# Interest Rates and Equity Valuations

NIELS J. GORMSEN
*CBS, Chicago Booth, & NBER*

EBEN LAZARUS
*UC Berkeley Haas*

NBER SI Asset Pricing

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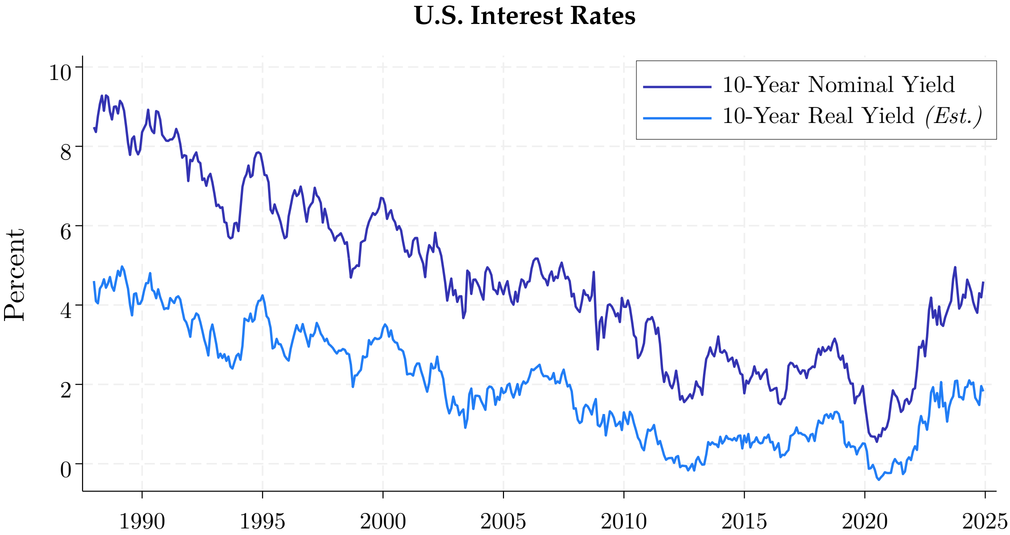
# Well-Known Trends: Declining Interest Rates. . .



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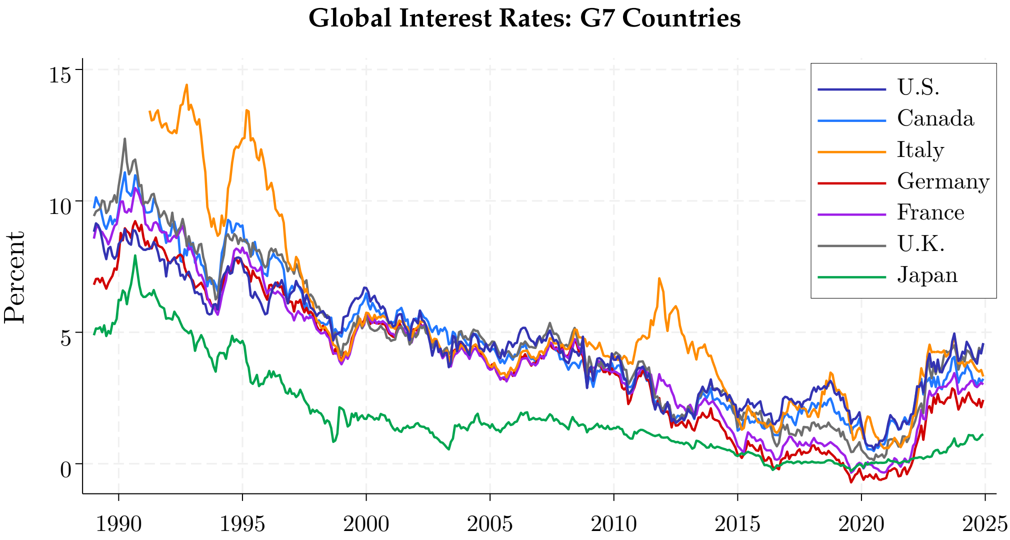
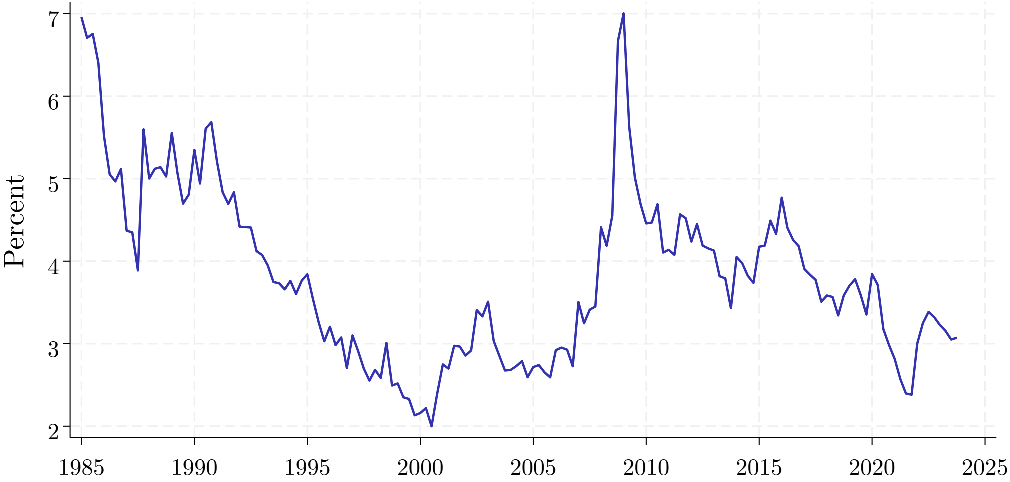


# . . .and Increasing Domestic Stock Valuations

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



# How Do Interest Rates Affect Equities?

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

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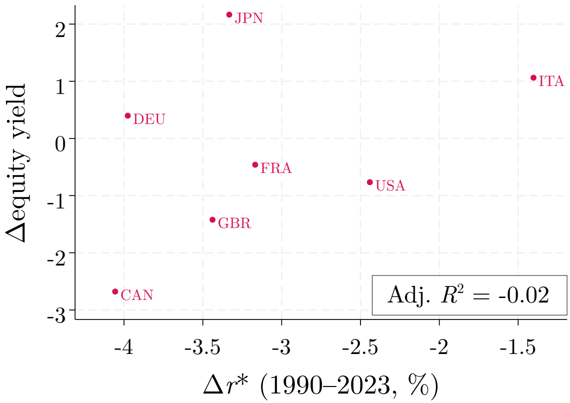
**. . . but empirically, interest rates and equity valuations are often disconnected:**



