Formal identification of sentiment effects in asset markets

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Motivation

- Many economists believe that investor sentiment is a powerful force.
  - Unravelling of excessive sentiment
- Can the presence of excessive sentiment effects in asset pricing be confidently identified or even verified (in a timely fashion)?
- Difficulty is due to various identification issues, omitted variable effects and endogeneity?
- I will concentrate on the identification problem mostly here.

Early Warning of Sentiment Effects

- If sentiment is identified as distorting asset prices this has implications for policy
  - Policy could be used to subdue the effects of sentiment
  - Usually asset price misalignments reflect other macroeconomic or financial misalignments
    - EWI is could increase awareness of other misalignments
  - Identifying sentiment effects is a first step in understanding what drives the swings in sentiment and when they can be most harmful

Challenge is significant

- At his confirmation hearing in the fall of 2009 the Chairman of the US Federal Reserve, Ben Bernanke described the problem of how to respond to bubbles as "the most difficult problem for monetary policy this decade."

- Shiller (June 2012) "…learning how to spot bubbles and deal with them before they infect entire economies will be a major challenge for the next generation of finance scholars."

Why so difficult?

- Sentiment can transmit via risk aversion as well as through misperception of the fundamentals of asset valuation so there is a measurement problem and an identification issue.

- If we ignore sentiment when fitting asset prices to fundamentals then there is an omitted variable bias.

- If we include sentiment effects then there is likely to be an endogeneity problem.

Objective

- Modify an existing valuation approach to address

  - Missing sentiment effects

  - Assignment of risk aversion related sentiment to discounting and investor sentiment to perceptions of earnings growth

  - Deal with an omitted variable bias that arises when sentiment drives asset prices

  - Deal with endogeneity issues

  - Assess the statistical significance of the contribution of investor sentiment to equity valuation

- We report results for the US

  – Sample includes recent crisis

- We find sentiment effects are clustered by sector

Framework

- Gordon growth model

$$P_t = V_t = \frac{e_t}{r^e - g}$$

Assume on-average dividend is irrelevant at the margin (so it doesn't matter when the earnings are dispersed). This assumes that internal source of capital is the same as external.

This valuation formula is parsimonious (and therefore approximate).

g represents all future growth effects – allow this to be determined by fitting.

But this still leaves a lot of complexity!

Framework

- Gordon growth model

Near term IBES forecast of core "earned for ordinary" per share

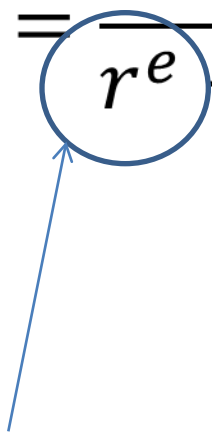$$P_t = V_t = \frac{e_t}{r^e - g}$$

Framework

- Gordon growth model

We suppose that these are too near-term to be affected by sentiment

$$P_t = V_t = \frac{e_t}{r^e - g}$$
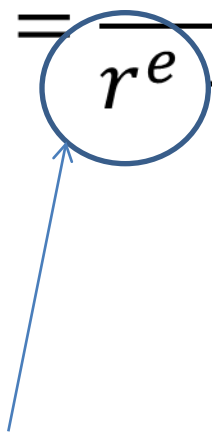
Framework

- Gordon growth model

$$P_t = V_t = \frac{e_t}{r^e - g}$$

$$r_t^e = \boldsymbol{r}_t^f + \beta_t \, Q \, VIX_t$$

Risk aversion, risk, and beta (all time varying and ex ante). Fix Q.

