

Hard Times

Campbell, Giglio, and Polk

Christopher Polk

London School of Economics

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Amelia Island

Overview

Research Question

- Forecasting the equity premium with a pure time-series-based approach is a difficult task
- Long history in economics of the usefulness of imposing economic structure to facilitate out-of-sample forecasts
- How can one impose economic structure when forecasting the equity premium? Does it help?

Contribution

- We impose the cross-sectional restrictions of the ICAPM to sharpen our time-series forecasts:
 - Value stocks (relative to growth stocks) should do better on average but worse during those stock market downturns that are permanent
- As the cross section is more precisely measured than the time series, the technique twists our market forecasts away from the usual OLS estimates
- These theoretical restrictions improve the out-of-sample forecasting power of the equity premium forecasts

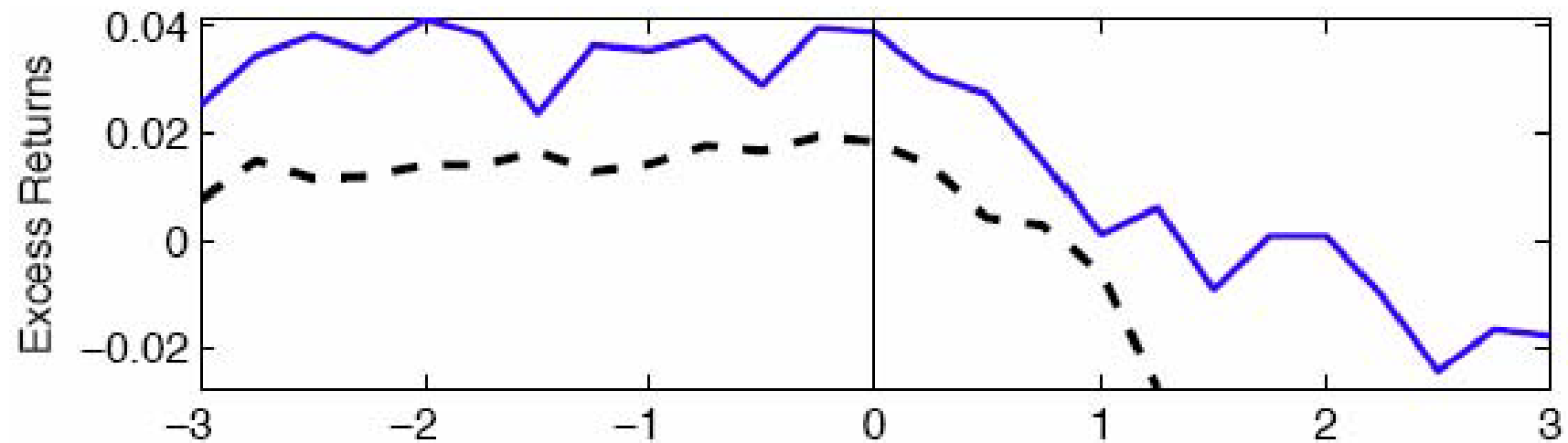
Implications

- Improved forecasts of the market premium are of fundamental importance
 - Market timing
 - Strategic portfolio allocation
 - Firm cost of capital and real investment
- Insight into the pricing of the cross section of equities
 - Value stocks performed particularly poorly during the credit bust
 - Consistent with theory, a good portion of the recent downturn reflects expectations of significantly lower future profitability
 - This conclusion is confirmed by other market aggregates

