High Valuations and Low Growth

Low-Frequency Evidence in the Time Series and Cross Section

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Background

Almost 100% of asset pricing:

- ▶ Consumption, dividends, prices, wealth are non-stationary...

- ▶ ... but cash-flow *growth* Δc_t, Δd_t and returns r_t are stationary

- ▶ ... and prices and cash flows are cointegrated, so valuation ratios $(p_t - d_t, w_t - c_t)$ are stationary

- ▶ Then all questions are effectively about deviations from long-run means
  - ▶ E.g., risk premia $\Longleftrightarrow$ second moments, $\mathbb{E}[r_i - r_f] \leqslant -\text{Cov}(M, r_i - r_f)$

- ▶ Similar to (often overlapping with) the focus of business-cycle research

- ▶ Source of real controversy and debate in 1980s

- ▶ Since then, not much discussion (a little around tech bubble, not a ton since)

Background

Today:

- ▶ Does it make sense to revisit these issues?
- ▶ First-order questions (literally)
- ▶ Logically impossible to get dispositive evidence in either direction
- ▶ But still some interesting features of the data
- ▶ Will first present a bunch of basic empirical facts (some collected myself, some from other papers)
- ▶ Then: implications and questions arising within basic structural frameworks

Outline

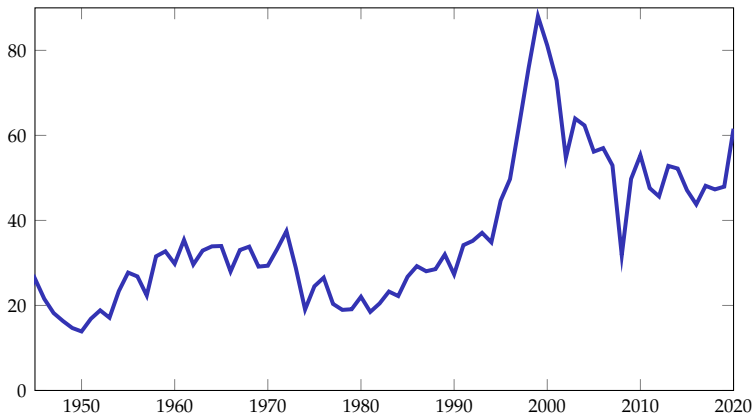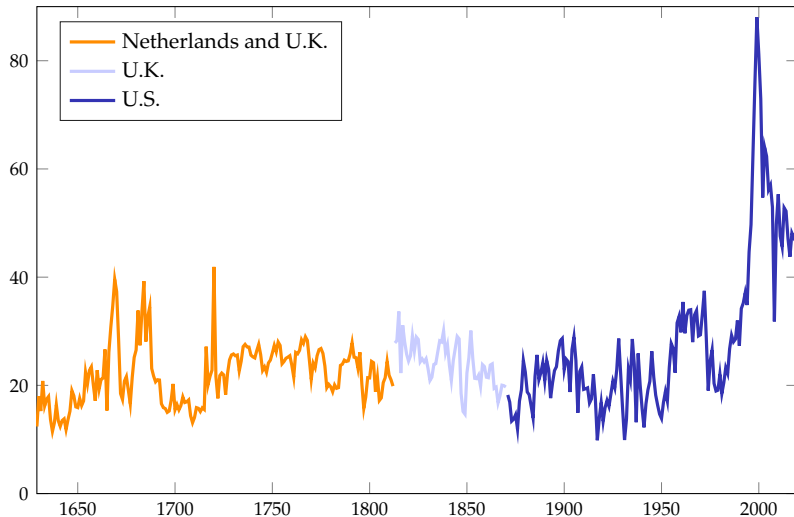# Long-Run Empirical Facts: Valuations

Price-Dividend Ratio
Annual, U.S. (CRSP)

Note: End-of-year market cap divided by total dividends for prior 12 months.

