Duration-Driven Returns

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Motivation: Understanding Equity Risk Factors

We want to understand the major equity risk factors:

Value	Profit	Low investment	Low risk	Payout

- Key factors in leading factor models
- Highly persistent, implying price importance

Challenge for understanding these risk factors:

- Hard to relate to fundamental economics
- Hard to relate to one another

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- Hard to relate to one another

New facts about the major risk factors:

- The major risk factors are long short-duration stocks
- New data to pin down duration as key driver of cross-section

Cash-Flow Duration of Risk Factors

- Duration is the PV-weighted time to maturity of expected cash flows:

$$\text{Duration} = \sum_{i=1}^{\infty} i \times w_i, \text{ where } w_i = \frac{PV(CF_i)}{\sum PV(CF_i)}$$

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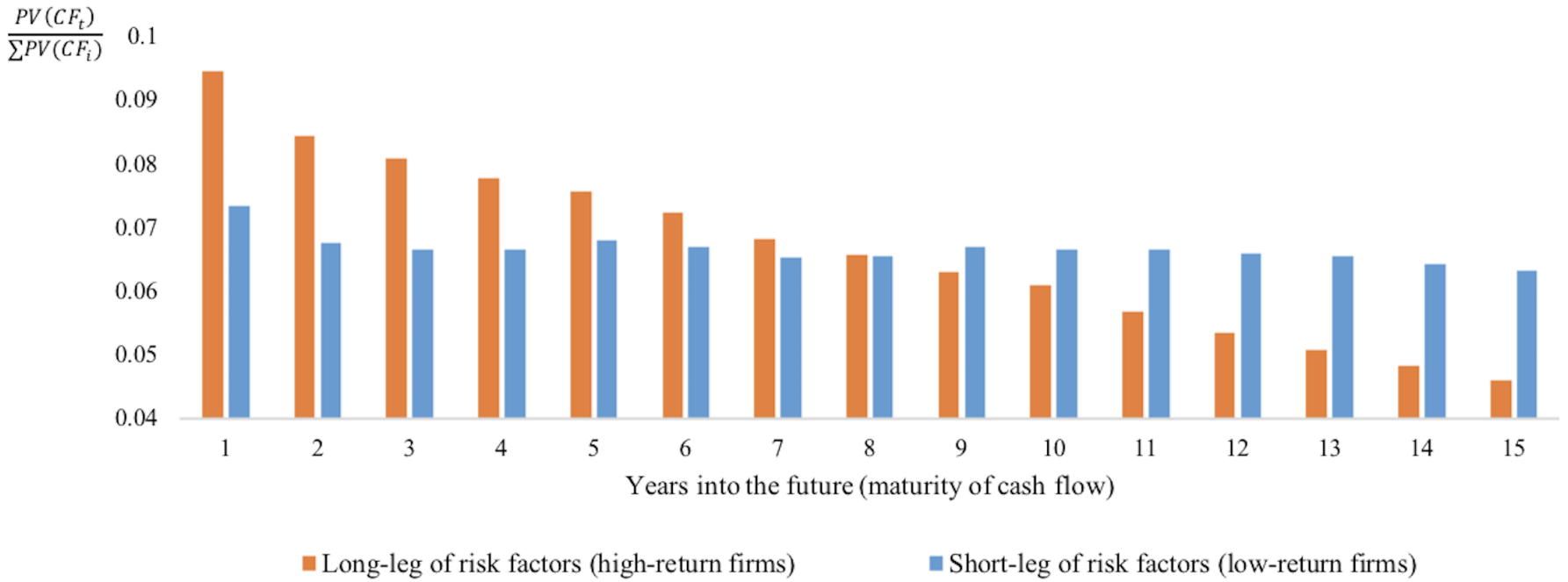
$$\text{Duration} = \sum_{i=1}^{\infty} i \times w_i, \text{ where } w_i = \frac{PV(CF_i)}{\sum PV(CF_i)}$$

  - Used to measure interest-rate sensitivity for bonds, but applicable here as simple measure of cash-flow timing
  - For equities, growth rates are key determining for duration (high growth = long duration)

