Interest Rates and Equity Valuations

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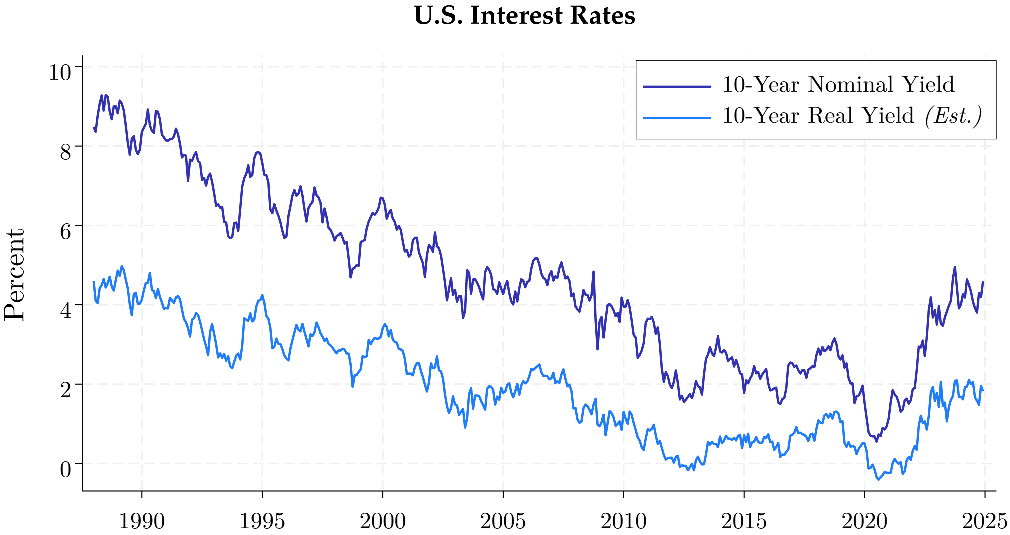
Well-Known Trends: Declining Interest Rates...



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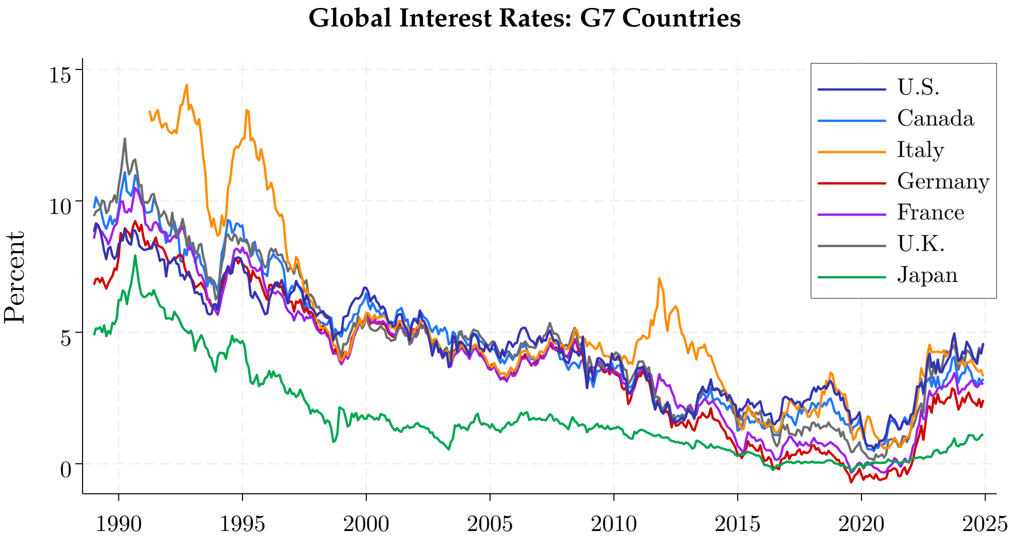
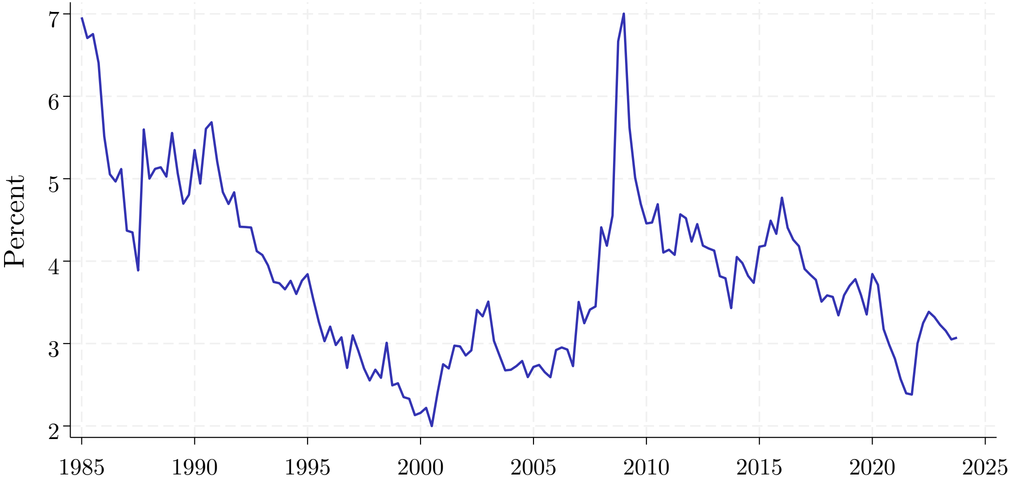


. . .and Increasing Domestic Stock Valuations

U.S. Value-Weighted Equity Earnings Yield (E/P)

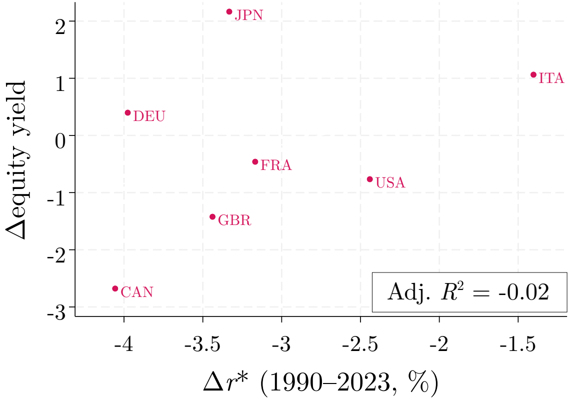


How Do Interest Rates Affect Equities?

Tempting line of reasoning:

$$\text{interest rates} \searrow \implies \text{discount rates} \searrow \implies \text{equity prices} \nearrow$$

. . . **but empirically, interest rates and equity valuations are often disconnected:**



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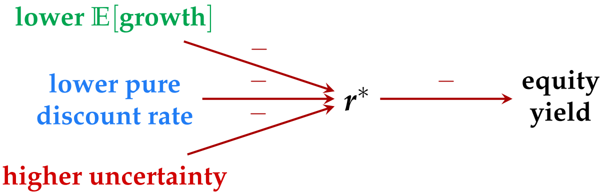
Stock–yield disconnect arises because interest rates are endogenous:



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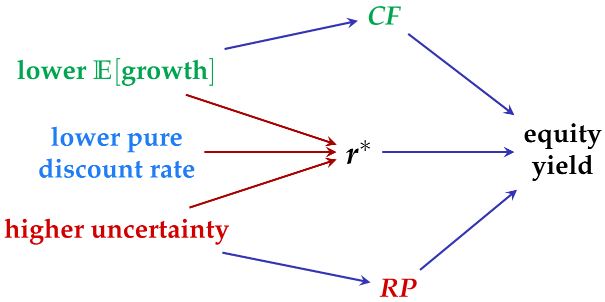

Bonds and stocks move 1-for-1 <u>only under</u> (ii). Weaker/neg. comovement for (i) & (iii).