Framework
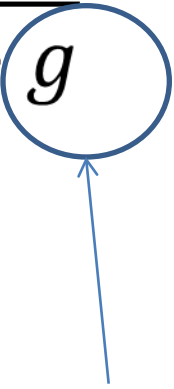
- Gordon growth model

$$P_t = V_t = \frac{e_t}{r^e - g}$$

$$r_t^e = \boldsymbol{r}_t^f + \beta_t \, Q \, VIX_t$$

We assume that Sentiment drives VIX to some degree

Crucially, we observe beta, risk free rate and set Q at some reasonable value
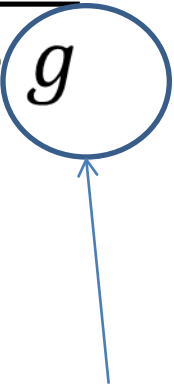
Framework

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Forecasts of future growth of earnings will be time varying have a common macro component and an idiosyncratic component.
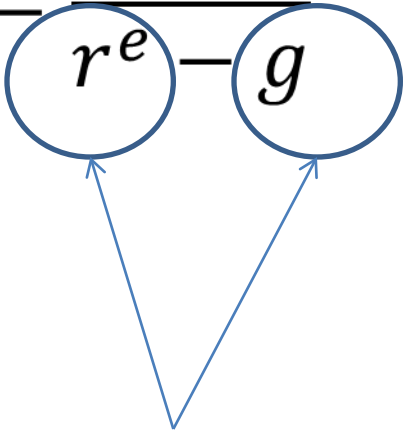
Framework

- Gordon growth model

$$P_t = V_t = \frac{e_t}{r^e - g}$$

But also possibly a function of *investor sentiment* and sentiment probably correlated with idiosyncratic bit.

Framework

- Gordon growth model

$$P_t = V_t = \frac{e_t}{r^e - g}$$

There is an identification problem if we allow sentiment to be in both these terms.
So we clean VIX of sentiment and leave sentiment to be picked-up in the g term.

Strategy

- Some variables are clean of sentiment:
  - Near-term earnings forecast unaffected by sentiment
  - Past actual earnings are unaffected by sentiment
  - Macro-economic forecasts unaffected by sentiment
- Some variables measure aspects of sentiment:
  - Baker & Wurgler's investor sentiment index (ISI) measures growth related sentiment effects and is clean of macroeconomic effects
  - VIX measures the risk aversion effects of sentiment but also contains expected macroeconomic risk
- Variables infected with sentiment can be cleaned using instruments based on those that are clean of sentiment and similarly for sentiment variables
  - Long-term earnings growth is a function of macro growth, idiosyncratic growth opportunities and sentiment effects.
  - Risk aversion is sometimes excessively affected by short term caution that is not explained by risk in fundamentals
  - Price of equity is infected with sentiment through growth and risk aversion transmission mechanisms

Strategy

- Use past earnings *actuals* as an instrument for future expected growth.
  - Regress growth in past 'actuals' on macro growth forecasts and use the residuals to compile an idiosyncratic earnings growth indicator.
- Use macro forecast error variance to isolate non-sentiment related VIX.
- Model the price value relation using the cleaned variables and put sentiment measures in the g part (no omitted effects).

Growth sub-equation

$$g_{i,t} = \alpha_{i,0} + \alpha_{i,1}t + \alpha_{i,2}t^2 + \alpha_{i,3}g_{i,t}^* + \alpha_{i,4}\,\text{RGDP10}_t + \alpha_{i,5}\,\text{CPI10}_t + \alpha_{i,6}\,\text{ISI}$$

GDP growth from Survey of
Professional Forecasters
(distant horizon)

Instrument using the most
recent 3 year past growth of
IBES actuals cleaned of
macro effects

BW Investor Sentiment Index

This can be estimated within the Price equation but it hard to fit when (r-g) is small.
We do something easier here.
We derive the value for g that satisfies P=V and then examine how much of this is
explained by macro, idiosyncratic and sentiment drivers in an IV regression.

Model Validation
An ECM can be formed

$$\ln \Delta P_t = \theta_{11,i} \ln \Delta P_{t-i} + \phi_{12,i} \ln \Delta \hat{V}_{t-i} + \pi_1 ECM_{t-1}$$
$$\ln \Delta V_t = \theta_{21,i} \ln \Delta P_{t-i} + \phi_{22,i} \ln \Delta \hat{V}_{t-i} + \pi_2 ECM_{t-1}$$

log $\mathbb{P}/\hat{V}$

We can see whether returns or re-valuations are being driven by disequilibrium between the fundamental valuation and price

Statistical verification of sentiment effects

- This is based on ratio of with and without sentiment valuations or growth rates.