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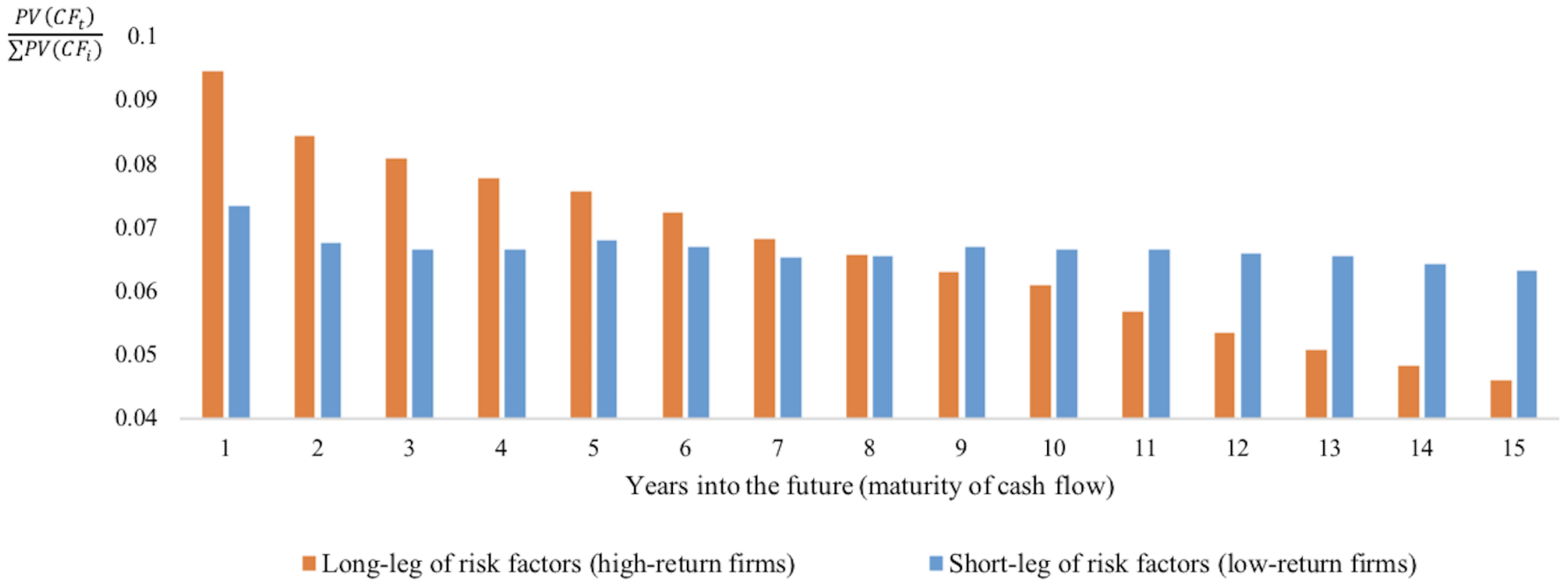
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Firms in the long leg have shorter duration

- Based on combination of risk factors
- But holds as well for individual risk factors

Duration-Driven Returns

Hypothesis: the risk-factors are driven by premium on near-future cash flows

Recall,

$$E_t[r_{t+1}] = \sum_{m=1}^{\infty} w_t^m E_t[r_{t+1}^m] \tag{1}$$

where r_{t+1}^m is one-period excess return on the $t+m$ cash flow and w_t^m is its relative present value.

We argue that $E_t[r_{t+1}^m]$

- is the same across firms
- but decrease in m

$\Rightarrow$ Firms with higher weight on near-future cash-flows have higher returns.

Duration-Driven Returns: Evidence from Dividend Strips

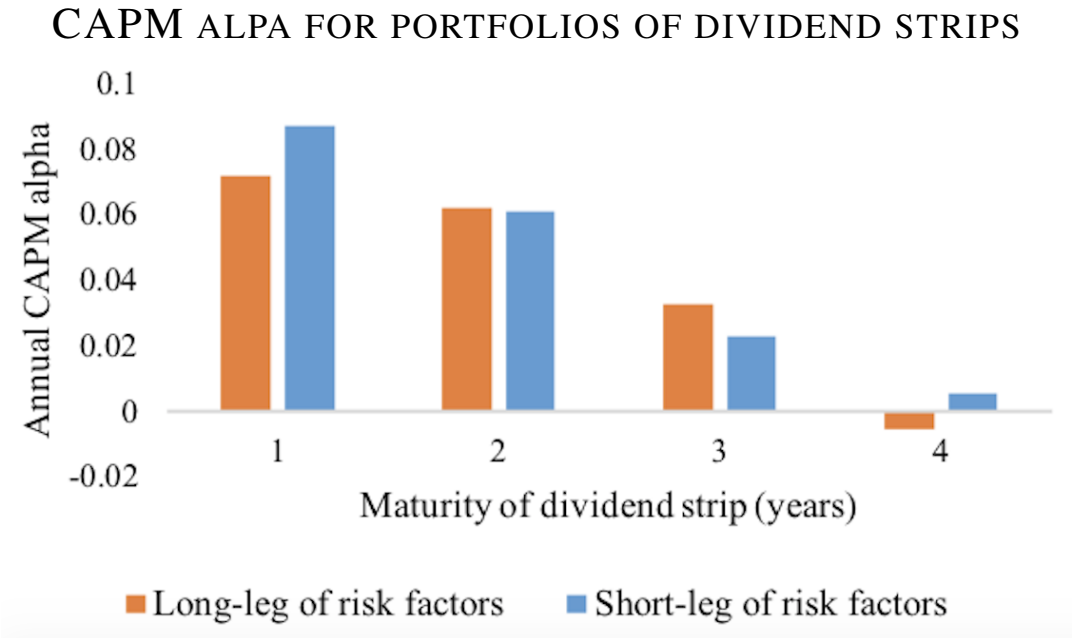
New dataset of **single-stock** dividend futures