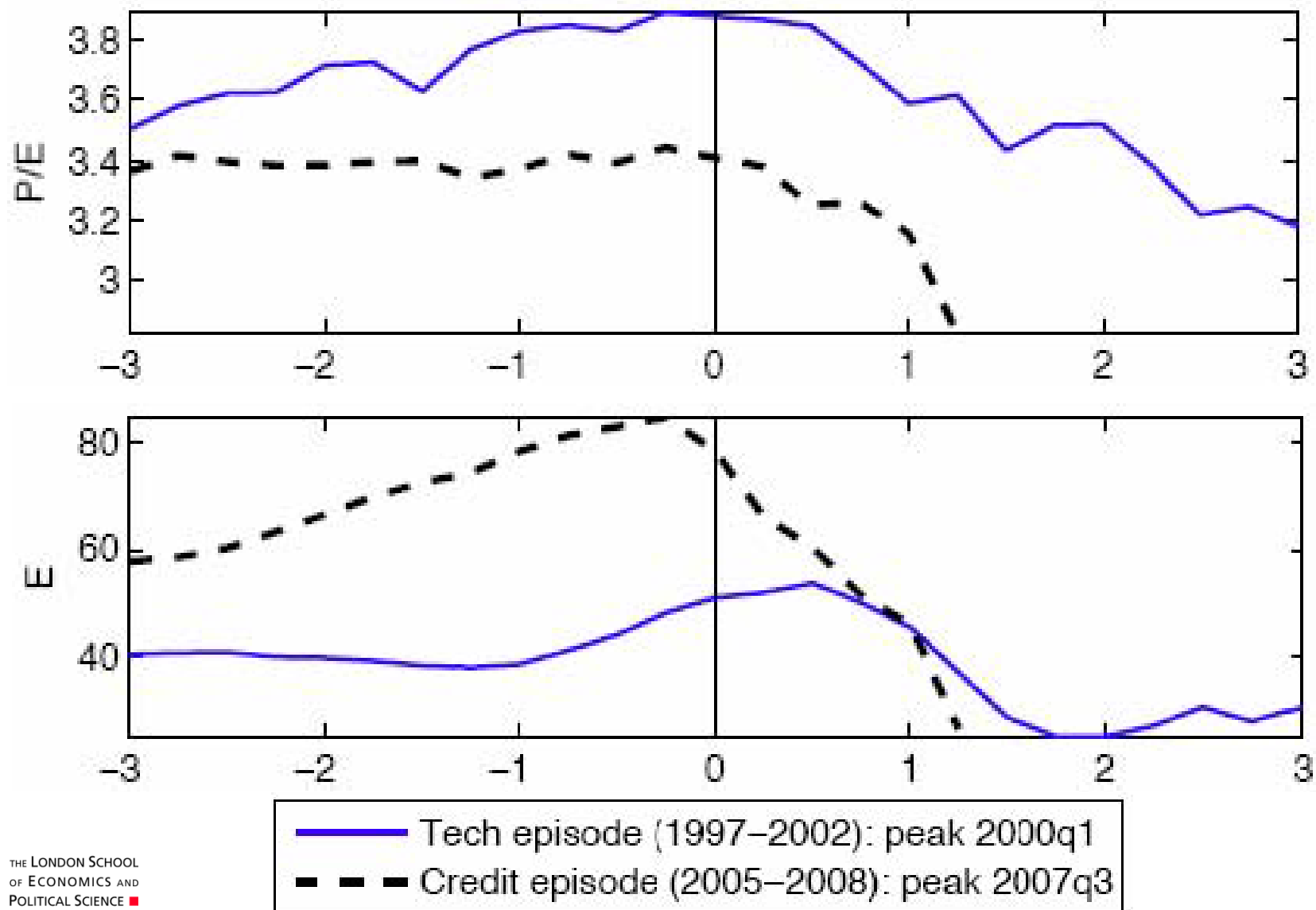
Two Recent Booms and Busts

- Compare 1994-2002 and 2002-2009
 - March 1994:March 2000 177% real increase in S&P, then March 2000:September 2002 42% real decrease
 - September 2002:September 2007 57% real increase in S&P, then September 2007:March 2009 45% real decrease
- Were these boom-bust cycles driven by changing cash flow forecasts, or changing discount rates?
 - These are proximate causes
 - Helpful clues about ultimate causes
 - Important implications for welfare and consumption of long-term investors (e.g. universities)

