

PRIVATE COMPANY VALUATIONS BY MUTUAL FUNDS

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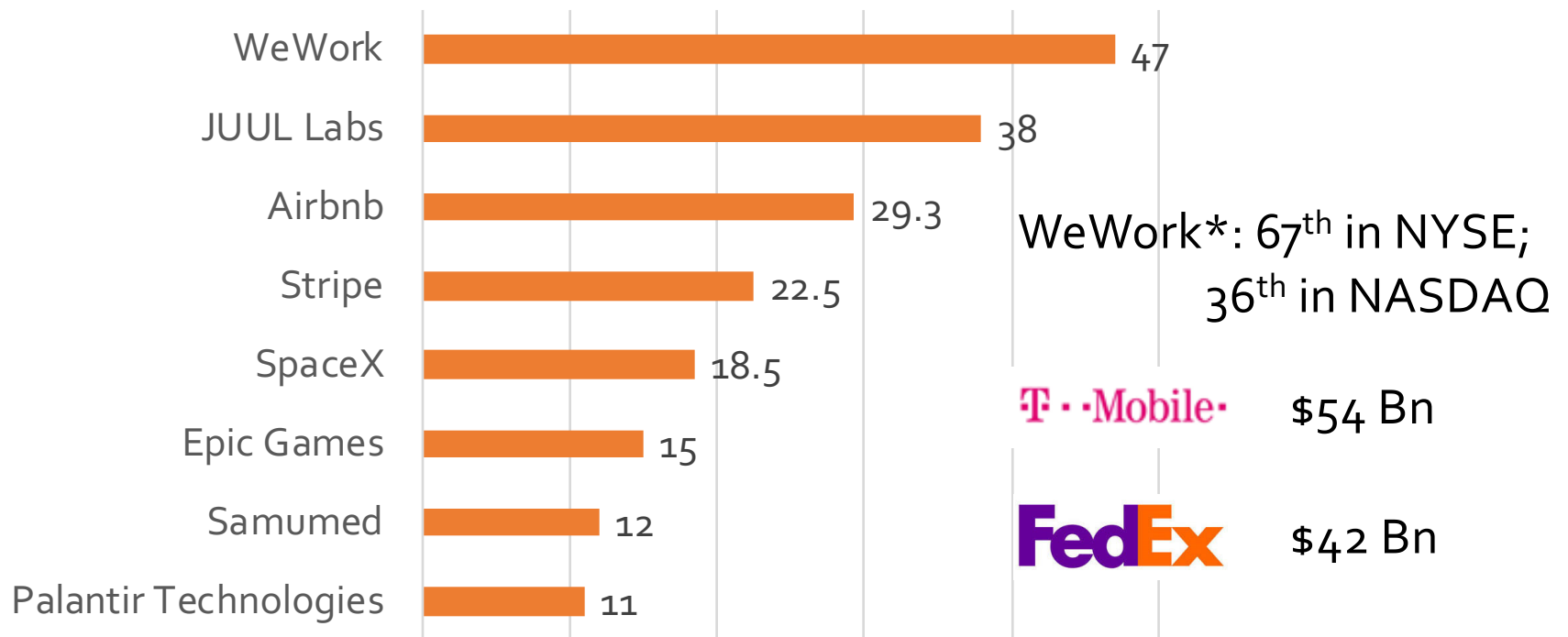
(with V. Agarwal, B. Barber, S. Cheng, A. Hameed)

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Background

- Pre-IPO startup valuations have soared.
 - 353 “**Unicorns**” (>\$1B) as of May 2019 (45 in Jan 2014, 141 in Oct 2015)
 - Airbnb, SpaceX are “**Decacorns**” (>\$10B).