- Claims on individual dividends on individual firms

Duration-Driven Returns: Evidence from Dividend Strips

New dataset of **single-stock** dividend futures

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- The alpha decrease in maturity
- But it is the same across firms

$\Rightarrow$ Duration-driven returns

The Economics: Why might near-future cash flows have high returns?

Multiple economic mechanisms give duration-driven returns:

1. Cash-flow versus discount-rate risk (Campbell and Vuolteenaho, 2004)
   - Distant-future cash flows more exposed to discount-rate risk (low risk premium)
   - Near-future cash flows more exposed to cash-flow risk (high risk-premium)
2. Near future cash-flows *perceived* as riskier
3. See Binsbergen and Koijen (2017) for more

Our contribution:

- Organize the risk factors into a single fact
- Illustrate that they can be explained by a model where near-future cash flows content...

Related Literature

Duration and the cross-section of stocks:

- Dechow, Sloan, and Soliman (2004) studies the relation between duration and stock returns
- Goncalves (2018) and Chen and Li (2018) use duration factor to explain return
- We contribute by:
  1. Explaining payout, beta and volatility anomalies
  2. Directly linking the different anomalies to expected growth rates and duration
  3. Studying a novel dataset of dividend futures
  4. Studying the equity yield curve
  5. Theoretical model
  6. Global evidence

The factor zoo:

- Recent literature on taming the factor zoo based on statistical methods

  $\rightarrow$ Feng, Giglio, and Xiu (2017); Giglio, Liao, and Xiu (2018); Harvey and Liu (2017); Harvey, Liu, and Zhu (2016); Freyberger, Neuhierl, and Weber (2017); Kozak, Nagel, and Santosh (2017)
- We differ by using basic economics and intuition to shrink the cross-section

Part 1: The Major Risk Factors Invest in Short-Duration Firms

Measuring Expected Growth Rates

Two Different Approaches

1. **Realized growth rates**

2. **Long term growth forecast (LTG) from I/B/E/S database**

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   - Ex ante analyst expectations of growth rate of next business cycle
   - Available for a subset of firms from 1982

Measuring Expected Growth Rates

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2. **Long term growth forecast (LTG) from I/B/E/S database**
   - Ex ante analyst expectations of growth rate of next business cycle
   - Available for a subset of firms from 1982

   We run the following firm-level panel regression:

$$\text{LTG}_{i,t} = X'_{i,t}\Gamma + e_{i,t} \tag{2}$$

   where

   - $\text{LTG}_{i,t}$ is the median LTG for firm i at time t
   - $X'_{i,t}$ is a vector of firm i characteristics at time t
   - LTG and firm characteristics are measured as cross-sectional percentiles

Expected Growth Rates and Characteristics

Results of the following panel regression:

$$\text{LTG}_{i,t} = X'_{i,t}\Gamma + e_{i,t} \tag{3}$$

	Dependent variable: LTG
High BM	
High profit	
Low investment	
Low beta	
High payout	
Fixed effect	
Cluster	
Weight	
Sample	
Observations	
R-squared	

Expected Growth Rates and Characteristics

Results of the following panel regression:

$$\text{LTG}_{i,t} = X'_{i,t}\Gamma + e_{i,t} \tag{4}$$

	Dependent variable: LTG	
	US	US
High BM	**-0.493**	**-0.544**
	(-52.86)	(-22.31)
High profit	**-0.191**	**-0.240**
	(-21.62)	(-10.25)
Low investment	**-0.093**	**-0.090**
	(-16.07)	(-4.71)
Low beta	**-0.174**	**-0.277**
	(-18.22)	(-12.40)
High payout	**-0.262**	**-0.203**
	(-33.21)	(-7.85)
Fixed effect	Firm/Date	Firm/Date
Cluster	Firm/Date	Firm/Date
Weight	Analysts	Market Cap
Sample	Full	Full
Observations	539,297	539,297
R-squared	0.48	0.44

