Equity Premium Prediction

Amit Goyal, Ivo Welch, Athanasse Zafirov

Oct 2023, Cincinnati

Choice of Paper

- ▶ Chosen for importance of findings,
    - ▶ ...not for innovativeness or cleverness,
    - ▶ ...and not sure if this is a paper or a dictionary.
- ▶ Not a good JMP.

Background

- Goyal-Welch (2008) investigated 17 variables claiming successful equity timing
  - offered clever way to display performance
  - no variable really held up out of sample
  - disproportionate influence of 1974-5 bear market
  - (*useful* disagreements with John Cochrane and John Campbell)
    - PS: This paper is *not* about D/P
    - PS: Cochrane's is an identity, but earlier GW (MS 2003): "sort of mean-reversion". Changes in D/P predicted shorter-term changes in itself. No time to discuss.

Philosophical Disagreement

- ▶ We do both IS and OOS, but
- ▶ Campbell-Thompson defend IS over OOS test.

Philosophical Disagreement

- ► We do both IS and OOS, but
- ► Campbell-Thompson defend IS over OOS test.
- ► Under the prior / hypothesis that the model is true, the model offers the best (guidance to a) test of the theory.

Philosophical Disagreement

- We do both IS and OOS, but
- Campbell-Thompson defend IS over OOS test.
- Under the prior / hypothesis that the model is true, the model offers the best (guidance to a) test of the theory.
- Correct!

- If your priors are strong enough, maybe even feel free to ignore empirical evidence.
    - IS, OOS, whatever.

Who Won the War?

- since then, another 26 papers mostly in top journals
  - 29 variables
- most claim improvement based on "solid theory,"
- and many claim OOS tests.
- many don't have last 10-15 years fully yet
  - interesting sample period: 2000s, 2008, 2018, 2020.
  - valid question about "unusual draws," but
  - history was also used to identify variables in the first place.
  - what is usual and unusual??
  - also, some ignore data from before. (not just OOS)

Does academic finance research really now know how to predict equity premia?

with solid theory?

Are Negative Findings an Indictment?

- ▶ Mostly no!
    - ▶ not 100% resolved, but pretty good.
- ▶ Researchers are never prescient.
- ▶ Only tautologies are guaranteed to hold.
    - ▶ external validity is *never* assured.
    - ▶ someone else needs to look at evidence again later,
    - ▶ which is what our paper is going to do.
    - ▶ I don't know of a better scientific approach in social science.

- Just a little yes.
    - note every empirical paper must make choices. authors choose frequency, overlapping, etc.
    - Professionwide, our incentives make us eager for findings,
    - ...and perhaps a little gullible.
    - Who wouldn't want to know how to predict equity premia?

- the evidence tilts one way, but with good priors, you can still believe.

Paper Outline

- ▶ Replicate authors' data (two exceptions [vol])
- ▶ Extend sample forward, IS and OOS
  - ▶ about 10 years on avg forward.
  - ▶ ergo, just not screw up badly, and it should still be ok.
- ▶ Extend sample backwards, too, if possible
- ▶ OOS: Constrain (via Campbell-Thompson) 0-eqprem
- ▶ Simple stability test: First half vs. second half

- ▶ Original specification and "homologous" tests
    - ▶ not overlapping
    - ▶ log returns
    - ▶ highest (mo) frequency, earliest availability, CRSP, same Rf
    - ▶ not multivariate!
- ▶ This paper also considers investment performance:
    - ▶ (think Fama-MacBeth vs. Fama-French as analogy)
    - ▶ Inv strtgy: choose based on when above/below historical.
        - ▶ one tilts towards equity, given high average $E(R_m)$ in sample.
    - ▶ choose either varying amounts or fixed \$1 long/short

- ▶ Adding a consensus estimator based on past T statistic

How To Present 45 Variables?

- ▶ A paper on each one would have been easy.
- ▶ A paper on 45 variables is much harder.
  - ▶ heck: hard even to remember all variables!