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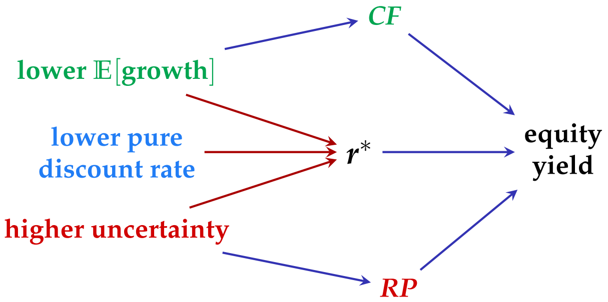
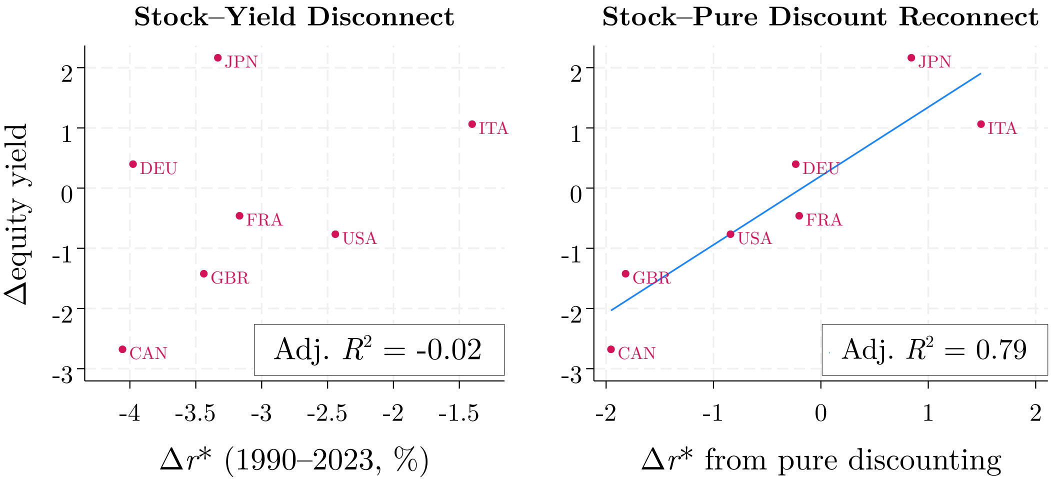


Our goal: Decompose Δr^* to estimate pass-through & importance of each component to equity.

Main Results: Long-Term Decomposition



Implications for a Range of Literature

1. The impact of falling rates on wealth accumulation & ineq. [Catherine et al. 2023, Greenwald et al. 2023]
   - In U.S., only 35% of the decline in interest rates has passed through to stock prices
   - Assuming full pass-through overstates impact

2. Duration-matched equity premia [van Binsbergen 2024; Andrews & Gonçalves 2020]
   - Sizable equity premium relative to pure discount-rate claim (more precise meas. of ex ante RP)

3. Duration in the cross-section of stock returns [Gormsen & Lazarus 2023, Moskowitz & Maloney 2021
   - Pure discount-rate exposure reveals substantial cross-sectional differences in duration

4. In paper: Unpacking monetary policy shocks, effects of changing profit shares, and more

Roadmap

1. Introduction
2. Theoretical Decomposition
3. Empirical Implementation
4. Additional Implications
5. Final Notes

Decomposition for Interest-Rate Changes

- **Goal:** Decomposition of changes in trend long-term real rate r^*
- **Stochastic discount factor** $M_{t+1} \Longrightarrow$ gross risk-free rate $R^f_{t+1} = 1/\mathbb{E}_t[M_{t+1}]$. Logs:

$$r^f_{t+1} = -\mathbb{E}_t[m_{t+1}] - \underbrace{L_t(M_{t+1})}_{\substack{\text{SDF entropy} \\ \log \mathbb{E}_t[M_{t+1}] - \mathbb{E}_t[m_{t+1}]}}$$

- **Consumption-based benchmark:** CRRA γ, discount factor $\beta_t = e^{-\rho_t}$, log growth $g_{t+1} = c_{t+1} - c_t$

$$r^f_{t+1} = \underbrace{\rho_t}_{\text{time preference}} + \underbrace{\gamma \mathbb{E}_t[g_{t+1}]}_{\text{expected growth}} - \underbrace{L_t(M_{t+1})}_{\substack{\text{uncertainty/prec. savings} \\ = \frac{\gamma^2}{2}\sigma^2 \text{ if lognormal}}}$$

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- **Consumption-based benchmark:** CRRA γ, discount factor $\beta_t = e^{-\rho_t}$, log growth $g_{t+1} = c_{t+1} - c_t$

$$\begin{aligned} r^f_{t+1} &= \rho_t + \gamma\mathbb{E}_t[g_{t+1}] - L_t(M_{t+1}) \\ r^* &= \rho^* + \gamma g^* - L^*_M \end{aligned}$$

- **Interpretation:** Δr^* reflects changes in (i) time preference (pure discounting), (ii) growth, or (iii) risk
- **Less restrictive:** Additive decomposition for log SDF [Hansen 2012] $\Longrightarrow$ **general analogue holds**

$$r^f_{t+1} = \underbrace{\rho_t}_{\text{predetermined trend}} + \underbrace{\mathbb{E}_t[f(X_{t+1}) - f(X_t)]}_{\text{diff. for Markov } X} - \underbrace{L_t(M_{t+1})}_{\text{uncertainty/prec. savings}}$$

Implications for Equity Prices

- **Equity:** Levered claim to consumption, $d_t = \lambda c_t$ [robustness: $d_t \not\propto c_t$], risk prem. $rp_t \equiv \mathbb{E}_t[r^{\text{mkt}}_{t+1}] - r^f_{t+1}$

- **Steady state for equity dividend yield** $ey^* \equiv \log(1 + (D/P)^*)$**:**

$$ey^* = r^* + \underbrace{rp^*}_{L^*_M - L^*_{MR}} - \lambda g^*$$

- Holds to 1st order $\forall t$ if ey_t is (i) random walk or (ii) stationary [using Campbell-Shiller sums]

- $\frac{\partial ey^*}{\partial r^*}$ has no structural interpretation; **instead, want ∂ey^* for each of the three terms in r^***

Real Rates and Equity Valuations

Result 1

Real rate:

$$r^* = \rho^* + \gamma g^* - L_M^*$$

Equity yield:

$$\begin{aligned} ey^* &= r^* + rp^* - \lambda g^* \\ &= \rho^* + (\gamma - \lambda) g^* + (rp^* - L_M^*) \end{aligned}$$

Implications:

- **Only change in pure discount rate ρ^* generates 1-for-1 comovement in r^* and equity yields ey^***
- For **growth** and **risk** shocks, offsetting components give weaker or negative passthrough ("impure" discount rate shocks)

Implications for Equity Duration

- **Equity duration $\mathcal{D}$:** Defined as the value-weighted time to maturity of expected cash flows
- Often referred to as relevant for measuring interest-rate sensitivity of equity...but care is needed
- **Real rate:** $r^* = \rho^* + \gamma g^* - L_M^*$

Result 2 (*Three Interest-Rate Sensitivities*)

Duration is equal to the interest-rate sensitivity of stock prices w.r.t. pure discount-rate shocks, but not w.r.t. growth shocks or risk shocks:

$$\text{(i)} \quad -\frac{\partial \log P}{\partial \rho^*} = \mathcal{D}, \qquad \text{(ii)} \quad -\frac{\partial \log P}{\partial (\gamma g^*)} < \mathcal{D}, \qquad \text{(iii)} \quad -\frac{\partial \log P}{\partial (-L_M^*)} < \mathcal{D},$$

with exact expressions provided in the paper.