Expected Growth Rates and Characteristics

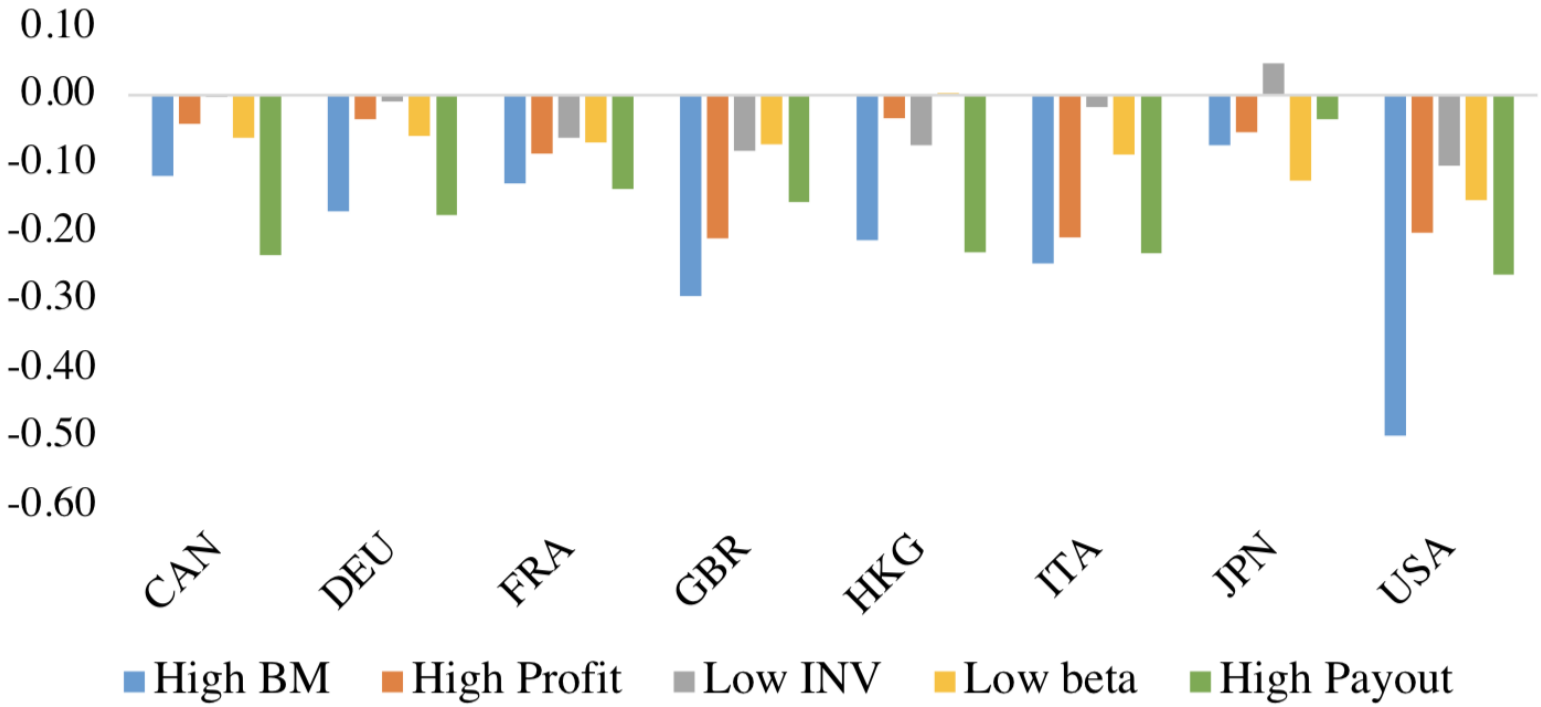
Results of the following panel regression:

$$\text{LTG}_{i,t} = X'_{i,t}\Gamma + e_{i,t} \tag{5}$$

	Dependent variable: LTG			
	US	US	INT	INT
High BM	**-0.485**	**-0.530**	**-0.167**	**-0.202**
	(-54.81)	(-23.81)	(-15.77)	(-9.52)
High profit	**-0.172**	**-0.230**	**-0.078**	**-0.092**
	(-20.42)	(-10.37)	(-7.28)	(-3.62)
Low investment	**-0.092**	**-0.090**	**-0.027**	-0.007
	(-16.37)	(-4.874)	(-3.55)	(-0.50)
Low beta	**-0.112**	**-0.230**	**-0.058**	**-0.126**
	(-12.30)	(-10.44)	(-5.41)	(-7.16)
High payout	**-0.229**	**-0.183**	**-0.144**	**-0.134**
	(-30.15)	(-7.655)	(-15.08)	(-7.86)
Fixed effect	Firm/Date	Firm/Date	Firm/Date	Firm/Date
Cluster	Firm/Date	Firm/Date	Firm/Date	Firm/Date
Weight	Analysts	Market Cap	Analysts	Market Cap
Sample	Full	Full	Full	Full
Observations	539,290	539,290	290,418	290,418
R-squared	0.50	0.46	0.06	0.10