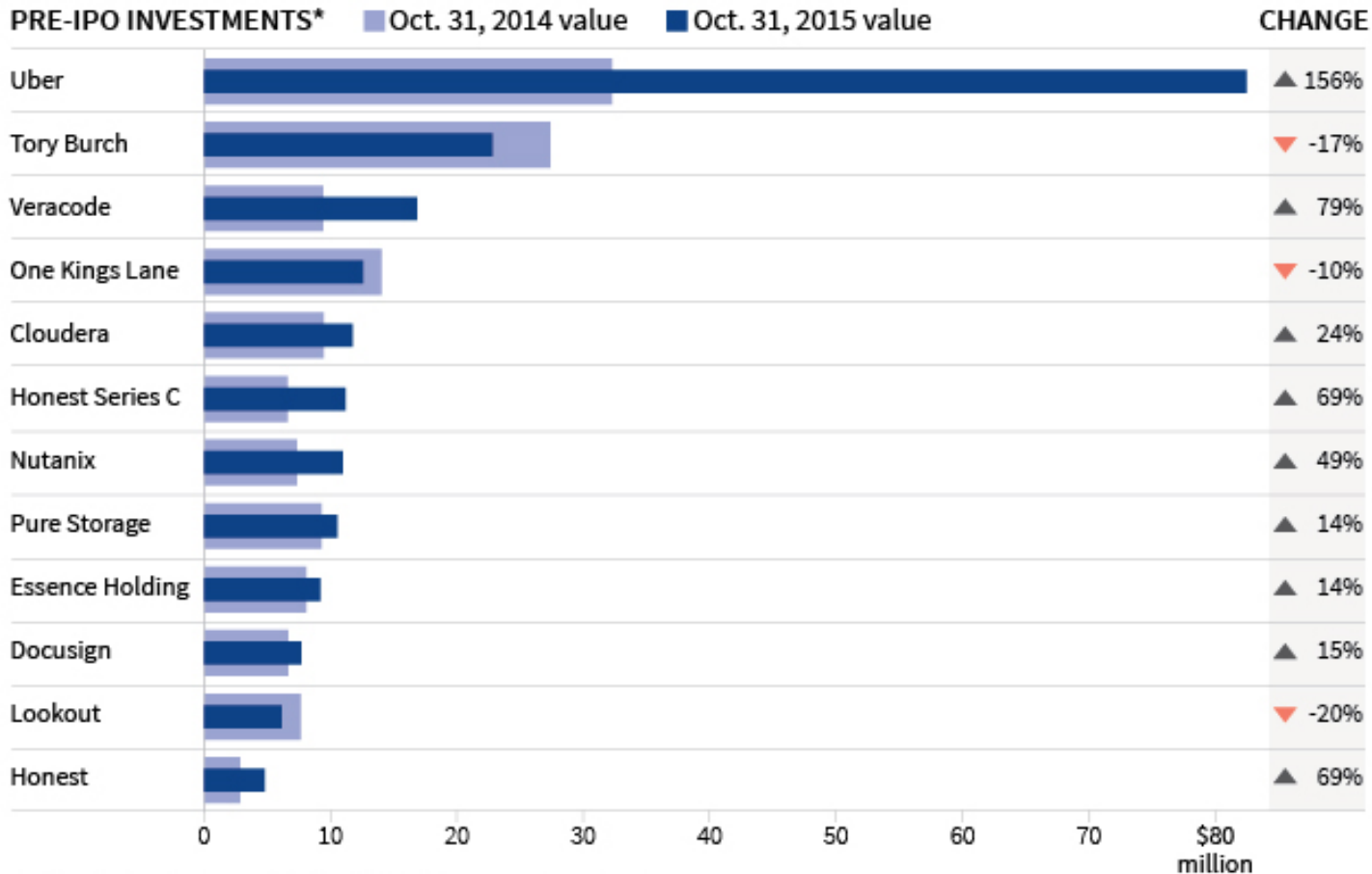
* Based on last private funding round valuation

Background

- Pre-IPO startup valuations have soared.
 - 353 “**Unicorns**” (>\$1B) as of May 2019 (45 in Jan 2014, 141 in Oct 2015)
 - WeWork, Airbnb, SpaceX are “**Decacorns**” (>\$10B).
- Tech startups started delaying going public in the 2000’s.
 - Age at IPO: **10** years in 2018 vs. **5** years in 1999
 - Number of Tech IPOs: **38** in 2018 vs. **370** in 1999
- Mutual funds started routinely investing in pre-IPO private securities around 2010.

Hartford fund rides Uber to a top performance

Growth Opportunities Fund loads up on private companies



REUTERS

- Hartford Growth Opportunities Fund: >6% pre-IPO investments
- It delivered 12.7% in 2015 compared to peer performance of 5.2%.

How does this affect fund investors?