Only a change in r^* induced by ρ^* moves equities in line with duration.

Roadmap

1. Introduction
2. Theoretical Decomposition
3. Empirical Implementation
    - Measurement
    - Secular Trends
    - Higher-Frequency Changes & Forecasting
4. Additional Implications
5. Final Notes

Measurement Strategy

For each date & country, want to decompose trend real rate into components:

$$r^* = \underbrace{\rho^*}_{\text{pure disc.}} + \underbrace{\gamma g^*}_{\text{growth}} - \underbrace{L_M^*}_{\text{risk}}$$

We'll measure r^*, g^*, and L_M^* directly from surveys & options data, then back out ρ^*.

Measurement Strategy

For each date & country, want to decompose trend real rate into components:

$$r^* = \underbrace{\rho^*}_{\text{pure disc.}} + \underbrace{\gamma g^*}_{\text{growth}} - \underbrace{L_M^*}_{\text{risk}}$$

- **Survey data:** Consensus Economics long-term forecasts [1990–2023, 2-4x/yr, 20-30 forecasters per country]
  - r^*: 5-year-ahead forecast of 10-year bond yield − forecast of inflation
  - g^*: 5-year-ahead forecast of real output growth
  - **Key features:**
    - (i) Long-hor. *forward* forecasts remove cyclical variation that affects short-hor. forecasts
    - (ii) Data available in panel of countries
    - (iii) Lower volatility and predictable mean-reversion than, e.g., SPF or IBES data

- **Options data:** Global panel of index options from OptionMetrics
  - L_M^*: proxy using VIX^2 *($L_M^* \propto VIX^2$ under set of assumptions)*
  - Calculate 6-month VIX^2 using option prices

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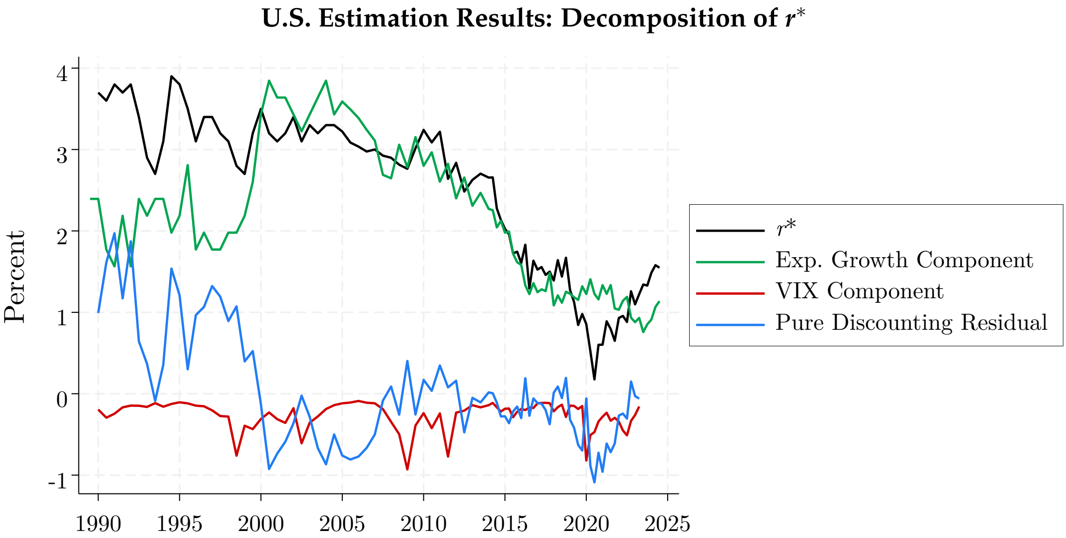
- **Options data:** Global panel of index options from OptionMetrics
  - L_M^*: proxy using 6-month VIX^2, calculated from option prices
- ρ^***: Back out as residual from panel regression (quarter t, country j):**

$$r^*_{t,j} = \gamma g^*_{t,j} + \beta_j \text{VIX}^2_{t,j} + \underbrace{\text{Constant} + \text{FE}_j + \varepsilon_{t,j}}_{\rho^*_{t,j}}$$

$$[\hat{\gamma} = 2.1^{***}, \overline{\hat{\beta}_j} = -4.0^{**}, \text{Within } R^2 = 0.61]$$

Time-Series Decomposition Results



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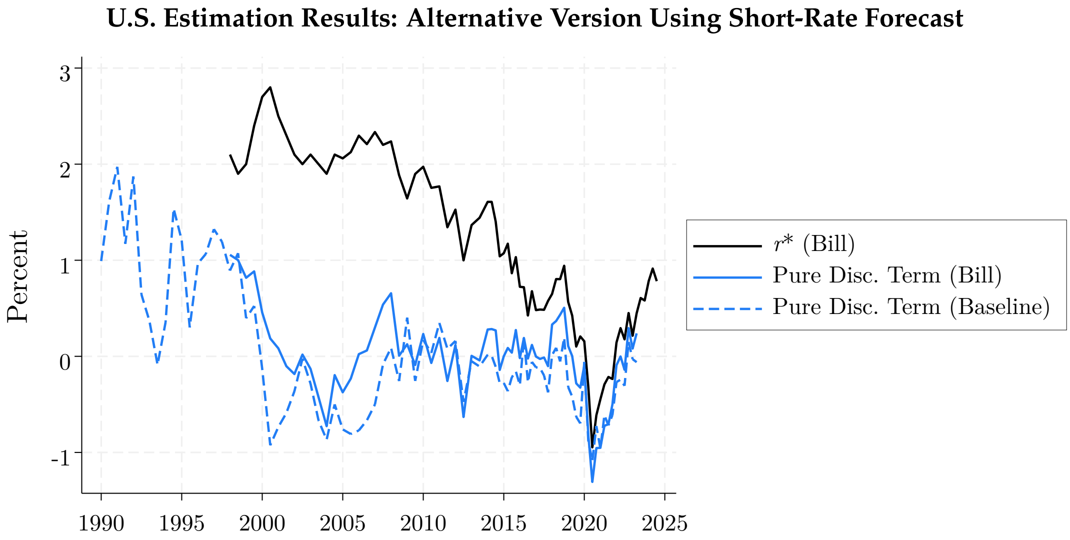

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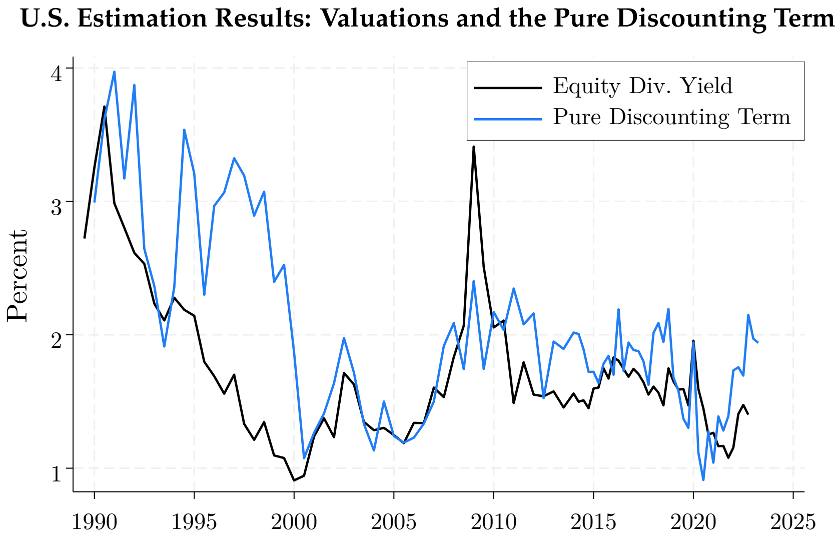
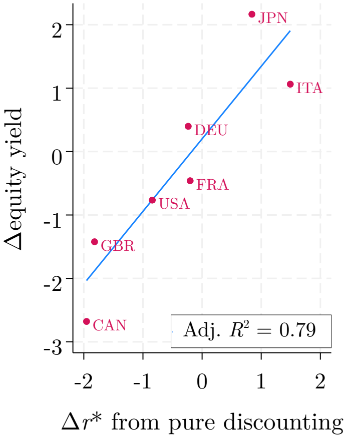