Variable Types

1. Macroeconomic
2. Sentiment
3. Volatility
4. Cross-section

Quick summary finding:

- annual variables tended to predict better

Favorites:

Out of 45 or so:

1. Cochrane's I/K
2. 14 Technical Indicators
3. Short-Stock interest
4. 4th-Quarter Consumption growth.
5. Accruals (though only 2000-2)

- ▶ Think 10%.
- ▶ Another 10-20% with pluses and minuses.
- ▶ 70-80% poof.

List of Papers

1	Atanasov, Møller, Priestley (JF 2021), » *Consumption Fluctuations and Expected Returns*
	pce aggregate consumption to its trend (1953:q1 – 2020:q4)

2	Bakshi, Panayotov, Skoulakis (JFE 2011), » *Improving the predictability of real economic activity and ass*
	impvar forward implied variances (1996:01 – 2021:12)

3	Bekaert, Hoerova (JE 2021), » *The VIX, the variance premium and stock market volatility* .
	vp The VIX squared minus the implied volatility. See also BTZ. (1990:01 – 2010:09)

4	Belo and Yu (JME 2013), » *Household & government investment and the stock market* .
	govik public-sector investment (1947:q1 – 2021:q4)

5	Bollerslev, Tauchen, Zhou (RFS 2009), » *Expected Stock Returns and Variance Risk Premia*
	vrp variance risk premium (1990:01 – 2021:12)

6	Chen, Eaton, Paye (JFE 2018), » *Micro(structure) before macro? The predictive power of aggregate illiqu*
	lzrt 9 illiquidity measures (1926:01 – 2021:12)

7   Colacito, Ghysels, Meng, Siwasarit (RFS 2016),   *» Skewness in Expected Macro Fundamentals and the P*

skew   skewness of GDP growth forecasts (1951:q2 – 2019 :q2)

8   Chava, Gallmeyer, Park (JME 2015),   *» Credit conditions and stock return predictability*

crdstd   loan officer credit standards (1990:q2 – 2021:q4)

9   Cooper and Priestley (RFS 2009),   *» Time-Varying Risk Premiums and the Output Gap*

ogap   output gap of industrial production (1926:01 – 2021:12)

10   Driesprong, Jacobsen, Maat (JFE 2008),   *» Striking oil: Another puzzle?*

wtexas   oil price changes (1926:01 – 2021:12)

11   Hirshleifer, Hou, Teoh (JFE 2008),   *» Accruals, cash flows, and aggregate stock returns*

accrul, cfacc aggregate accruals and cash flows (1965 – 2021)

12   Huang, Jiang, Tu, Zhou (RFS 2015),   *» Investor Sentiment Aligned: A Powerful Predictor of Stock Retur*

sntm   optimized investor sentiment index (1965:07 – 2018:12)

13   Jones and Tuzel (RFS 2013),   *» New Orders and Asset Prices*

ndrbl   new orders to shipments of durable goods (1958:02 – 2021:12)

14	Jondeau, Zhang, Zhu (JFE 2019), *» Average Skewness Matters*
skvw	average stock skewness (1926:07 – 2021:12)

15	Kelly and Jiang (RFS 2014), *» Tail Risk and Asset Prices* .
tail	tail risk from cross-section (1926:07 – 2021:12)

16	Kelly and Pruitt (JF 2013), *» Market Expectations in the Cross-Section of Present Values* .
fbm	single factor from B/M cross-section (1926:06 – 2021:12)

17	Li and Yu (JFE 2012), *» Investor attention, psychological anchors, and stock return predictabilit.*
dtoy,dtoat	nearness to Dow 52-week high (1926:01 – 2021:12)

18	Maio (RF 2013), *» The Fed Model and the Predictability of Stock Returns* .
ygap	stock-bond yield gap (1953:04 – 2021:12)

19	Maio (JFM 2016), *» Cross-sectional return dispersion and the equity premium* .
rdsp	stock-return dispersion (1926:09 – 2021:12)