- Here we concentrate on the relative squared with- and without-sentiment growth fit.

Operationalizing in real time (work-in-progress)

- HF Sentiment index based on a linear combination of the pricing errors.

- Obtain the mispricing in real-time and combine them in linear combination that identifies most sentiment variation.

- This requires a recursive calculation because BW sentiment variables are not available in real-time.

Data

- FY1, FY2, Macro Forecasts, Sentiment (BW and VIX), forward-looking betas.

- Earnings forecasts relate to macro

- Macro SPF.
  - Near and long-term

- BW sentiment variables

Sentiment variables

- VIX….
  - proxy for ex ante near-term equity market volatility
- What is the BW Investor sentiment index?
  - Lagging indicator!
  - Only about 7% of the variation of the BW Sentiment Index is explained by VIX index.
  - (i) the closed-end fund discount (CEFD), (ii) NYSE share turnover, (iii & iv) the number and average first-day returns on IPOs, (v) the equity share in new issues, and (vi) the dividend premium.
  - Principal factor of these cleaned of their relation with macroeconomic variables.

SPF & IBES

- SPF
  - Real consumption GROWTH
  - REAL NON-RESIDENTIAL INVESTMENT GROWTH
  - REAL RESIDENTIAL FIXED INVESTMENT
  - REAL FEDERAL GOVERNMENT CONSUMPTION & INVESTMENT
  - REAL STATE & LOCAL GOVERNMENT C&I SPENDING
  - REAL NET EXPORTS GROWTH
  - GROWTH IN CHANGE IN INVENTORIES

SPF & IBES

- IBES
  - Year-end earnings forecasts
    - One and two year ahead (FY1 and FY2)
  - These are similar to the horizon profiles of the SPF "A" and "B" forecasts so (B-A)/A is a growth forecast
 - The out-turn relative to what was expected gives a forecast error which we use in the VIX regression.

