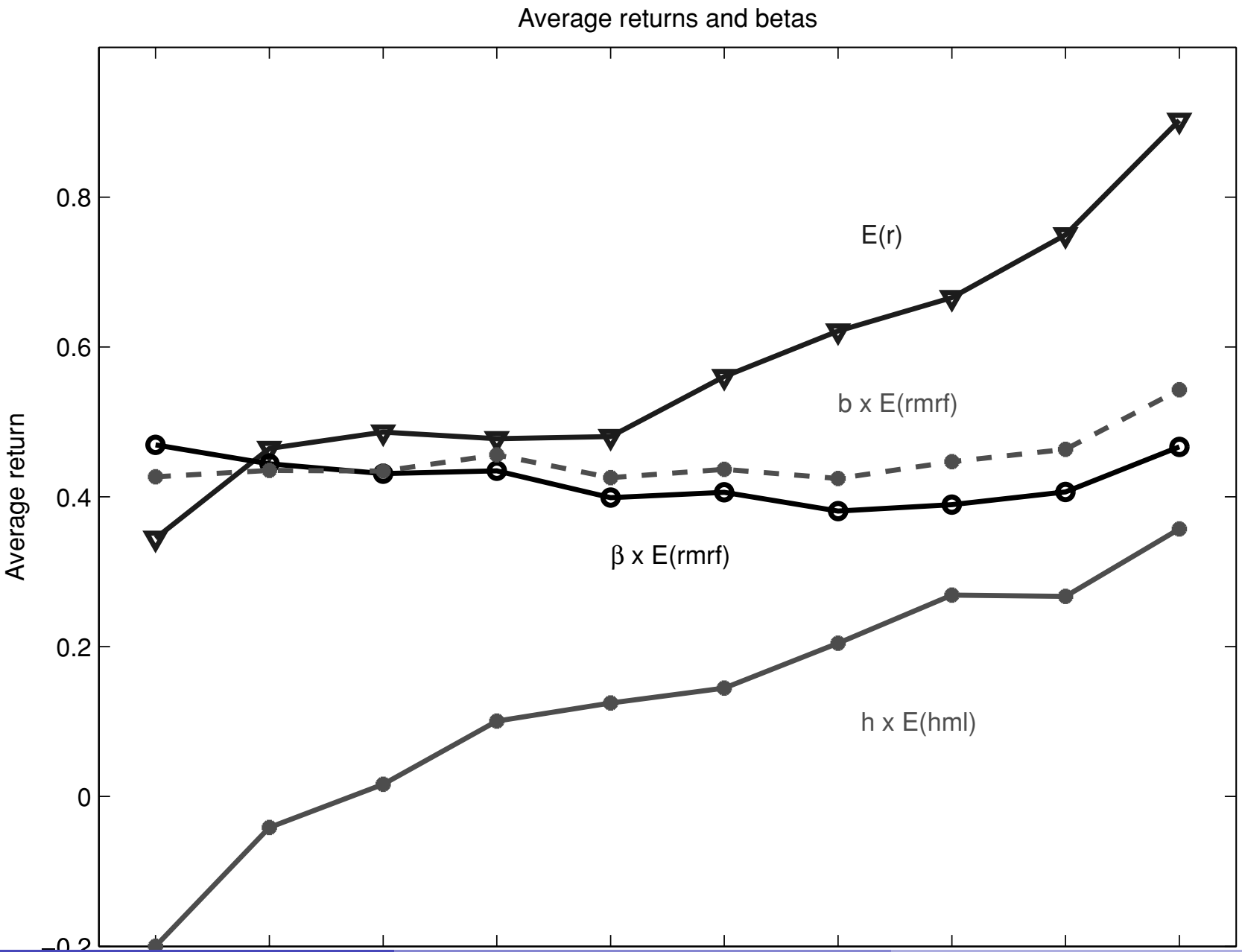
Period	Portfolio Formation Months	Average Excess Returns									
		1	2	3	4	5	6	7	8	9	10
6307–9312	12-2	−0.00	0.46	0.61	0.55	0.72	0.68	0.85	0.90	1.08	1.31
6307–9312	24-2	0.36	0.60	0.59	0.66	0.71	0.81	0.73	0.80	0.93	1.05
6307–9312	36-2	0.46	0.60	0.77	0.69	0.73	0.81	0.69	0.78	0.84	0.97
6307–9312	48-2	0.66	0.70	0.77	0.74	0.71	0.71	0.72	0.71	0.72	0.89
6307–9312	60-2	0.86	0.76	0.73	0.75	0.70	0.71	0.74	0.70	0.66	0.73
6307–9312	60-13	1.16	0.81	0.77	0.76	0.74	0.72	0.72	0.73	0.54	0.42
3101–6306	12-2	1.49	1.52	1.32	1.49	1.39	1.45	1.45	1.55	1.58	1.87
3101–6306	24-2	2.24	1.60	1.57	1.70	1.41	1.31	1.32	1.24	1.26	1.46
3101–6306	36-2	2.31	1.74	1.65	1.46	1.40	1.40	1.32	1.23	1.27	1.36
3101–6306	48-2	2.34	1.81	1.62	1.60	1.37	1.30	1.33	1.22	1.24	1.26
3101–6306	60-2	2.49	1.78	1.74	1.50	1.39	1.33	1.27	1.18	1.28	1.14
3101–6306	60-13	2.62	1.85	1.63	1.61	1.43	1.24	1.34	1.28	1.08	1.01

Fama, French (1992)



Fama and French 25

Cochrane (2011)



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Discount Rates

- Back to the textbook asset pricing identity:

$$p = \mathbb{E}(mx),$$

  with p the asset price, m the "stochastic discount factor", x the cash flow. (say we do not tie that to consumption)

- **Pervasive fact**: Δp come mostly (if not entirely) from Δm, not in Δx:
  - Stocks: why do P/D move: discount rates, almost no Δx
  - Bonds: same insight. More salient: short maturity bonds. Almost no variation in Δx.

- Finance: about theories of m, the "price of risk". m reconciles cash flows with asset prices.

Cochrane (2011): predictibility

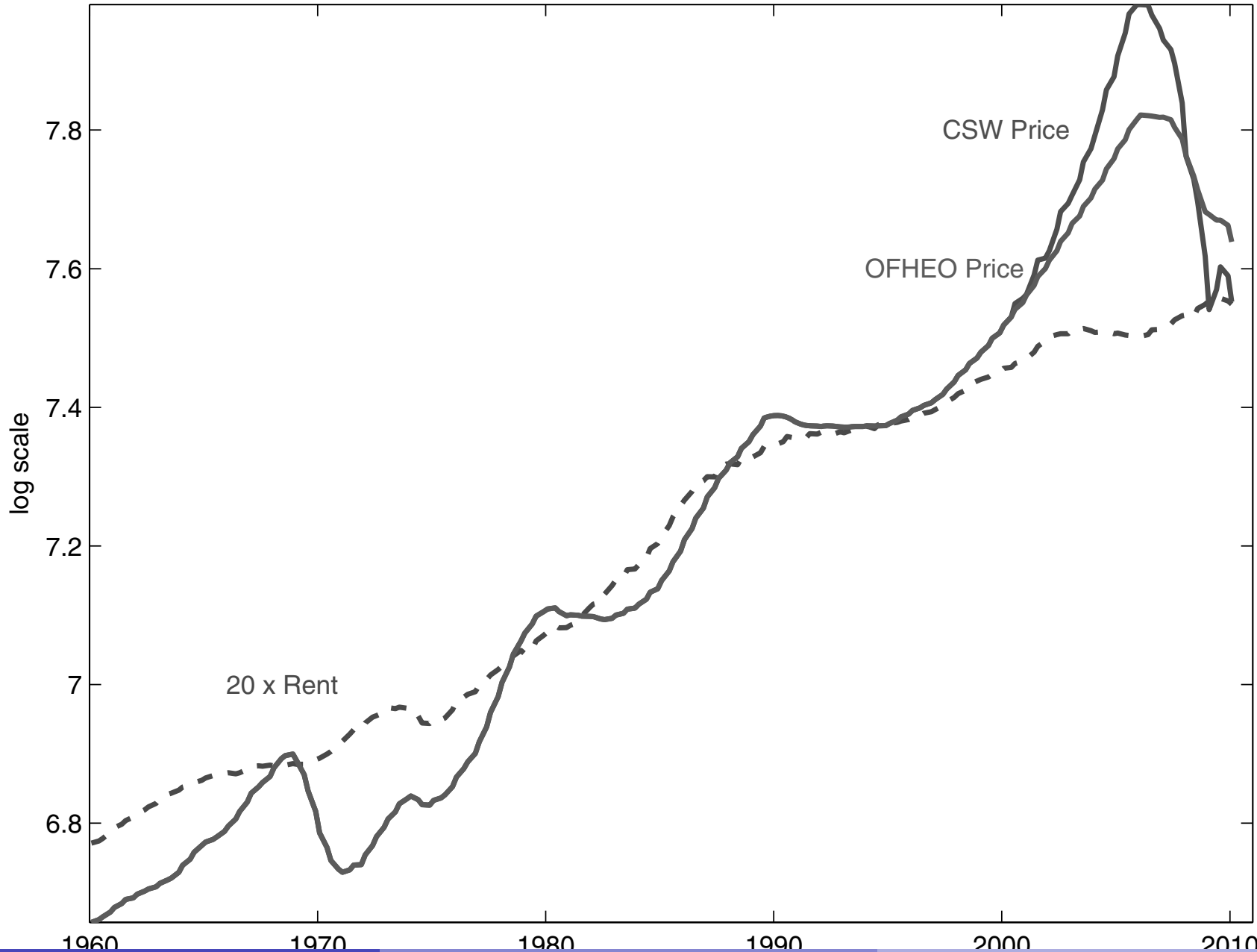
Table I

Return-Forecasting Regressions

The regression equation is $R^e_{t\to t+k} = a + b \times D_t/P_t + \varepsilon_{t+k}$. The dependent variable $R^e_{t\to t+k}$ is the CRSP value-weighted return less the 3-month Treasury bill return. Data are annual, 1947–2009. The 5-year regression t-statistic uses the Hansen–Hodrick (1980) correction. $\sigma[E_t(R^e)]$ represents the standard deviation of the fitted value, $\sigma(\hat{b} \times D_t/P_t)$.

Horizon k	b	$t(b)$	R^2	$\sigma[E_t(R^e)]$	$\frac{\sigma[E_t(R^e)]}{E(R^e)}$
1 year	3.8	(2.6)	0.09	5.46	0.76
5 years	20.6	(3.4)	0.28	29.3	0.62

Cochrane (2011): predictibility



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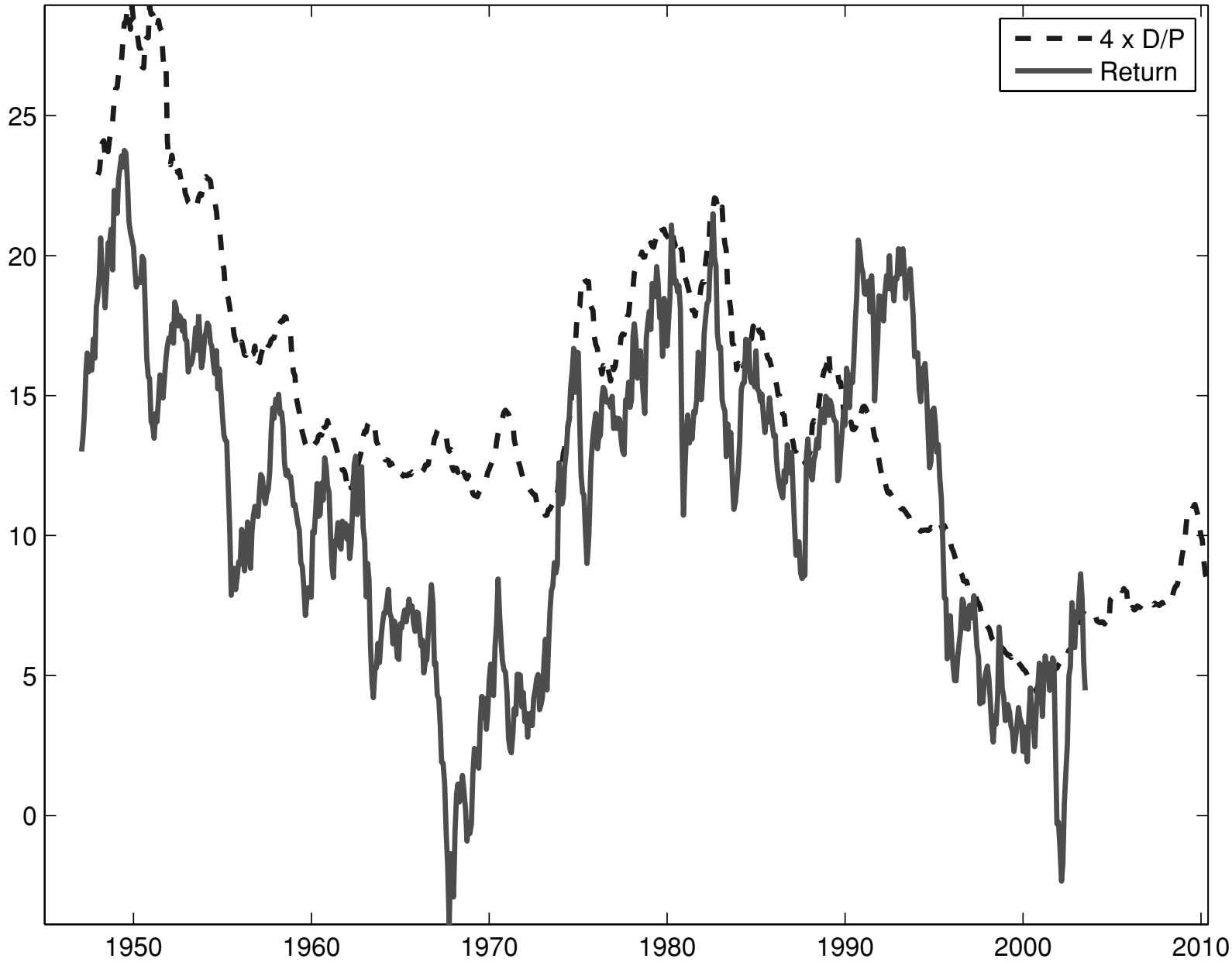


Consumption-Based AP 1/2

- High stock prices signal low future returns, not high dividends. Systematic pattern. Same story in the housing market. High house prices do not signal rising rents, but future falling housing prices.
- Chances that this is due to randomness are very thin, given the pervasiveness of the phenomenon. Financial econometrics is all about giving flesh to this statement.
- Traditional finance attributes this to time-varying risk premia.
- The question is then: what is the source of time-varying risk premia? Well, with CRRA people become more risk averse as their consumption decreases (right?).
- Problem: with reasonable risk aversion, you're not getting much since the fall of consumption in recessions is minor. (+ if you jack up γ you have a risk free rate puzzle... hence epstein-zin preferences.

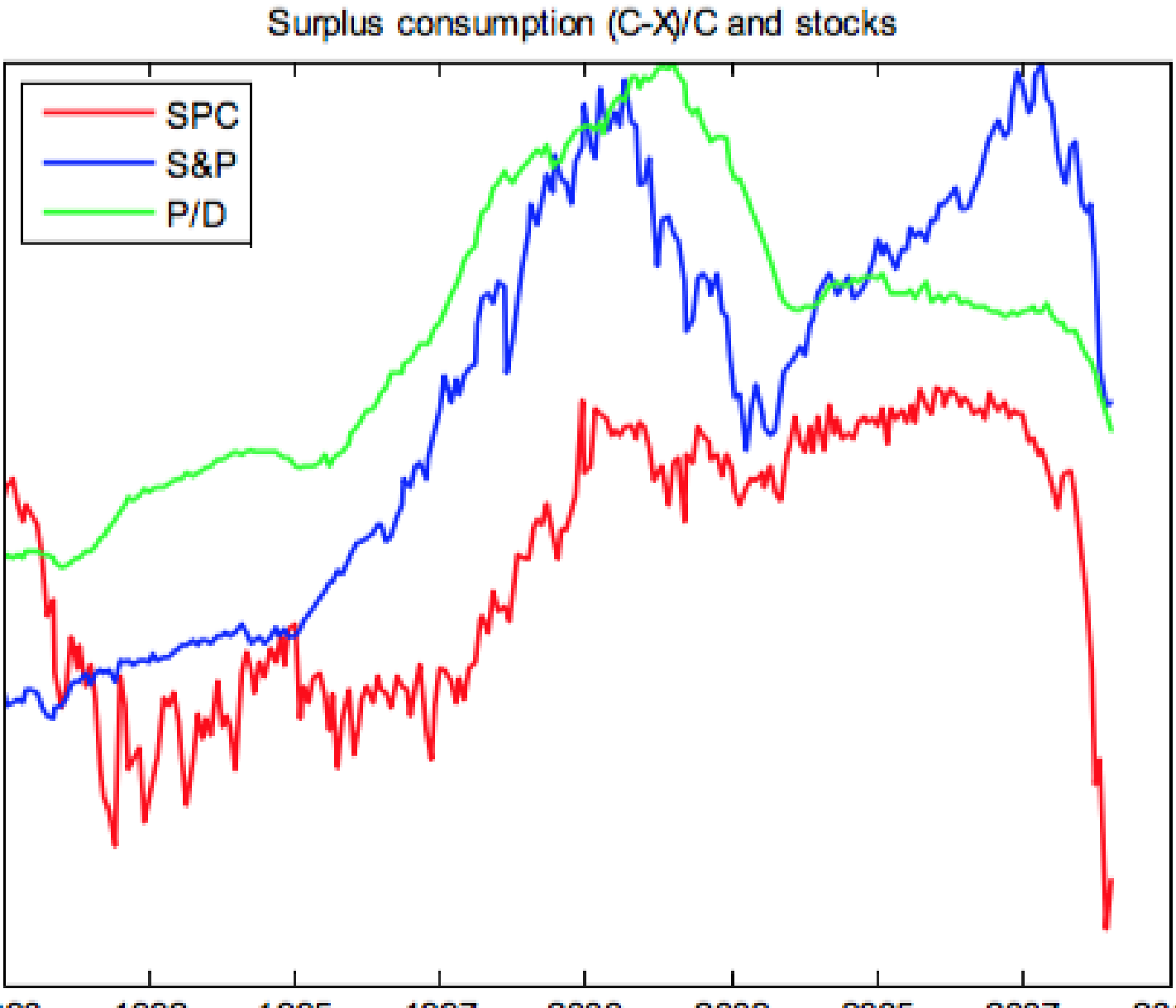
Consumption-Based AP 1/2

- Proponents of time varying risk premia argue the puzzle is quantitative, not qualitative. Consumption does fall at the same time as stock prices fall, which somewhat validates the theory (one alternative is that behavioral asset prices can feed into C through wealth effects...)
- Correlation with consumption is not perfect however, and falling consumption should lead all asset prices to fall but housing and stocks sort of behave differently...
- Alternative. Campbell-Cohrane habit formation:

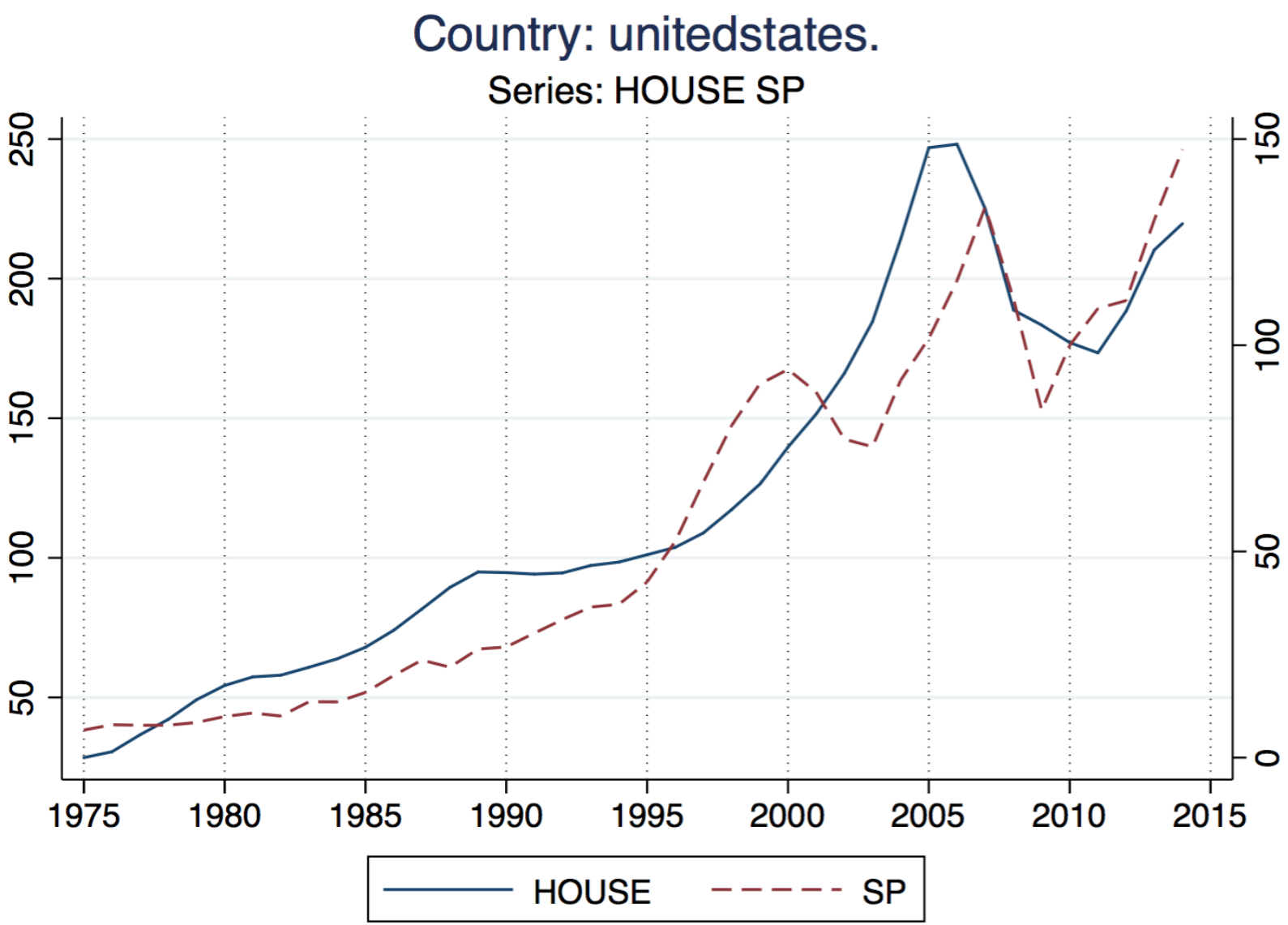
$$u(C_t) = \frac{(C_t - X_t)^{1-\gamma}}{1-\gamma}.$$

- Rise in $-cu''(x)/u'(c)$ as consumption decreases from their old habit.
- That's one fix, many asset pricing papers are about playing with preferences like that. But overall, no fix is well accepted.

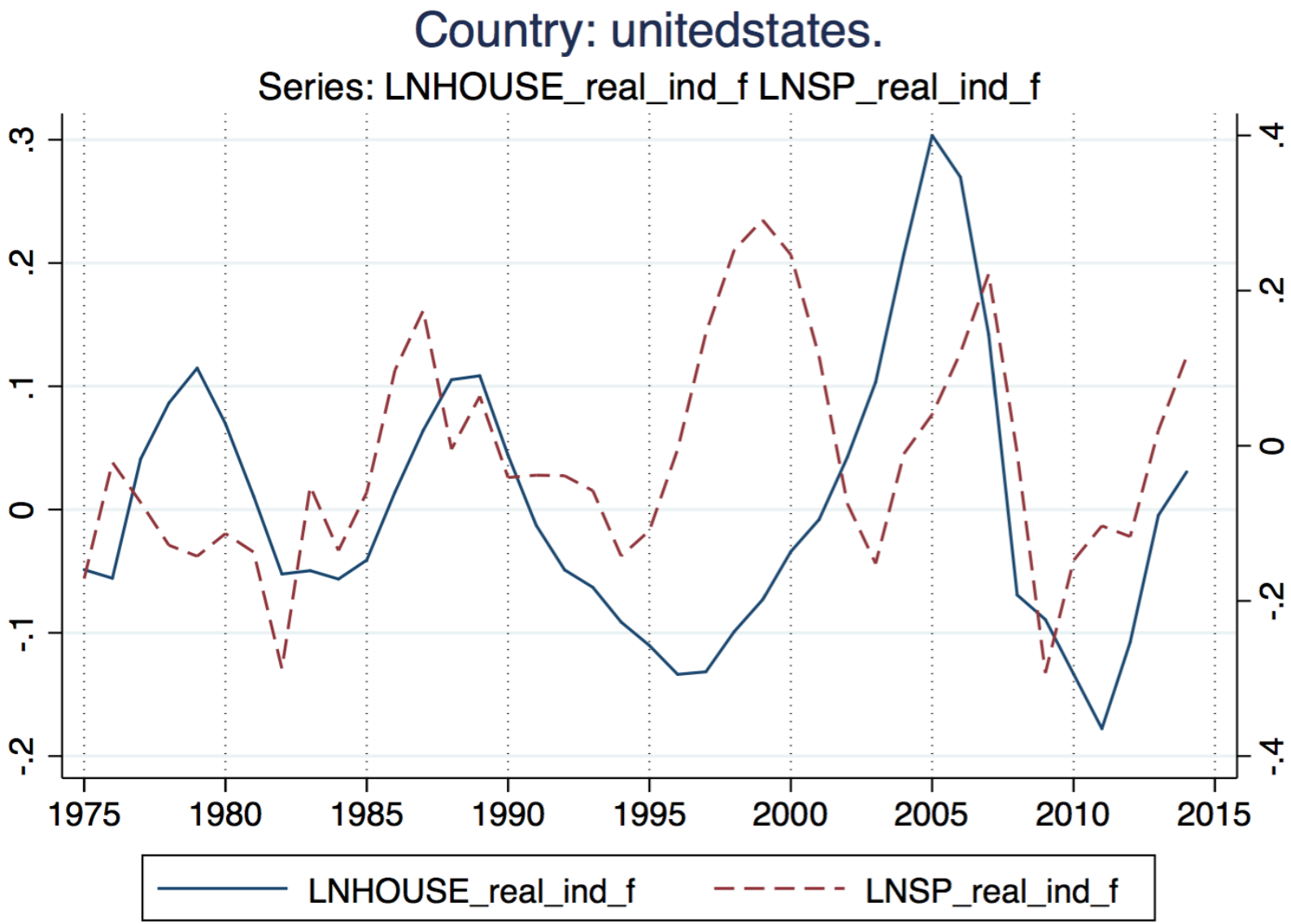
Habits work not so bad? (taken from Cochrane's notes)



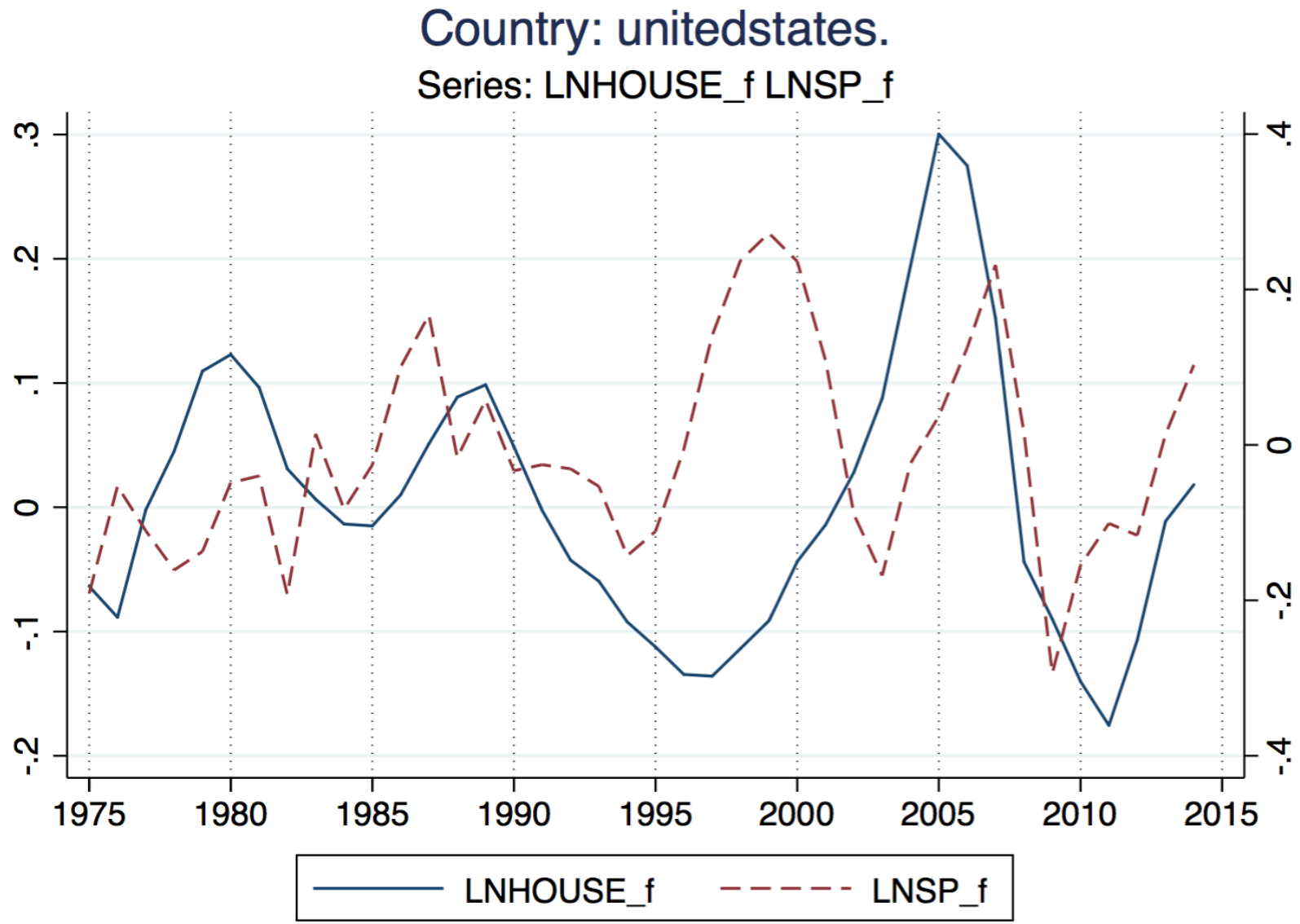
Stock Prices and House Prices, Raw



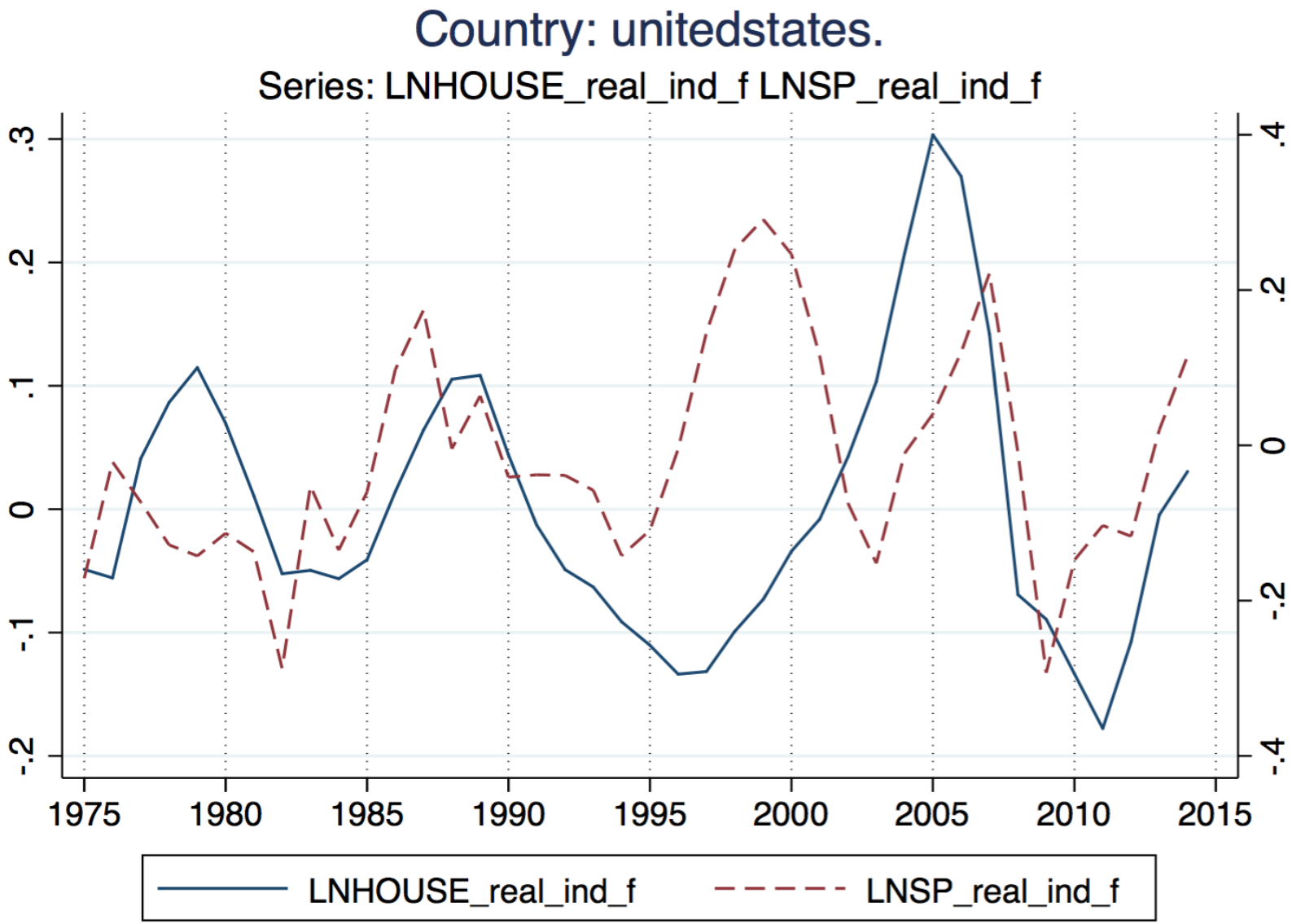
Stock Prices and House Prices, Filtered



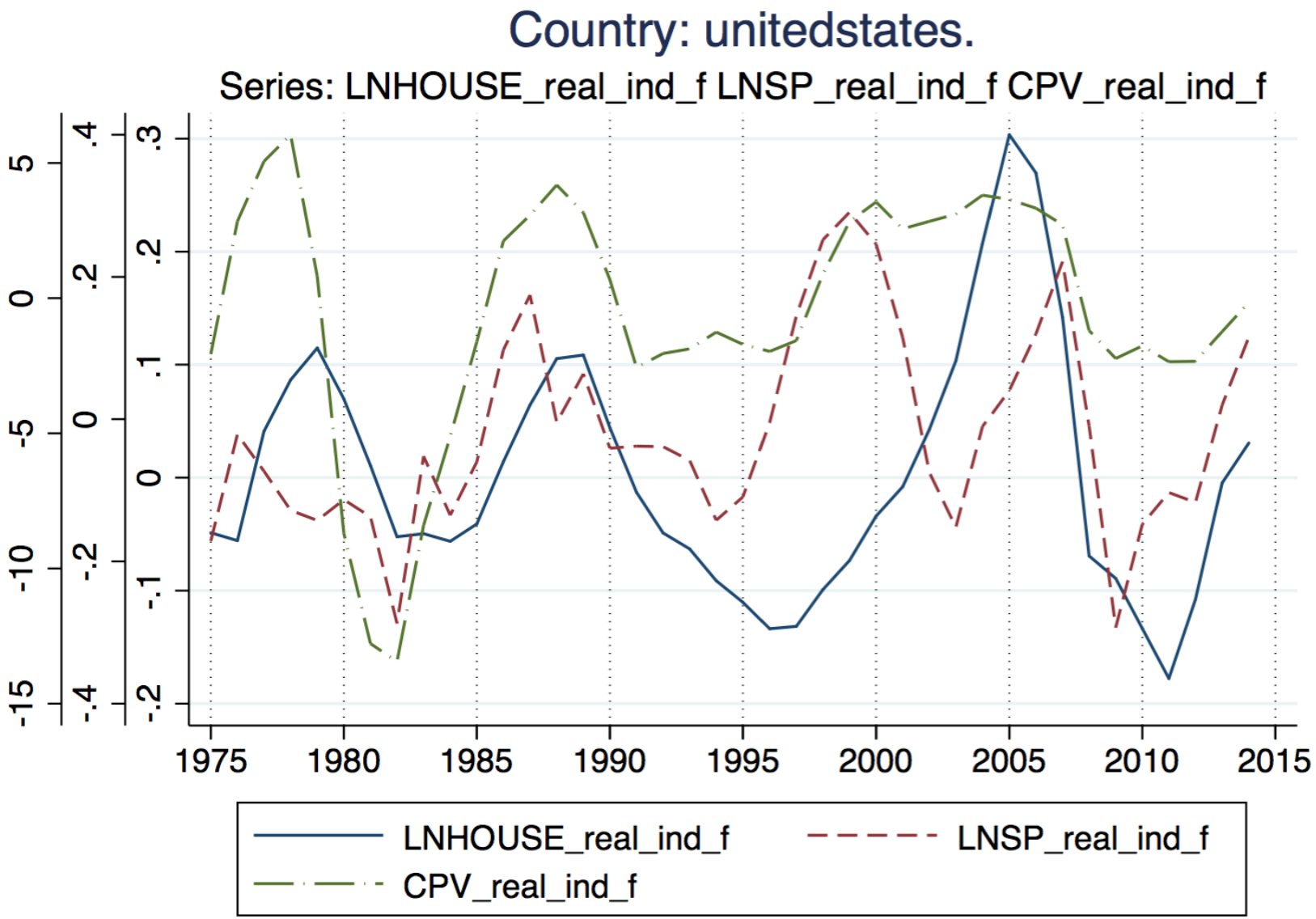
Fluctuations increase, that's why we Log Stuff (more stationary?)