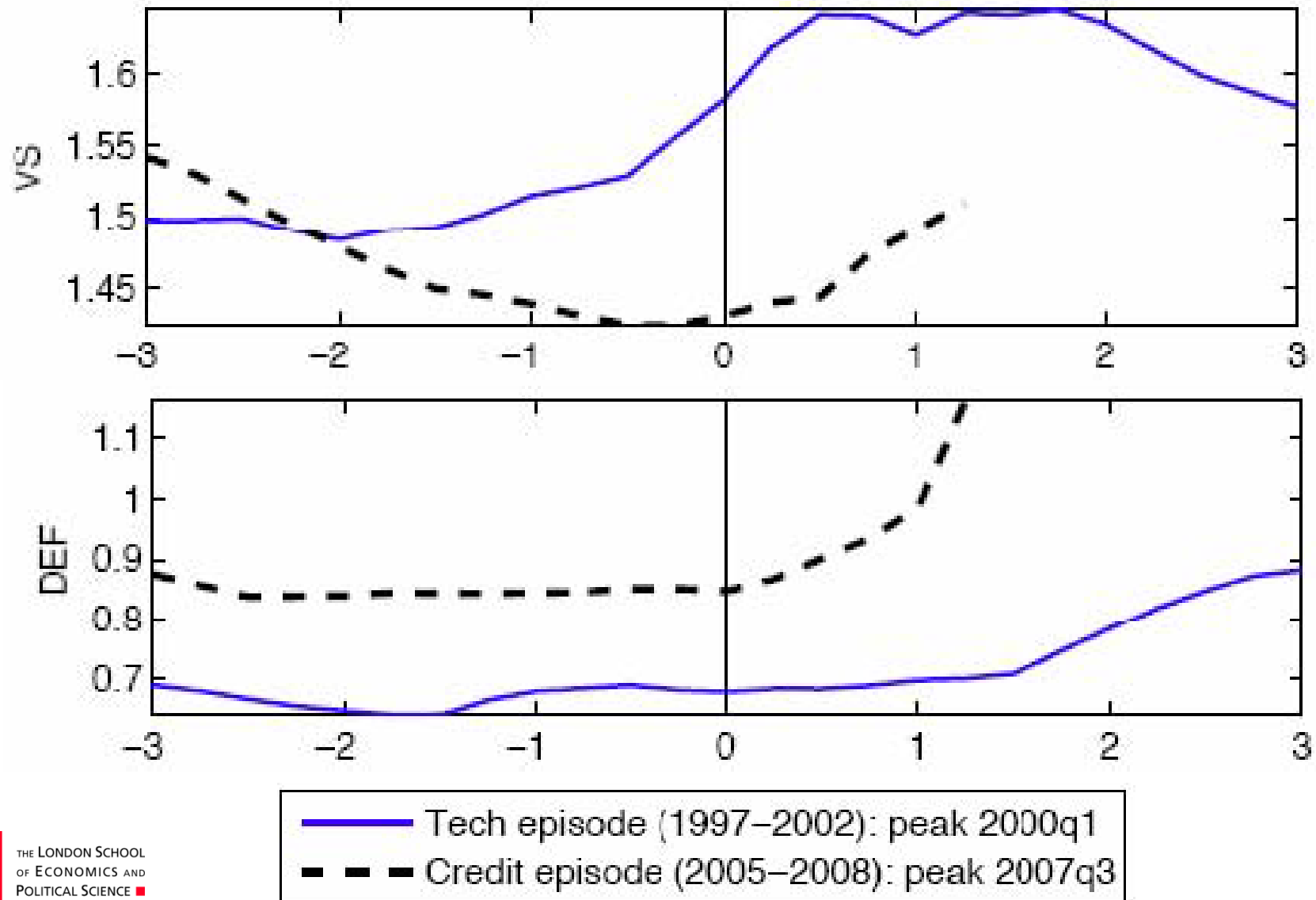
Two Recent Booms and Busts



Two Recent Booms and Busts



Two Recent Booms and Busts



Our Approach

Our Approach

- Exploit the loglinear approximate accounting identity of Campbell and Shiller (1988) to decompose returns
- Estimate a VAR model to predict excess stock returns
 - Two challenges: Returns are noisy and results can be sensitive to the information set
- Therefore, also impose an asset-pricing model on the cross section of equities
 - Taking the VAR estimates as given, Campbell and Vuolteenaho (2004) argue that the ICAPM explains the value premium
 - We use GMM to estimate the VAR parameters jointly with risk aversion, the sole free parameter in that model