Main Results: Full-Sample Decomposition



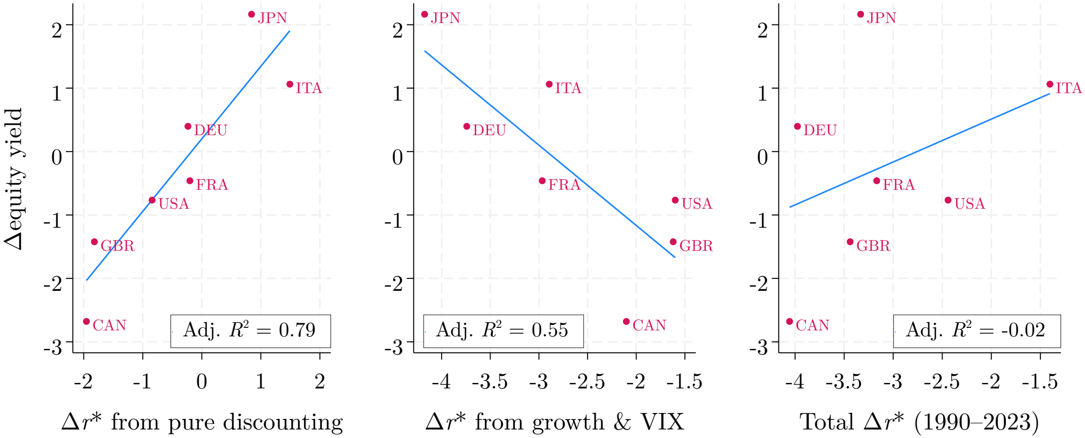
Strikingly good fit!

- As theory predicts, valuations move 1:1 with $\Delta\widehat{\rho}^*$
- **Further:** Intercept of 0, corr. near 1 *(recall ey^* not used to get $\widehat{\rho}^*$!)*

$\Longrightarrow$ to understand long-run valuations, $\Delta\widehat{\rho}^*$ is nearly sufficient

- Natural Q: What drives pure discount-rate changes?
  - Time pref. shocks: **unlikely**
  - More later, but important question going forward

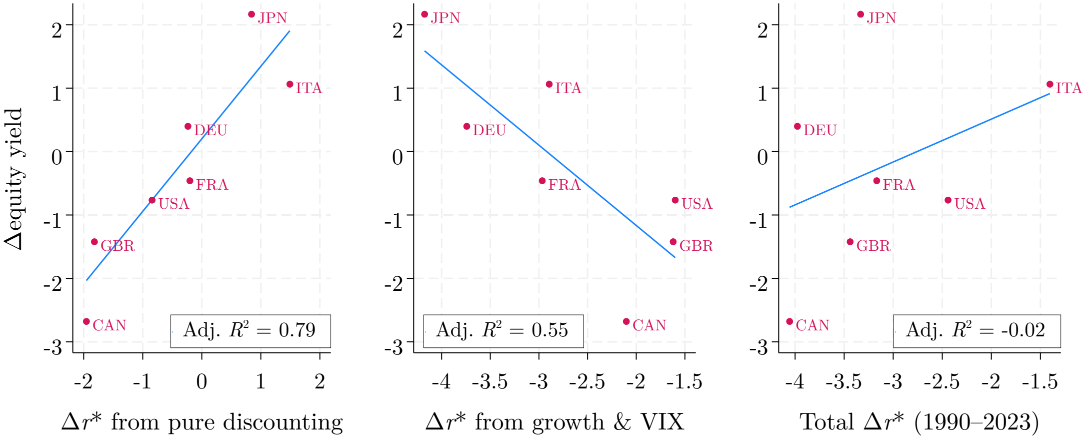
Main Results: Full-Sample Decomposition



Equity moves negatively with remaining predicted yield ("impure" discounting)

$\Longrightarrow$ overall weak relationship. **Yield changes do not in general transmit to risky assets.**

Main Results: Full-Sample Decomposition



Equity moves negatively with other terms $\Longrightarrow$ yield changes do not in general transmit to equity.

U.S.: Transmission of Δr^* to equity has only been $\Delta\rho^* / \Delta r^* = \frac{-0.9}{-2.5} \approx$ **35%**.

Rate Sensitivities and Equity Duration

Regressions for Three-Year Stock Returns

	(1) U.S.	(2) U.S.	(3) All	(4) All
Δ10y yield	4.19		-3.39	
	(3.51)		(2.20)	
Δpure discount ($\widehat{\Delta\rho_t^*}$)		-19.1**		-9.61**
		(7.64)		(3.26)
Δexp. growth		-1.49		16.9*
		(14.0)		(8.82)
$\Delta\text{VIX}^2 \times 100$		-3.08**		-5.44***
		(1.33)		(0.90)
Country FEs	✗	✗	✓	✓
Obs.	74	74	781	781
R^2	0.04	0.20	0.05	0.27
Within R^2	—	—	0.02	0.24

All changes contemporaneous. SE: (1)-(2) block bootstrap, (3)-(4) clustered by j & t.

- Weak yield exposure *except* for ρ^* shocks, exactly in line with theory
- **Duration:** $-\frac{\partial \log P}{\partial \rho^*} \approx 19\text{y}$ for U.S.

  [lower bound given meas. uncertainty in $\widehat{\Delta\rho_t^*}$]

$\Rightarrow$ Measurement also works at higher freq.

- In paper: ρ^* strongly predicts **future** ret.

Robustness to Alternative Measurement Approaches

Results are robust under a range of approaches:

1. **Alternatives to Consensus survey data:** Using SPF to measure g^* & r^* in U.S.
   - Same secular change in pure discounting term ($\Delta\widehat{\rho}^* \sim -1\%$ in the U.S.)
   - Somewhat weaker fit in time series, consistent with less precise measurement
2. **Alternatives to VIX^2 for uncertainty:** Estimating uncertainty via GARCH or using uncertainty index
   - Uncertainty matters mostly for higher-frequency variation
   - No impact on main results; slightly higher estimated market duration
3. **Accounting for time-varying profit shares:**
   - Easy to generalize to allow for changing profit shares & output growth $\not\propto$ dividend growth
   - We see expected profit growth in U.S. Consensus data, or can use IBES LTG; neither affects results