Long-Run Empirical Facts: Valuations
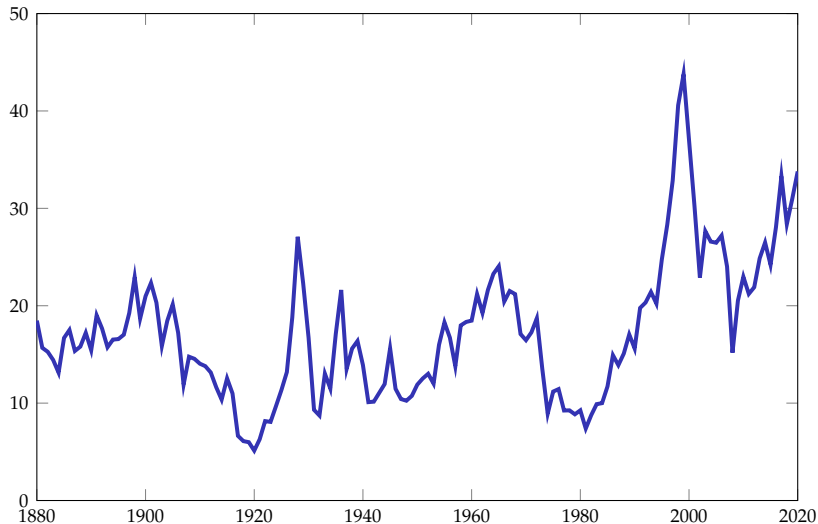

Price-Dividend Ratios

Source: Golez and Koudijs (2018), CRSP.

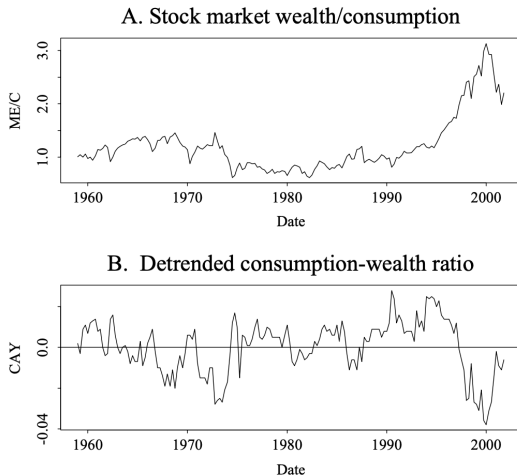# Long-Run Empirical Facts: Valuations

Price to 10-Year Earnings

Source: Robert Shiller. Figure shows real S&P 500 price to 10-year real earnings (CAPE).

Long-Run Empirical Facts: Valuations

Wealth-consumption ratio from Duffee (2005) *[series end 2001]*:

A. Stock market wealth/consumption

B. Detrended consumption-wealth ratio

Figure 2. Ratios of wealth to consumption. The top panel plots the ratio of the market capitalization of publicly traded stocks to total consumption on nondurables and services. The bottom panel plots the detrended consumption–wealth ratio introduced in Lettau and Ludvigson (2001).

Long-Run Empirical Facts: Yields

International evidence from Kuvshinov and Zimmermann (2020a) *[note ratio inverted relative to previous slides & includes real-estate valuations]*:

Figure 1: *The risky asset yield*
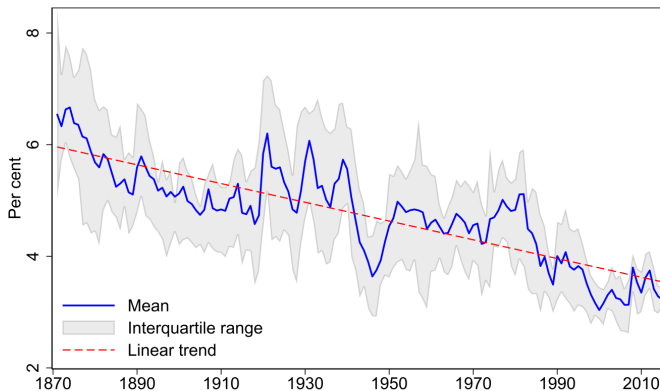
Notes: Data for 17 countries. The yield is the average of the dividend-price and rent-price ratios. The solid line and the shaded area are, respectively, the mean and interquartile range of the individual country data in each year. The dashed line represents the linear trend.

Long-Run Empirical Facts: Yields

Real rates from Schmelzing (2020):

Trend decline:

All-time (1317-): **-1.59bps p.a.**
Post Bullion famine (1494-): **-1.36bps p.a.**
North-Weingast (1694-): **-1.44bps p.a.**
Post-Napoleonic (1820-): **-2.29bps p.a.**