1ˢᵗ Stage regresssion

- Clean VIX of sentiment.
  - VIX = f(Forecast error variance of SPF macro variables)
  - We use the fitted value in the derivation of implied g
- Earnings growth is regressed on macro growth forecasts.
  - Idiosyncratic growth over 3 previous years used as instrument for idiosyncratic long-term growth
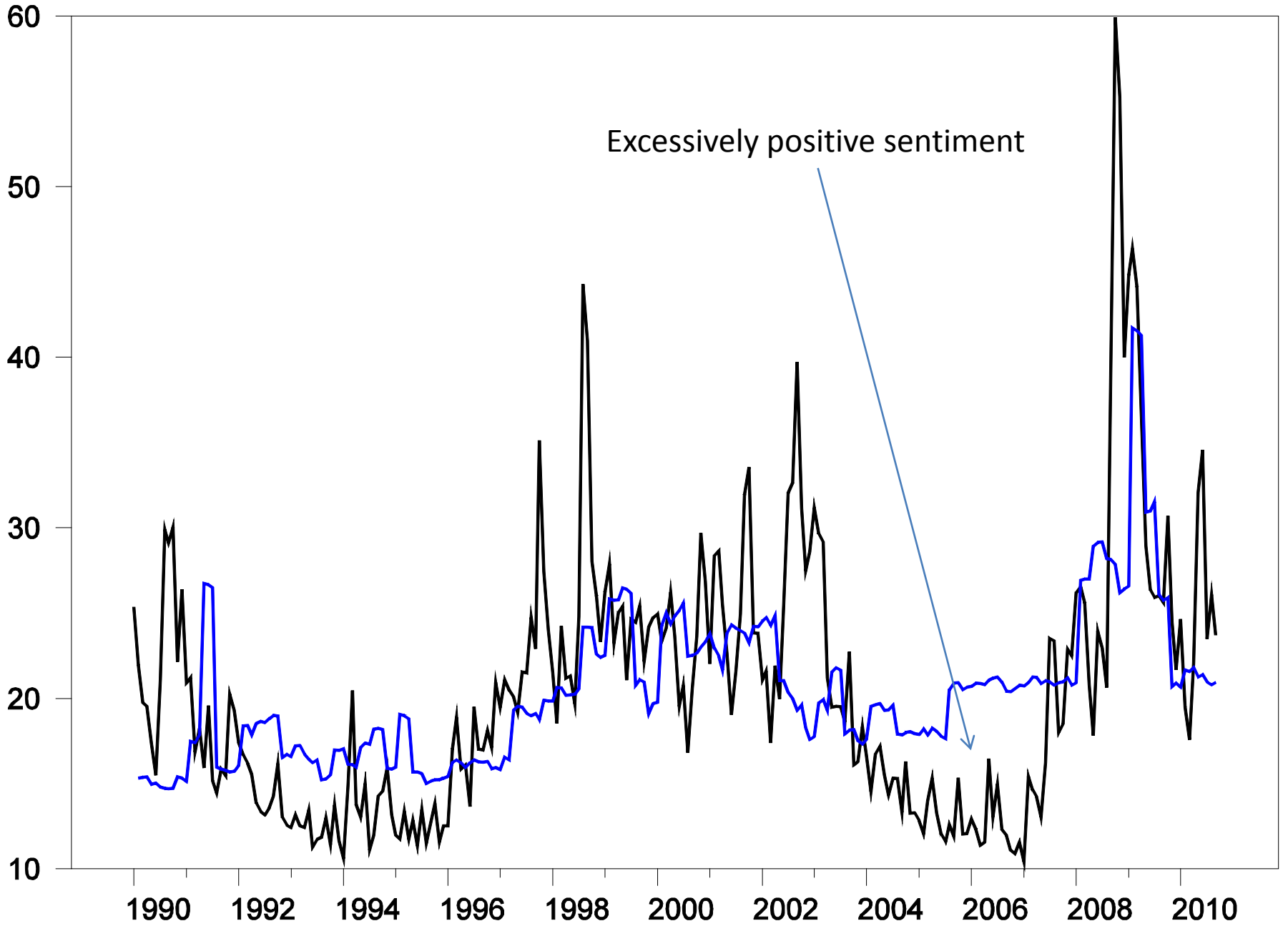
Results; VIX

- Roughly 28% of VIX variation is explained by forecast error variance in forecast of Consumption expenditure and T-bill Rate.