Even more stationary: real variables



Consumption in the Picture



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Credit Spread Puzzle

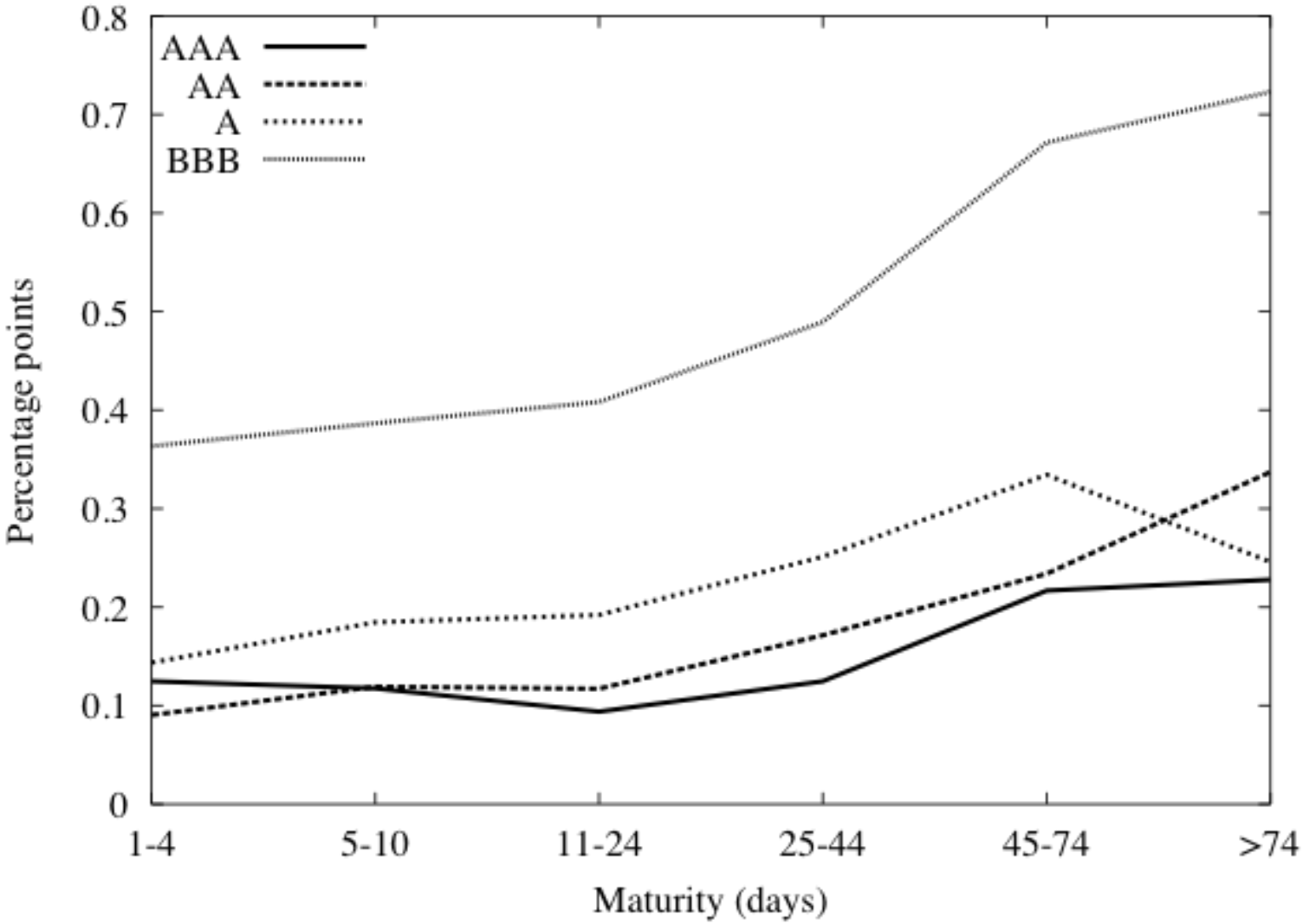
- **Level:** underprediction of the level spreads for bonds, particularly those < 1 Yr (very high Sharpe ratios) – Jones et al. (1984), Amato and Remolona (2003), Almeida and Philippon (2007), Giesecke et al. (2011).
- **Changes:** even more puzzlingly large compared to changes in expected default probabilities.
- **Common to level and changes**: both signal future high expected returns, not high default rates. (just as high D/P signals high returns, not low dividends)

Why care about credit spreads?

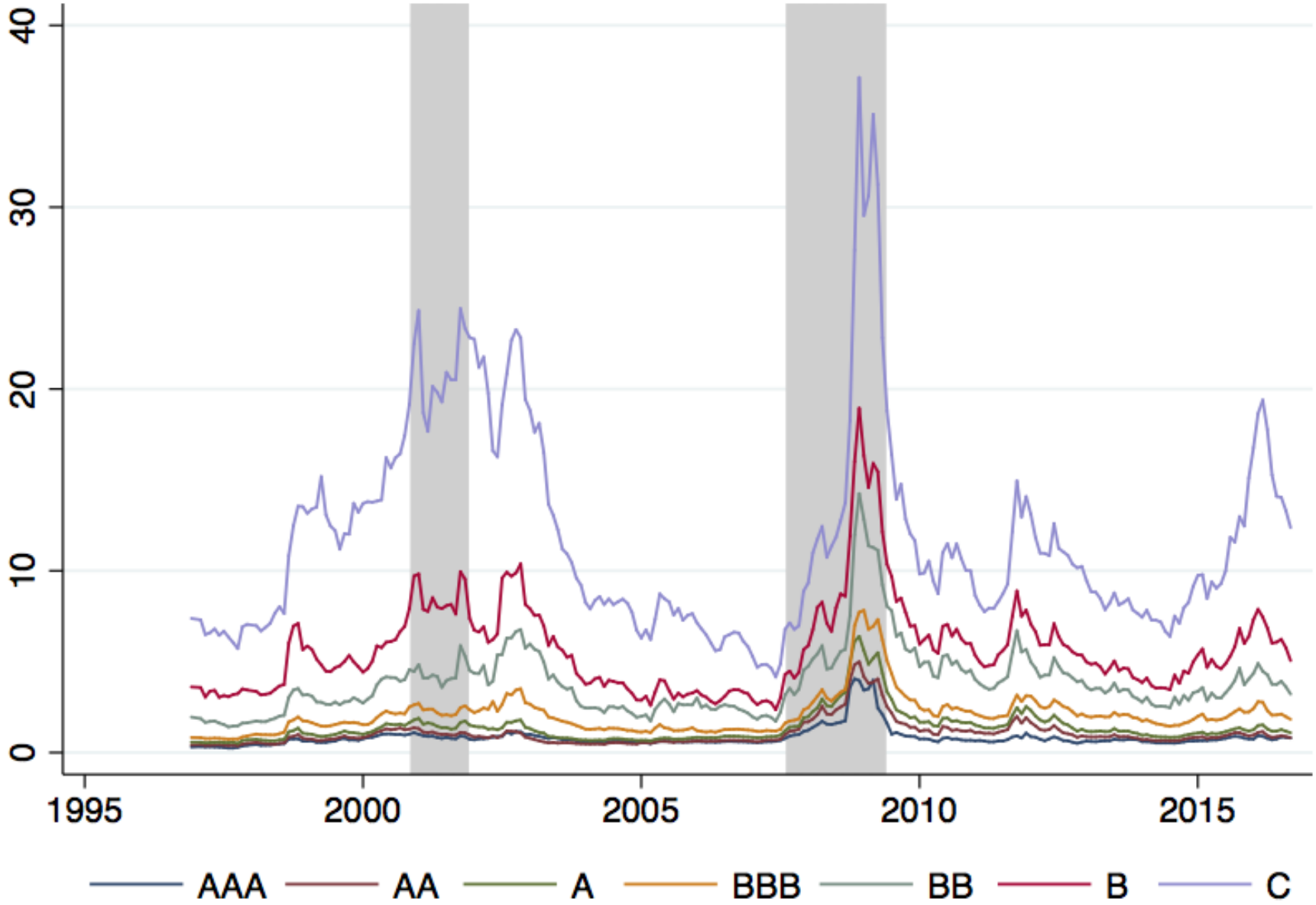
- **Prices (Finance):**
  - Similar behavior as discount rates for equities
  - Why fixed income then?
    1. Lots of microeconomic theories of debt
    2. Harder to argue empirically, because x is (almost) certain.
    3. Rules out (rational) bubbles, "greater fool" theories
- **Quantities (Macro)**:
  - Macro models (RBC) typically have one interest rate.
  - Price of risk is what moves over the cycle ($\neq$ RBC with safe rate)
  - Credit spreads "predict" economic activity. (Gilchrist and Zakrajšek (2012))
  - Central banks (QE) act on risk premia primarily.

Levels of Short Maturity Spreads

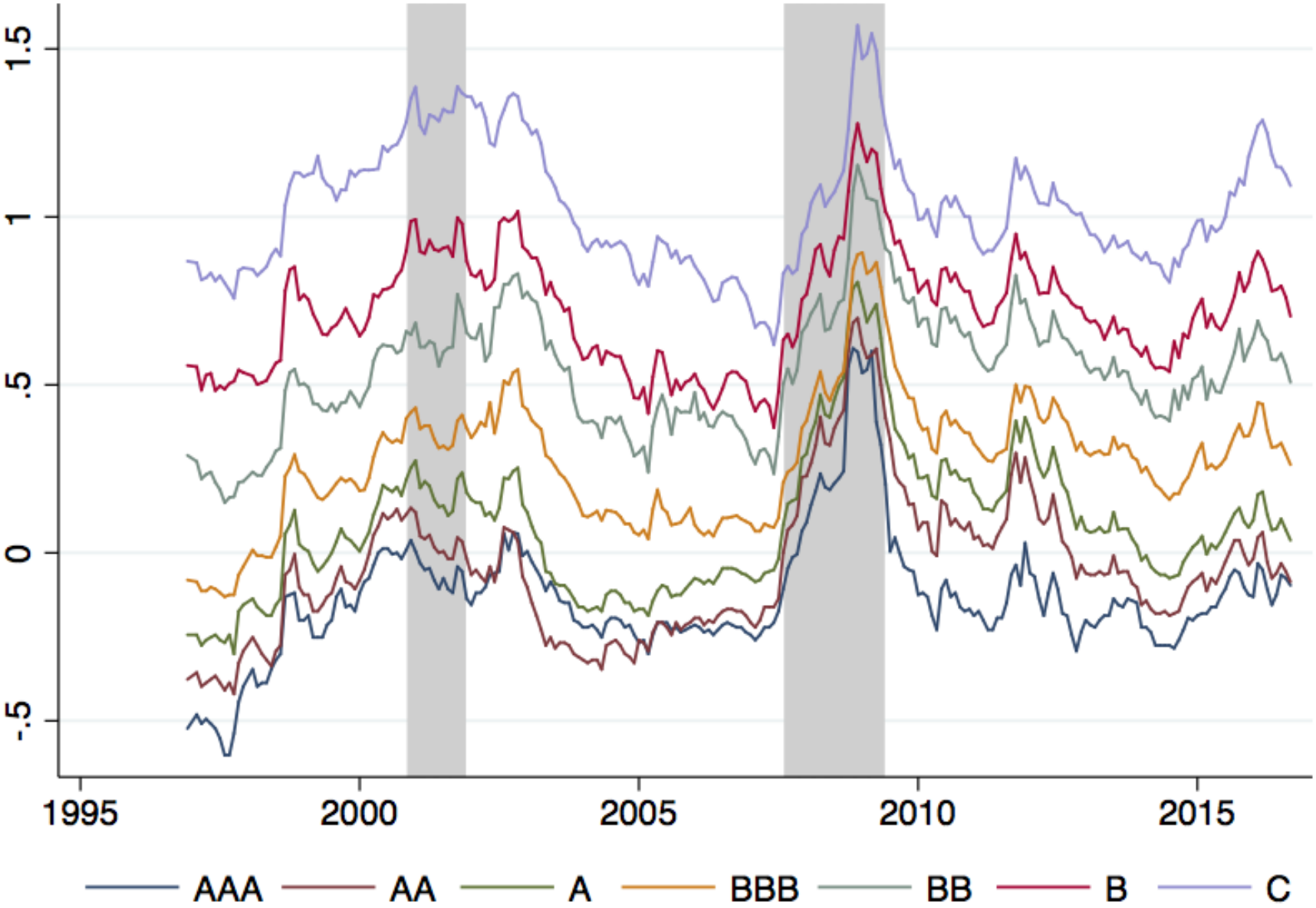
- Covitz, Downing (JF, 2007)



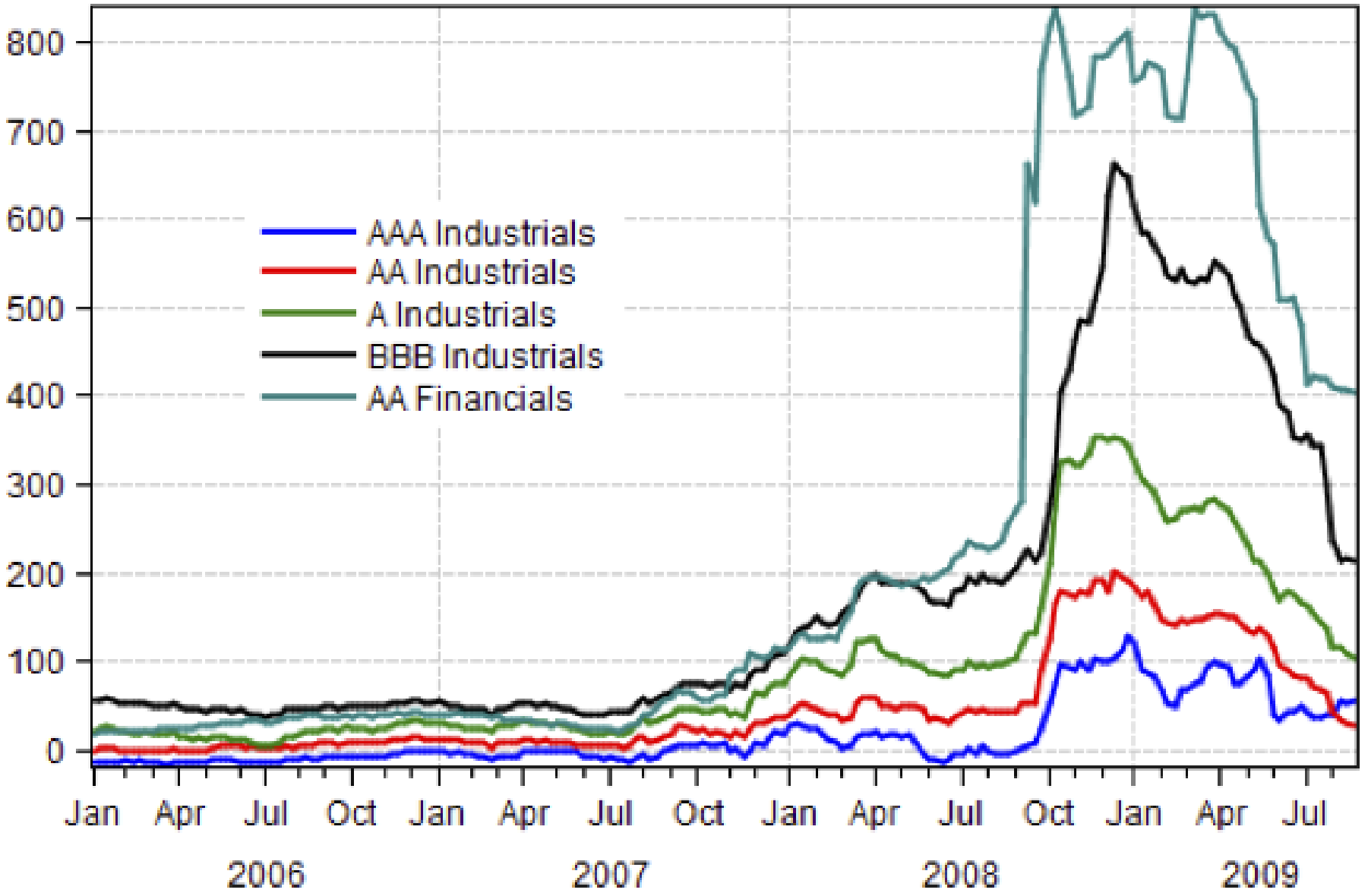
Changes in credit spreads (Source: Moody's)



Changes in Log credit spreads (Source: Moody's)

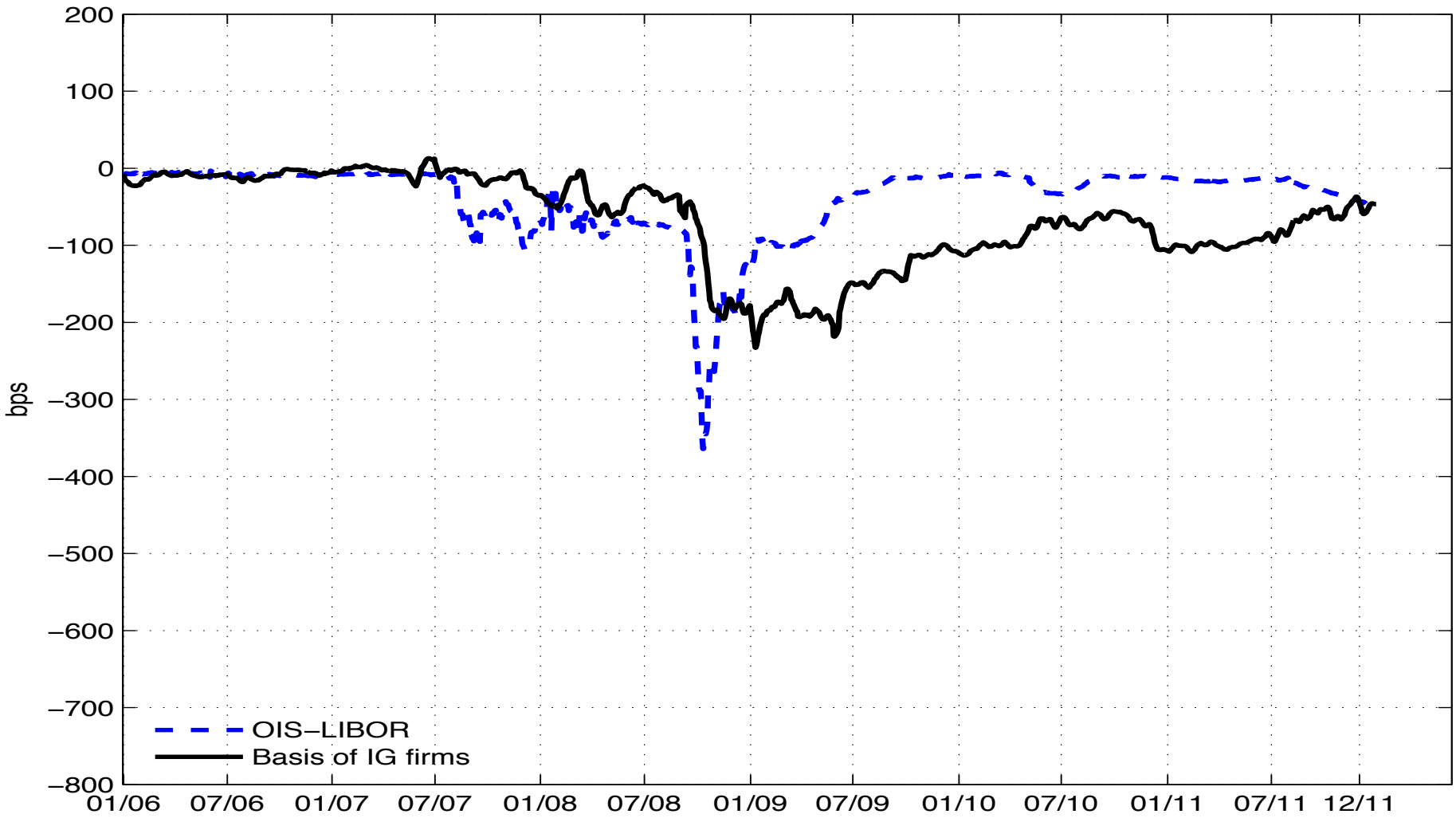


Bond Spread - Fontana (2011)