Legend:
— Global real rate, 7-Y MA
— North-Weingast global R slope (1694-)
— Linear (Global real rate, 7-Y MA)
— Post-Napoleonic global R slope (1820-)
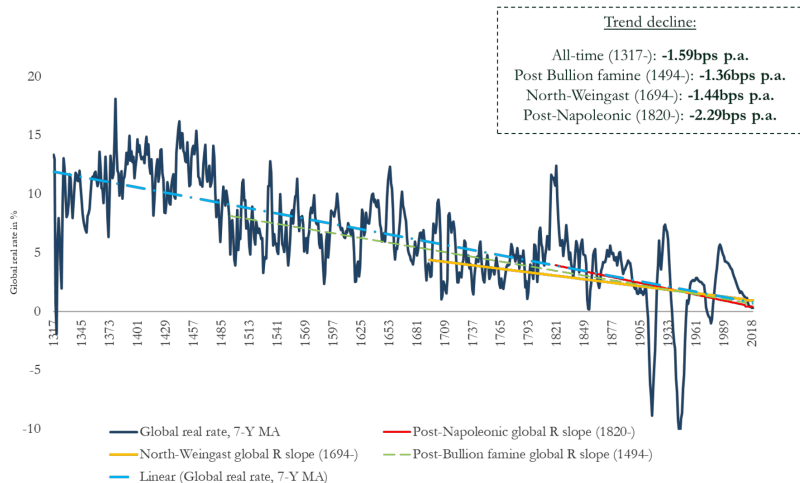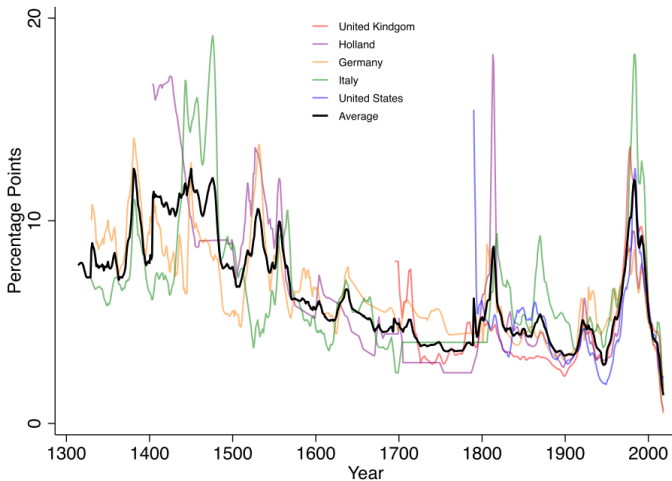--- Post-Bullion famine global R slope (1494-)

<u>Figure IV</u>: Headline global real rate, GDP-weighted, and trend declines, 1317-2018.

Long-Run Empirical Facts: Yields

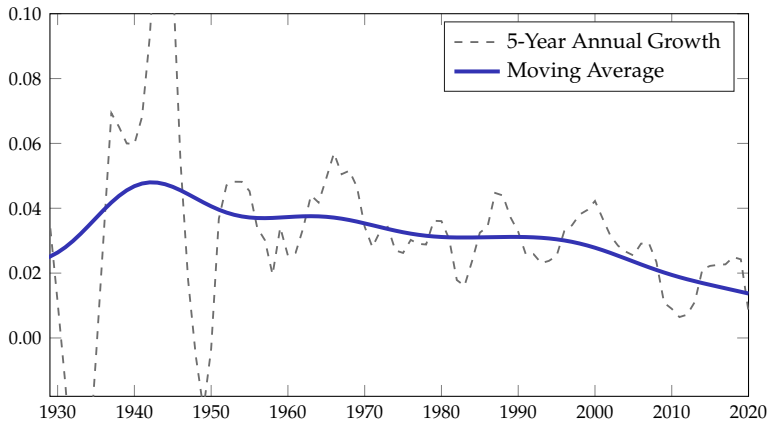**Nominal rates from Miller, Paron, and Wachter (2020) via Schmelzing:**

Figure 1: Nominal government rates

Long-Run Empirical Facts: Output & Cash Flows

U.S. Real GDP Growth

Notes: Moving average uses Gaussian kernel weights with 15-year bandwidth.
Both series calculated using BEA yearly log real GDP growth.

Long-Run Empirical Facts: Output & Cash Flows
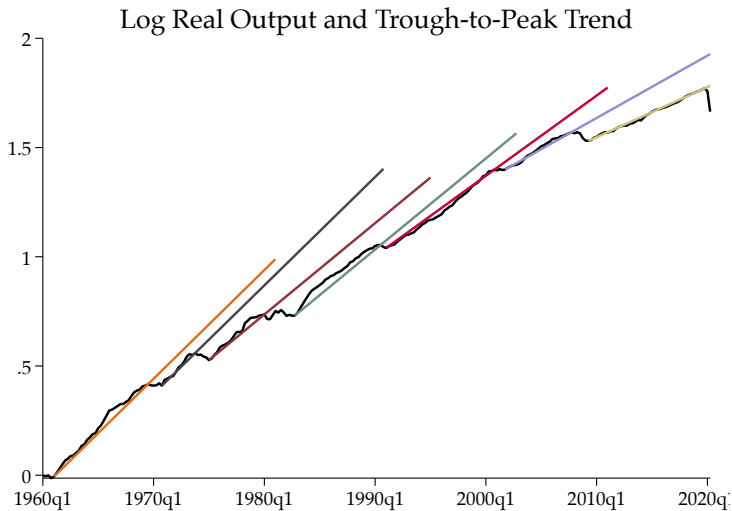