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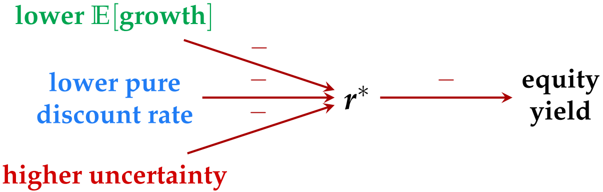

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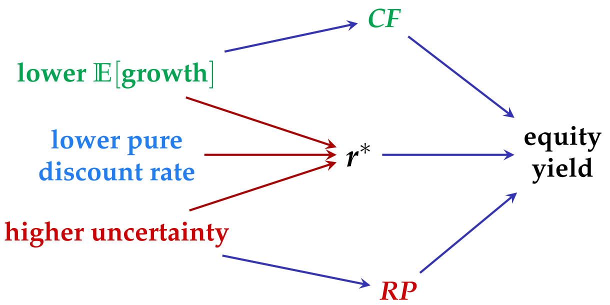


**Bonds and stocks move 1-for-1 only under (ii). Weaker/neg. comovement for (i) & (iii).**

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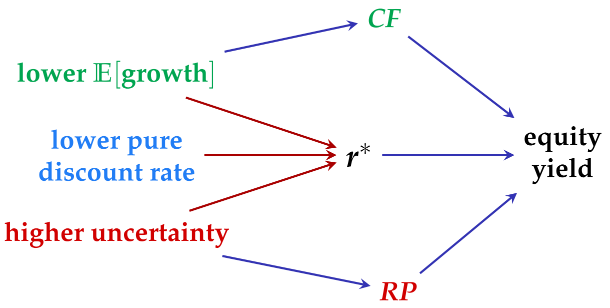
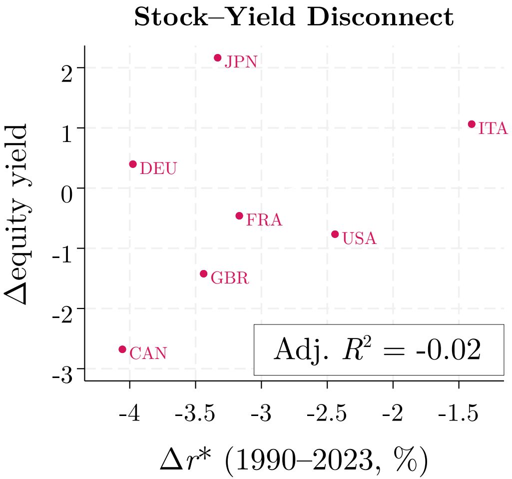



**Our goal: Decompose $\Delta r^*$ to estimate pass-through & importance of each component to equity.**

# Main Results: Long-Term Decomposition



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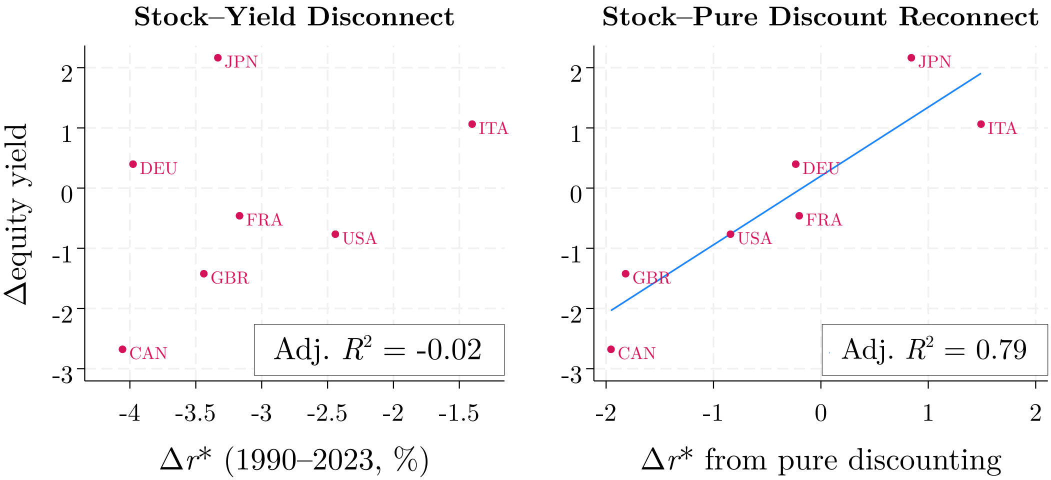

# Implications for a Range of Literature

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:

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

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

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

$$= \frac{\gamma^2}{2}\sigma^2 \text{ if lognormal}$$

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- **Interpretation:** $\Delta r^*$ reflects changes in (i) time preference (pure discounting), (ii) growth, or (iii) risk

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- **Interpretation:** $\Delta r^*$ 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 $\partial ey^*$ 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:**

$$ey^* = r^* + rp^* - \lambda g^*$$

$$= \rho^* + (\gamma - \lambda) g^* + (rp^* - L_M^*)$$

**Implications:**

- **Only change in pure discount rate $\rho^*$ 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

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- **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 $\rho^*$ moves equities in line with duration.**

# Roadmap

# 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 $\rho^*$.

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- **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

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- **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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- $\rho^*$**: Back out as residual from panel regression (quarter $t$, country $j$):**

$$r_{t,j}^* = \gamma g_{t,j}^* + \beta_j \text{VIX}_{t,j}^2 + \underbrace{\text{Constant} + \text{FE}_j + \varepsilon_{t,j}}_{\rho_{t,j}^*}$$