VIX & Fitted VIX

VIX & Fitted VIX

Excessively positive sentiment
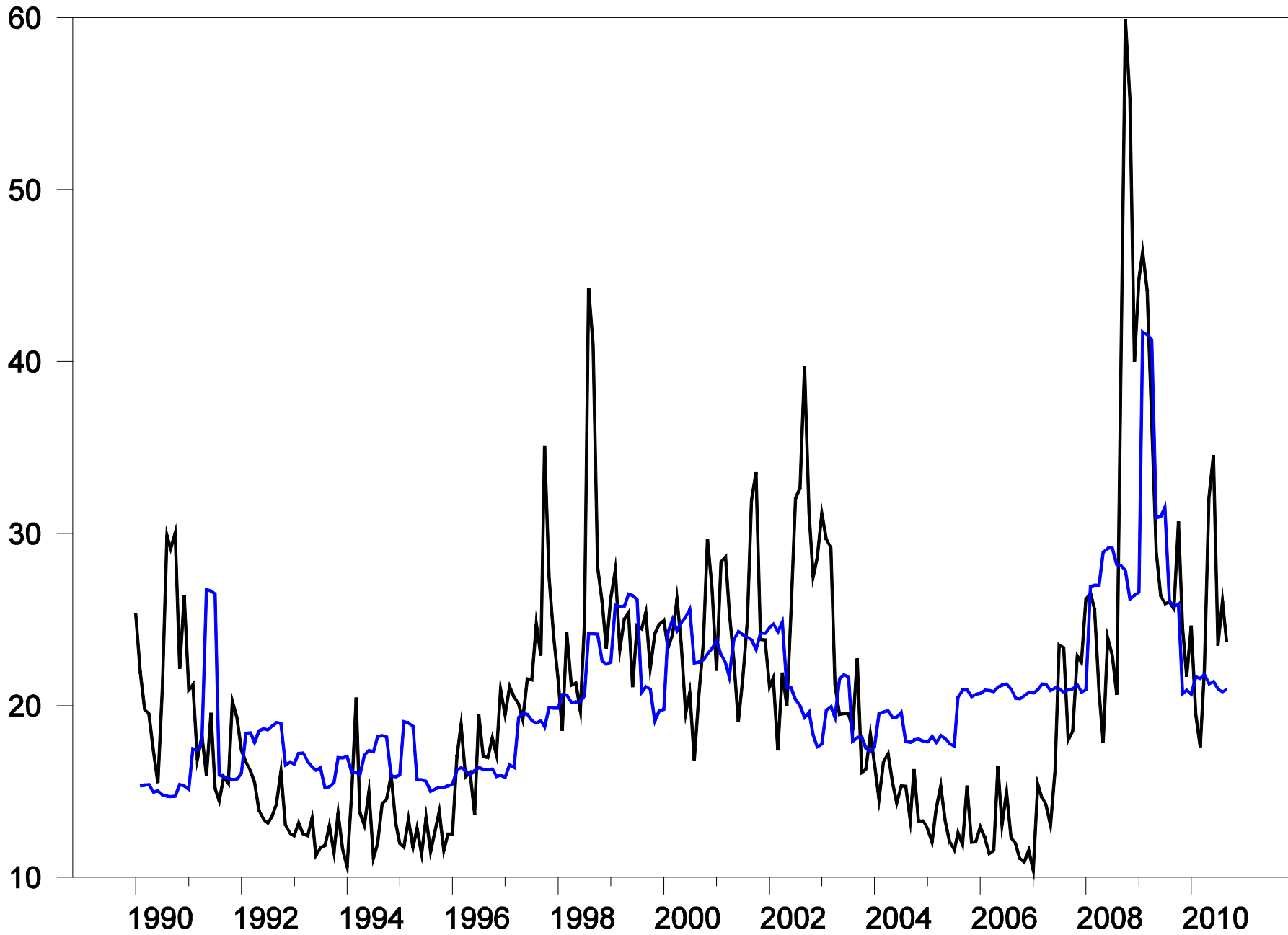
Coefficient on sentiment in growth regressions:

	Coeff. ISI	T-Stat. ISI	R-BarSQ-ISI	R-BARSQ
AA	0.004	0.523	0.680	0.627
AXP	0.026	2.534	0.476	0.586
AIG	0.051	4.177	0.416	0.466
BA	0.023	3.382	0.257	0.306
CAT	0.035	5.508	0.560	0.405
JPM	0.005	0.406	0.317	0.487
C	0.023	1.773	0.453	0.532
KO	0.042	7.335	0.637	0.424
DIS	0.008	1.185	0.447	0.478
DD	0.038	5.774	0.379	0.453
XOM	0.033	3.400	0.208	0.060
GE	0.016	1.950	0.380	0.493
GM	0.034	2.974	0.551	0.510
HPQ	-0.074	-7.498	0.481	0.186

Coefficient on sentiment in growth regressions: Continued...