Log Real Output and Trough-to-Peak Trend

Long-Run Empirical Facts: Output & Cash Flows
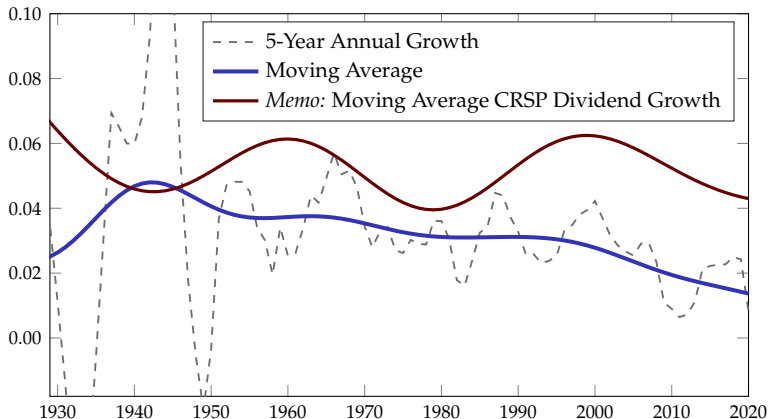
U.S. Real GDP and Dividend Growth

Notes: Moving average uses Gaussian kernel weights with 15-year bandwidth.
Both series calculated using BEA yearly log real GDP growth.

Long-Run Empirical Facts: Output & Cash Flows

Exhibit 8: Long-term real global GDP growth forecast is at a historical low
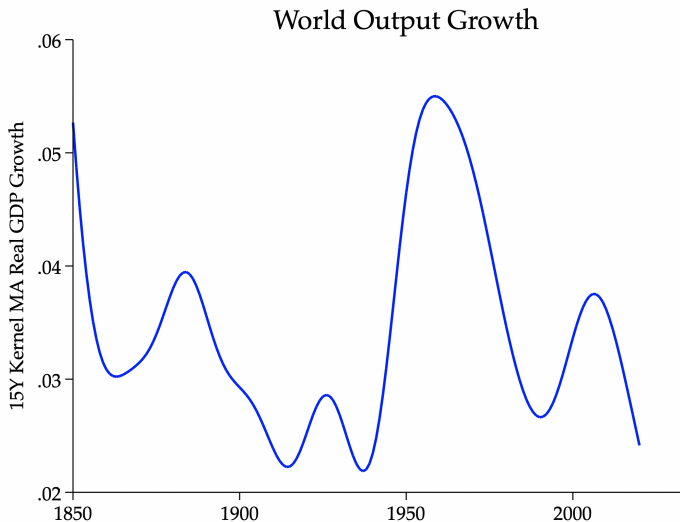Long-term (6-10y) GDP growth from Consensus Economics

Source: Consensus Economics, Goldman Sachs Global Investment Research

► Holds using aggregated IBES forecasts of long-term growth as well

Long-Run Empirical Facts: Output & Cash Flows

World Output Growth

Initial Takeaways

1. Valuations and cash-flow growth are moving in "wrong" direction relative to one another
   - And series fail standard stationarity tests at 5% level, for what it's worth
   - Some of the effect is compositional: listed firms are different now (more repurchases, higher profit share) than in the past
   - Will show more on this in a bit

2. Interest rates seem to be declining fairly steadily
   - Can't literally be trending down (or have neg. drift) over very long run

Next: What it means and how to make sense of it

- Time-series decompositions: Long-run vs. transitory components of valuation and cash flows
- Cross-sectional decompositions: Valuation changes within firm vs. reallocation across firms
- Implications

Complementary recent work: Greenwald, Lettau, Ludvigson (2021); van Binsbergen (2020); Farhi and Gourio (2018)

Outline

Time-Series Decomposition

Two cases:

1. Standard: Stationary growth and valuation
   - ▶ Log dividend growth $g_t = \Delta d_t$ and equity return r_t are stationary
   - ▶ Campbell-Shiller decomposition:

$$
\begin{aligned}
d_t - p_t \equiv dp_t &= k + \mathbb{E}_t \sum_{j=0}^{\infty} \rho^j [r_{t+1+j} - g_{t+1+j}] \\
&= \overline{dp} + \mathbb{E}_t \sum_{j=0}^{\infty} \rho^j [(r_{t+1+j} - \bar{r}) - (g_{t+1+j} - \bar{g})],
\end{aligned}
$$

where $\overline{dp} = \log\left(\frac{\exp\bar{r} - \exp\bar{g}}{\exp\bar{g}}\right) \implies \exp(\overline{dp}) \approx \bar{r} - \bar{g}$

Time-Series Decomposition

Two cases:

2. Alternative: Non-stationary growth and valuation

- Log dividend growth g_t, equity returns r_t have martingale components:

$$g_t = \overline{g}_t + \eta_{g,t}, \quad r_t = \overline{r}_t + \eta_{r,t},$$
$$\mathbb{E}_t[\overline{g}_{t+1} - \overline{g}_t] = \mathbb{E}_t[\overline{r}_{t+1} - \overline{r}_t] = 0 = \mathbb{E}_t[\eta_{g,t+1}] = \mathbb{E}_t[\eta_{r,t+1}]$$

- Modified decomposition based on Lettau and Van Nieuwerburgh (2008):

$$dp_t = \overline{dp}_t + \mathbb{E}_t \sum_{j=0}^{\infty} \rho^j [(r_{t+1+j} - \overline{r}_t) - (g_{t+1+j} - \overline{g}_t)],$$

where $\overline{dp}_t = \log\left(\frac{\exp \overline{r}_t - \exp \overline{g}_t}{\exp \overline{g}_t}\right) \implies \exp(\overline{dp}_t) \approx \overline{r}_t - \overline{g}_t$

- In fact a generalization of stationary case

Time-Series Decomposition

$$\exp(\overline{dp_t}) \approx \bar{r}_t - \bar{g}_t \tag{1}$$

$$dp_t - \overline{dp_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \rho^j [(r_{t+1+j} - \bar{r}_t) - (g_{t+1+j} - \bar{g}_t)] \tag{2}$$

1. Shifting steady states $\overline{dp_t}, \bar{r}_t, \bar{g}_t$: Measure using kernel-weighted average
   - ▶ Gaussian kernel ($\sim$ exponentially weighted moving average)
   - ▶ 15-year bandwidth (centered ± 7.5 years, truncated at each end, and then shifted to end of window)
   - ▶ Forecasting regressions for $\bar{r}_{t+15}, \bar{g}_{t+15}$ on $\overline{dp_t}$
2. Forecasting regressions for stationary components (relative to $\bar{r}_t, \bar{g}_t$)

Time-Series Decomposition: Results

$$\exp(\overline{dp_t}) \approx \bar{r}_t - \bar{g}_t \tag{1}$$

$$dp_t - \overline{dp_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \rho^j [(r_{t+1+j} - \bar{r}_t) - (g_{t+1+j} - \bar{g}_t)] \tag{2}$$

Forecasting Regressions: Returns and CRSP Dividend Growth

Regressions for:	$\bar{r}_{t+15}$	$\bar{g}_{t+15}$	$\sum_{j=0}^{15}[(r_{t+1+j} - \bar{r}_t)]$	$\sum_{j=0}^{15}[(g_{t+1+j} - \bar{g}_t)]$
$\exp(\overline{dp_t})$	0.70 (2.3)	**0.85** (3.1)		
$dp_t - \overline{dp_t}$			**1.38** (5.7)	-0.35 (-1.5)
R^2	0.16	0.25	0.03	0.19

Notes: Heteroskedasticity- and autocorrelation-robust *t*-statistics in parentheses, estimated via equal-weighted periodogram estimator using 6 periodogram ordinates [Lazarus, Lewis, Stock (2021)]. $N = 95$.

Holds as well using total payouts (incl. net repurchases), output growth, consumption growth

Time-Series Decomposition: Results

$$\exp(\overline{dp_t}) \approx \bar{r}_t - \bar{g}_t \qquad (1)$$

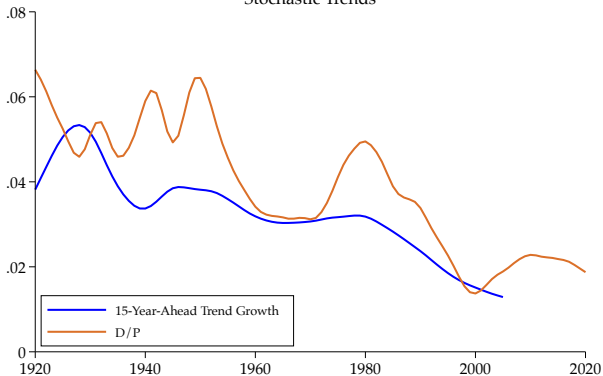$$dp_t - \overline{dp_t} = \mathbb{E}_t \sum_{j=0}^{\infty} \rho^j [(r_{t+1+j} - \bar{r}_t) - (g_{t+1+j} - \bar{g}_t)] \qquad (2)$$