20	Mrtn (QJE 2017), *» Expected Return on the market* .
rsvix	scaled risk-neutral vix (1996:01 – 2021:12)

| 21 | Møller and Rangvid (JFE 2015), *» End-of-the-year economic growth and time-varying expected returns* |
| | gpce, gip   year-end economic growth (1947/26 – 2021) |

| 22 | Neely, Rapach, Tu, Zhou (MS 2014), *» Forecasting the Equity Risk Premium: The Role of Technical Indi…* |
| | tchi   14 technical indicators (1951:02 – 2021:12) |

| 23 | Piazzesi, Schneider, Tuzel (JFE 2007), *» Housing, consumption, and asset pricing.* |
| | house   share of housing in consumption (1929 – 2021) |

| 24 | Pollett and Wilson (JFE 2010), *» Average correlation and stock market returns* |
| | avgcor   average correlation of daily stock returns (1926:03 – 2021:12) |

| 25 | Rapach, Ringgenberg, Zhou (JFE 2016), *» Short interest and aggregate stock returns* |
| | shtint   short stock interest (1973:01 – 2021:12) |

| 26 | Yu (JFE 2011), *» Disagreement and return predictability of stock portfolios* . |
| | disag   analyst forecast disagreements (1981:12 – 2021:12) |

Monthly Variables and Predictions

- ▶ T2= replication
- ▶ T3= homologous: log equity premium, non-overlapping
- ▶ joint significance on IS, OOS based on simul

- ▶ following is *not* the only viable interpretation:
- ✔ predicts, usually statistically signif
- ✗ fails to predict (underperform on investment)
- · not a problem
- ☒ lost money in absolute terms, too

Ppr	Var	Table 1 Same	Table 2 Forw	Table 2 F/B	Table 3 F/B	Tbl A1 Halves	Tbl 3 OOSCT	Tbl 3 IS&OOSCT	Tbl 4 InvZLE
			IS Performance					Other Performance	
BH	vp	✔	✔	✔	✗	· ·	✗	✗	✗✗✗✗
BPS	impvar	✔	✗	✗	✗	· ·	✗	✗	✗✗✗✗
BTZ	vrp	✔	✗	✗	✗	· ✗	·	✗	✗✗✗✗
CEP	lzrt	✔	✗	✗	✗	· ✗	·	·	✗✗✗✗
CP	ogap	✔	✔	†✗	†✗	· ·	†✗	†✗	✗✗✗✗
DJM	wtexas	✔	✗	✗	✗	· ·	✔	·	✗✗✗✗
HJTZ	sntm	✔	✔	✔	✗	· ·	✗	✗	✗✗✗✗
JT	ndrbl	✔	✔	✔	✗	· ·	✗	✗	✗✗✗✗
JZZ	skvw	✔	✗	✗	✗	· ✗	✗	✗	✗✗✗✗
KJ	tail	✔	✔	†✗	†✗	· ✗	†✗	†✗	✗✗✗✗
KP	fbm	✔	✔	✔	✗	· ·	✗	✗	✗✗✗✗

| | Table 1 | IS Performance | | | | Tbl A1 | Other Performance | | Tbl 4 |
| | | Table 2 | | | Table 3 | | Tbl 3 | | |
Ppr	Var	Same	Forw	F/B	F/B	Halves	OOSCT	IS&OOSCT	InvZLE
LY	dtoy	✔	✗	✗	✗	✗ ·	✗	✗	✗✗✗✗
LY	dtoat	✔	✔	✔	✗	· ·	✗	✗	✗✗✗✗
Maio$_{(13)}$	ygap	✔	✗	✗	✗	· ·	✗	✗	✗✗✗✗
Maio$_{(16)}$	rdsp	✔	✗	✗	✗	· ✗	✗	✗	✗✗✗✗
Mrtn	rsvix	✔	✔	✔	✗	· ✗	✗	✗	✗✗✗✗
NRTZ	tchi	✔	✔	✔	✗	· ·	✔	✔	✗✗ · ·
PW	avgcor	✔	✔	†✗	†✗	· ·	†✗	†✗	✗✗✗✗
RRZ	shtint	✔	✔	✔	✗	· ·	✔	✔	✗ · ✗ ·
YU	disag	✔	✗	✗	✗	· ✗	✗	✗	✗ · · ·