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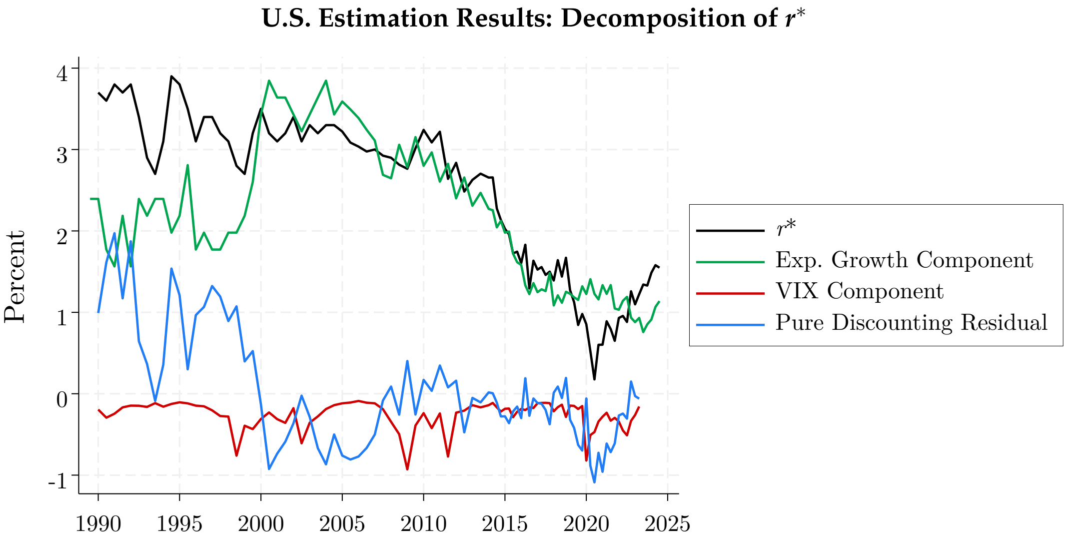
$$[\widehat{\gamma} = 2.1^{***}, \overline{\widehat{\beta}_j} = -4.0^{**}, \text{Within } R^2 = 0.61]$$

# Time-Series Decomposition Results



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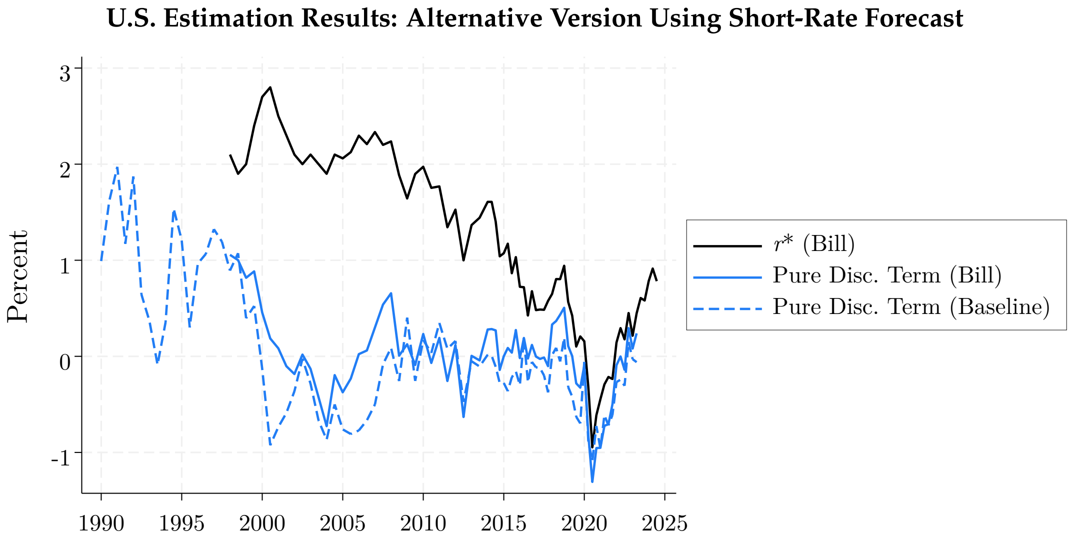
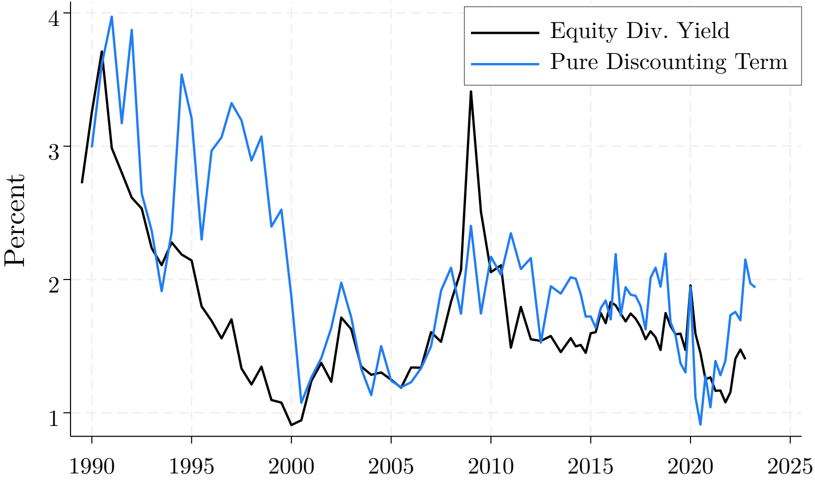
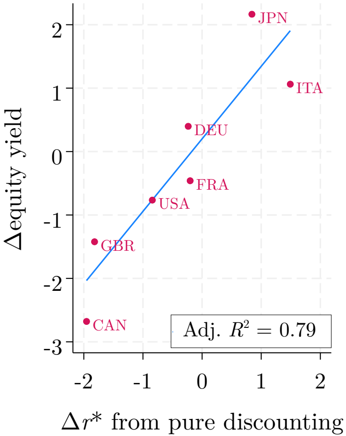


# Time-Series Decomposition Results

**U.S. Estimation Results: Valuations and the Pure Discounting Term**



# 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

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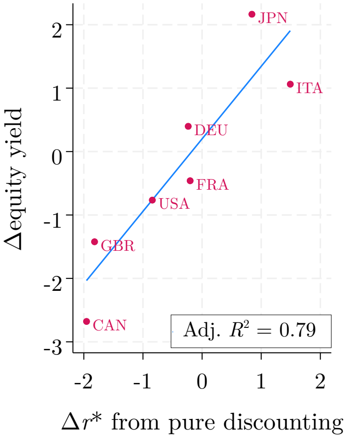