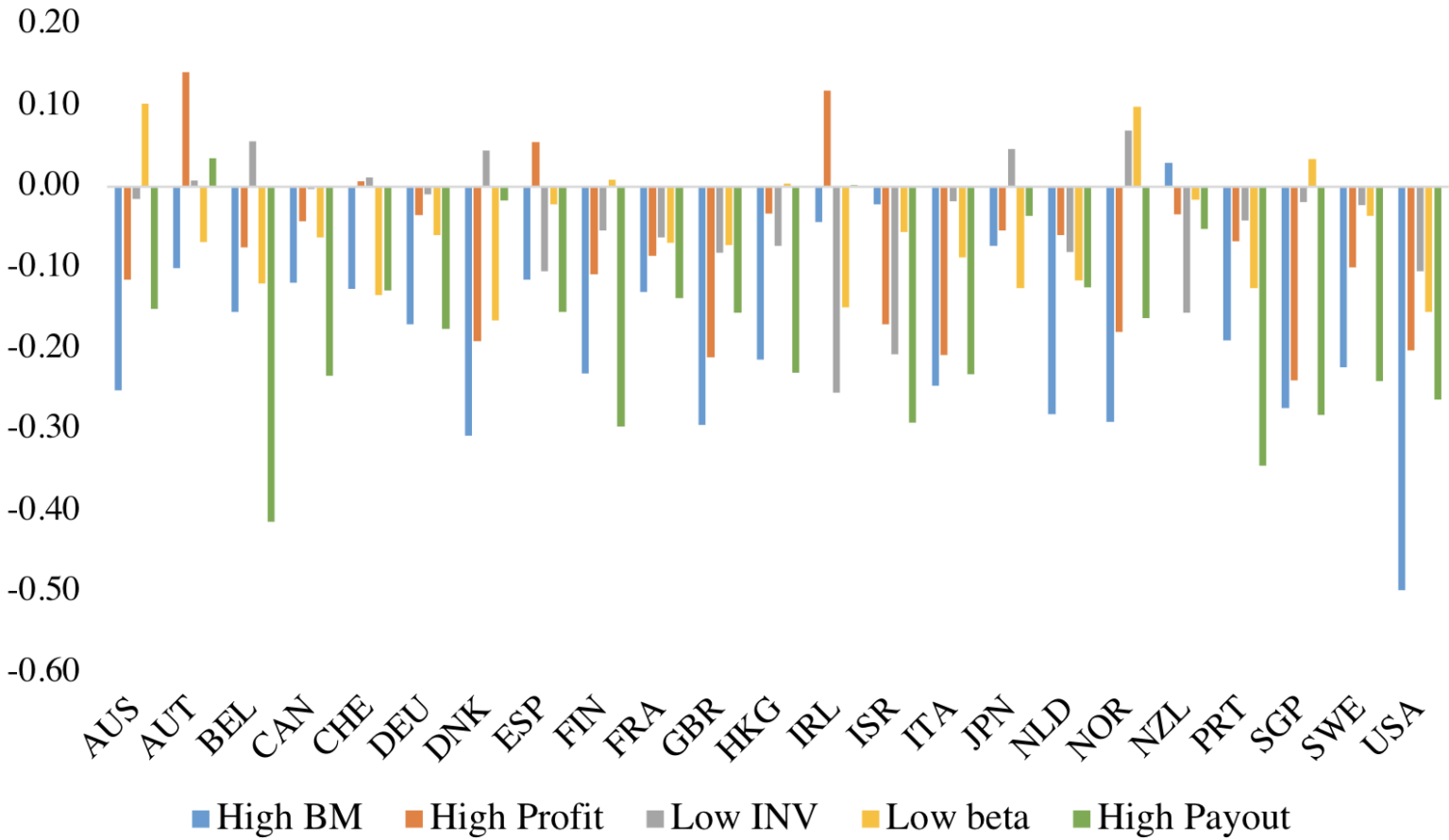
Growth Rates and Characteristics

G7-countries



Growth Rates and Characteristics

Country-level evidence



Equity Risk Factors & Duration: Intuition

Equity risk factors are intuitively related to duration:

- **Low investment**: Low investment in generating future cash flows
- **High profit**: High profit firms are in the profitable part of their life cycle
- **High payout**: High payout because of low future growth prospects
- **Low valuation**: Low valuations arise partly because of low future growth rates
- **Low beta/low volatility**: Firms with a short cash-flow duration are less sensitive to discount rate shocks and growth rate shocks, meaning they have lower betas and volatility