Bai-Collin Dufresne (2013)

Figure 1: A. The CDS-bond Basis of IG Firms weighted by Market Cap



Chen (2010)

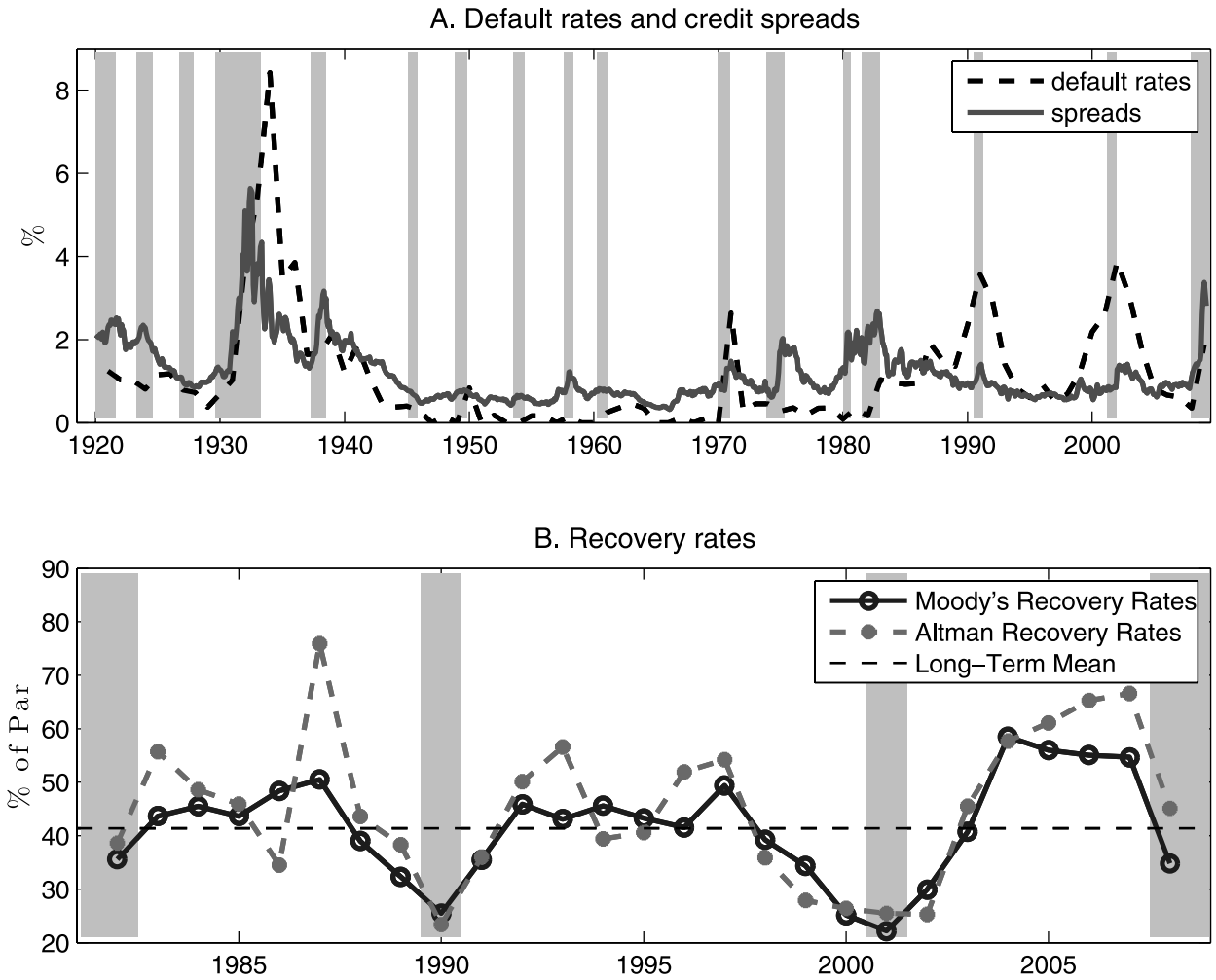
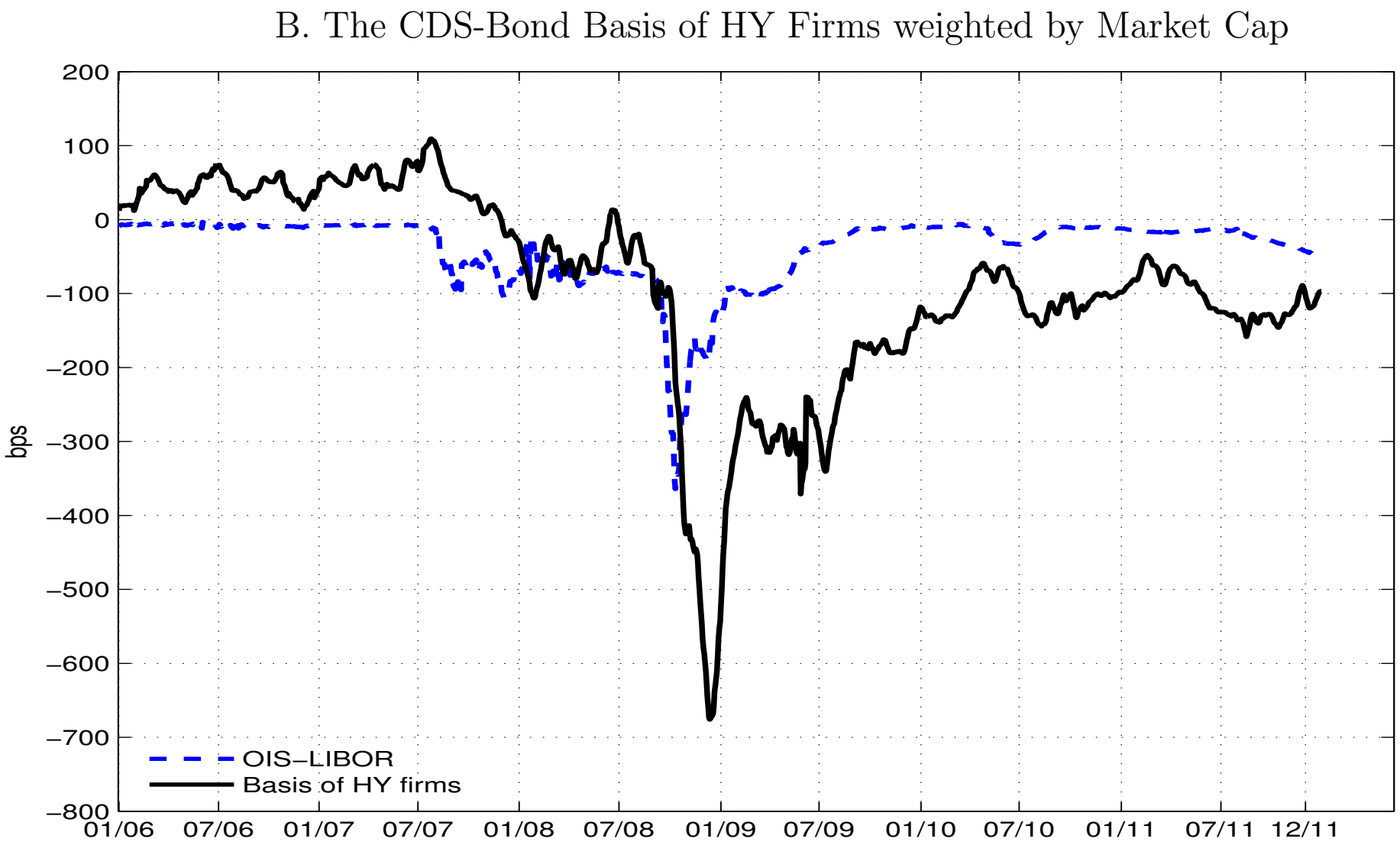
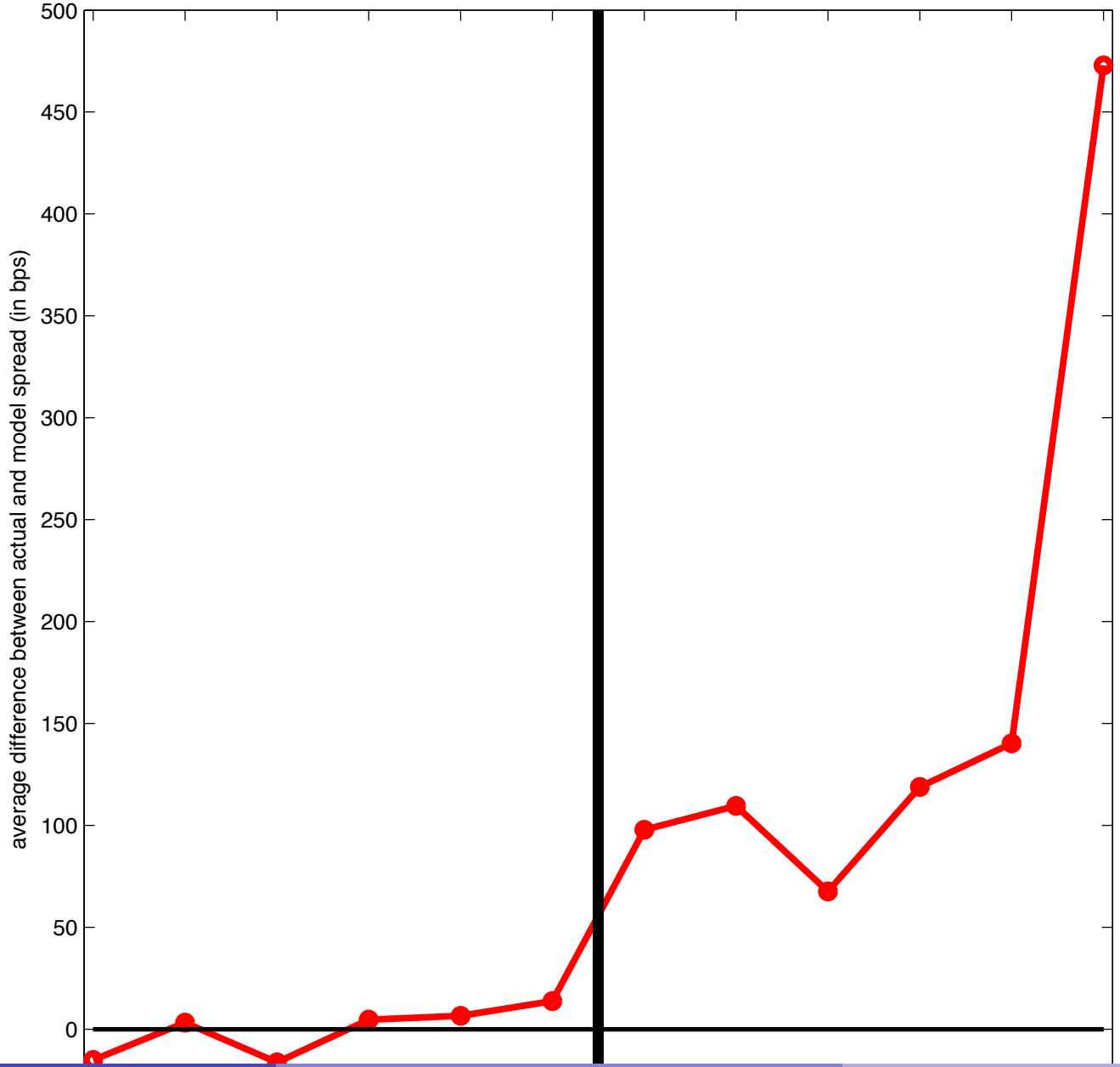


Figure 1. Default rates, credit spreads, and recovery rates over the business cycle. Panel A plots the Moody's annual corporate default rates during 1920 to 2008 and the monthly Baa-Aaa credit spreads during 1920/01 to 2009/02. Panel B plots the average recovery rates during 1982 to 2008. The "Long-Term Mean" recovery rate is 41.4%, based on Moody's data. Shaded areas are NBER-dated recessions. For annual data, any calendar year with at least 5 months being in a recession as defined by NBER is treated as a recession year.

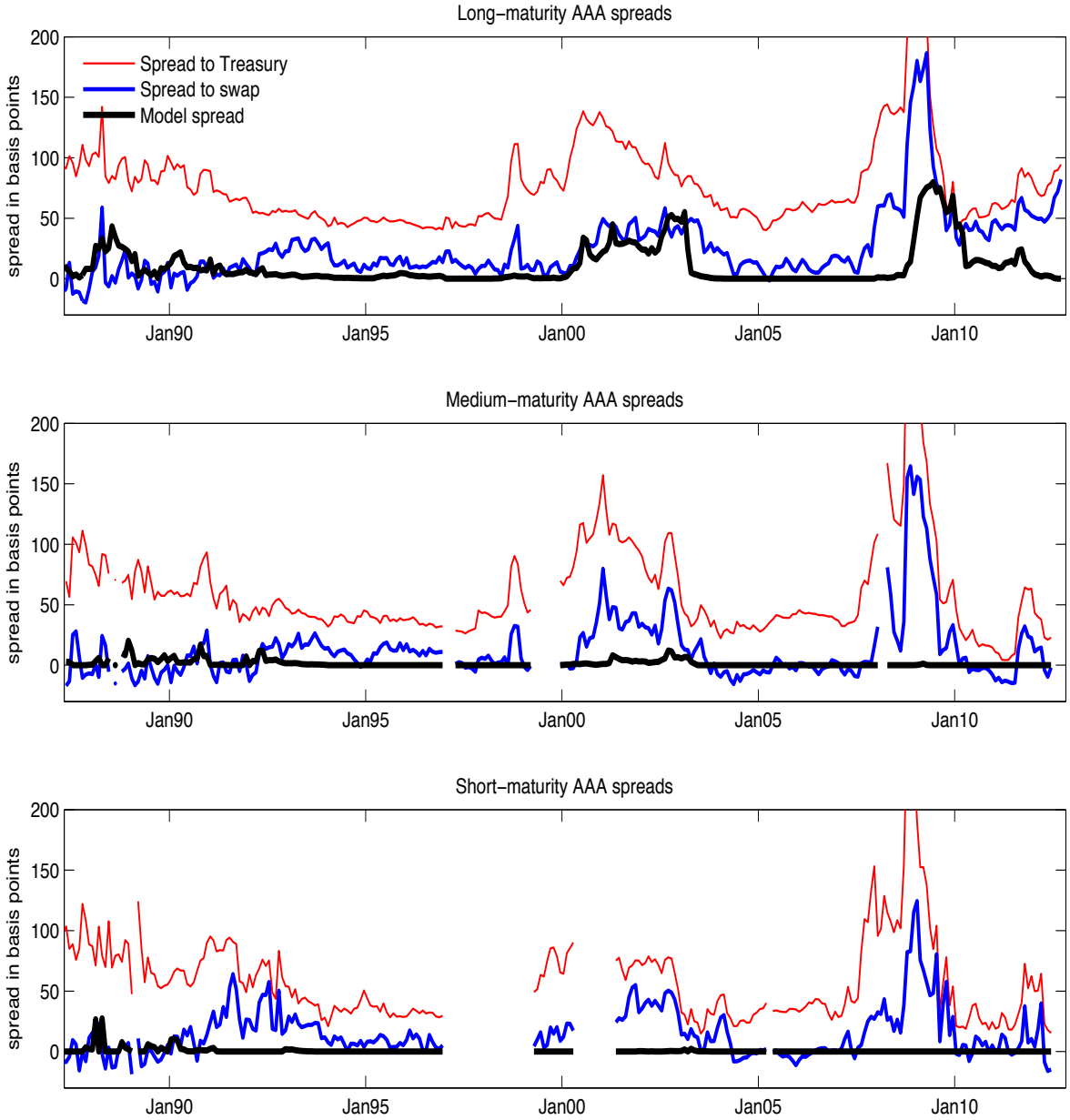
Bai-Collin Dufresne (2013)