		IS Performance					Other Performance		
		Table 2			Table 3	Tbl A1	Tbl 3		Tbl 4
Table 1									
Ppr	Var	Same	Forw	F/B	F/B	Halves	OOSCT	IS&OOSCT	InvZLE
BMRR	ntis	n/a	n/a	n/a	✗	n/a ·	✗	✗	✗ ✗ ☒ ☒
Cmpl	tby	n/a	n/a	n/a	✔	n/a ·	✔	✔	☒ ☒ ☒ ✗
CSa	d/p	n/a	n/a	n/a	✗	n/a ·	✗	✗	☒ ☒ ☒ ✗
CSb	d/y	n/a	n/a	n/a	✗	n/a ·	✗	✗	☒ ☒ ☒ ✗
CSc	e/p	n/a	n/a	n/a	✗	n/a ·	✗	✗	☒ ✗ ✗ ✗
CSd	d/e	n/a	n/a	n/a	✗	n/a ✗	✗	✗	☒ ☒ ☒ ☒
CSe	svar	n/a	n/a	n/a	✗	n/a ✗	✗	✗	☒ ✗ ✗ ✗
FFa	lty	n/a	n/a	n/a	✗	n/a ·	✔	✔	☒ ✗ ☒ ☒
FFb	ltr	n/a	n/a	n/a	✗	n/a ·	✗	✗	✗ · ✗ ·
FFc	tms	n/a	n/a	n/a	✗	n/a ·	·	✔	✗ ✗ ✗ ·
FFd	dfy	n/a	n/a	n/a	✗	n/a ·	✗	✗	☒ ✗ ✗ ✗
FFe	dfr	n/a	n/a	n/a	✗	n/a ·	✗	✗	✗ ✗ ✗ ✗
FS	infl	n/a	n/a	n/a	✗	n/a ·	✔	·	✗ · ☒ ✗
KS	b/m	n/a	n/a	n/a	✗	n/a ✗	✗	✗	☒ ☒ ☒ ✗

Quarterly Variables and Prediction

| | | IS Performance | | | | | Other Performance | | |
| | | Table 2 | | | Table 3 | Tbl A1 | Tbl 3 | | Tbl 4 |
Ppr	Var	Same	Forw	F/B	F/B	Halves	OOSCT	IS&OOSCT	InvZLE
AMP	pce	✔	✔	✔	✔	· ·	✗	✔	✗✗✗✗
BY	govik	✔	·	✗	✗	✗✗	·	·	[✗✗✗✗]
CGP	crdstd	✔	·	✗	✗	· ·	✔	✔	✗ · ✗ ·
Crn	i/k	n/a	n/a	n/a	✔	n/a ·	✔	✔	✗✗[✗✗]
LL	cay	n/a	n/a	n/a	✗	n/a✗	✗	✗	✗✗[✗✗]

Annual Variables and Prediction

| | | IS Performance | | | | | Other Performance | | |
| Table 1 | | Table 2 | | | Table 3 | Tbl A1 | Tbl 3 | | Tbl 4 |
Ppr	Var	Same	Forw	F/B	F/B	Halves	OOSCT	IS&OOSCT	InvZLE
CGMS	skew	✗	✗	✗	✗	✗✗	✗	✗	✗✗✗✗
HHT	accrul	✔	✔	✔	✔	· ·	✔	✔	✗ · ✗ ·
HHT	cfacc	✔	✔	✔	✔	· ·	✔	✔	✗ · · ·
MR	gpce	✔	✔	✔	✔	· ·	✔	✔	✗ · ✗̲ ·
MR	gip	✔	✔	✗	✗	· ✗	✗	✗	✗✗✗̲✔
PST	house	✔	✔	✗	✗	✗✗	✔	✗	✗̲✗̲✗̲✗̲
BW	eqis	n/a	n/a	n/a	✔	n/a ·	✔	✔	✗✗ · ·