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$\Longrightarrow$ to understand long-run valuations, $\Delta\widehat{\rho}^*$ is nearly sufficient

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

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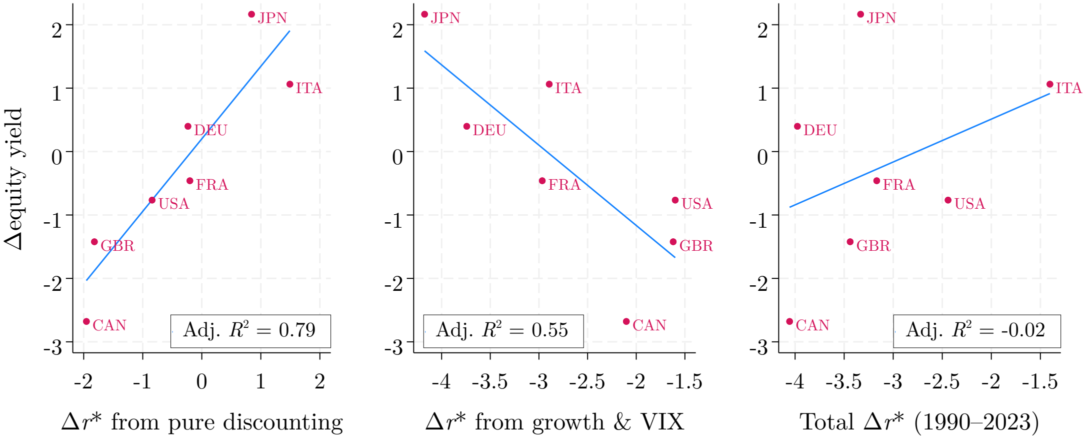


Equity moves negatively with remaining predicted yield ("impure" discounting)

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

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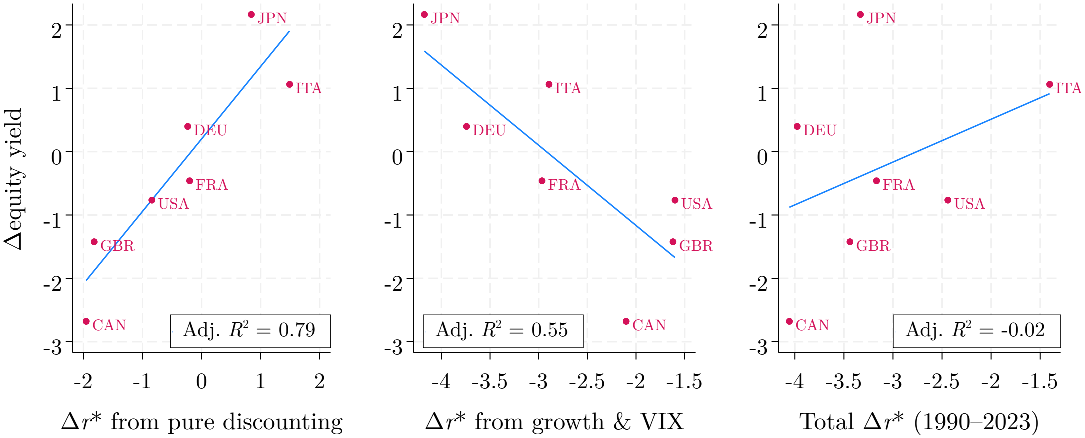


Equity moves negatively with other terms $\Longrightarrow$ yield changes do not in general transmit to equity.

**U.S.:** Transmission of $\Delta r^*$ 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. |
|---|---|---|
| $\Delta$10y yield | 4.19 | |
| | (3.51) | |
| $\Delta$pure discount $(\widehat{\Delta\rho_t^*})$ | | -19.1** |
| | | (7.64) |
| $\Delta$exp. growth | | -1.49 |
| | | (14.0) |
| $\Delta \text{VIX}^2 \times 100$ | | -3.08** |
| | | (1.33) |
| Country FEs | ✗ | ✗ |
| Obs. | 74 | 74 |
| $R^2$ | 0.04 | 0.20 |
| Within $R^2$ | — | — |

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

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

# Rate Sensitivities and Equity Duration

**Regressions for Three-Year Stock Returns**

| | **(1)** U.S. | **(2)** U.S. | **(3)** All | **(4)** All |
|---|---|---|---|---|
| $\Delta$10y yield | 4.19 | | -3.39 | |
| | (3.51) | | (2.20) | |
| $\Delta$pure discount ($\widehat{\Delta\rho_t^*}$) | | -19.1** | | -9.61** |
| | | (7.64) | | (3.26) |
| $\Delta$exp. growth | | -1.49 | | 16.9* |
| | | (14.0) | | (8.82) |
| $\Delta VIX^2 \times 100$ | | -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.*

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- **Duration:** $-\frac{\partial \log P}{\partial \rho^*} \approx$ 19y for U.S.

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

$\Rightarrow$ Measurement also works at higher freq.

- In paper: $\rho^*$ strongly predicts **future** ret.

# Robustness to Alternative Measurement Approaches

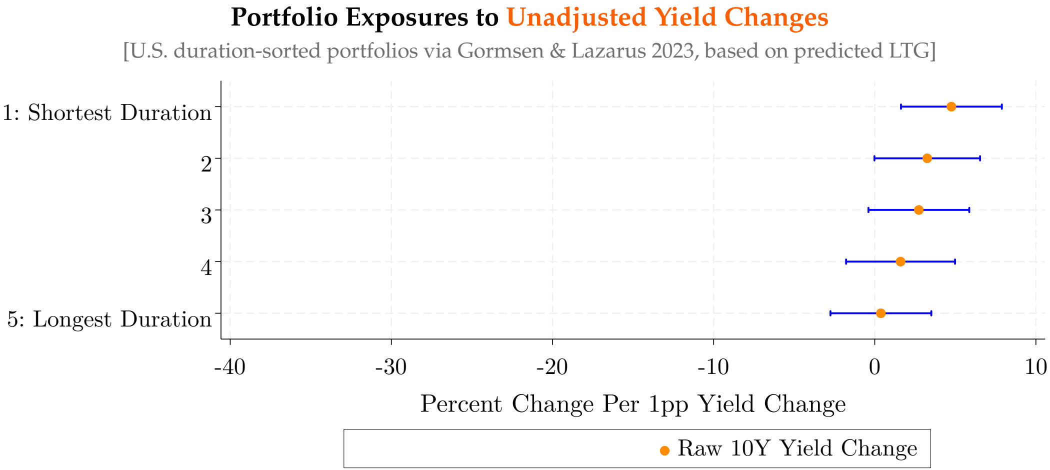
**Results are robust under a range of approaches:**