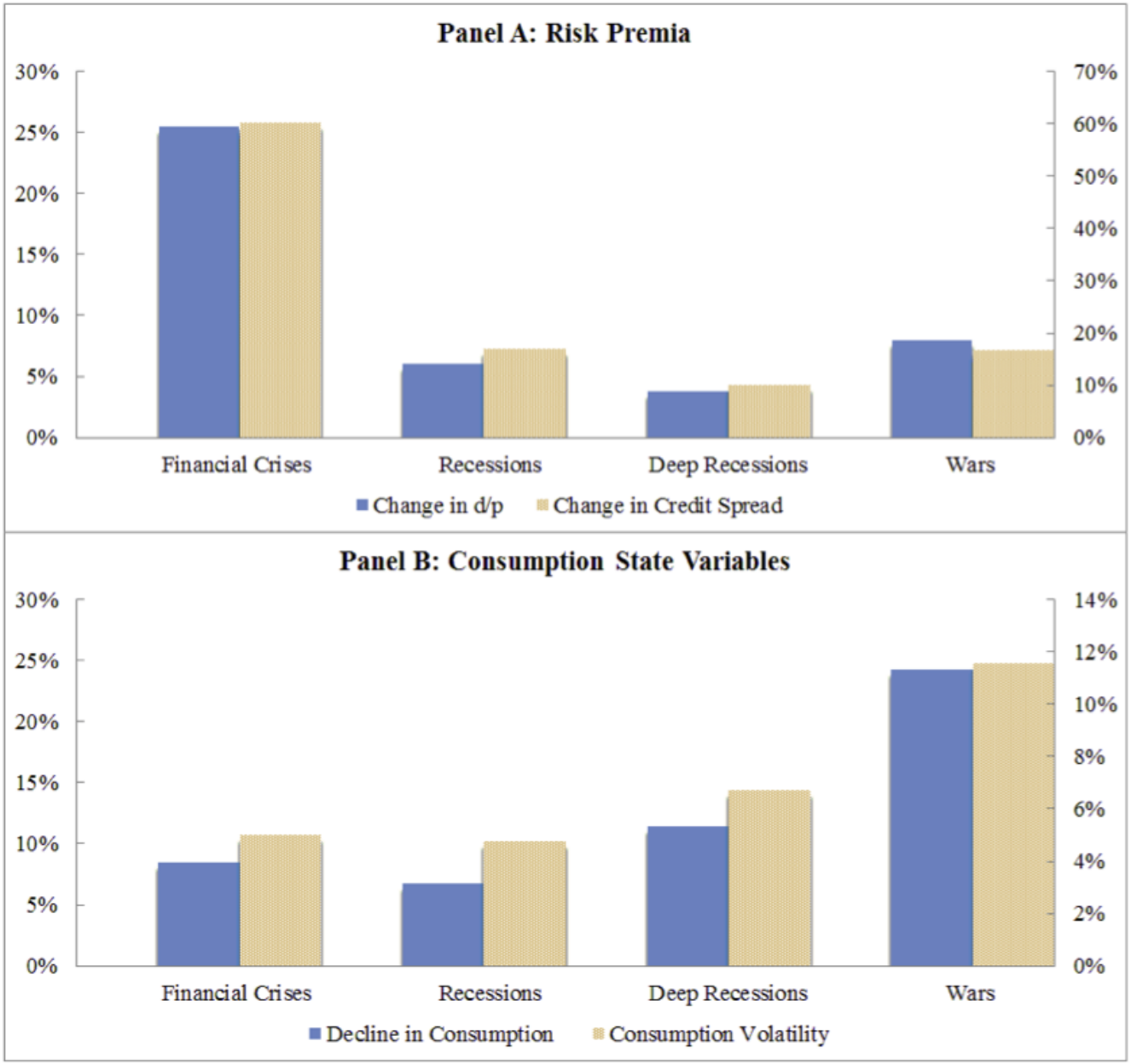
Feldhutter-Schaefer



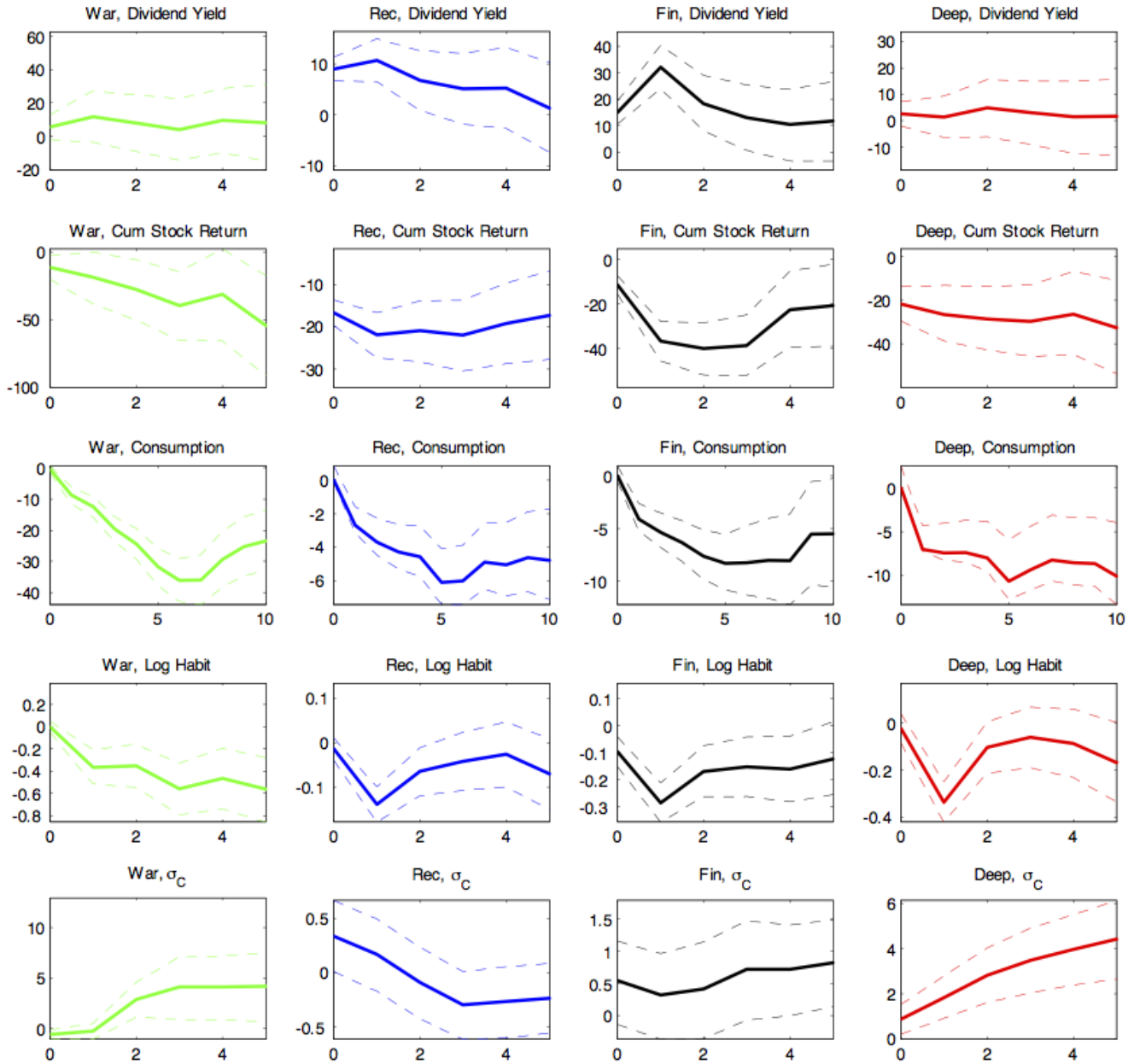
Feldhutter-Schaefer



Muir (2015): Wars VS Financial Crises



VAR Evidence



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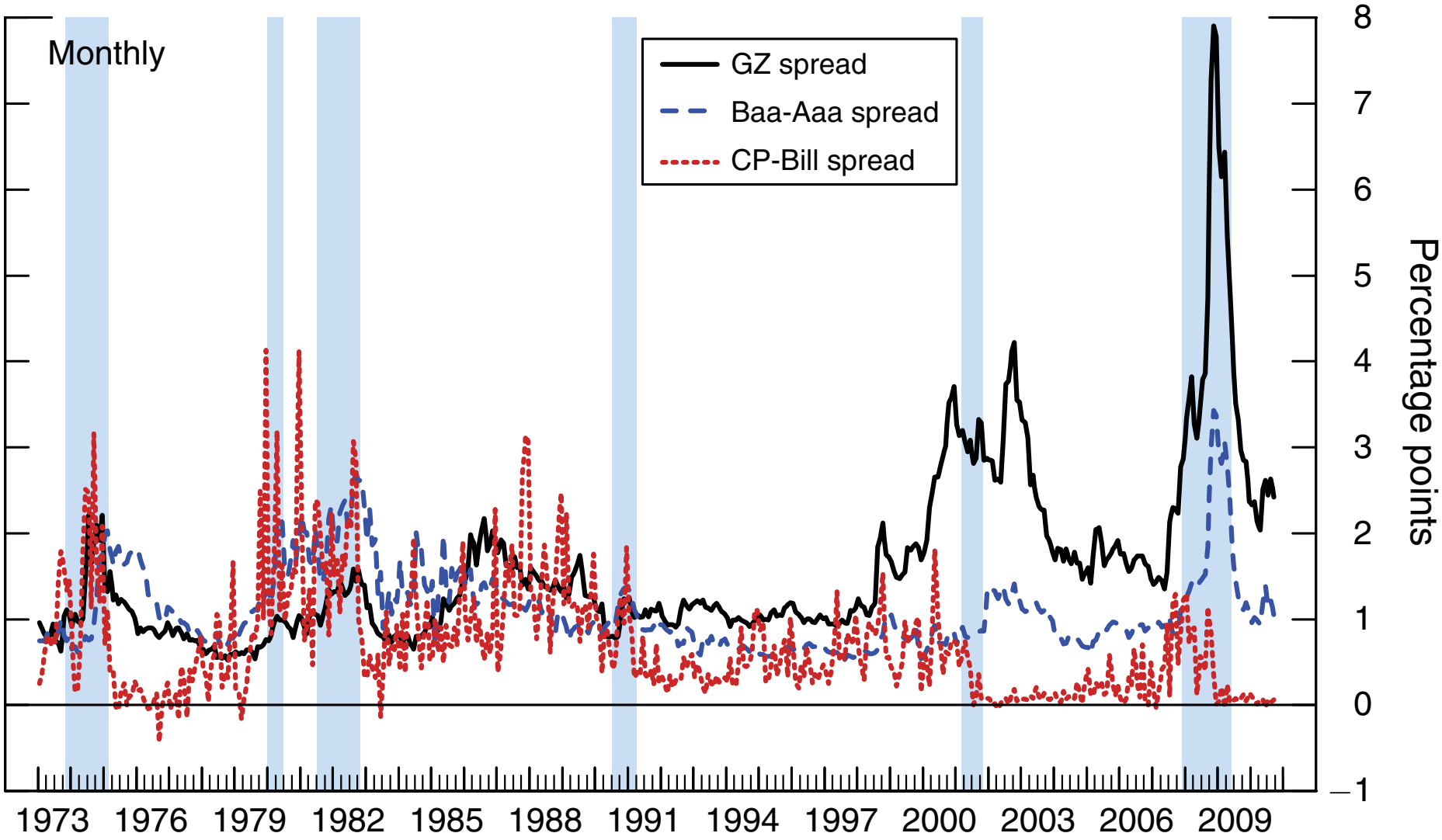
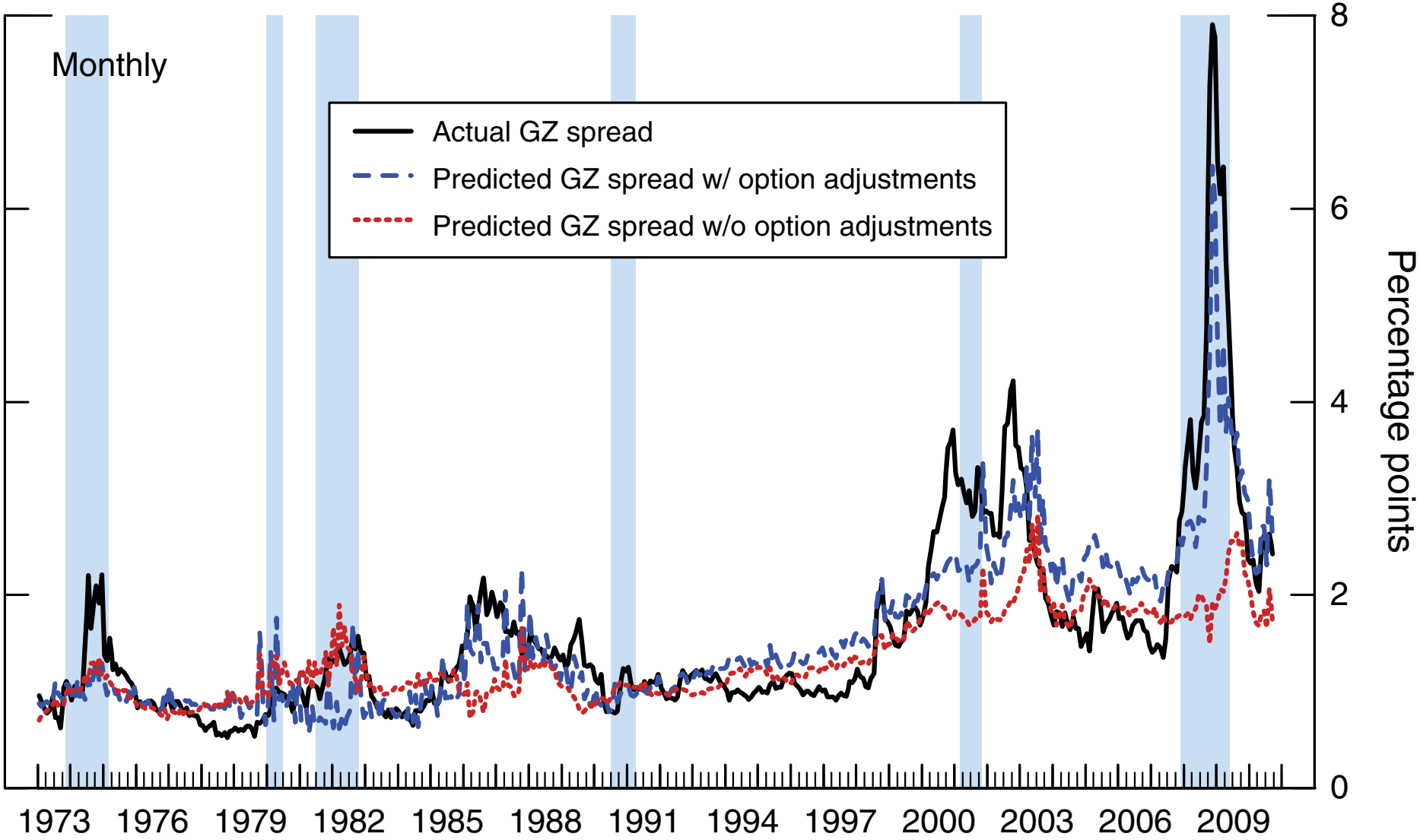
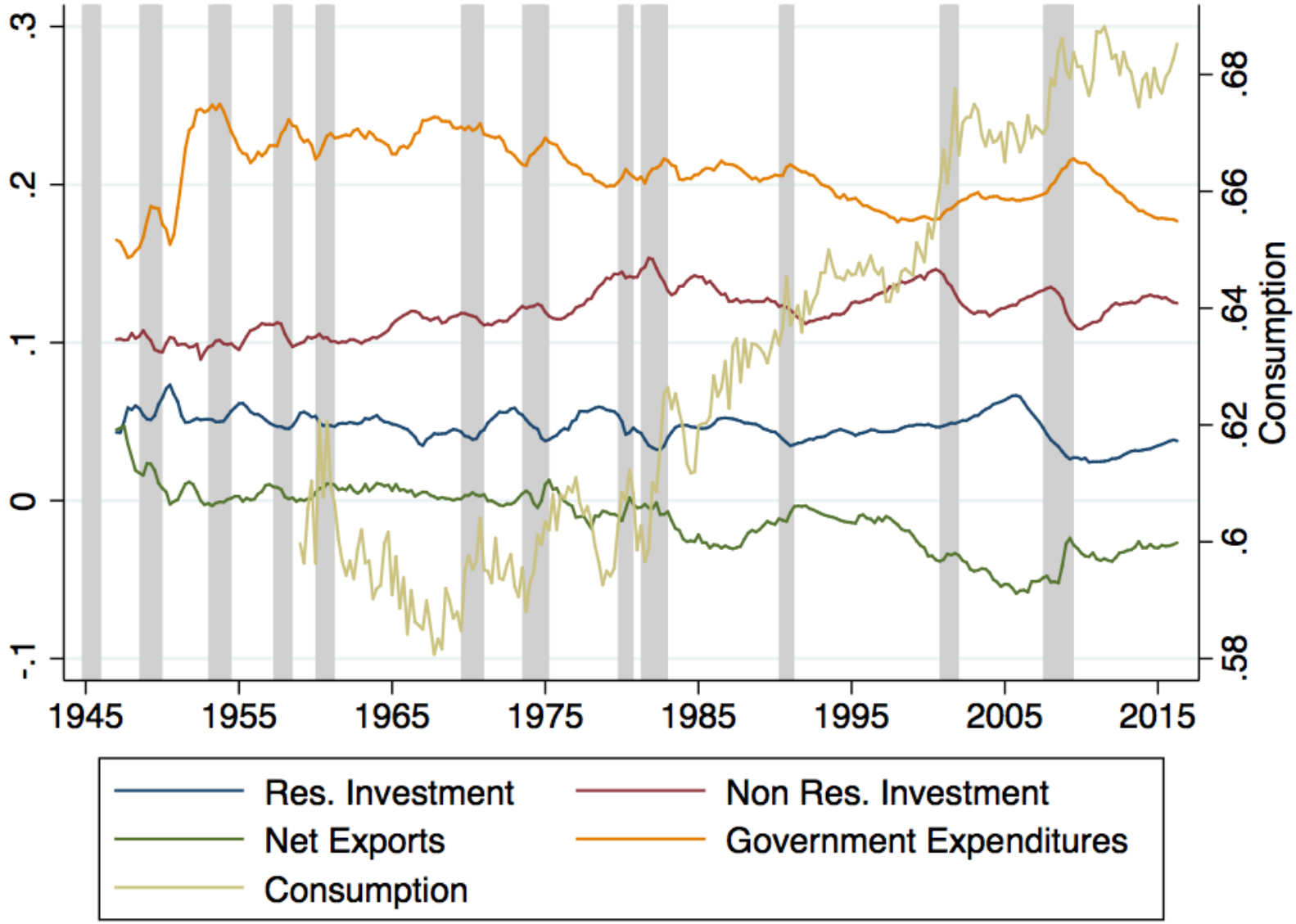
Gilchrist, Zakrajsek (2012)



Gilchrist, Zakrajsek (2012)



Other aggregates



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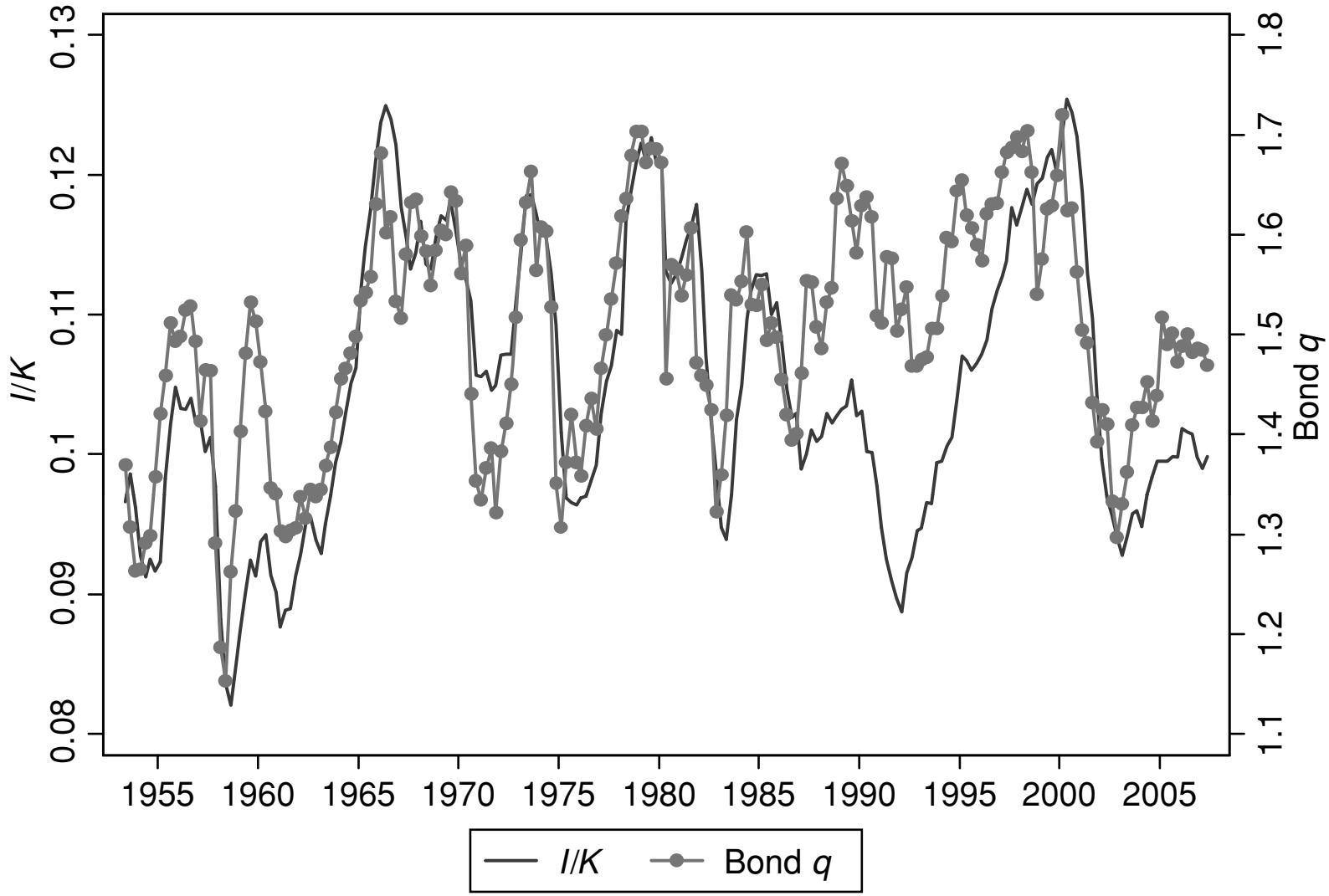
Philippon (2009)