Part 2: Explaining Returns with a Duration Factor

Explaining Risk Factors with the Duration Factor

Fama and French-type Duration factor:

- Factor sorted on predicted LTG in (5)

We introduce new three-factor model:

$$r^i_{t+1} = \alpha_t + \beta^{MKT}(r^{MKT}_{t+1} - r^f_t) + \beta^{SMB} r^{SMB}_{t+1} + \beta^{DUR} r^{DUR}_{t+1} + \varepsilon_{t+1}$$

Factor	CAPM model			Three-factor model						
	α_{CAPM}	β_{CAPM}	R^2	α_{Three}	β_{Mkt}	β_{Smb}	β_{Dur}	R^2	*LTG*	*# obs*
HML	**0.32** (2.82)	**-0.14** (-5.61)	0.04						-2.5%	666
RMW	**0.28** (3.69)	**-0.11** (-6.17)	0.05						-0.8%	666
CMA	**0.30** (4.57)	**-0.15** (-9.73)	0.12						-1.4%	666
BETA	**0.56** (4.36)	**-0.81** (-28.39)	0.56						-1.8%	631
PAYOUT	**0.24** (3.51)	**-0.32** (-20.69)	0.39						-1.5%	666

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RMW	**0.28** (3.69)	**-0.11** (-6.17)	0.05	0.09 (1.40)	**0.09** (4.99)	**-0.12** (-4.87)	**-0.41** (-15.27)	0.36	-0.8%	666
CMA	**0.30** (4.57)	**-0.15** (-9.73)	0.12	0.07 (1.15)	0.00 (-0.10)	**0.19** (8.73)	**-0.33** (-13.49)	0.33	-1.4%	666
BETA	**0.56** (4.36)	**-0.81** (-28.39)	0.56	0.08 (0.86)	**-0.37** (-14.06)	**-0.09** (-2.53)	**-0.91** (-24.32)	0.79	-1.8%	631
PAYOUT	**0.24** (3.51)	**-0.32** (-20.69)	0.39	-0.04 (-0.86)	**-0.07** (-5.07)	-0.03 (-1.83)	**-0.53** (-27.50)	0.73	-1.5%	666

Part 3: Duration-Driven Returns: Evidence From Dividend-Futures and Corporate Bonds

Understanding the Driver of Expected Returns

So far:

- Major equity risk factors are all long short-duration stocks
- Their return can be summarized by a duration factor

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Next:

- Are the high returns due to the short cash-flow duration?
- Or some other firm level characteristic correlated with duration?

  Recall,

$$E_t[r_{t+1}] = \sum_{m=1}^{\infty} w_t^m E_t[r_{t+1}^m]$$

- We argue that risk-adjusted returns on cash-flows
  - Are the same across firms (i.e., not firm specific drivers)
  - Decrease in maturity

  $\Rightarrow$ Duration-driven returns

Single Stock Dividend Futures

- Single stock dividend futures are claims to a given year's dividend on a firm
- Exchange traded products that allow you to buy a single year's dividend
- Similar to zero-coupon bonds, only the outcome is stochastic



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- Exchange traded on EuroStoxx
- Prices available on Bloomberg
- Maturity: 1 to 4 years
- Period: 2010 - 2018
- Notional outstanding: USD 6 billion

Duration versus Firm Effects

Calculate annualized expected returns based on expected dividends among analysts:

$$E_t[r^m_{t+m}] = E_t[D_{t+m}]/P^m_t - 1 \tag{6}$$

AVERAGE ALPHA TO DIVIDEND FUTURES WITH DIFFERENT MATURITY FOR DIFFERENT FIRMS

	Maturity of Strip				
	1 year	2 year	3 year	4 year	Average
Short-duration firms					
Long-duration firms					
Average across firms					

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AVERAGE ALPHA TO DIVIDEND FUTURES WITH DIFFERENT MATURITY FOR DIFFERENT FIRMS

	Maturity of Strip				
	1 year	2 year	3 year	4 year	Average
Short-duration firms	0.072	0.062	0.033	-0.005	0.041
Long-duration firms	0.087	0.061	0.023	0.006	0.044
Average across firms	0.080	0.062	0.028	0.000	

Takeaways:

- Retruns are the same across firms (i.e., not firm specific drivers)
- Returns decrease in maturity

Maturity versus Firm-Level Effects

Panel regressions with annual CAPM alpha on LHS for firm i, maturity m:

$$\alpha_{i,t+m} = \beta_0 + \beta_1 FIRM_{i,t} + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + FE_t + \varepsilon_{i,m,t}$$