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

# Cross-Sectional Evidence: Duration-Sorted Portfolios

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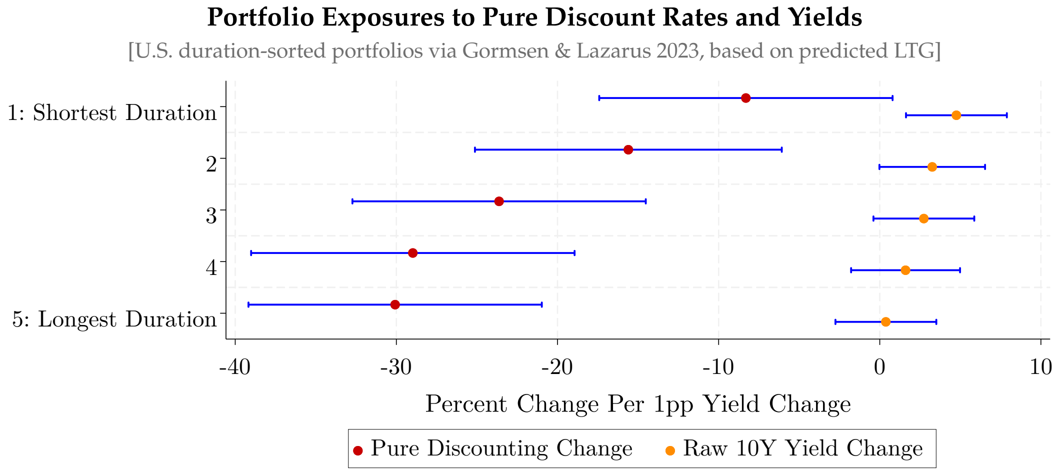
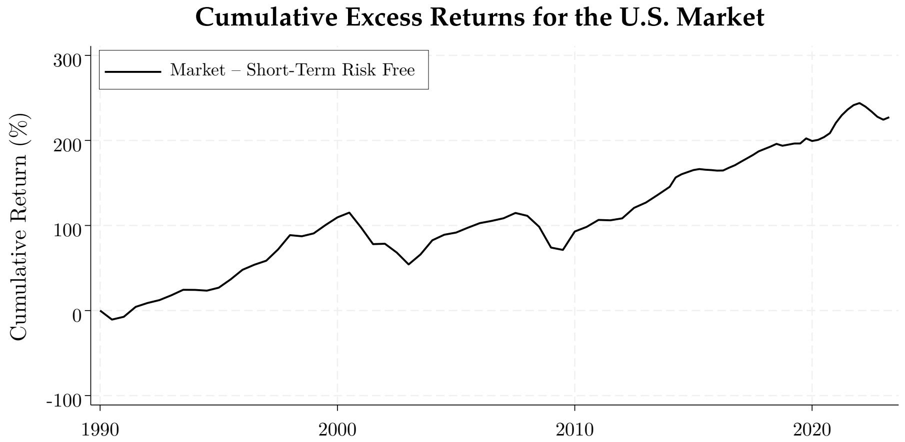



- Long-duration portfolios are not substantially more exposed to raw interest-rate changes…
- …**but they're substantially more exposed to $\rho^*$ shocks, implying large duration spread**

# A Significant Duration-Matched Equity Premium



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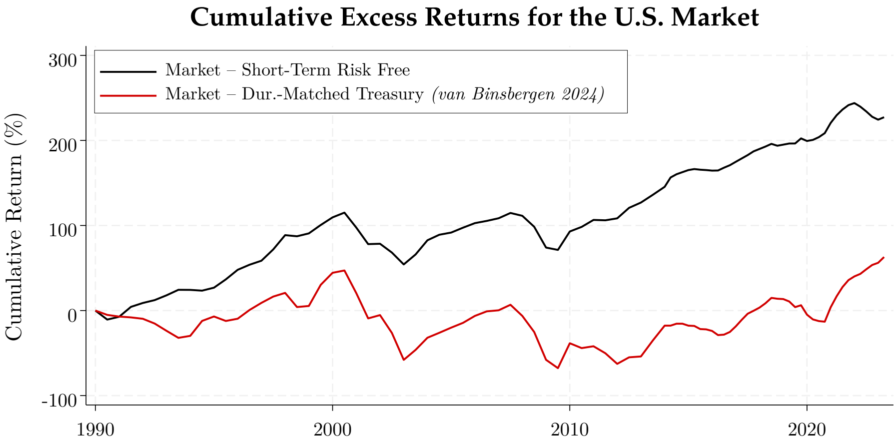
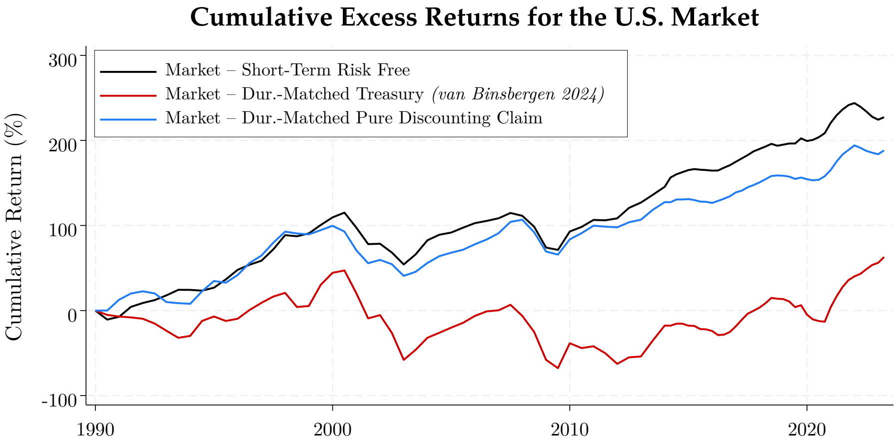