Robustness: Alternative data, time-varying profit shares

Roadmap

1. Introduction

2. Theoretical Decomposition

3. Empirical Implementation

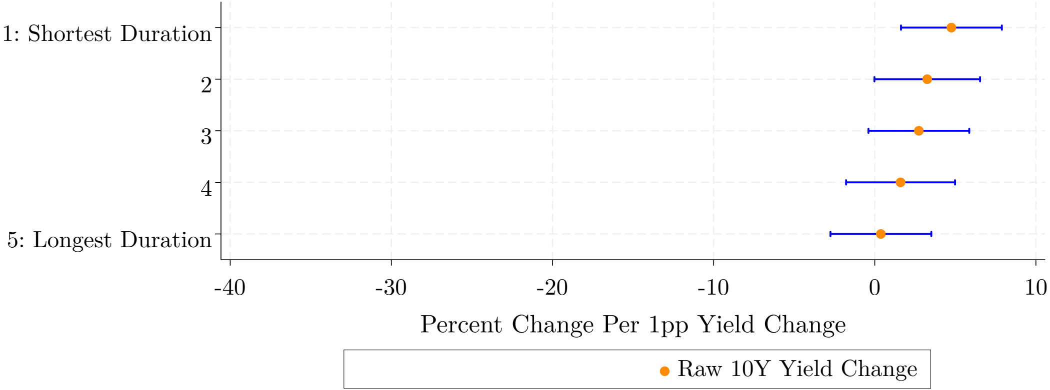
4. Additional Implications
   - Cross-Sectional Portfolios
   - A Significant Duration-Matched Equity Premium

5. Final Notes

Cross-Sectional Evidence: Duration-Sorted Portfolios

Portfolio Exposures to Unadjusted Yield Changes

[U.S. duration-sorted portfolios via Gormsen & Lazarus 2023, based on predicted LTG]



- Long-duration portfolios are not substantially more exposed to raw interest-rate changes…

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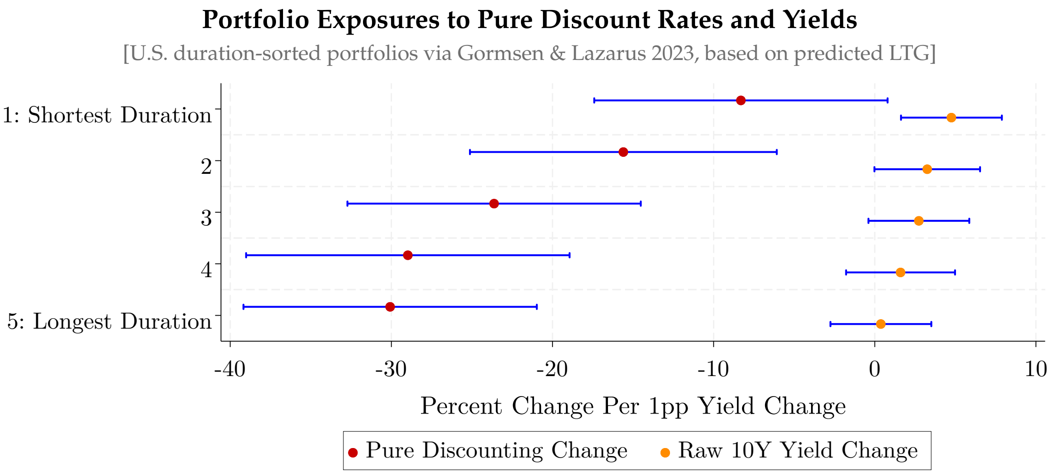
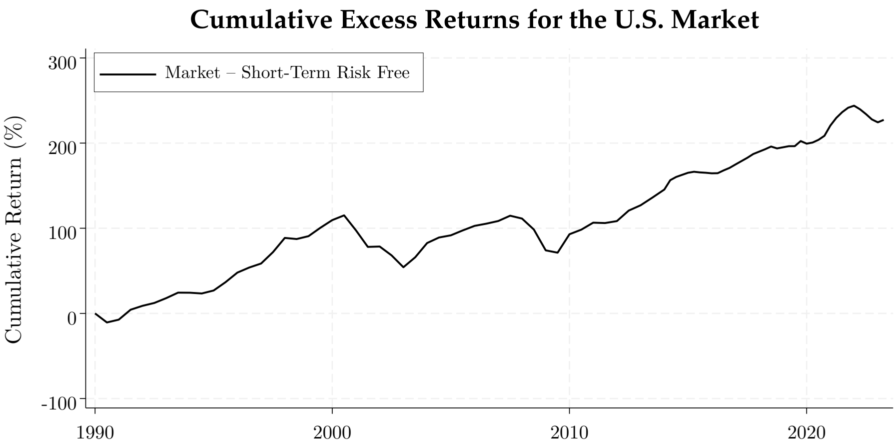


- Long-duration portfolios are not substantially more exposed to raw interest-rate changes…
- …**but they're substantially more exposed to ρ^* shocks, implying large duration spread**

A Significant Duration-Matched Equity Premium



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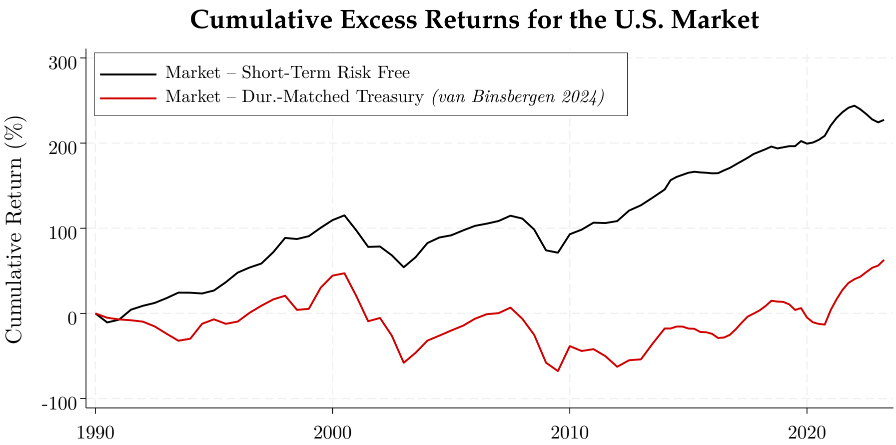
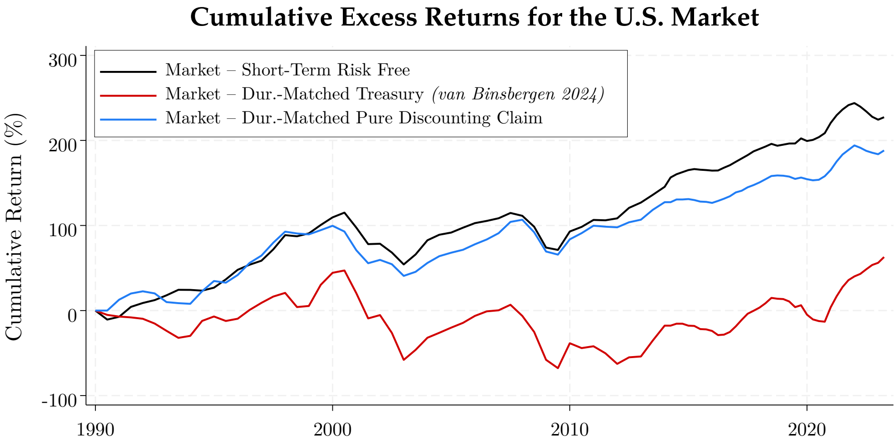