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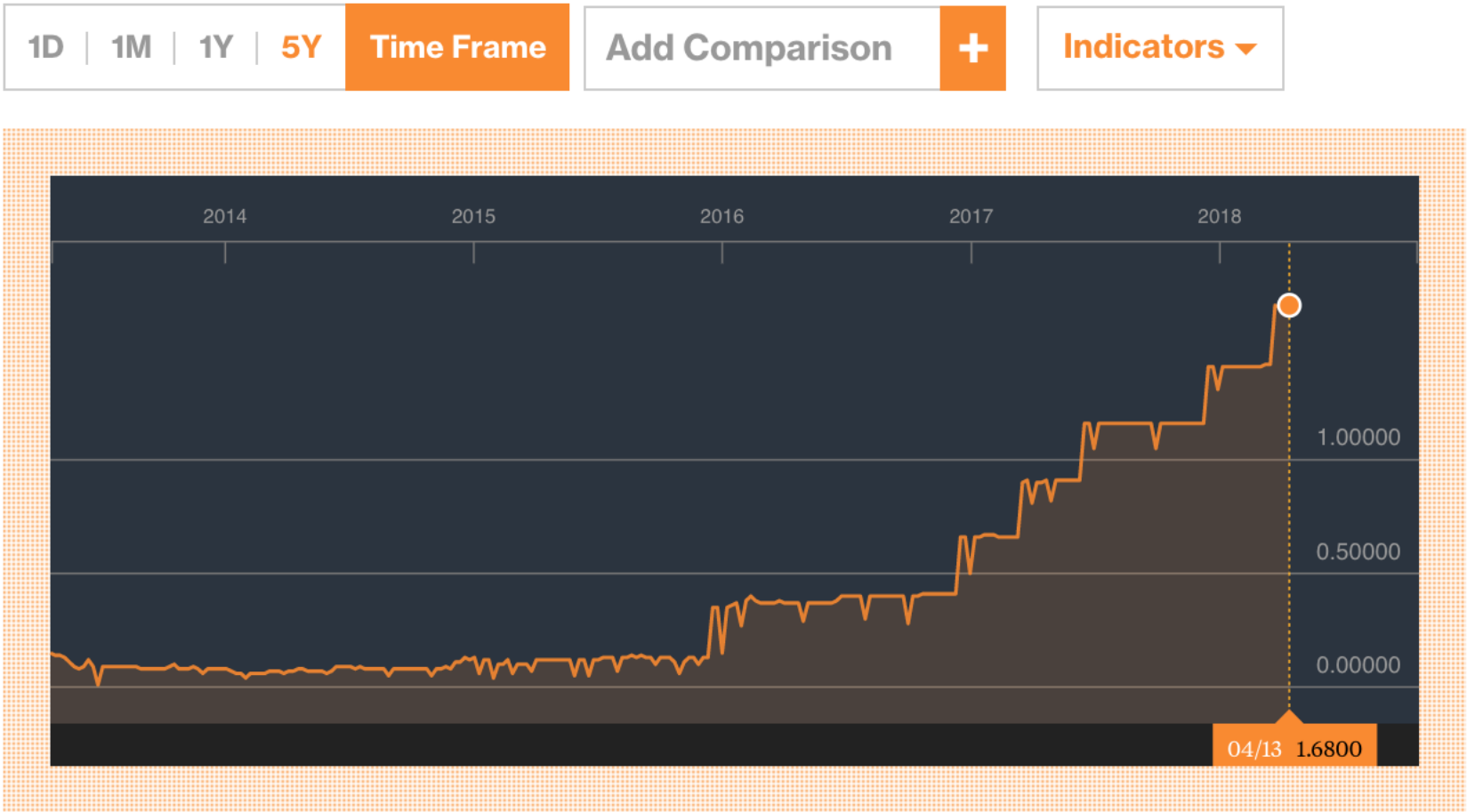
Federal Funds Rate

Source: Bloomberg, Screenshot, April 14, 2018. Link



Federal Funds Rate

Source: Bloomberg, Screenshot, April 14, 2018. Link

Federal Reserve Rates

RATE	CURRENT	1 YEAR PRIOR
FDFD:IND **Fed Funds Rate**	1.68	0.90
FDTR:IND **Fed Reserve Target**	1.75	1.00
PRIME:IND **Prime Rate**	4.75	4.00

US Treasury Yields

Source: Bloomberg, Screenshot, April 14, 2018. Link

Treasury Yields

NAME	COUPON	PRICE	YIELD	1 MONTH	1 YEAR	TIME (EDT)
GB3:GOV **3 Month**	0.00	1.72	1.75%	0	+95	4/13/2018
GB6:GOV **6 Month**	0.00	1.91	1.95%	+2	+103	4/13/2018
GB12:GOV **12 Month**	0.00	2.03	2.09%	+6	+108	4/13/2018
GT2:GOV **2 Year**	2.25	99.80	2.36%	+10	+115	4/13/2018
GT5:GOV **5 Year**	2.50	99.20	2.67%	+6	+90	4/13/2018
GT10:GOV **10 Year**	2.75	99.34	2.83%	+1	+59	4/13/2018
GT30:GOV **30 Year**	3.00	99.47	3.03%	-3	+14	4/13/2018

US TIPS

Source: Bloomberg, Screenshot, April 14, 2018. Link

Treasury Inflation Protected Securities (TIPS)

NAME	COUPON	PRICE	YIELD	1 MONTH	1 YEAR	TIME (EDT)
GTII5:GOV **5 Year**	0.13	98.45	0.52%	+6	+74	4/13/2018
GTII10:GOV **10 Year**	0.50	98.29	0.68%	-5	+37	4/13/2018
GTII20:GOV **20 Year**	3.38	134.75	0.75%	-12	+31	4/13/2018
GTII30:GOV **30 Year**	1.00	103.19	0.88%	-9	+2	4/13/2018

US TIPS

Source: Bloomberg, Screenshot, April 14, 2018. Link

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GTII30:GOV **30 Year**	1.00	103.19	0.88%	-9	+2	4/13/2018

Selected Rates (Federal Reserve)

Source: Selected Interest Rates (Daily) - H.15, April 14, 2018. Link

Federal funds (effective)	1.69	1.69	1.69	1.69	1.69	Bank prime loan	4.75	4.75	4.75	4.75	4.75
Commercial Paper						Discount window primary credit	2.25	2.25	2.25	2.25	2.25
Nonfinancial						U.S. government securities					
1-month	1.82	1.81	1.80	1.83	1.81	Treasury bills (secondary market)					
2-month	1.90	1.91	1.89	1.88	1.88	4-week	1.65	1.64	1.61	1.61	1.62
3-month	1.99	2.00	2.00	2.00	2.00	3-month	1.70	1.73	1.71	1.70	1.72
Financial						6-month	1.86	1.89	1.89	1.90	1.90
1-month	1.75	1.85	1.82	1.86	1.79	1-year	2.00	2.01	2.02	2.02	2.04
2-month	n.a.	2.06	2.00	2.01	1.90						
3-month	2.29	2.23	2.29	2.27	2.01						
						Treasury (Inflation indexed)					
Treasury (Nominal)						5-year	0.57	0.58	0.62	0.56	0.62
Nominal						7-year	0.66	0.67	0.70	0.63	0.69
1-month	1.68	1.67	1.63	1.64	1.65	10-year	0.70	0.71	0.72	0.68	0.70
3-month	1.73	1.76	1.74	1.73	1.75	20-year	0.83	0.83	0.84	0.80	0.82
6-month	1.91	1.93	1.93	1.95	1.95	30-year	0.92	0.92	0.92	0.88	0.90
1-year	2.06	2.08	2.09	2.09	2.11	Inflation-indexed long-term average	0.85	0.85	0.85	0.82	0.84
2-year	2.27	2.29	2.32	2.32	2.34						
3-year	2.40	2.43	2.45	2.45	2.49						
5-year	2.58	2.60	2.62	2.62	2.67						
7-year	2.70	2.72	2.74	2.72	2.78						
10-year	2.77	2.78	2.80	2.79	2.83						
20-year	2.89	2.89	2.89	2.87	2.92						
30-year	3.01	3.02	3.02	2.99	3.05						

10-Year Europe

Source: Bloomberg, Screenshot, April 14, 2018. Link

Europe, Middle East & Africa — 10-Year Government Bond Yields

COUNTRY	YIELD	1 DAY	1 MONTH	1 YEAR	TIME (EDT)
Germany »	0.51%	0	-8	+32	4/13/2018
United Kingdom »	1.43%	-2	0	+39	4/13/2018
France	0.74%	-1	-10	-17	4/13/2018
Italy	1.79%	-1	-22	-51	4/13/2018
Spain	1.22%	-2	-16	-46	4/13/2018
Netherlands	0.65%	-1	-11	+22	4/13/2018
Portugal	1.63%	-4	-15	-222	4/13/2018
Greece	4.04%	+6	-7	-250	4/13/2018
Switzerland	-0.04%	0	-8	+18	4/13/2018

10-Year Asia

Source: Bloomberg, Screenshot, April 14, 2018. Link

Asia Pacific 10-Year Government Bond Yields

COUNTRY	YIELD	1 DAY	1 MONTH	1 YEAR	TIME (EDT)
Japan »	0.03%	+0	-1	+3	4/13/2018
Australia »	2.73%	+7	0	+26	4/13/2018
New Zealand	2.81%	+4	-10	-11	4/13/2018
Hong Kong	1.83%	+3	-6	--	4/13/2018
Singapore	2.36%	+1	-2	+26	4/13/2018
South Korea	2.60%	+3	--	+42	4/13/2018
India	7.44%	-5	-24	+62	4/13/2018

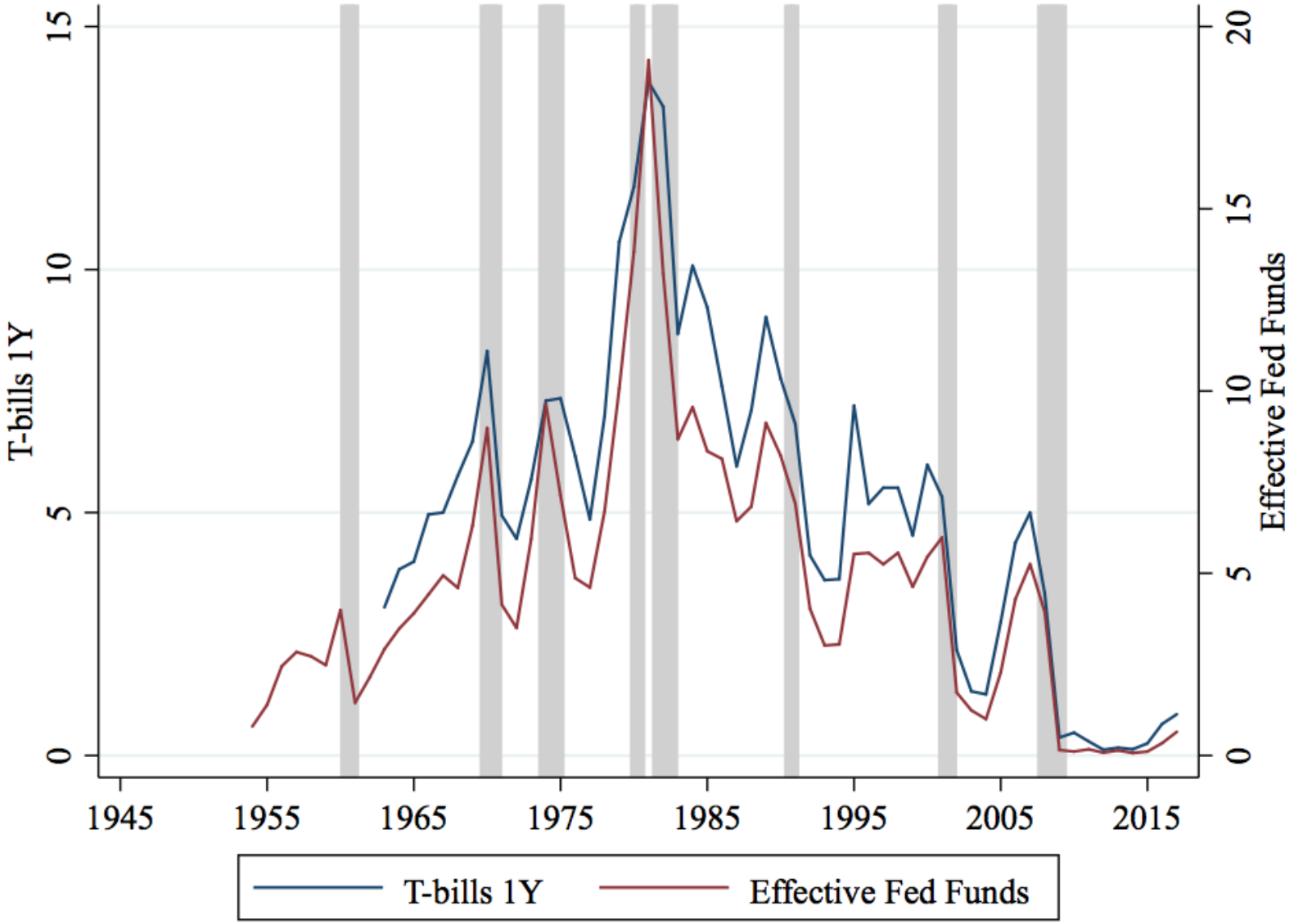
Japan Government Bonds Yields

Source: Bloomberg, Screenshot, April 14, 2018. Link

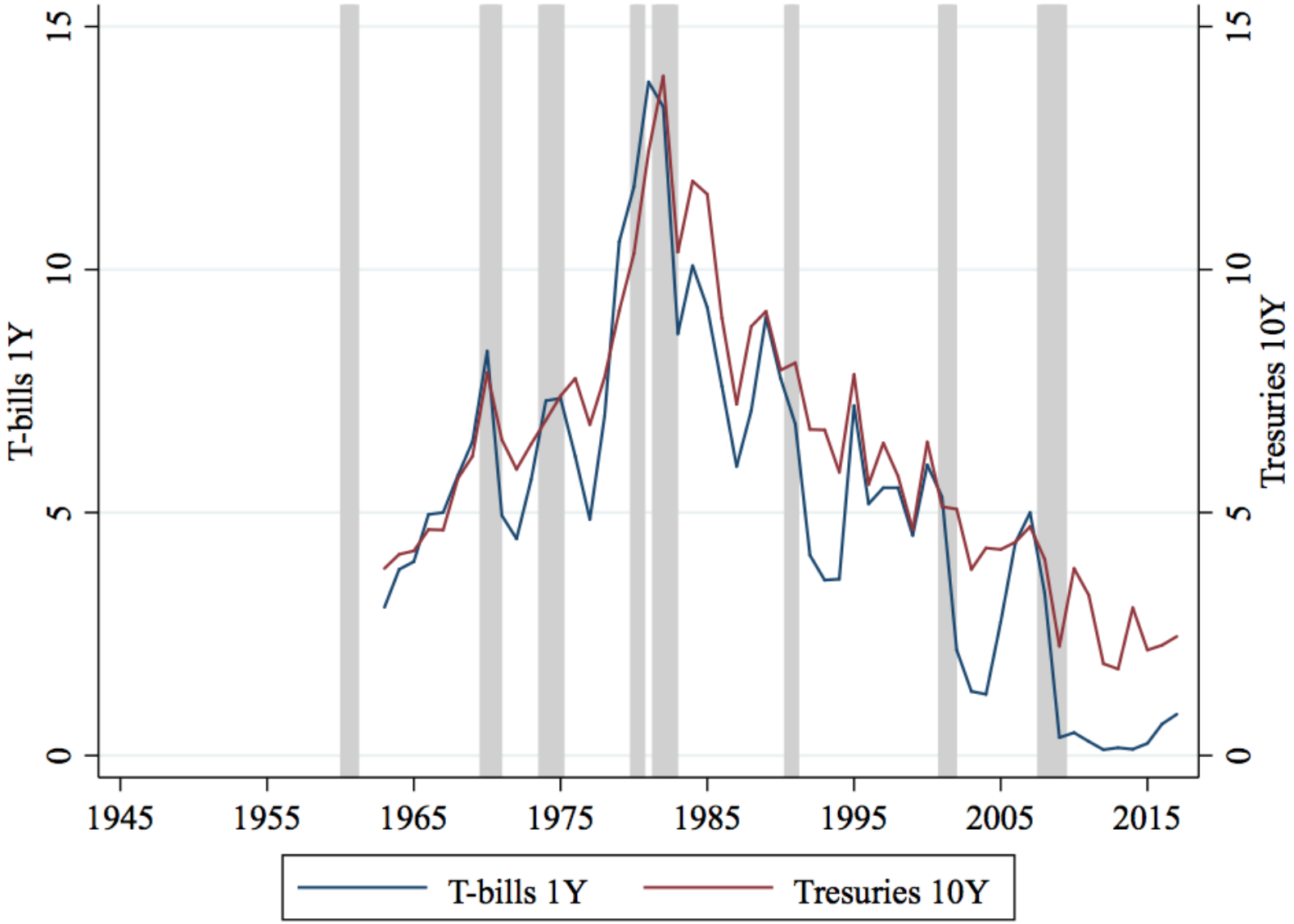
Government Bond Yields

NAME	COUPON	PRICE	YIELD	1 DAY	1 MONTH	1 YEAR	TIME (EDT)
GTJPY2Y:GOV **JGB 2 Year Yield**	0.10	100.52	-0.16%	0	-1	+7	4/13/2018
GTJPY5Y:GOV **JGB 5 Year Yield**	0.10	101.05	-0.12%	+0	-1	+7	4/13/2018
GTJPY10Y:GOV **JGB 10 Year Yield**	0.10	100.67	0.03%	+0	-1	+3	4/13/2018
GTJPY20Y:GOV **JGB 20 Year Yield**	0.50	100.05	0.49%	-1	-3	-6	4/13/2018
GTJPY30Y:GOV **JGB 30 Year Yield**	0.80	102.65	0.69%	-1	-6	-7	4/13/2018