Return Decomposition

- Cash-flow news: Change in discounted sum of current and future expected dividend growth rates
- Discount-rate news: Change in discounted sum of future expected returns
- Set the discount coefficient ρ to .95 per annum

$$\begin{aligned}r_{t+1} &\approx k + \rho p_{t+1} + (1 - \rho)d_{t+1} - p_t \\r_{t+1} - E_t r_{t+1} &\approx (E_{t+1} - E_t) \sum_{i=0}^{\infty} \rho^i \Delta d_{t+1+i} - (E_{t+1} - E_t) \sum_{j=1}^{\infty} \rho^j r_{t+1+j} \\&\approx N_{CF,t+1} - N_{DR,t+1}\end{aligned}$$

VAR Implementation

- Assume that a VAR model generates returns
- One can then compute unexpected returns and thus discount-rate news
- Cash-flow news can be taken as a residual

$$z_{t+1} = a + \Gamma z_t + u_{t+1}, \quad e1' z_{t+1} = r_{M,t+1}^e$$

$$\lambda \equiv \rho \Gamma (I - \rho \Gamma)^{-1}, \quad e1' = [1, 0, \dots, 0]$$

$$N_{DR,t+1} = (e1' \lambda) u_{t+1}, \quad N_{CF,t+1} = (e1' + e1' \lambda) u_{t+1}$$

Merton's ICAPM

- Campbell and Vuolteenaho (2004) build off of Merton's ICAPM to predict that, for a conservative long-horizon investor,
 - “bad” cash-flow beta (covariance of a firm's stock return with the market's cash-flow news) should have a high premium
 - “good” discount-rate beta (covariance of a firm's stock return with the market's discount-rate news) should have a very small premium

$$E_t[r_{i,t+1}] - r_{f,t+1} + \frac{\sigma_{i,t}^2}{2} = \gamma \sigma_{M,t}^2 \beta_{i,CF} + \sigma_{M,t}^2 \beta_{i,DR}$$
$$\beta_{i,CF} \equiv \frac{\text{cov}(r_{i,t}, N_{CF,t})}{\text{var}(r_{M,t})} \quad \beta_{i,DR} \equiv \frac{\text{cov}(r_{i,t}, -N_{DR,t})}{\text{var}(r_{M,t})}$$

Implementation

VAR Data

Five variables:

- Excess log return on CRSP value-weighted index
- Log ratio of S&P index to 10-year smoothed earnings (avoiding earnings interpolation)
- Term spread in Treasury yields (10 years to 3 months)
- Small-stock value spread (difference in log B/M for small growth and small value portfolios)
- Default spread (BAA to AAA bonds)

Test Asset Data

Six portfolios from Ken French:

- One size breakpoint, NYSE median market cap
- Two B/M breakpoints, 30% and 70% of NYSE
- Small-stock value spread is log B/M difference for small high vs. small low portfolios
- Excess returns on test assets measured relative to the market to reduce correlation of errors in GMM moment conditions

Estimation Methodology

- Use continuously-updated GMM
 - K : dimension of the VAR
 - I : number of test assets
 - Number of free parameters: $K(K + 1) + 1$
 - Orthogonality conditions: $R = K(K + 1) + I + 1$
 - Thus, I overidentifying restrictions
- Impose two additional restrictions to assist convergence
 - $\gamma \leq 15$
 - VAR is stationary

Empirical Results

Forecasting Variables

Variable	Mean	Median	Std.	Min	Max
r_M^e	0.012	0.027	0.108	-0.437	0.641
PE	2.910	2.895	0.382	1.495	3.891
TY	1.419	1.369	1.029	-1.650	3.748
VS	1.640	1.509	0.366	1.183	2.685
DEF	1.071	0.829	0.686	0.324	5.167
<i>Correlations</i>	r_M^e	PE	TY	VS	DEF
r_M^e	1.000	0.075	0.035	-0.036	-0.167
PE	0.075	1.000	-0.244	-0.334	-0.591
TY	0.035	-0.244	1.000	0.338	0.408
VS	-0.036	-0.334	0.338	1.000	0.654
DEF	-0.167	-0.591	0.408	0.654	1.000