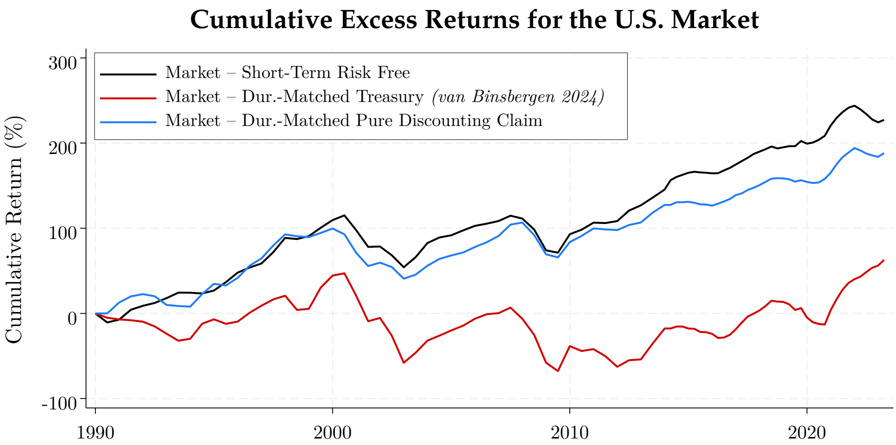
- Long-term nominal bonds have had high returns $\rightarrow$ low apparent duration-matched premium
- But long-term bonds differentially exposed to growth & risk, so we consider new counterfactual
- Construct **maturity-matched** ($\mathcal{D} = 19$y) **pure discounting claim** that appreciates when $\rho^* \searrow$

A Significant Duration-Matched Equity Premium



- Long-term nominal bonds have had high returns → low apparent duration-matched premium
- Construct **maturity-matched** ($\mathcal{D} = 19$y) **pure discounting claim** that appreciates when $\rho^* \searrow$
- Market has **6.1%** ann. excess return relative to this claim: cleaner measure of ex ante premium

A Significant Duration-Matched Equity Premium



Additional empirical implications:

Rates & the declining value premium

Unpacking monetary policy shocks

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Final Notes

New framework & measurement tools to decompose changes in rates into underlying drivers.

Two interpretations:

1. **Glass half empty: Rate changes matter less for stocks than one might think.**
   - Rate changes transmit only partly to stocks *(U.S.: 35%)*; assuming full transmission may be misleading

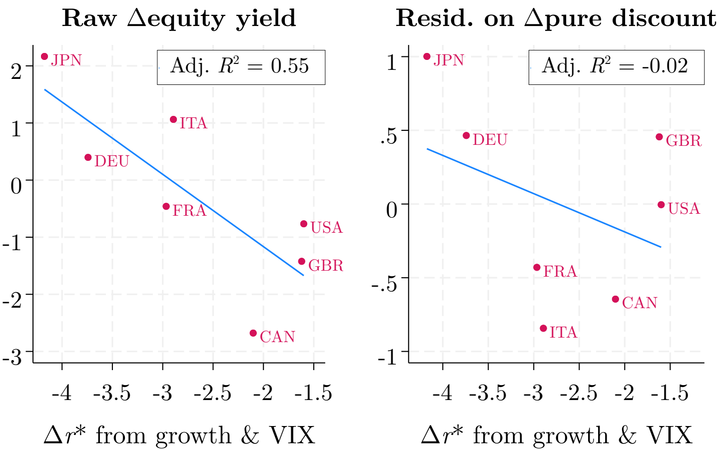
2. **Glass half full: Transmission is quite strong, once you isolate the right component.**
   - Δpure discounting component of rates $\overset{\sim}{\Longleftrightarrow}$ Δvaluations
   - Understanding drivers of ρ^* goes a long way to understanding secular valuation changes

Natural next question: What explains ρ^* changes?

- **In paper:** Net capital flows, MP shocks as drivers of $\Delta\rho^*$ (in theory & data), but worth exploring more

Appendix

Interpreting the Growth & VIX Contributions



Left: Raw best-fit line does not pass through origin. **Right:** $\Delta\rho^*_{t,j}$ accounts for most of the variation.

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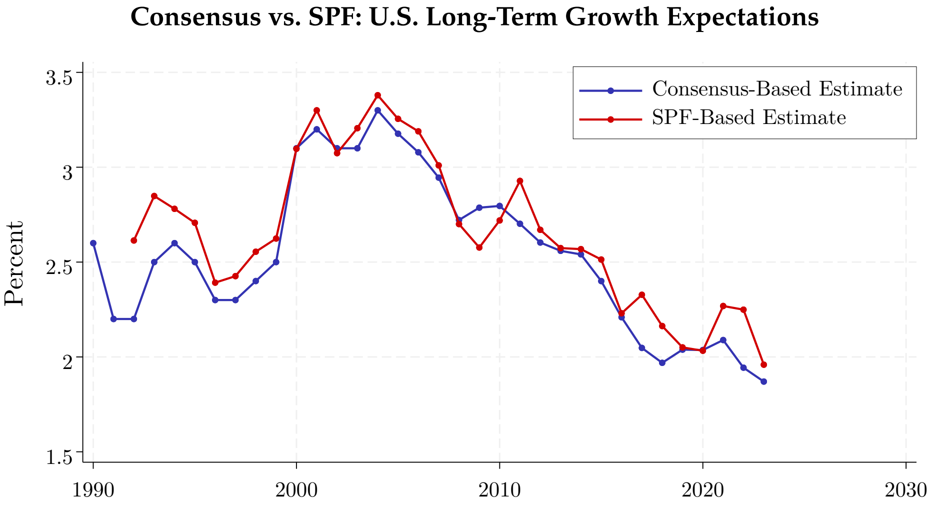
Robustness: SPF Survey Data



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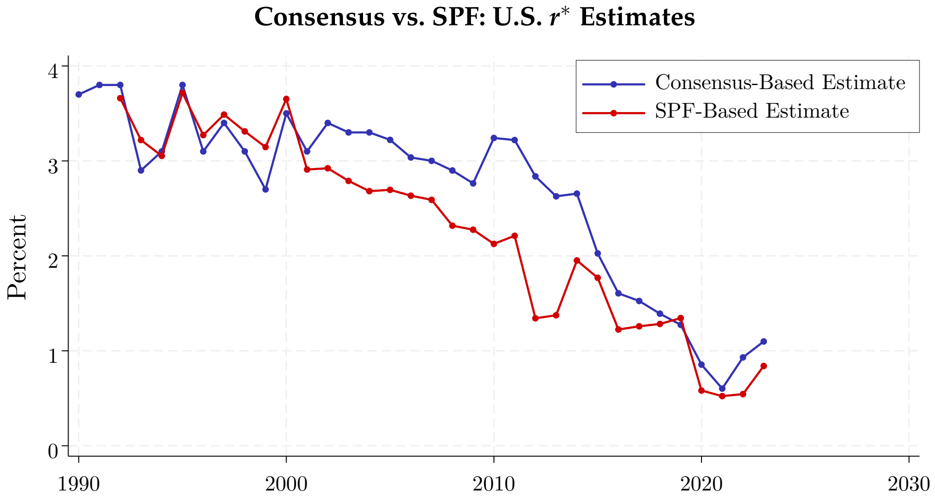

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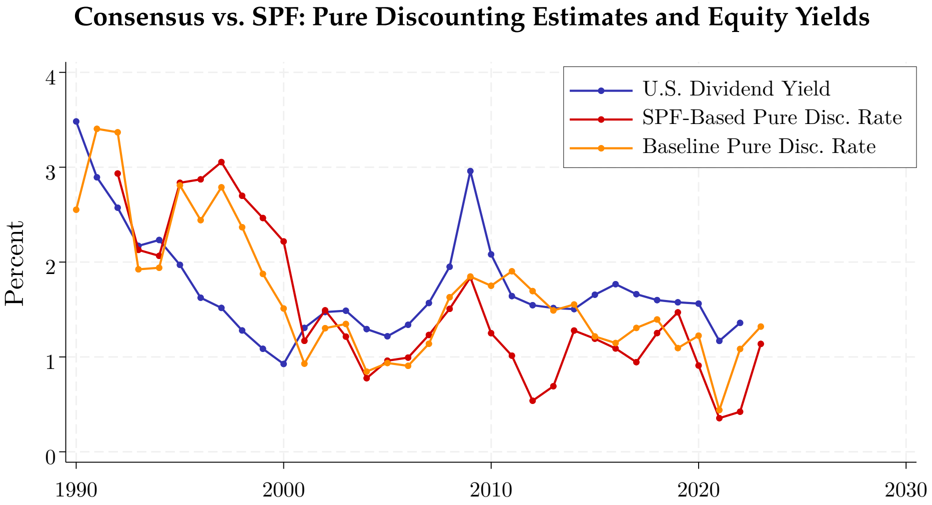
Robustness: SPF Survey Data