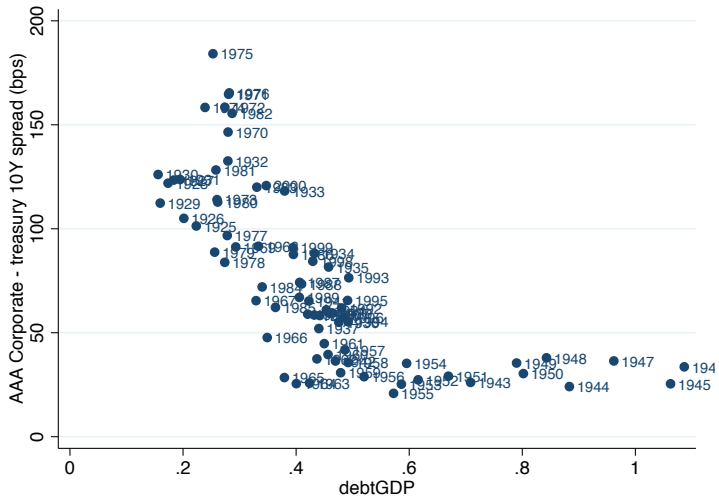
Term Premium: Fed Funds VS 1-Year



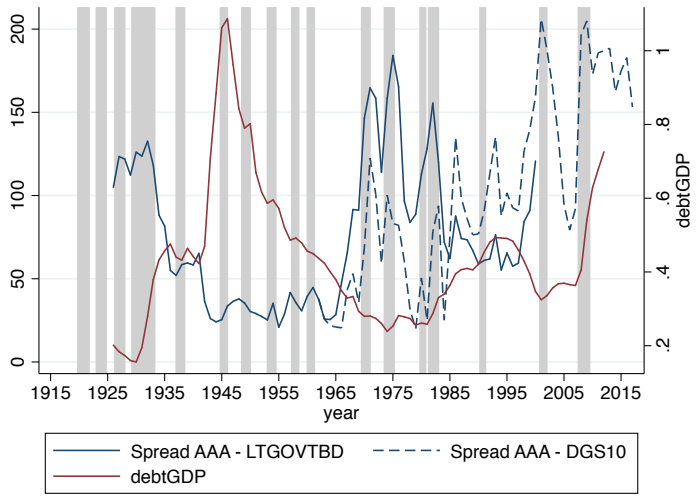
Term Premium: 1-Year VS 10-Year



Krishnamurthy and Vissing-Jorgensen (2012)



Krishnamurthy and Vissing-Jorgensen (2012)

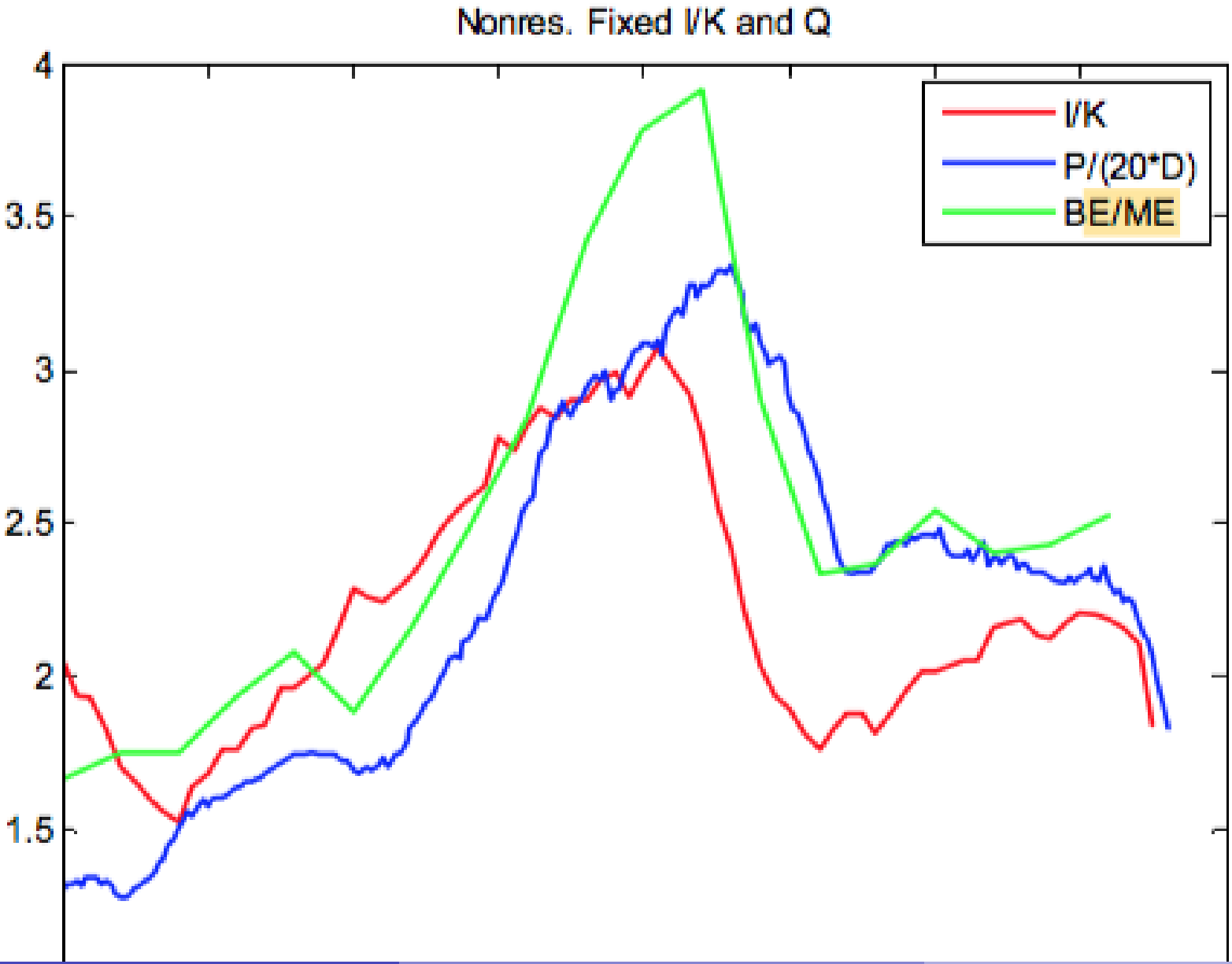


1. Equities
   - Equity Premium
   - Cross-section of stock returns
   - Time series variation of Expected returns
2. Issues with Credit Spreads
   - Asset Pricing
   - Credit spreads as predictors
   - Bond's market Q
3. Issues with the Term Structure (Liquidity related)
4. Introduction: Production Based Asset Pricing

Why is Investment Interesting?

- Some Economics before the maths.
- Investment is a key, very volatile, component of GDP.
- In particular, investment decreases a lot during recessions.
- Is that an efficient outcome?:
  - RBC (macro) view: yes, in response to productivity or other real shocks.
  - Q theory (finance) view: yes, in response to changing asset prices.
- Macro guys have given up a bit with Q theory. This is because investment does not really line up very well with interest rates. (the key asset price they look at)
- Philippon (2009): Q-theory does not work but spreads do.
- For a finance guy: they're wrong, risk premia vary, not interest rates. Stock market variables work very fine.

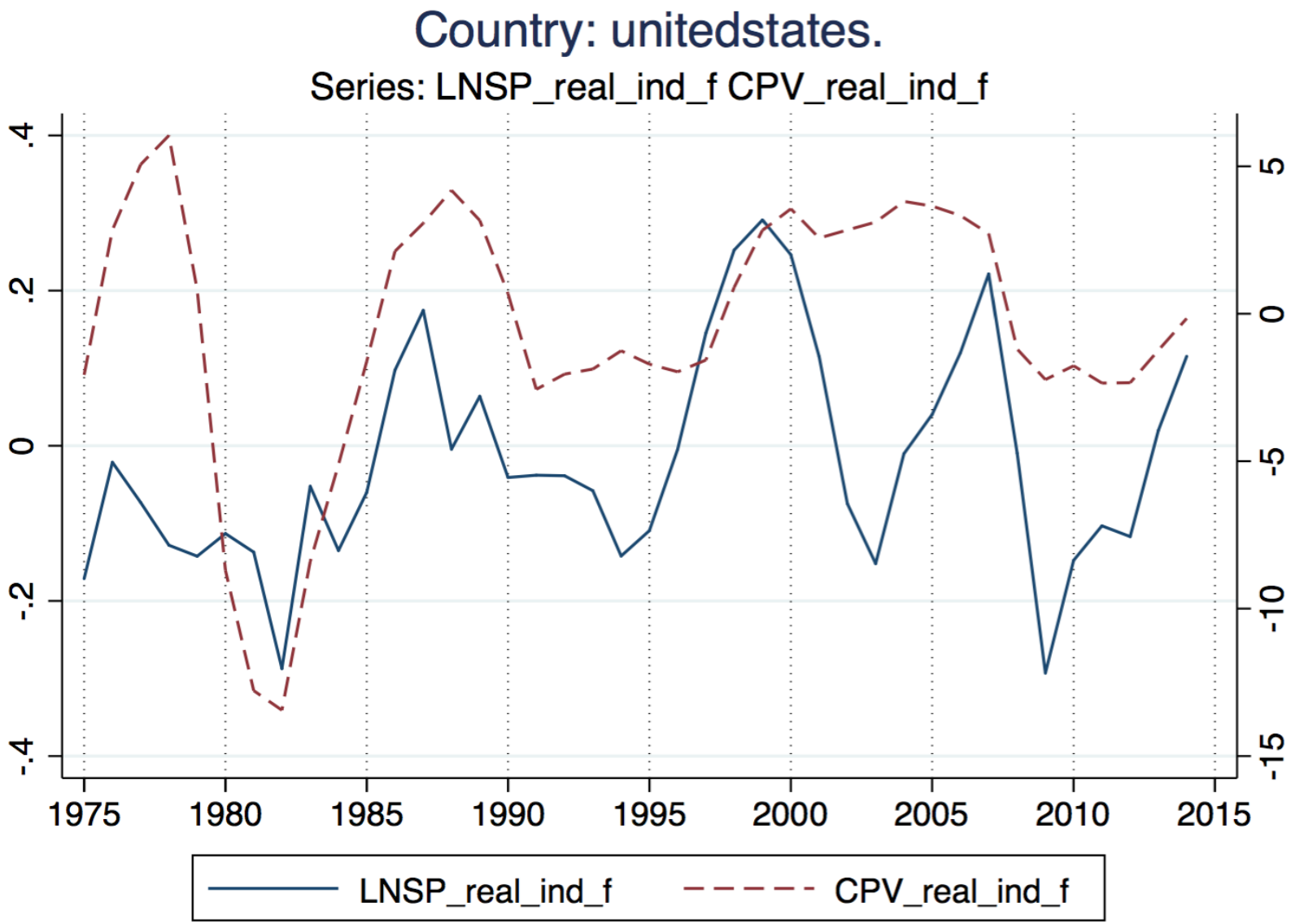
Taken from Cochrane: Q theory works just fine



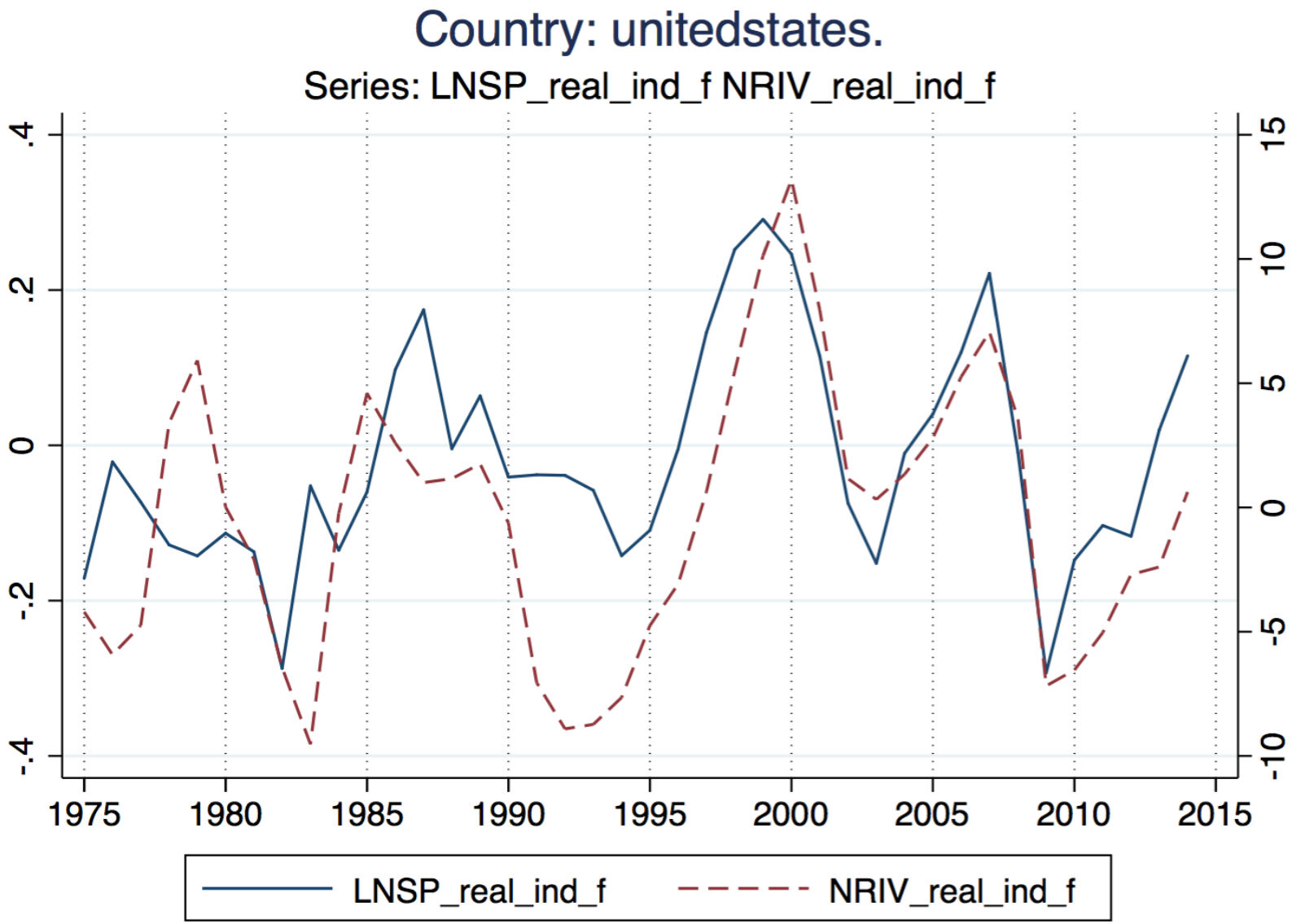
So what's the problem?

- What's the problem in this argument? Q theory works reasonably well !
- First, no expectational error in Q-theory. Same exact adjustment costs should give you a one to one mapping from price changes to investment. (in other words, R^2 is not 1, which rejects the model) $\Rightarrow$ You're working with a model misspecified in some way... What do you do?
- Worse: again, housing is key ! (which explains why we don't look at housing often. we don't like what housing says !) Residential investment should clearly be in this picture.
- Back to my time series graphs, sticking the US. (but looking at other countries actually makes you wonder even more...)