Variance Decomposition for dp_t Components

Percent explained by:	Returns	Dividend Growth
Martingale	70	85
Deviation	138	-35

Time-Series Decomposition: Results

Future Output Growth and Dividend Yield
Stochastic Trends

Time-Series Decomposition: Implications

Helps explain failure of return forecasting regressions out of sample using dp_t [as pointed out by Lettau and Van Nieuwerburgh (2008)]:

- If dp_t keeps hitting historic lows, an out-of-sample forecasting model will keep telling you to expect negative equity returns if you're assuming stationarity

- Table from Goyal and Welch (2008):

Table 3
Forecasts at monthly frequency using Campbell and Thompson (2005) procedure
Refer to Table 1 for basic explanations. This table presents statistics on forecast errors in-sample (IS) and out-of-sample (OOS) for equity premium forecasts at the monthly frequency (both in the forecasting equation and forecast). Variables are explained in Section 2. The data period is December 1927 to December 2002, except for csp (May 1937 to December 2002) and cay3 (December 1951 to December 2004). Critical values for all statistics are obtained empirically from bootstrapped distributions, except for cay3 model where they are obtained from McCracken (2004). The resulting significance levels at 90%, 95%, and 99% are denoted by one, two, and three stars, respectively. They are two-sided for IS model significance, and one-sided for OOS superior model performance. The first data column is the IS $\overline{R}^2$ when returns are logged, as they are in our other tables. The remaining columns are based on predicting simple returns for correspondence with Campbell and Thompson (2005). Certainty Equivalence (CEV) gains are based on the utility of an optimizer with a risk-aversion coefficient of $\gamma = 3$ who trades based on unconditional forecast and conditional forecast. Equity positions are winsorized at 150% ($w = w_{max}$). At this risk-aversion, the base CEV are 82bp for a market-timer based on the unconditional forecast, 79bp for the market, and 40bp for the risk-free rate. "T" means "truncated" to avoid a negative equity premium prediction. "U" means unconditional, that is, to avoid a forecast that is based on a coefficient that is inverse to what the theory predicts. A superscript h denotes high trading turnover of about 10%/month more than the trading strategy based on unconditional forecasts.

		Log returns	Simple returns									
		IS $\overline{R}^2$	IS		OOS	Campbell and Thompson (2005) OOS						
	Variable		$\overline{R}^2$	$\overline{R}^2$ T	$\overline{R}^2$	Frcst= T	U	$\overline{R}^2$ TU	ΔRMSE TU	$w = w_{max}$	ΔCEV	Fig
d/e	Dividend payout ratio	0.02	−0.10	−0.10	−0.70	0.0	7.9	−0.69	−0.0114	57.7	−0.01	
svar	Stock variance	−0.09	−0.07	−0.07	−0.79	0.0	0.0	−0.79	−0.0134	35.4	−0.04	
dfr	Default return spread	−0.02	−0.07	−0.08	−0.37	0.0	20.9	−0.29	−0.0030	44.9	0.01	
lty	Long term yield	−0.03	0.02	0.02	−0.80	34.1	0.0	0.26^{**}	+0.0085	19.5	0.06	
ltr	Long term return	0.04	0.07	0.08	−0.63	3.0	38.2	0.11^{**}	+0.0053	51.2^{h}	0.05	
infl	Inflation	−0.01	0.14	−0.05	0.01^{*}	1.3	0.0	0.07^{**}	+0.0045	43.5^{h}	0.04	
tms	Term spread	0.12	0.18	0.20	0.22^{**}	3.7	0.0	0.21^{**}	+0.0073	59.3	0.14	F3.G
tbl	Treasury-bill rate	0.10	0.20^{*}	0.15	$−0.08^{*}$	23.1	0.0	0.25^{**}	+0.0081	16.4	0.10	F3.F
dfy	Default yield spread	−0.06	0.28^{*}	0.28	−0.56	4.0	0.0	−0.49	−0.0071	27.3	−0.08	
d/p	Dividend price ratio	0.12	0.33^{*}	0.29	−0.30	32.3	0.0	0.17^{*}	+0.0066	16.1	−0.10	F3.E
d/y	Dividend yield	0.22^{*}	0.47^{**}	0.45	−1.12	54.2	0.0	$−0.04^{*}$	+0.0023	16.4	−0.14	
e/p	Earning price ratio	0.51^{**}	0.54^{**}	0.45	−1.04	18.1	0.0	−1.03	−0.0183	34.4	−0.04	
eqis	Pct equity issuing	0.82^{***}	0.80^{***}	0.59	0.14^{**}	6.7	0.0	0.30^{***}	+0.0093	55.8	0.14	F3.D
b/m	Book to market	0.45^{**}	0.81^{***}	0.88	−3.28	44.3	0.0	−2.23	−0.0432	31.3	−0.22	
e^{10}/p	Earning(10Y) price ratio	0.46^{**}	0.86^{***}	0.96	−2.21	52.4	0.0	−0.48	−0.0071	15.4	−0.13	
csp	Cross-sectional prem	0.92^{***}	0.99^{***}	0.93	−0.94	44.7	0.0	0.15^{**}	+0.0072	13.5	0.06	F3.B
ntis	Net equity issuing	0.94^{***}	1.02^{***}	0.88	−0.16	0.4	0.0	−0.16	−0.0003	57.4	0.02	F3.C
cay3	Cnsmptn, wlth, incme	1.88^{***}	1.87^{***}	1.57	−2.05	44.7	0.0	$−0.34^{*}$	+0.0088	13.2	0.06	F3.A