Unrestricted VAR

<i>VAR estimate</i>	r_M^e	<i>PE</i>	<i>TY</i>	<i>VS</i>	<i>DEF</i>	R^2
r_M^e	-0.036 (0.057)	-0.057 (0.020)	0.006 (0.006)	-0.032 (0.022)	-0.004 (0.015)	0.041
<i>PE</i>	0.049 (0.054)	0.962 (0.018)	0.004 (0.006)	-0.027 (0.021)	0.004 (0.014)	0.932
<i>TY</i>	0.043 (0.302)	0.039 (0.104)	0.772 (0.034)	0.046 (0.117)	0.179 (0.077)	0.698
<i>VS</i>	0.068 (0.046)	0.009 (0.016)	-0.004 (0.005)	0.950 (0.018)	0.024 (0.012)	0.946
<i>DEF</i>	-0.003 (0.002)	0.000 (0.001)	0.000 (0.000)	0.001 (0.001)	0.865 (0.040)	0.820
Error to N_{CF}	0.929	-1.056	0.002	-0.158	-0.080	
Error to $-N_{DR}$	0.071	1.056	-0.002	0.158	0.080	
<i>News terms corr/std</i>	N_{CF}	$-N_{DR}$				
	N_{CF}	0.045	-0.117			
	$-N_{DR}$	-0.117	0.102			

Restricted VAR

<i>VAR estimate</i>	r_M^e	<i>PE</i>	<i>TY</i>	<i>VS</i>	<i>DEF</i>	R^2
r_M^e	0.099 (0.084)	-0.057 (0.017)	0.013 (0.006)	-0.003 (0.024)	-0.050 (0.026)	-0.037
<i>PE</i>	0.190 (0.088)	0.964 (0.015)	0.011 (0.006)	0.000 (0.023)	-0.032 (0.025)	0.927
<i>TY</i>	-0.191 (0.300)	0.032 (0.096)	0.777 (0.049)	0.023 (0.113)	0.171 (0.088)	0.702
<i>VS</i>	-0.018 (0.066)	0.015 (0.018)	-0.004 (0.005)	0.940 (0.017)	0.038 (0.013)	0.945
<i>DEF</i>	-0.802 (0.375)	-0.004 (0.033)	-0.017 (0.016)	0.029 (0.054)	0.991 (0.092)	0.802
Error to N_{CF}	1.624	-1.899	0.086	-0.459	-1.047	
Error to $-N_{DR}$	-0.624	1.899	-0.086	0.459	1.047	
<i>News terms corr/std</i>	N_{CF}	$-N_{DR}$		Gamma	4.980	
	N_{CF}	-0.943				
	$-N_{DR}$	0.277	J-stat p-value		0.092	

Understanding Market History

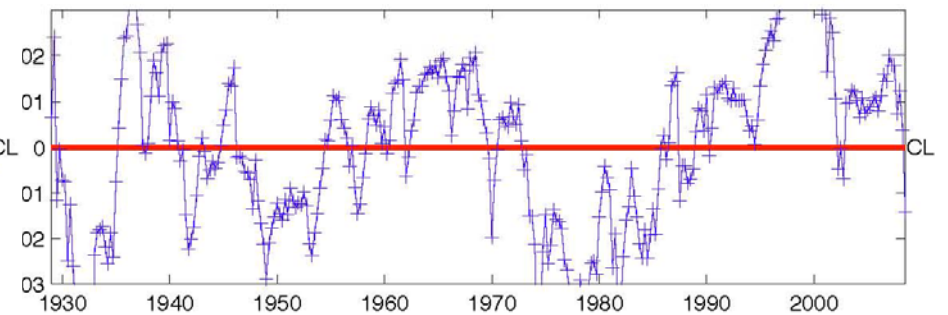
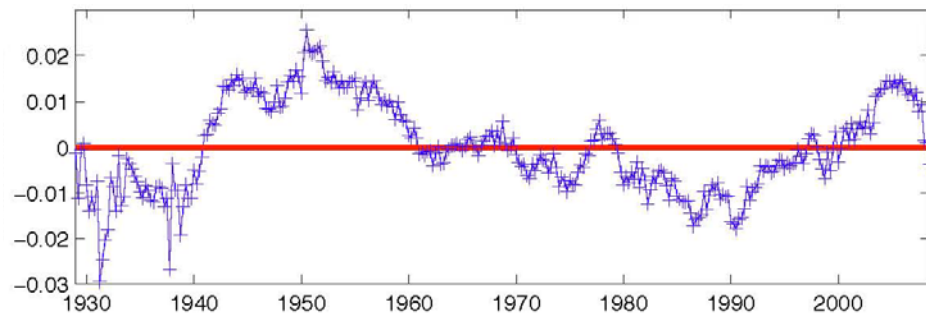
- History of cash-flow news:
 - Profit crash in early 1930's and late 1930's, with some recovery in mid 1930's
 - Profit boom in 1940's and 1950's
 - Generally weak profits in early 1970's and 1980's
 - Profit boom in 2000's
- History of discount-rate news:
 - Depressed investor sentiment in early 1930's
 - Strong sentiment in 1960's
 - Weak sentiment in late 1970's and early 1980's
 - Extremely strong sentiment in 1990's
 - Moderately strong sentiment in 2000's