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$$\alpha_{i,t+m} = \beta_0 + \beta_1 FIRM_{i,t} + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + FE_t + \varepsilon_{i,m,t}$$

Panel B: CAPM alpha	(1)	(2)	(3)	(4)	(5)
Dependent variable	CAPM alpha	CAPM alpha	CAPM alpha	CAPM alpha	CAPM alpha
2-year maturity dummy	-0.0109	-0.0503***	-0.0503***	-0.0573**	-0.0545***
	(-1.083)	(-3.774)	(-3.926)	(-3.209)	(-3.646)
3-year maturity dummy	-0.0415***	-0.0755***	-0.0755***	-0.0854***	-0.0814***
	(-3.353)	(-4.448)	(-4.968)	(-3.930)	(-4.798)
4-year maturity dummy	-0.0754***	-0.0748***	-0.0748**	-0.0707**	-0.0707**
	(-3.815)	(-4.072)	(-3.373)	(-3.124)	(-2.509)
Low LTG				-0.00018**	
				(-2.619)	
Short duration					-0.000990
					(-1.507)
Observations	675	667	667	615	615
R-squared	0.094	0.636	0.636	0.358	0.358
Fixed effect	Date/cur	Date/cur	Date/cur	Date/cur	Date/cur
Cluster	Firm	Firm	Firm/date	Firm/date	Firm/date
Weight	None	Notional	Notional	Notional	Notional

Conclusion: Duration-Driven Returns

Major equity risk factors

- Invest in short-duration firms
- Can be explained by a new duration factor in a three-factor model

Evidence from single-stock dividend futures:

- Suggests risk factors arise from premium on near-future cash flows
- Inconsistent with other firm-level drivers of returns

Future research

- Structural model for duration-driven returns
- Explicit links to risk or behavioral biases

Appendix

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Univariate Correlation

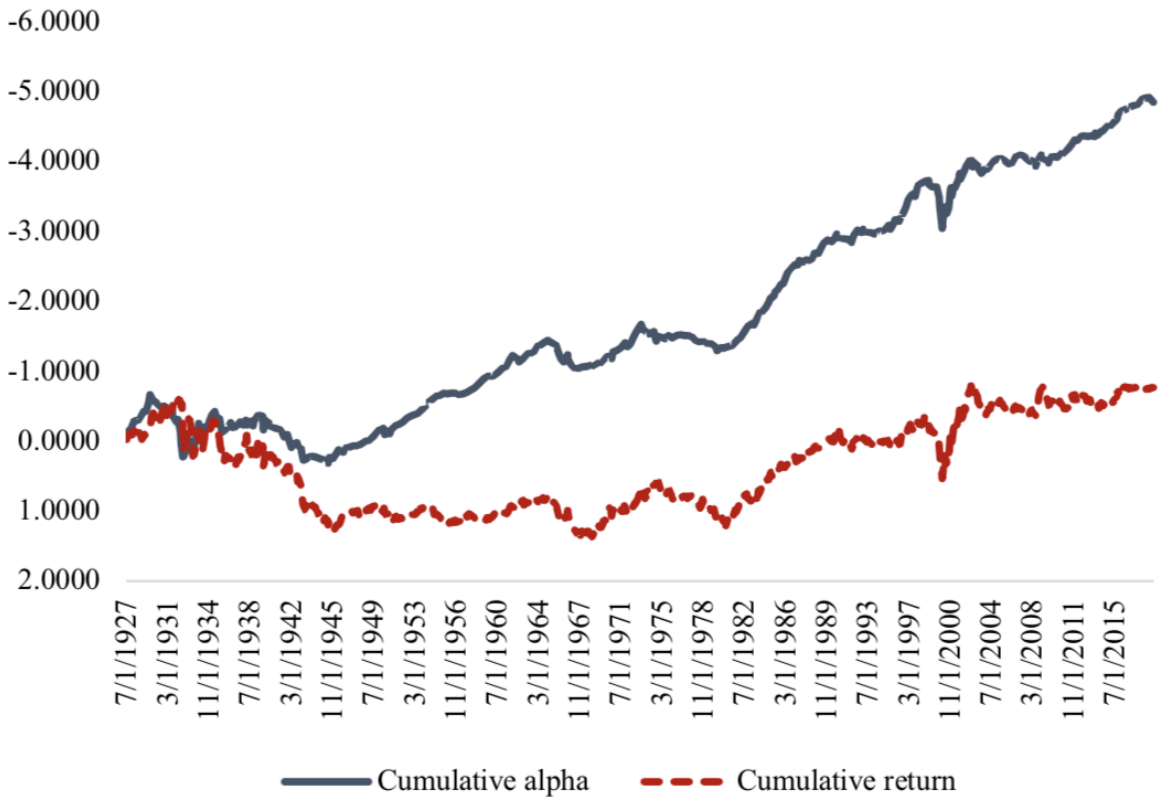
Panel B: Univariate Correlation Between LTG and Characteristics