Again, Consumption and Stock Prices



Q-theory?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1975
1980
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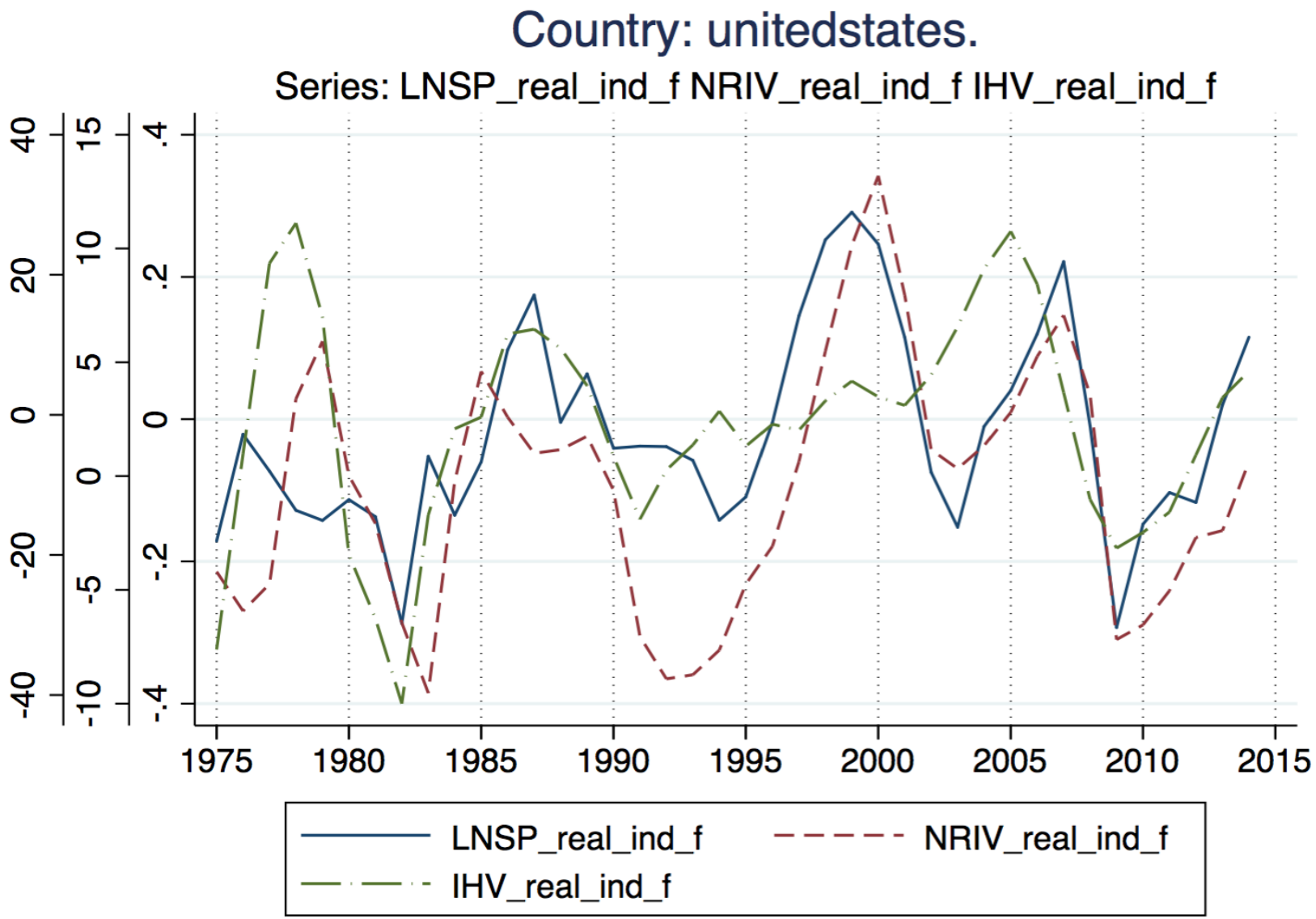
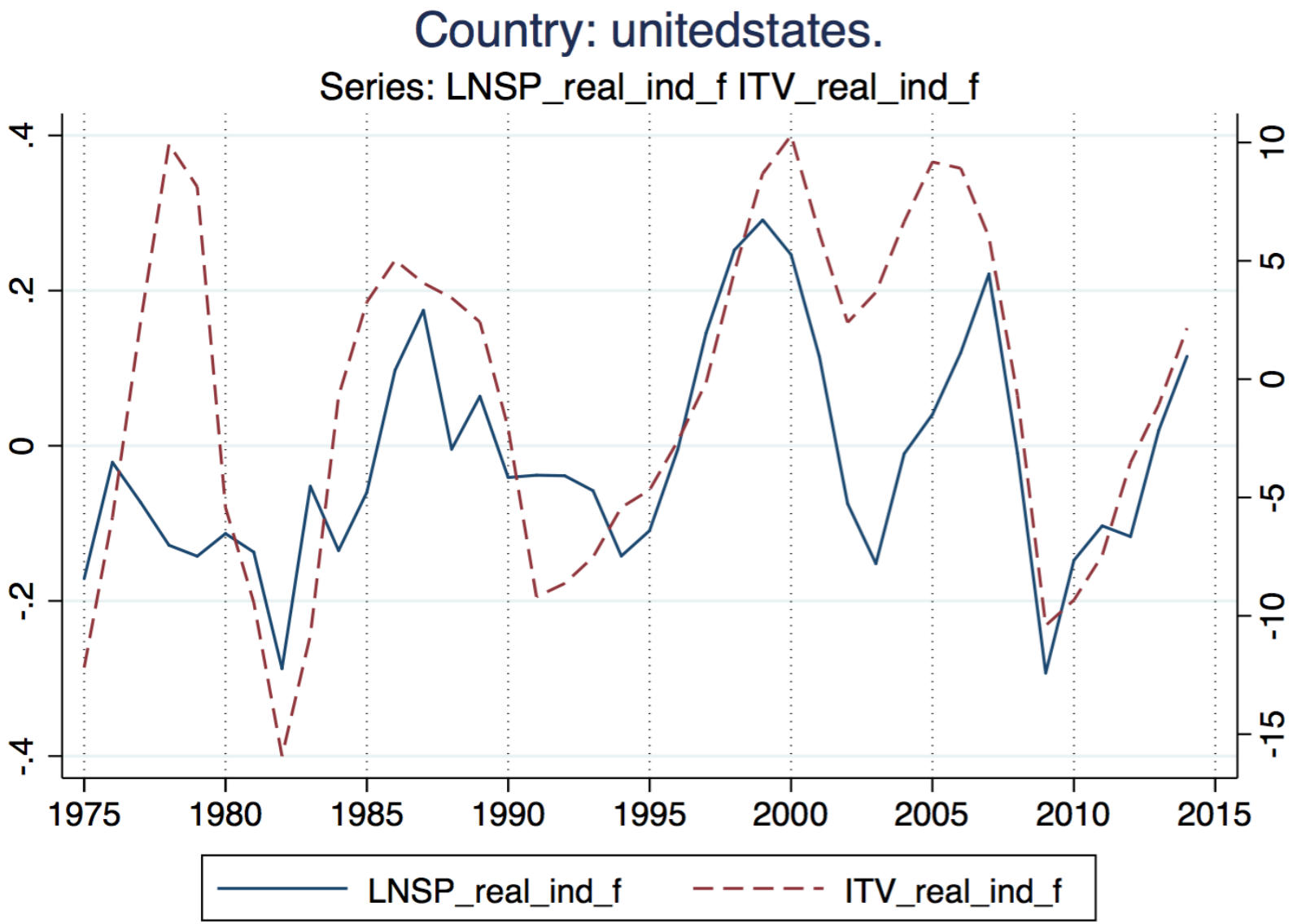
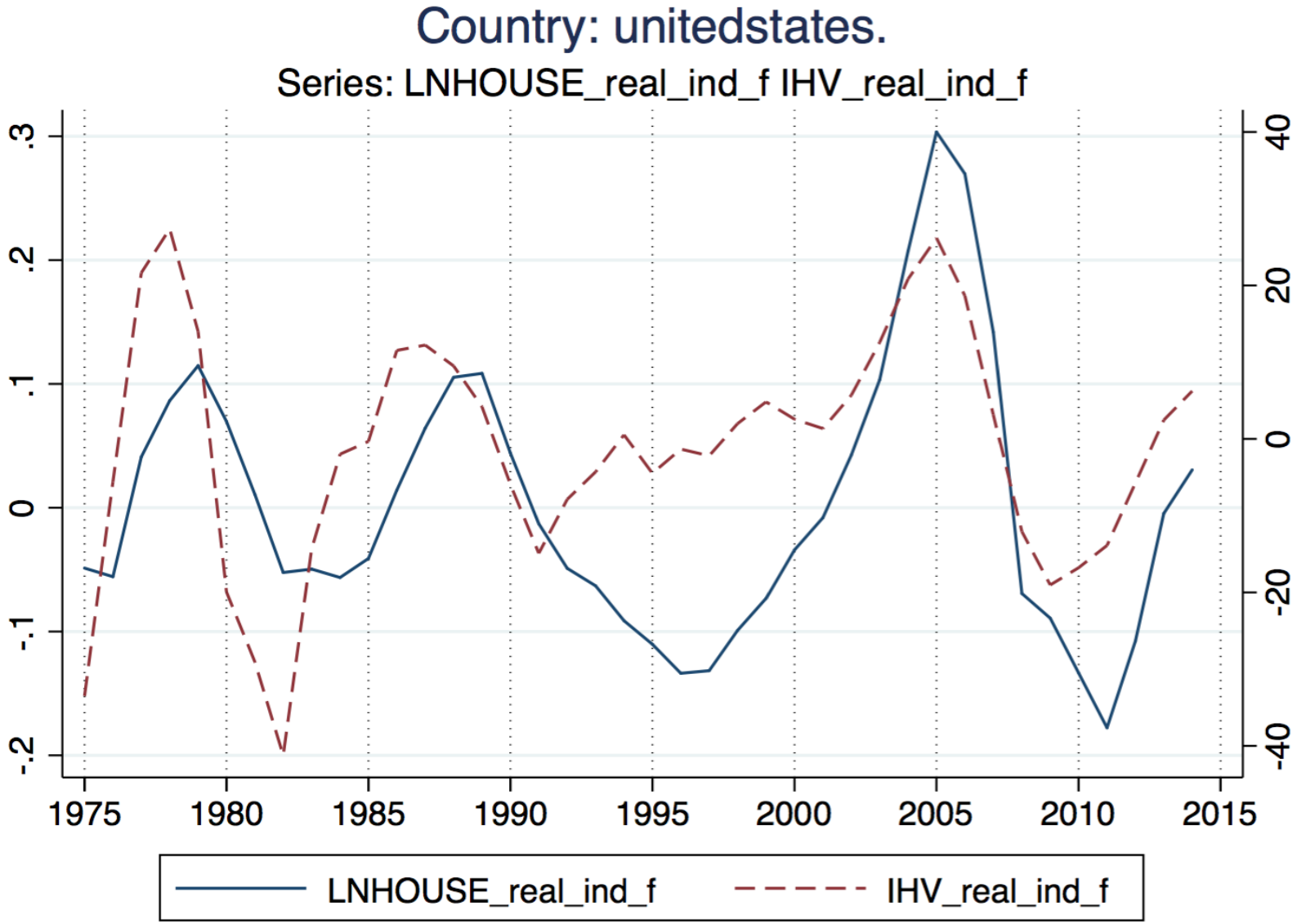
Putting Residential Investment in the Picture



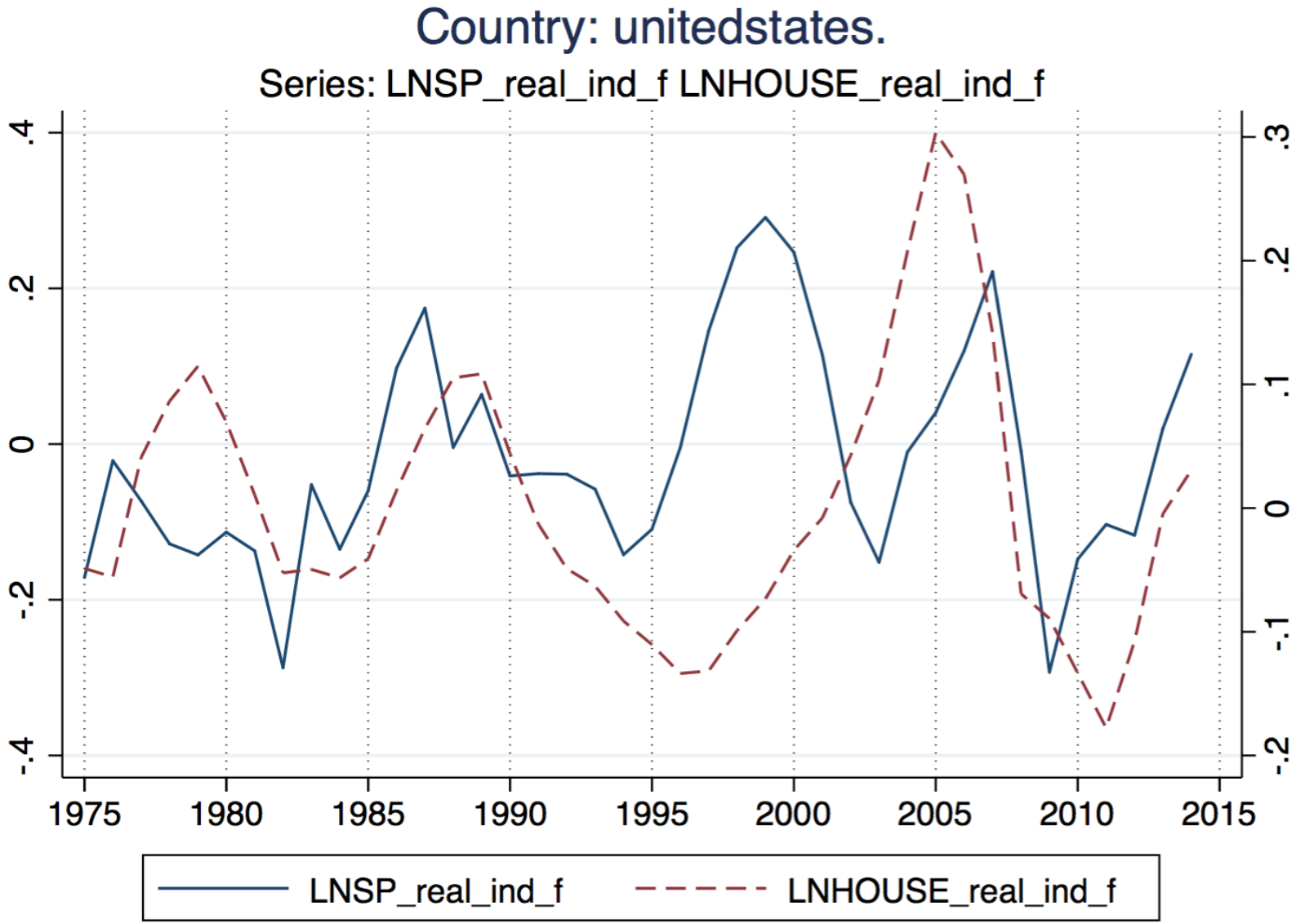
Total Investment



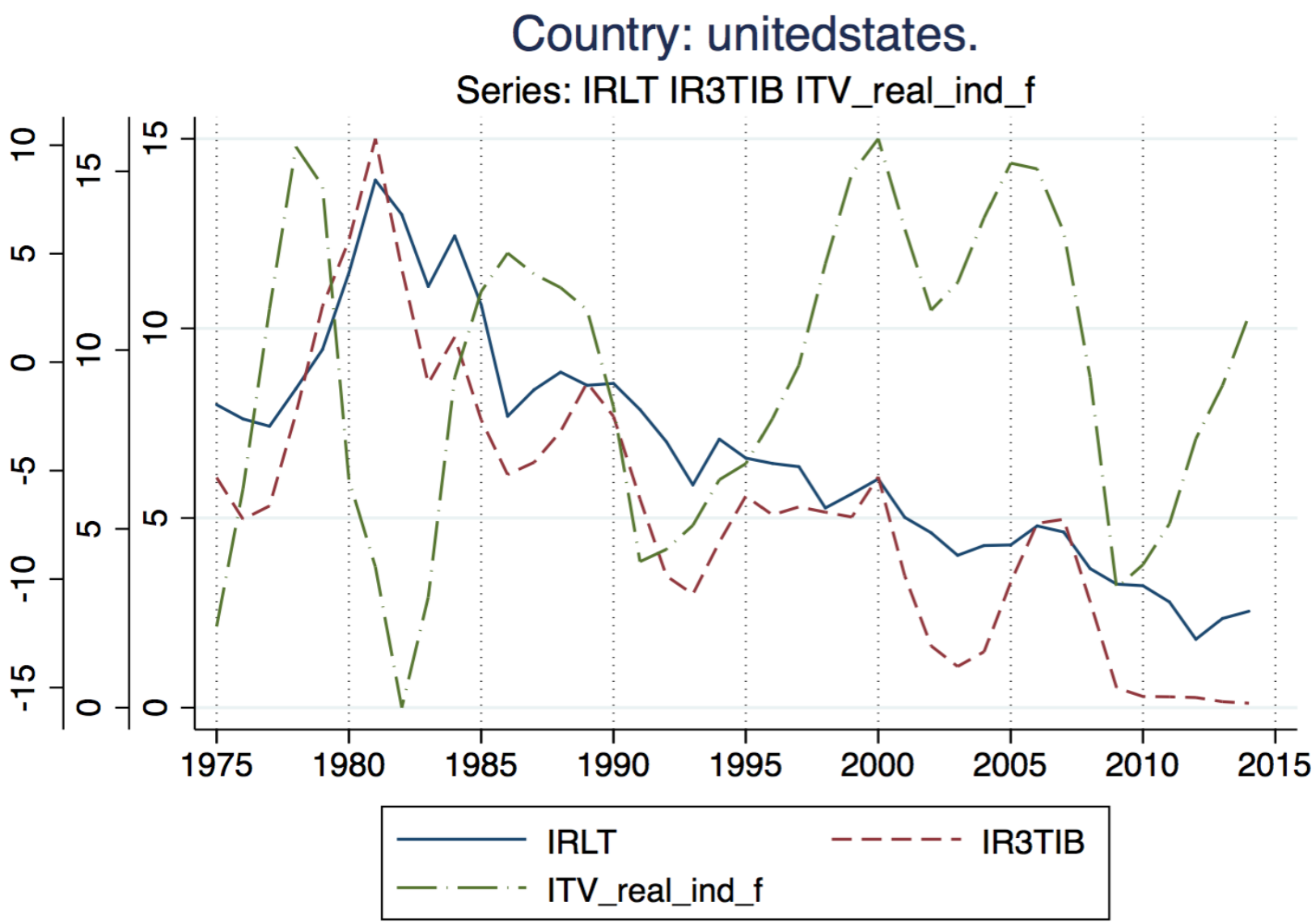
Actually, House Prices Explain Residential Investment, Stock Prices explain Non-Residential Investment



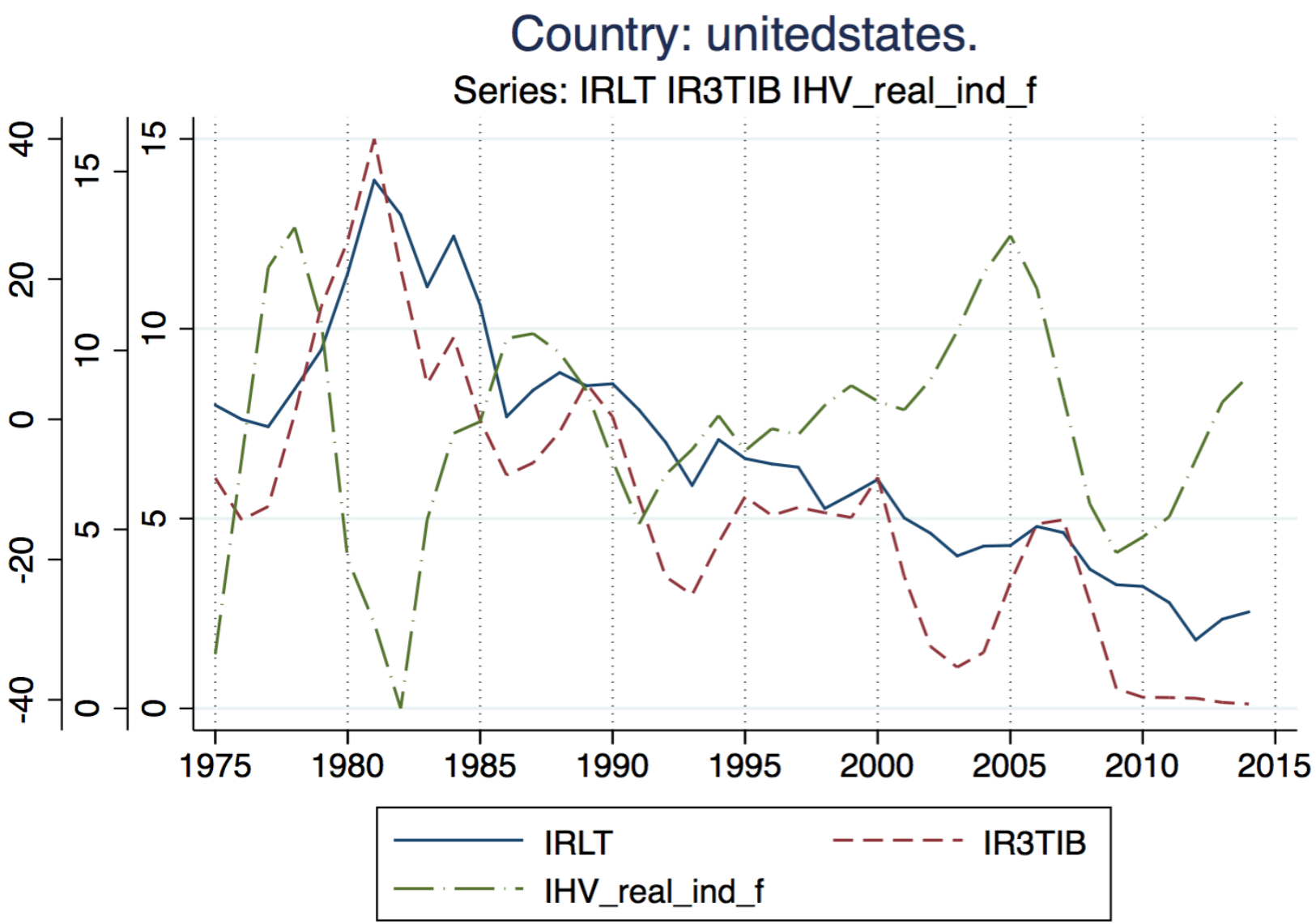
To the extent that dividends however never justify this, there is a problem...



Why macro guys have abandoned Q-theory 1/3



Why macro has abandoned Q-theory 2/3



Why macro has abandoned Q-theory 3/3