Understanding Market History

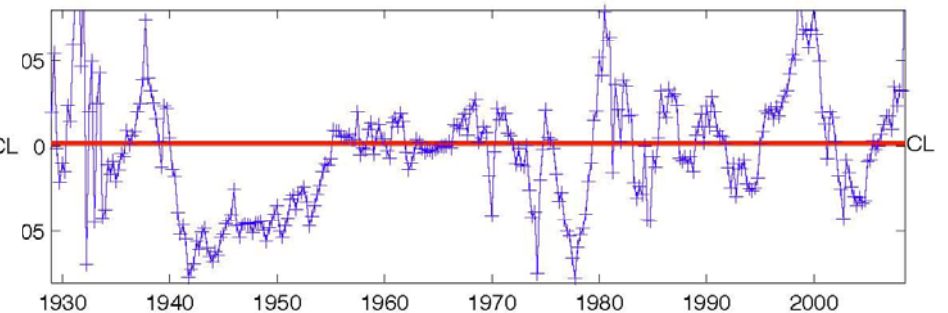
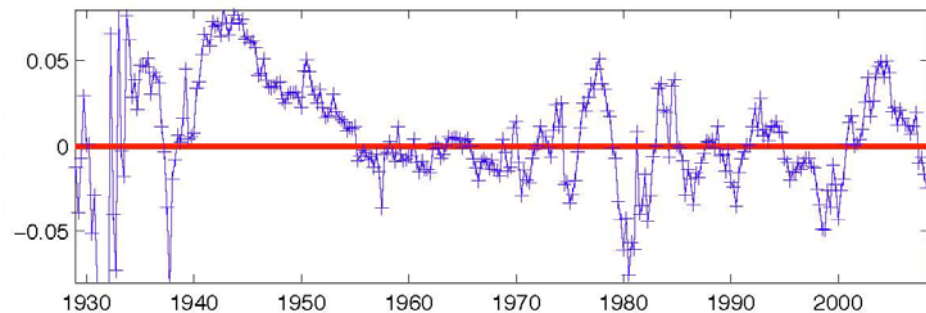
Smoothed N_{CF}