Implications

As a thought exercise:

- ▶ Assume conditional log-normality & homoskedasticity, Epstein-Zin preferences, but declining consumption growth:

$$c_t - w_t = const_t + \mathbb{E}_t \sum_{j=0}^{\infty} \rho_{t+j}(r_{t+1+j} - \Delta c_{t+1+j})$$

$$= const_t + \left(1 - \frac{1}{\psi}\right) \mathbb{E}_t \underbrace{\sum_{j=0}^{\infty} \rho_{t+j} \Delta c_{t+1+j}}_{\text{long-run growth}}$$

- ▶ Declining long-run growth increases valuations (decreases $c_t - w_t$) iff $\psi = \text{IES} < 1$

- ▶ Then discount rates more than offset declining growth (and equity market duration significantly lengthens, as it has in the data)
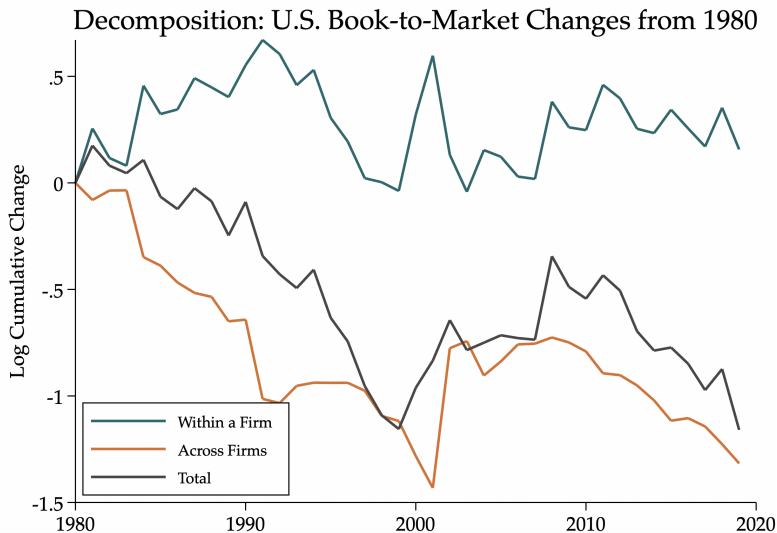
Cross-Sectional Decomposition

Is the story plausible?

▶ In aggregate, can have discount rate effect overwhelm (negative) growth effect in GE

▶ But what about for a single firm?