- Long-term nominal bonds have had high returns → low apparent duration-matched premium
- But long-term bonds differentially exposed to growth & risk, so we consider new counterfactual
- Construct **maturity-matched** ($\mathcal{D} = 19$y) **pure discounting claim** that appreciates when $\rho^* \searrow$

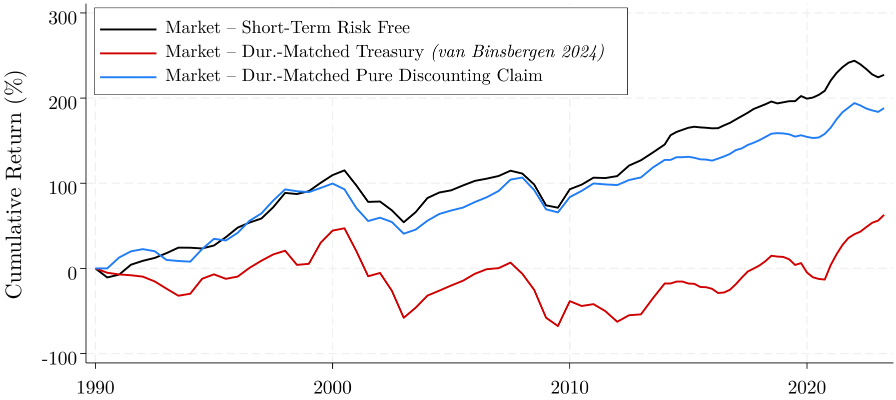
# A Significant Duration-Matched Equity Premium




- 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

**Cumulative Excess Returns for the U.S. Market**




**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

# Final Notes

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

**Two interpretations:**

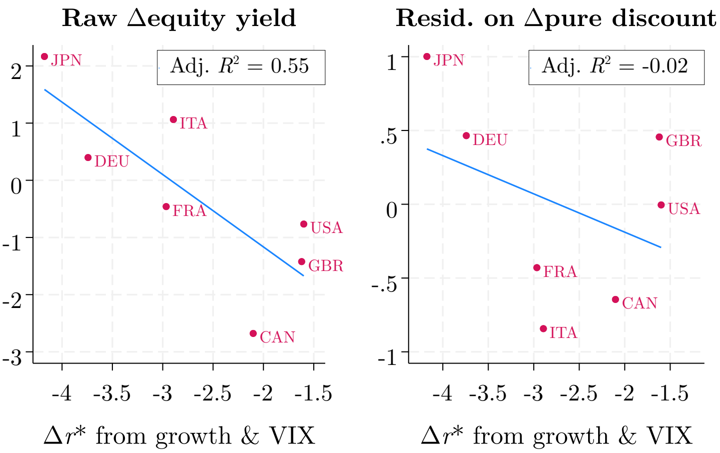
1. **Glass half empty: Rate changes matter less for stocks than one might think.**
   - Rate changes transmit only partly to stocks *(U.S.: 35%)*; assuming full transmission may be misleading
2. **Glass half full: Transmission is quite strong, once you isolate the right component.**
   - $\Delta$pure discounting component of rates $\overset{\sim}{\Longleftrightarrow}$ $\Delta$valuations
   - Understanding drivers of $\rho^*$ goes a long way to understanding secular valuation changes

**Natural next question:** What explains $\rho^*$ changes?

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

# Appendix

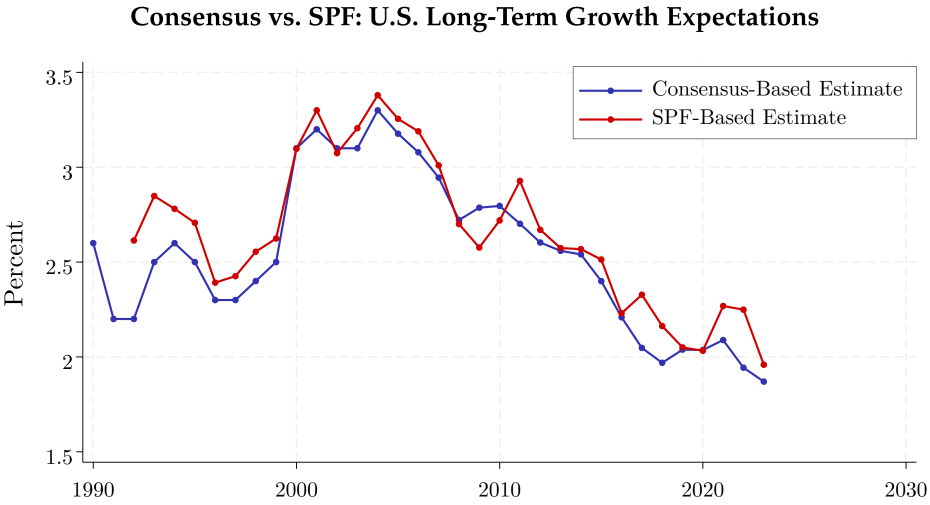
# Interpreting the Growth & VIX Contributions