Smoothed $-N_{DR}$

Unrestricted



Restricted

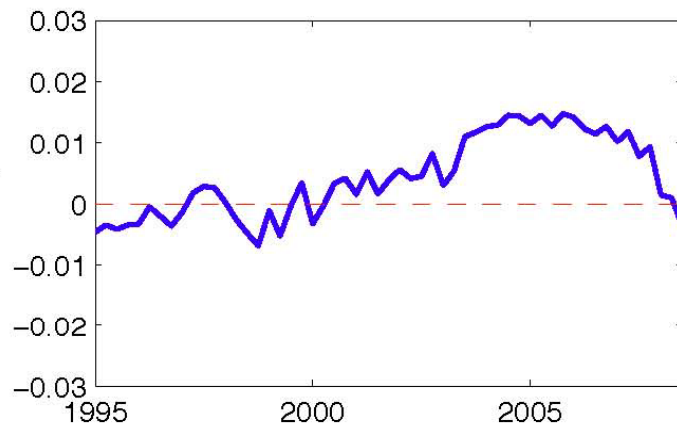


Two Recent Booms and Busts

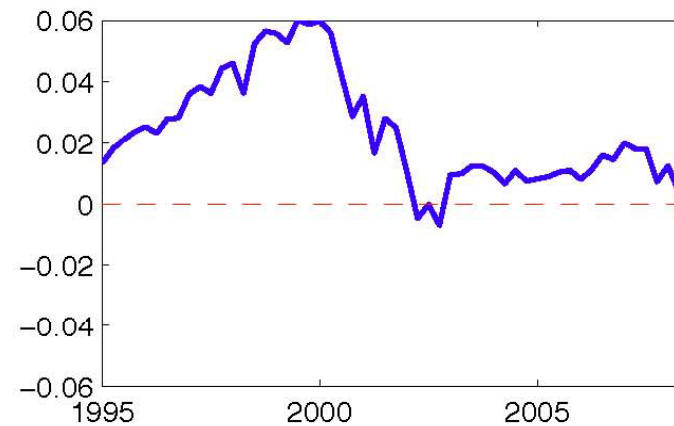
- Technology boom-bust (1990's and early 2000's)
 - Entirely driven by sentiment
 - Cash-flow news either neutral (unrestricted models) or offsetting (restricted model)
- Credit boom-bust (mid-late 2000's)
 - All models find strong hump in cash-flow news
 - Discount-rate news played supporting role (unrestricted models) or offsetting role (restricted model)
- Compare results to the different behaviour of
 - P/E and earnings growth
 - Value spread and default spread

Two Recent Booms and Busts

Smoothed N_{CF}

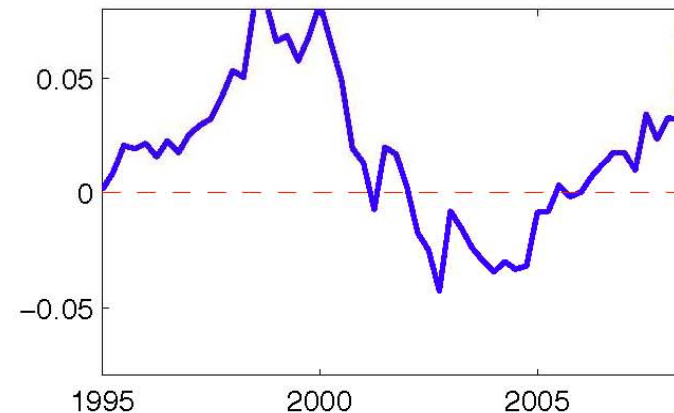
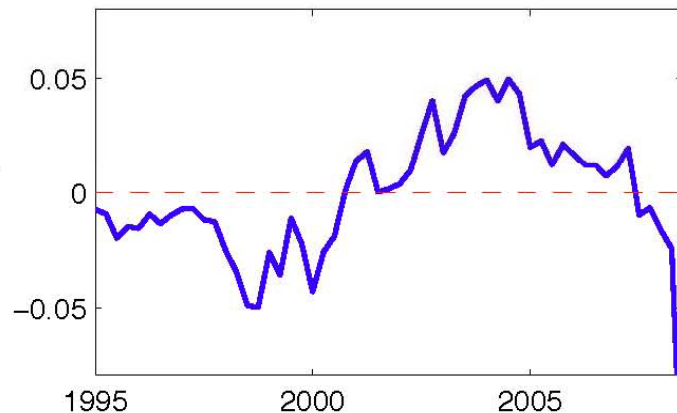