		IS Performance						Other Performance	
Table 1		Table 2			Table 3	Tbl A1		Tbl 3		Tbl 4
Ppr	Var	Same	Forw	F/B	F/B	Halves	OOSCT	IS&OOSCT	InvZLE
CGMS	skew	✗	✗	✗	✗	✗ ·	✗	✗	· ✗ · ✗
HHT	accrul	✔	✔	✔	✔	· ·	✔	✔	✗ · ✗ ✔
HHT	cfacc	✗	✗	✗	✗	· ·	✔	✔	✗ ✗ · ✗
MR	gpce	✔	✔	✔	✔	· ·	✔	✔	· · · ✔
MR	gip	✗	✔	✔	✗	· ·	✗	✗	✗✗✗✗
PST	house	✔	✗	✗	✗	✗✗	✗	✗	✗✗✗✗
BW	eqis	n/a	n/a	n/a	✗	n/a✗	✗	✔	✗✗✗✗

Noteworthy: Bekaert-Heroeva (2014)

- ▶ alphabetically, first
- ▶ overlaps monthly returns into quarterly
- ▶ and updates historical data over time
  - ▶ (posted ≠ historical)
- ▶ some inv strtgs earn negative returns
  - ▶ (better: choose opposite of vp?)
- ▶ ... many other undiscussed variables sort of like this

Noteworthy: Martin QJE (2017)

- ▶ Very appealing hypothesis intuitively.
- ▶ rsvix: 99.5% correlation with VIX^2 (on monthly)
- ▶ See specific appendix.
- ▶ Does not outpredict, even IS, at statistically sig levels.
- ▶ Switch of Hypothesis:
  - ▶ asks not to reject "no prediction" with 95% assurance,
  - ▶ but to reject "prediction is ok" with 95% assurance,
  - ▶ (and even has difficulties here on some frequencies!!)

Noteworthy: Kelly Pruitt (2013)

- ▶ (PLS: IS T is meaningless **and** worse than random.)
  - ▶ resample, rerun for PLS T
- ▶ Predicts stock returns, not equity premia.
  - ▶ Disappears predicting stock returns minus inflation.
  - ▶ also disappears when predicting OOS earlier or later

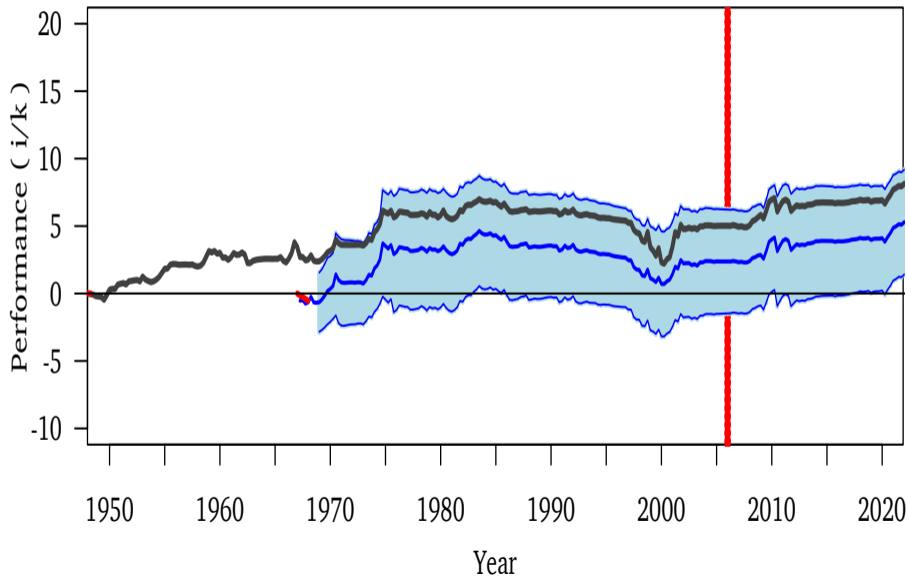# Noteworthy: Bollerslev, Tauchen, Zhou (2009)