▶ Consider book to market, since some firms pay no dividends (aggregate decline in log book-to-market of about 2.5% per year since 1980)

▶ Decompose aggregate book-to-market changes into within-vs.-across firm. Roughly, for aggregate book to market θ_t, firm shares $\{\sigma_{j,t}\}$:
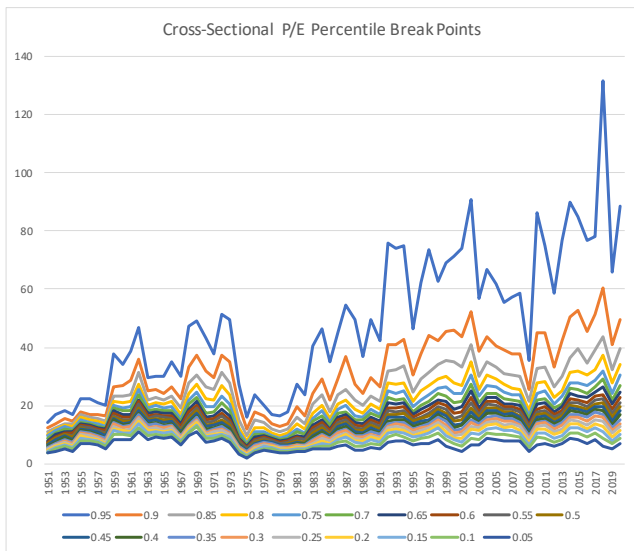
$$\Delta\theta_{t+1} = \sum_{j=1}^{n}(\theta_{j,t+1} - \theta_{j,t})\sigma_{j,t+1} + \sum_{j=1}^{n}(\sigma_{j,t+1} - \sigma_{j,t})\theta_{j,t}$$

▶ Using CRSP/Compustat data: Within (first term): $+0.2\%$/yr since 1981. Across: -3.6%! (Small remainder is entry/exit)

▶ So the entire increase in valuations (decline in B/M) can be explained in the cross-section with a compositional change from low- to high-valuation firms, but the average firm has a stable B/M! Market was GM, now is Tesla
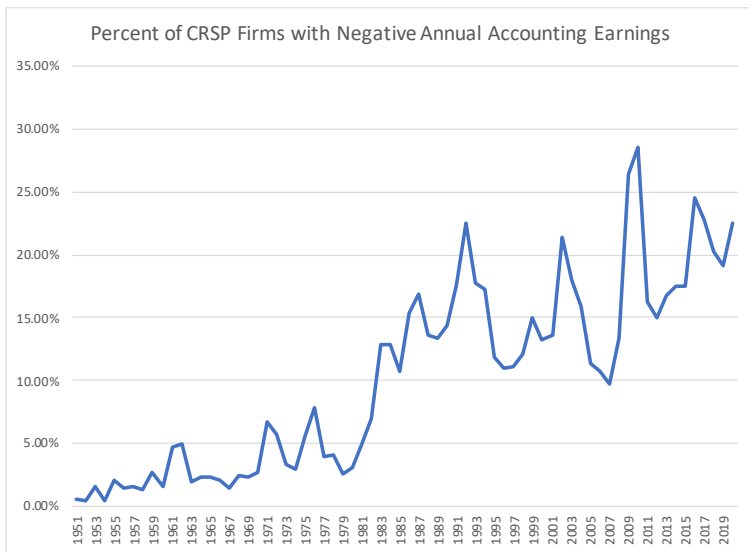
Cross-Sectional Decomposition

Decomposition: U.S. Book-to-Market Changes from 1980

Cross-Sectional Decomposition: More Evidence

Cross-Sectional P/E Percentile Break Points

Cross-Sectional Decomposition: More Evidence

Percent of CRSP Firms with Negative Annual Accounting Earnings

Next: Model

Want to consider a disaggregated model where:

1. The composition of public equity is changing over time
   - ▶ The average firm is now a long-duration firm: high intangibles, high markups

2. Offsetting effects: shift to these higher-productivity firms increases growth all else equal...

3. but the shift is spurred by a decline in firm-level productivity growth, whose effect is bigger than the reallocation effect
   - ▶ Alternative view: increasing appropriability of growth options by long-duration firms (which then further drags down g), . . .

Outline

Additional Implications and Final Thoughts

- ► Slight *decline* in within-firm valuation ratio implies (a) lower within-firm growth prospects or (b) higher expected returns
  - ► Either way, suggests aggregate equity valuations have increased *less* than expected given decline in interest rates
  - ► In line with evidence presented in van Binsbergen (2020): Equity has underperformed relative to duration-matched fixed income

- ► Additional evidence: Greenwald, Lettau, Ludvigson (2021) estimate that a big portion of the increase in valuations is from reallocation of output from workers to capital owners
  - ► Further lines up nicely with evidence here if there's been a reallocation from high- to low-labor-share firms. . .which there has, as Vincent and Kehrig (2021) show (and within-establishment change is again actually positive)

- ► A ton to be done
  - ► Questions are really fundamental: Smith, Marx, Ricardo argued over long-run growth declines & implications