	Coeff. ISI	T-Stat. ISI	R-BarSQ-ISI	R-BARSQ
HD	0.019	2.068	0.233	0.240
HON	-0.020	-4.807	0.542	0.527
INTC	-0.050	-4.236	0.417	0.283
IBM	-0.004	-0.455	0.392	0.200
JNJ	0.053	8.238	0.656	0.412
MCD	0.061	12.238	0.622	0.256
MRK	0.051	7.486	0.562	0.316
MSFT	0.001	0.074	0.567	0.313
MMM	0.010	2.359	0.615	0.431
PFE	0.080	11.381	0.678	0.241
MO	0.045	6.828	0.621	0.412
PG	0.056	9.553	0.674	0.452
SBC	0.034	5.616	0.392	0.207
UTX	0.014	2.975	0.533	0.491
VZ	0.022	4.119	0.300	0.256
WMT	0.041	7.989	0.755	0.404
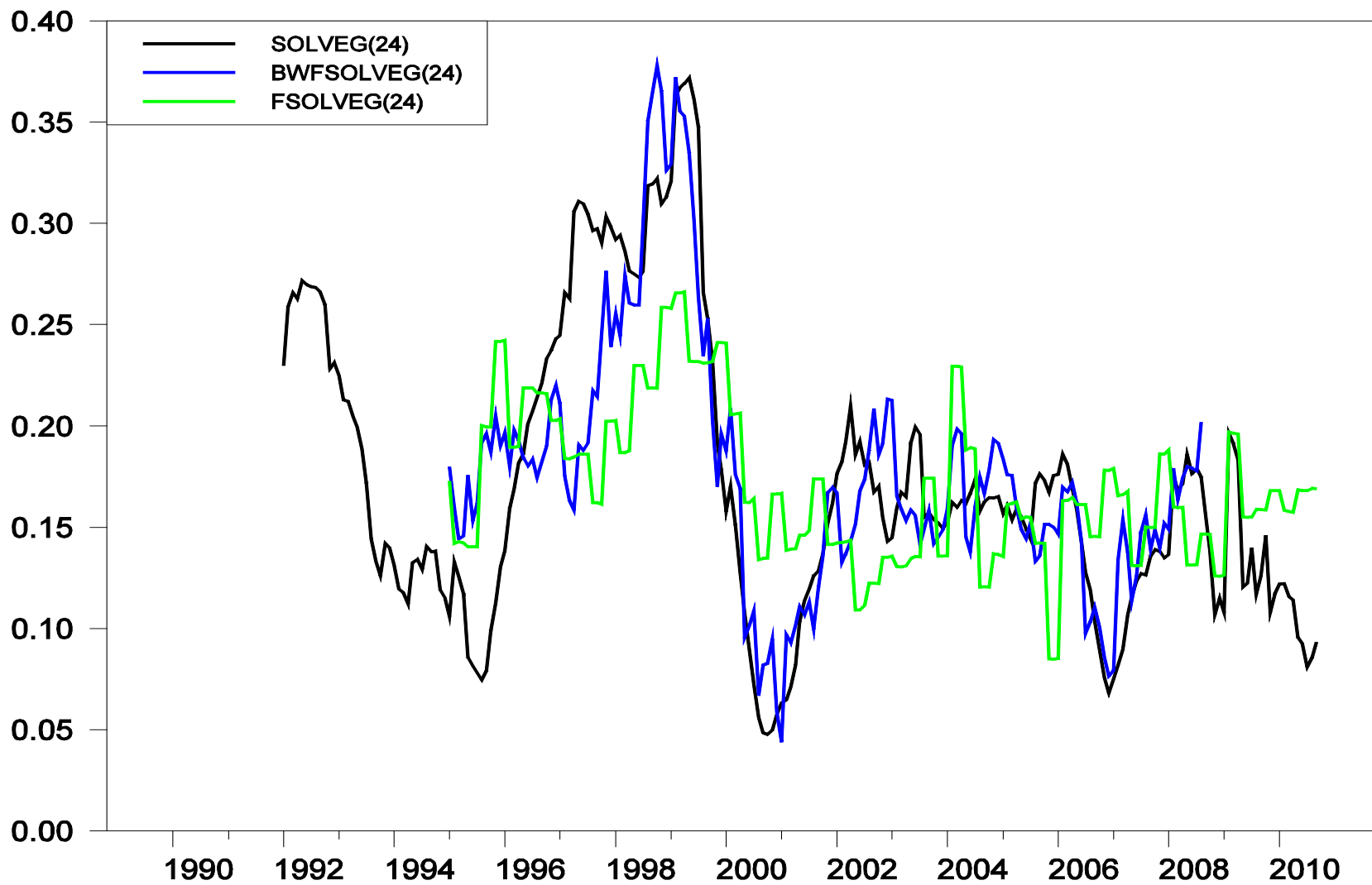
Sentiment Index
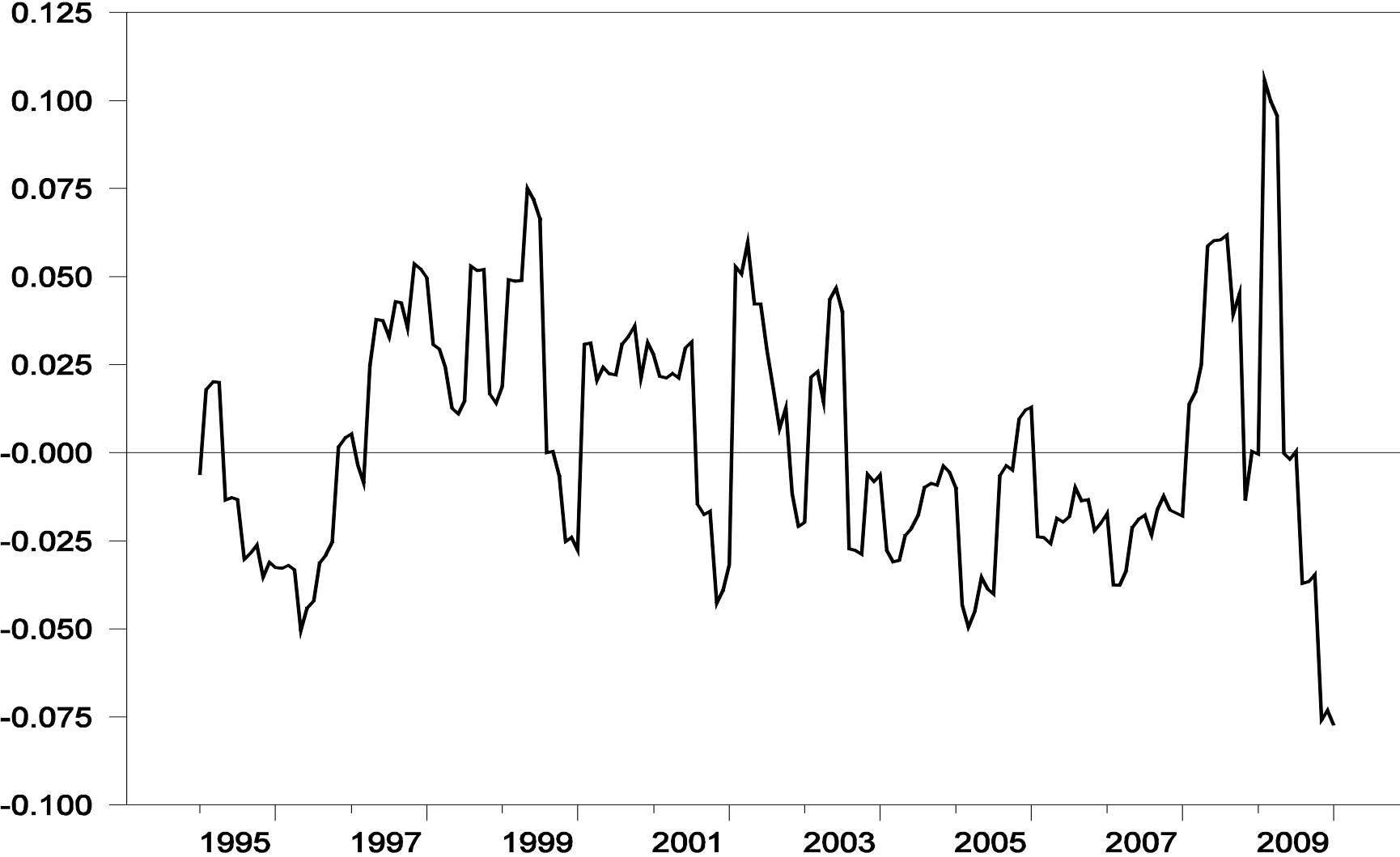
Other issues (Lucas critique)

- For some of the period studied the FED was using interest rates to counteract excessive exuberance.

- An after crashes the FED was using low interest rates to prevent too drastic an over-reaction.

- We would recommend using the Taylor rule to separate out the policy effects from the underlying appropriate interest rate.