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

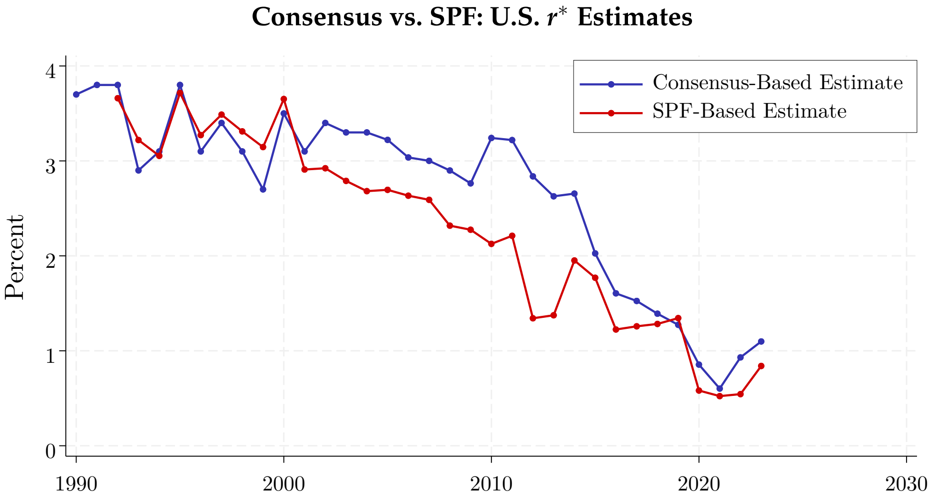
Back to main

# Robustness: SPF Survey Data



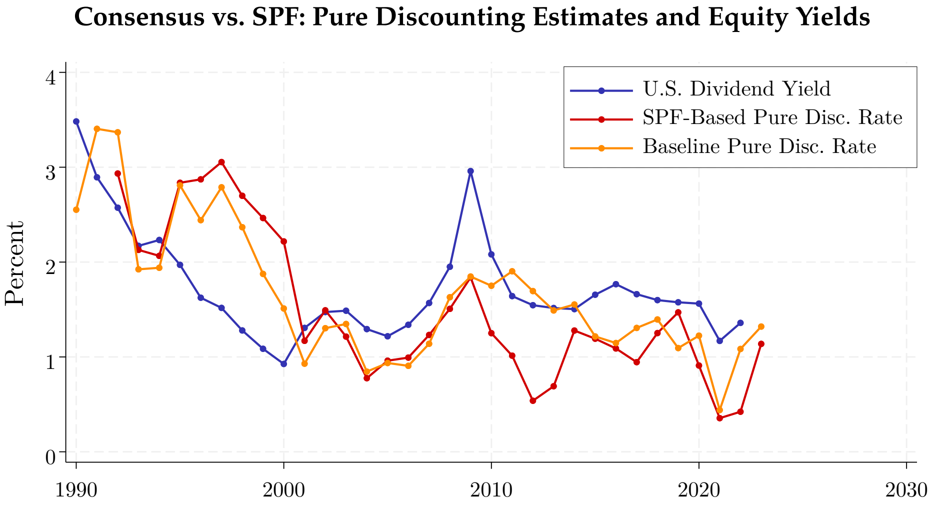

Back to main

# Robustness: SPF Survey Data




Back to main

# Robustness: SPF Survey Data




Back to main

# 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 $\pi$ 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 ($\pi$ is mean-reverting)

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- **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 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

- Greenwald, Lettau, Ludvigson (2025): 40% of equity returns since ’89 attributable to rising profit share
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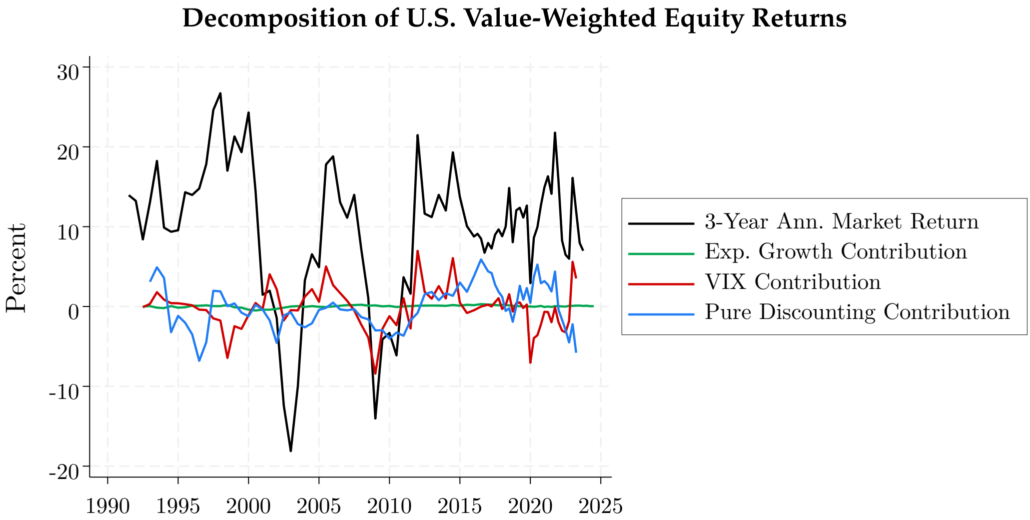
- **More generally:** Decoupling expected output growth $g^*$ & div. growth $g_d^*$ (i.e., Corr $< 1$) leads to

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

- **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., $\Delta$profit shares don’t appear to affect results (nor for high-freq., or w/ alt. vol. meas.)

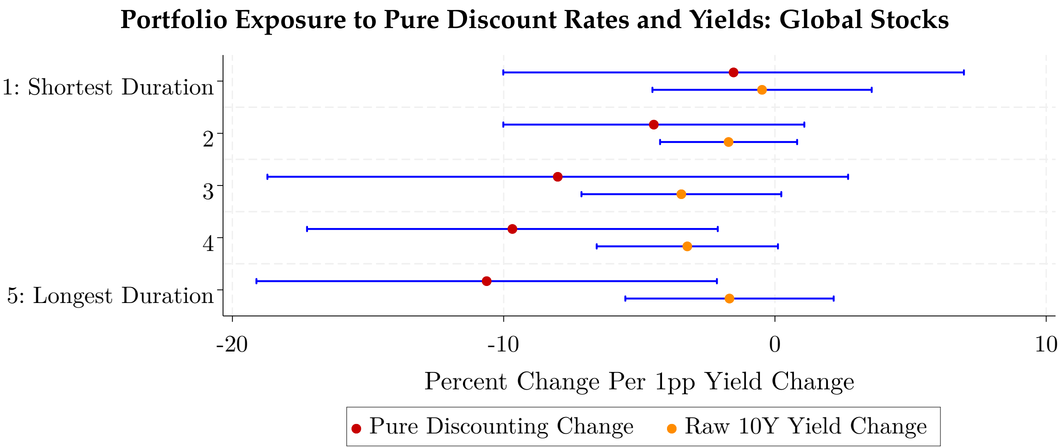
Back to main

# Higher-Frequency Equity Return Accounting




Back to main

# Duration-Sorted Portfolios in Global Sample




- Long-dur. portfolios are **substantially more exposed** to $\rho^*$ 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)