Smoothed $-N_{DR}$



Unrestricted

Restricted



This Time Was Different

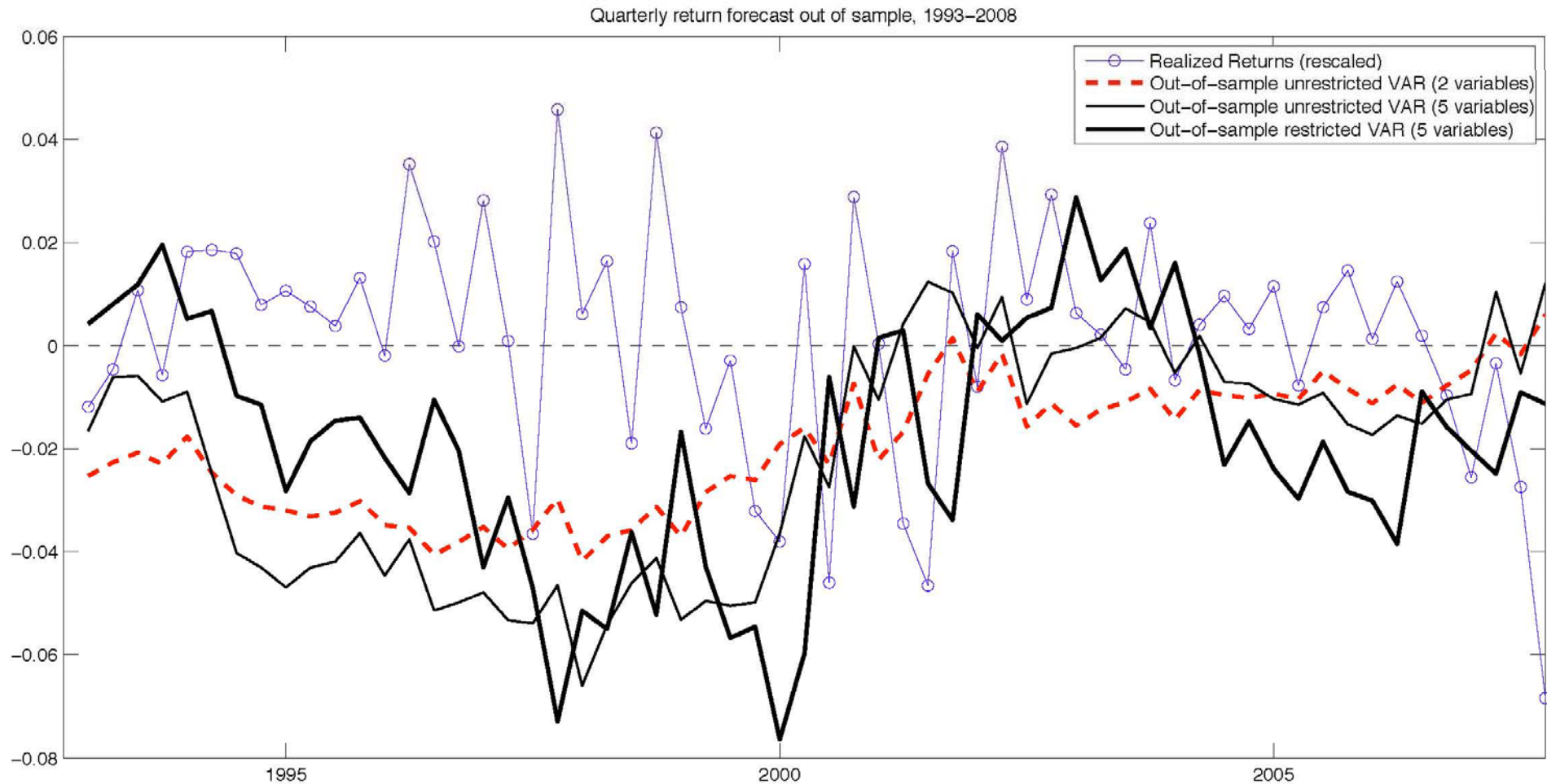
Ceridian-UCLA Pulse of Commerce Index™



Out-of-Sample Return Forecasts

- Theoretical restrictions improve the out-of-sample forecasting power of the VAR
- Return forecasts were much lower in the 1990's than in the mid 2000's and increased much more rapidly in 2000-02 than in 2007-09
 - The contrast is particularly striking in the theoretically-restricted model
- The increase in expected return mitigated the impact of the tech bust on long-term investors
- In this sense, times were particularly hard in March 2009
 - Strong recovery since then was not anticipated at the time

Out-of-Sample Return Forecasts



Conclusions

Conclusions

- Merton's ICAPM: Value stocks have higher returns on average because these stocks have lower realized returns during periods of negative cash-flow shocks
- Imposing this theory when estimating a time-series model for the equity premium improves out-of-sample performance
- Hard Times: In contrast to the tech boom/bust, a good portion of the recent downturn reflects expectations of significantly lower future profitability