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Robustness: Time-Varying Profit Shares in Theory

- Greenwald, Lettau, Ludvigson (2025): 40% of equity returns since ’89 attributable to rising profit share
- How does this affect our analysis?
- **Real rate:** Same decomposition applies: $r^* = \rho^* + \gamma g^* - L_M^*$, where g^* is output growth
- **Equity:** Rising profit share π can increase equity **prices** & **earnings** without affecting equity **yields**
  - Holds if $\Delta\pi$ is unanticipated level shock with no change in expected div. growth g_d^*
  - GGL25 estimate that this describes U.S. data (π is mean-reverting)

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- **Equity:** Rising profit share π can increase equity **prices** & **earnings** without affecting equity **yields**
- **More generally:** Decoupling expected output growth g^* & div. growth g^*_d (i.e., Corr < 1) leads to

$$ey^* = \rho^* + \gamma g^* - g^*_d - L^*_{MR}$$

- **Theoretical implications for change in r^* on ey^* are the same as before**
  - Only pure discounting shocks pass through directly
  - As long as $\text{Corr}(g^*, g^*_d) > 0$, weaker pass-through from growth shocks
  - Pure g^*_d shocks are entirely separate from r^* dynamics. Defining $\pi^* \equiv g^*_d - \lambda g^*$:

$$ey^* = \rho^* + (\gamma - \lambda) g^* - \pi^* - L^*_{MR}$$

Robustness: Time-Varying Profit Shares in the Data

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- How does this affect our analysis?
- **Real rate:** Same decomposition applies: $r^* = \rho^* + \gamma g^* - L_M^*$
- **Equity:** Rising profit share π can increase equity **prices** & **earnings** without affecting equity **yields**
- **More generally:** Decoupling expected output growth g^* & div. growth g_d^* (i.e., Corr < 1) leads to

$$ey^* = \rho^* + \gamma g^* - g_d^* - L_{MR}^*$$

- **Empirically:** Two proxies for g_d^* in U.S. data
  1. Agg. earnings growth forecast (LTG) [Nagel–Xu 2022]: for full sample, $\Delta g_d^* = -0.60$, $\Delta g^* = -0.70$
  2. Expected profit growth via Consensus: for avail. sample (since ’98), $\Delta g_d^* = -1.26$, $\Delta g^* = -0.50$
- So in U.S., Δprofit shares don’t appear to affect results (nor for high-freq., or w/ alt. vol. meas.)

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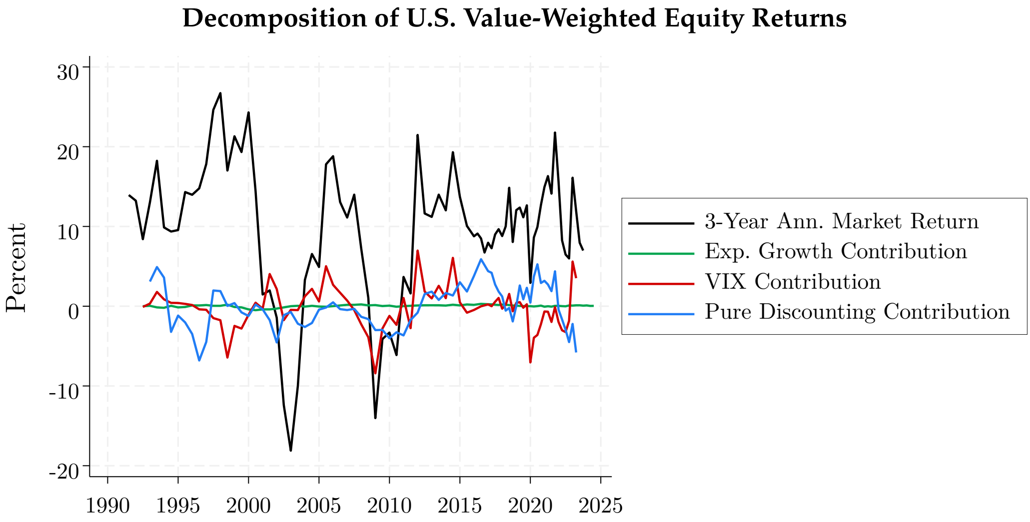
Higher-Frequency Equity Return Accounting



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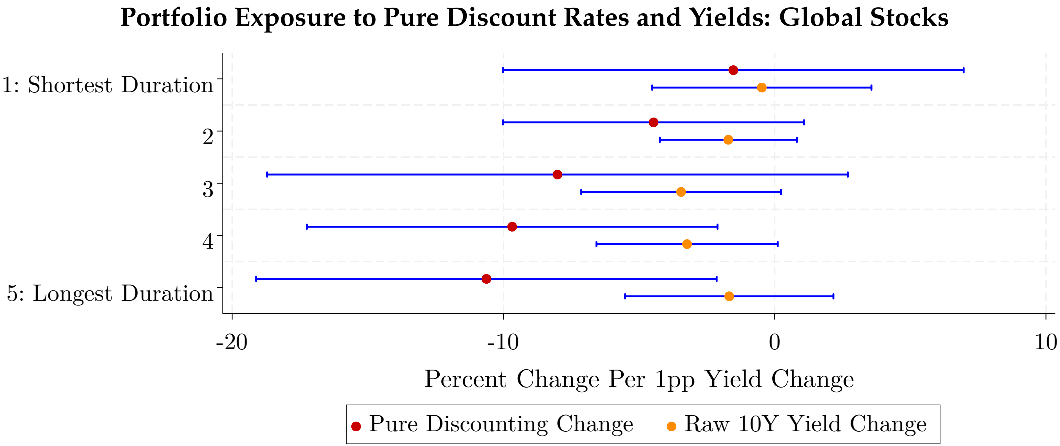
Duration-Sorted Portfolios in Global Sample



- Long-dur. portfolios are **substantially more exposed** to ρ^* shocks *(despite their negative CAPM alphas)*
- Implies a significant spread between lowest- and highest-duration stocks
- **Also apparent for global stocks** (and similarly for raw yield exposures)

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Discount-Rate Shocks and Value Returns

- Declining value premium? Value stocks have underperformed growth stocks since ~2006
- How much is due to interest rates?

AQR

Cliff's Perspective

—

Is Value Just an Interest Rate Bet?

Spoiler Alert: Not Even Close

August 11, 2022

Discount-Rate Shocks and Value Returns

- Declining value premium? Value stocks have underperformed growth stocks since ~2006
- How much is due to interest rates? We'll mostly agree

Cliff's Perspective

Is Value Just an Interest Rate Bet?