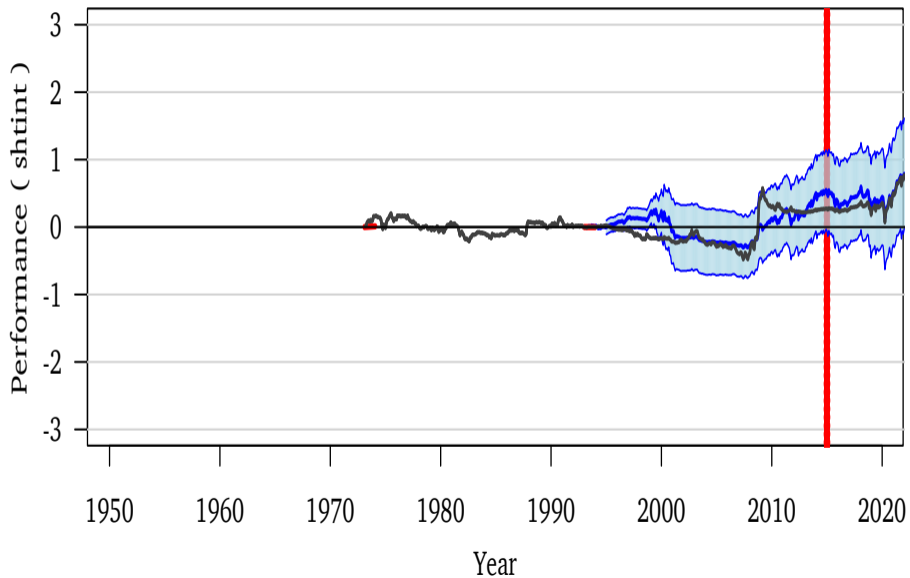▶ Most cited.
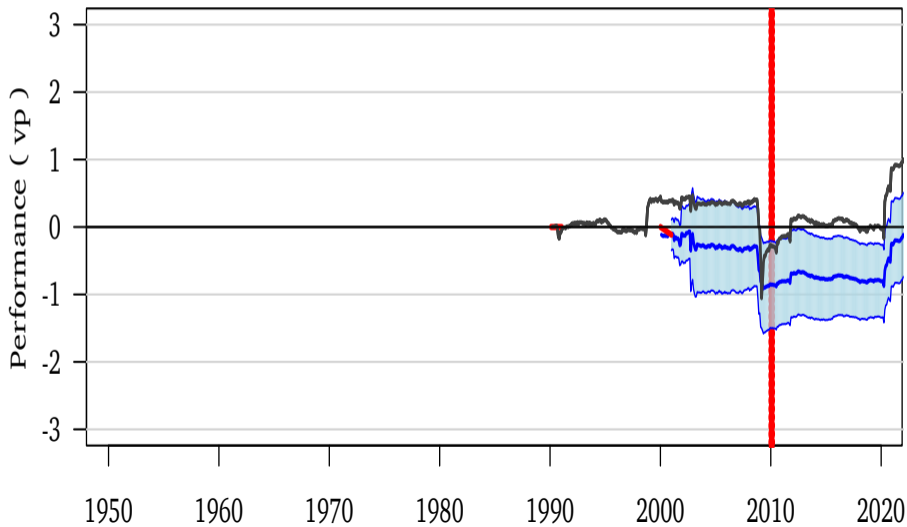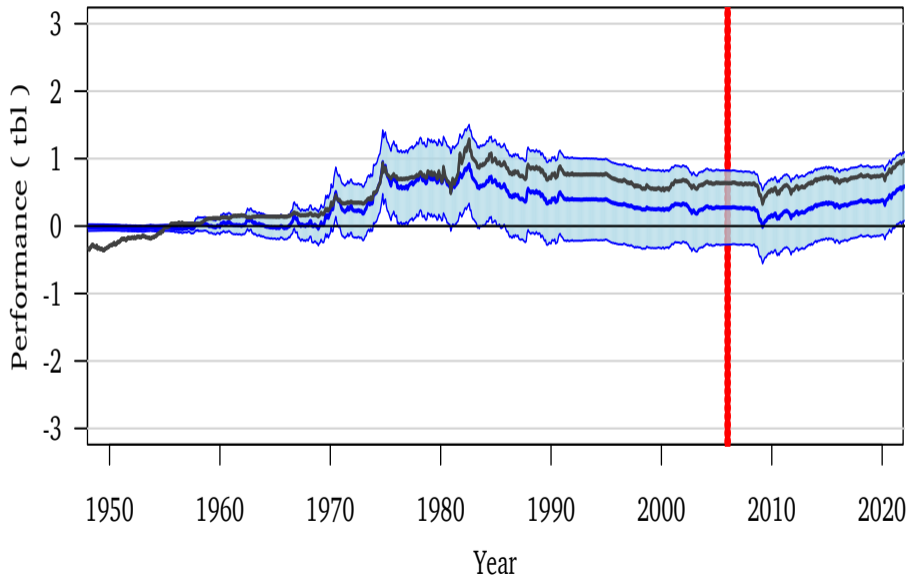
Noteworthy: HHT Accruals
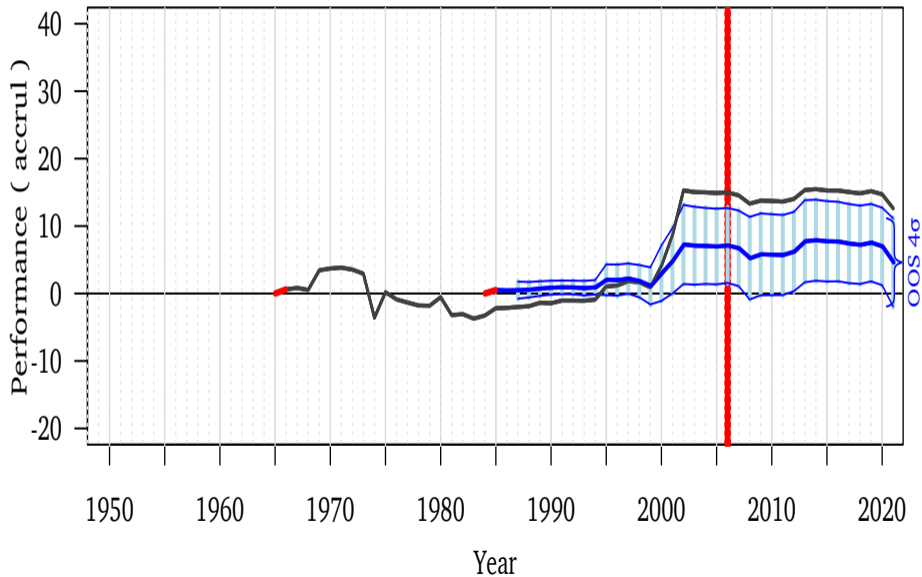
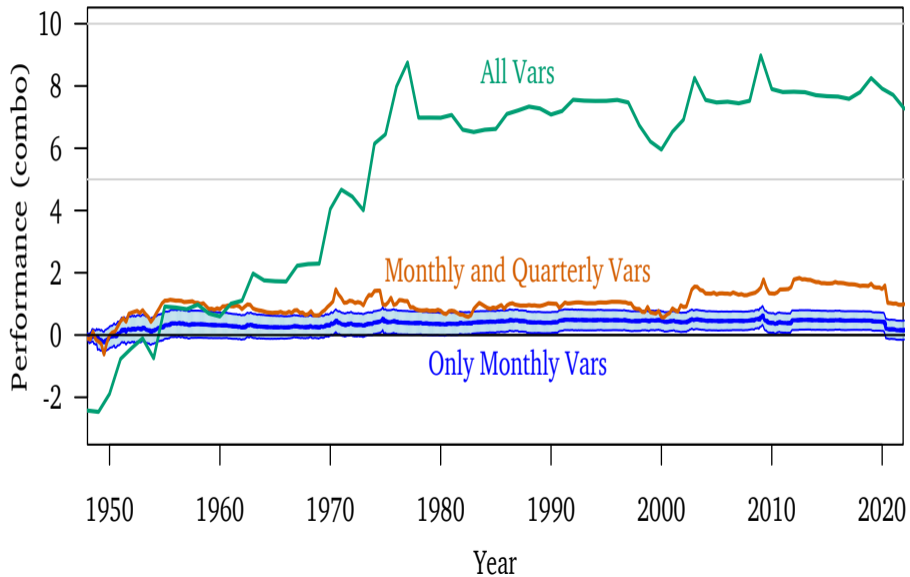Noteworthy: GPCE (Fourth Quarter)
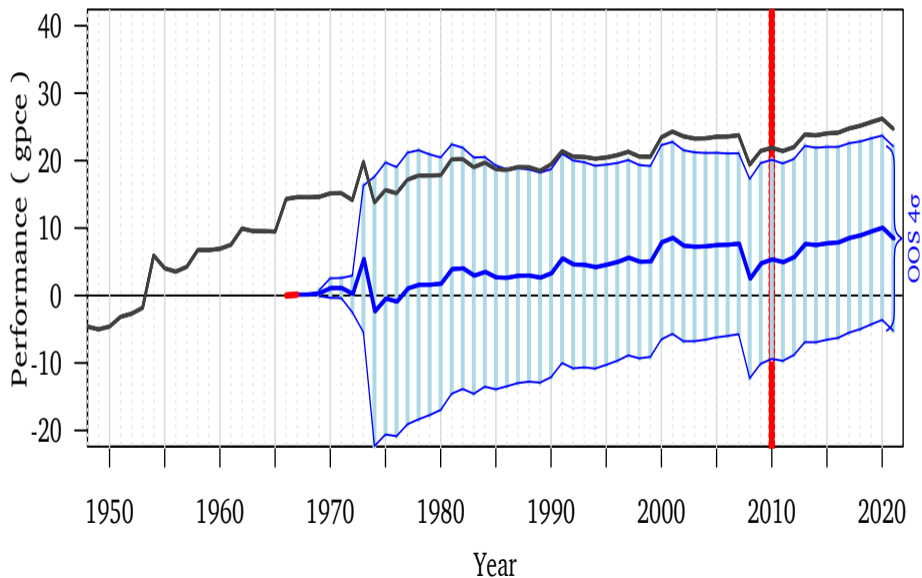
Noteworthy: I/K

Noteworthy: Short Stock Interest

Noteworthy: Interest Variables (TBY)

Consensus Predictors

Performance (combo) vs. Year

- All Vars
- Monthly and Quarterly Vars
- Only Monthly Vars

Summary

- 10 years later, including same data — not exactly a tough test
- Depending on your theory priors, our evidence is useful or useless.
- YMMV

- ▶ Theory is too flexible
    - ▶ has not done what we claimed we want it for: to provide meaningful constraints and more stable prediction.
    - ▶ behavioral often claims absurd ways to get rich
    - ▶ risk ones have not worked much, either
- ▶ My theory: how could I "beat" the market??
    - ▶ think small amount of your money into timing
    - ▶ 2023: I don't know what I can confidently recommend
    - ▶ (continue literature, but retest again.)