Panel B: Firm-level univariate correlations between characteristics and survey expectations of growth rates

	High BM	High profit	Low inv	Low beta	Low IV	High pay
Survey growth rates	-0.40	-0.12	-0.26	-0.30	-0.37	-0.37

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Figure 4: Cumulative Alpha for the Duration Factor

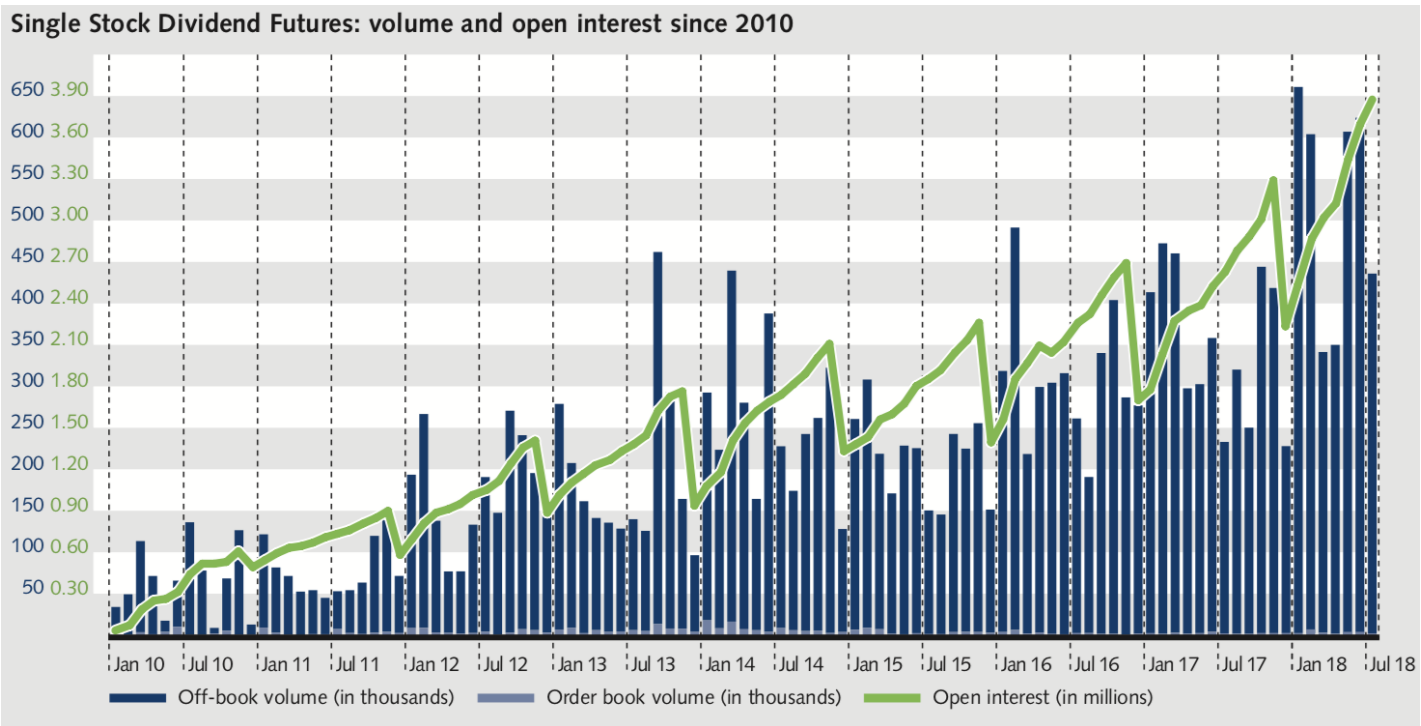


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Single Stock Dividend Futures

Some facts about dividend futures:

- Dividend futures arise from hedging demand for financial institutions
- Most trade takes place off the order book
- Daily volume 2018: 20,000 contracts (each contract is on 1,000 shares)



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Estimating Expected Return and Sharpe Ratios

- Use I/B/E/S estimates of expeced dividends to estimate expected returns on dividend strips:

$$E_t[r_{t+1}^{i,m}] = \left(\frac{E_t[d_{t+m}^i]}{f_t^{i,m}} \right)^{1/m} \tag{8}$$

  where $f_t^{i,m}$ is the futures price at time t for the $t+m$ dividend on firm i.

- Estimate CAPM alpha as

$$\alpha_t^{i,m} = E_t[r_{t+1}^{i,m}] - \beta^{i,m} E_t[r_{t+1}^{mkt}] \tag{9}$$

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