Back to main

# 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

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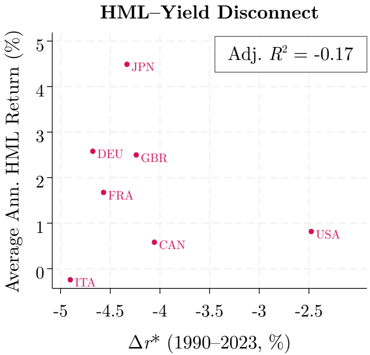
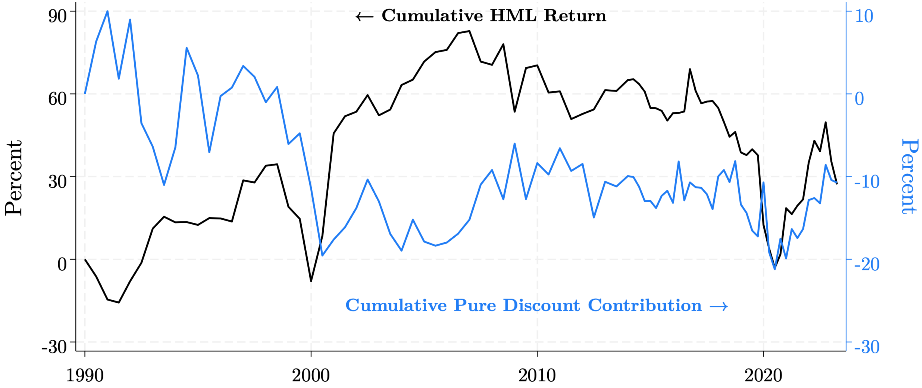
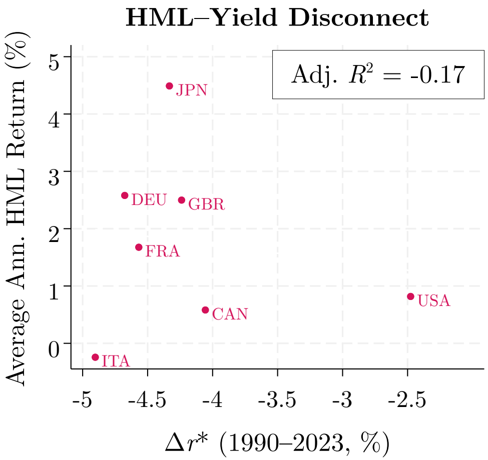


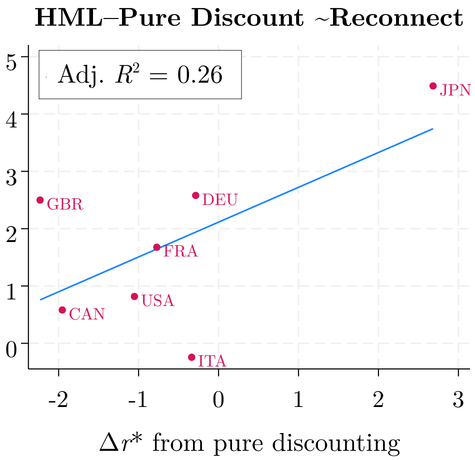
# Discount-Rate Shocks and Value Returns

- 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)*

Back to main

# What Is a Monetary Policy Surprise?

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

- The surprise $\Delta FF_t$ may be exogenous, but yield change $\Delta y_{\text{long-term},t}$ depends on $\Delta$ 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 $\Delta y_t$, $r_t^{\text{mkt}}$, and $\Delta\text{VIX}_t^2$ given identified MP surprises, allow us to invert two equations for two unknowns, $\Delta g_t$ and $\Delta\rho_t$:

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

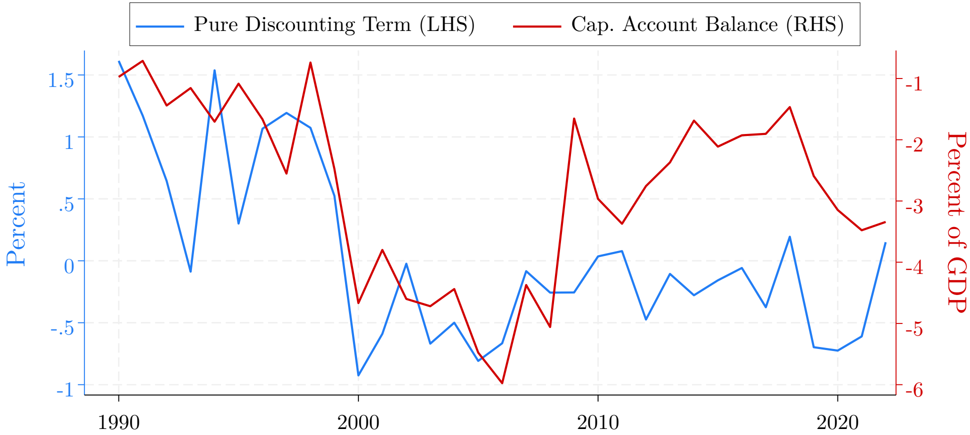
$$\text{Stock returns:} \quad r_t^{\text{mkt}} = \widehat{\pi}_\rho\,\Delta\rho_t + \widehat{\pi}_g\,\Delta g_t + \widehat{\pi}_V\,\Delta\text{VIX}_t^2$$

- We back out $\Delta\rho_t$ and $\Delta g_t$ 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

Back to main

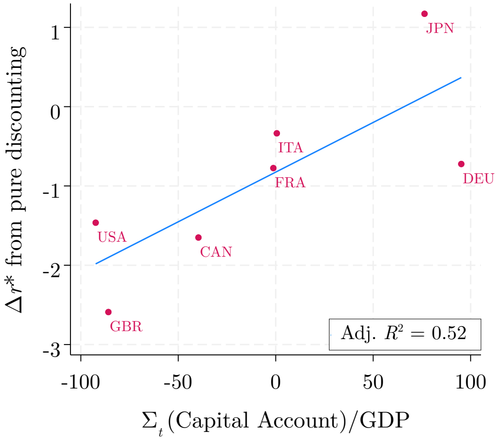
# Pure Discounting Changes and Capital Flows in the U.S.




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

Back to main

# 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 $\Delta$fundamentals)*

Back to main