Spoiler Alert: Not Even Close

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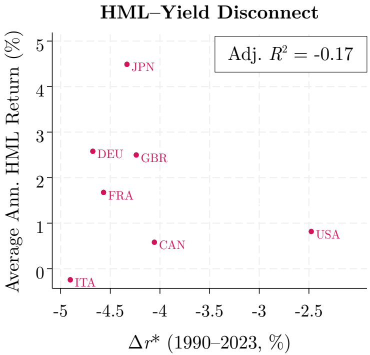
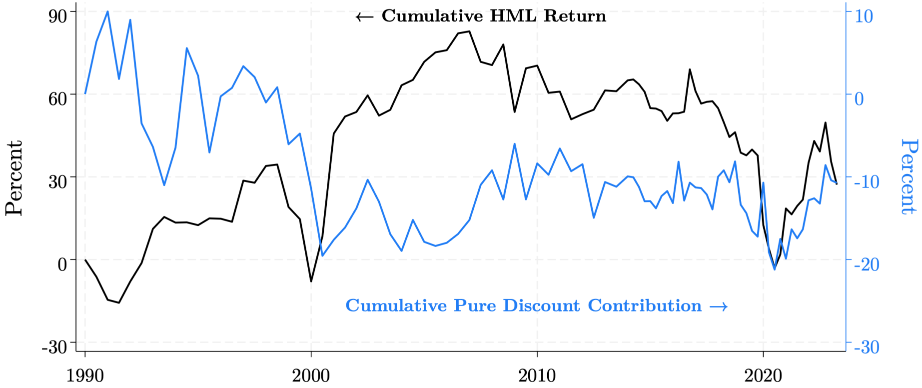
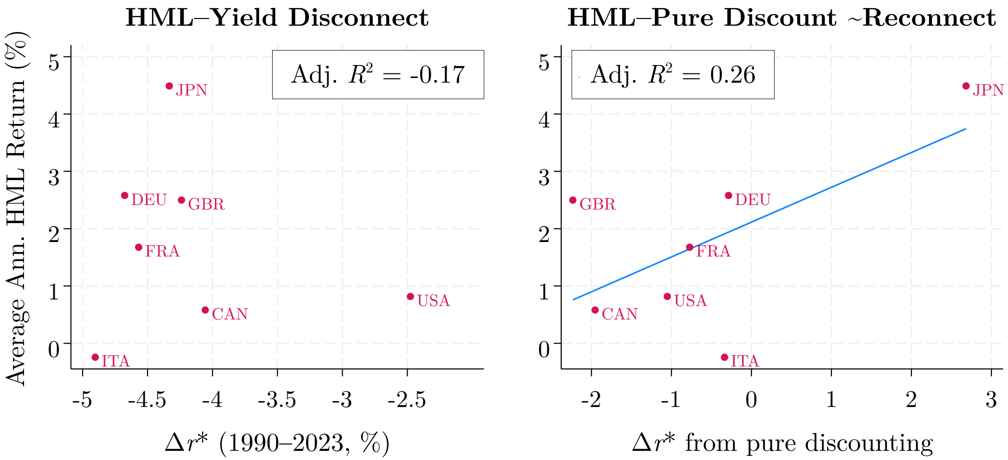


Discount-Rate Shocks and Value Returns

- Declining value premium? Value stocks have underperformed growth stocks since ∼2006
- How much is due to interest rates? We'll mostly agree. . .but not fully.
  HML is short-duration, exposed to recent discounting shocks.
- While pure discount contribution is often important, clearly not the full story *(note scale)*



Discount-Rate Shocks and Value Returns: Global Evidence



- Pure discounting changes important, but not the full story *(& other long-duration portfolios have done well)*

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What Is a Monetary Policy Surprise?

Papers often treat MP surprise as if it were a pure discount-rate shock

- The surprise ΔFF_t may be exogenous, but yield change $\Delta y_{\text{long-term},t}$ depends on Δ pure discount rate, expected growth rate, & uncertainty *given* surprise... and stock return does **not** identify duration
- If pos. MP shocks are contractionary & increase VIX, $\Delta\rho_{t,j} > \Delta y_{t,j}$. With an info. effect, ambiguous.
- Our estimates, along with Δy_t, r_t^{mkt}, and ΔVIX_t^2 given identified MP surprises, allow us to invert two equations for two unknowns, Δg_t and $\Delta\rho_t$:

$$\text{Bonds:} \quad \Delta y_t = \Delta\rho_t + \widehat{\gamma}\,\Delta g_t - \widehat{\beta}_j\,\Delta\text{VIX}_t^2$$

$$\text{Stock returns:} \quad r_t^{\text{mkt}} = \widehat{\pi}_\rho\,\Delta\rho_t + \widehat{\pi}_g\,\Delta g_t + \widehat{\pi}_V\,\Delta\text{VIX}_t^2$$

- We back out $\Delta\rho_t$ and Δg_t for each MP announcement and regress each on Bauer & Swanson (2023) orthogonalized MP shock: (1) $\beta_\rho = 0.29^{***}$ $[R^2 = 0.30]$, (2) $\beta_g = 0.07^{*}$ $[R^2 = 0.04]$

  $\Longrightarrow$ 75% of MPS is pure discounting shock, but some info. effect on average *(can also do t-specific plots)*
- Similar conclusions to Nagel & Xu (2024), using different methods

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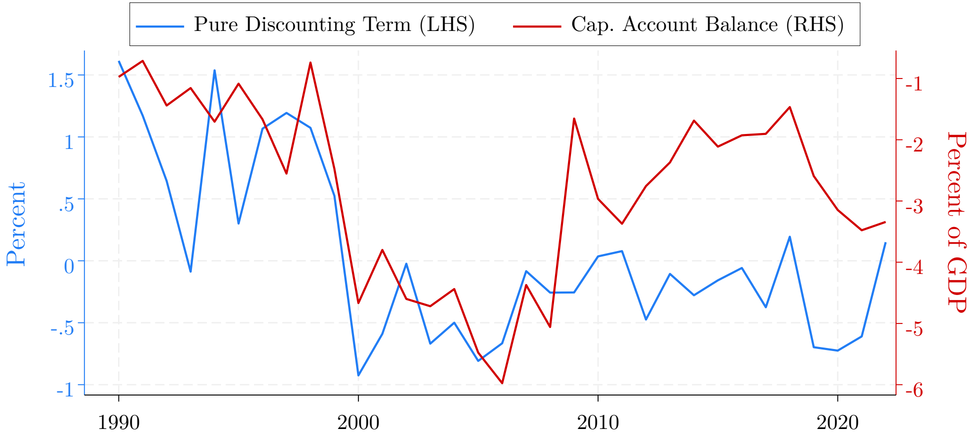
Pure Discounting Changes and Capital Flows in the U.S.



In paper: Net capital flows can induce $\Delta\rho^*_{t,j}$ in theory *(given $\Delta r^*_{t,j}$ without large Δfundamentals)*

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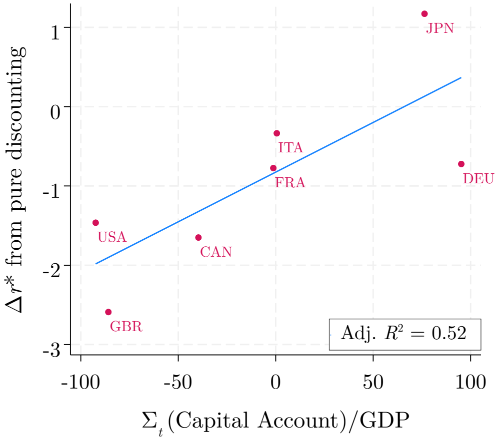
Pure Discounting Changes and Capital Flows Across Countries



In paper: Net capital flows can induce $\Delta\rho^*_{t,j}$ in theory *(given $\Delta r^*_{t,j}$ without large Δfundamentals)*

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