Pros: Expanded access to high-growth tech firms

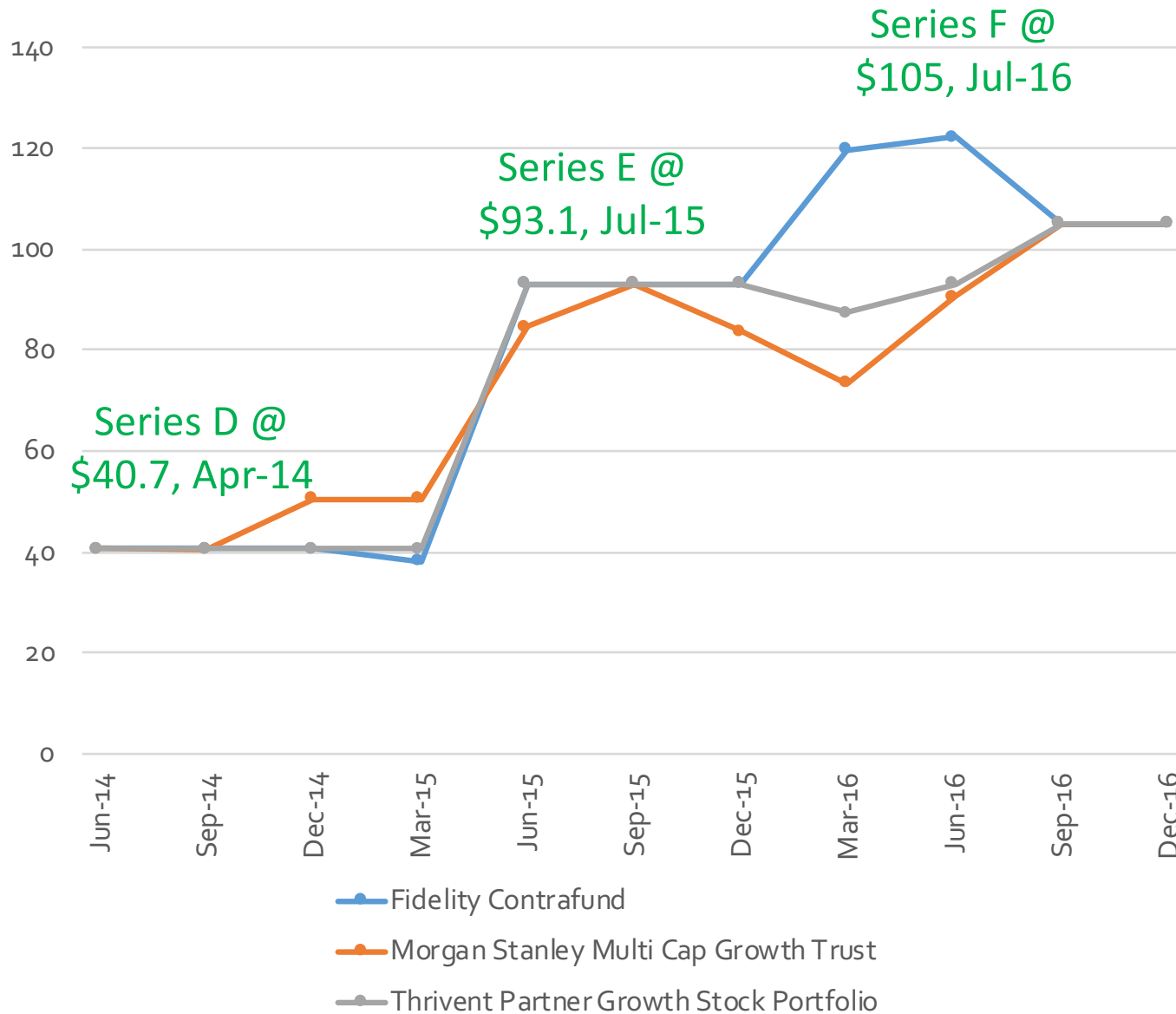
Cons: Potential conflicts of interest between investors and fund managers, between investors

- No observable market prices, mutual funds value these convertible preferred as Level 3 assets and report quarterly *private valuations* to the SEC. **Daily (unobserved) updates incorporated into fund NAV.**
- Potential incentives to strategically 'manage' valuation (Barber and Yasuda (2017))
- Open-end MF in contrast to VC funds where capital is locked up for 10 years, no trading at NAV
- MF Investors may be trading funds at **NAV that value the same startups at different prices**

WeWork

- Mutual funds participated in earlier rounds at purchase prices at or below \$54.
- In January 2019, Series H closed at \$110/share (\$47B val)
- At the time (latest), 3 mutual fund families valued WeWork shares at:
 - Vanguard: \$110 (\$69)
 - T. Rowe Price: \$52 (\$54)
 - Fidelity: \$75 (\$54)
- The company filed for IPO in summer 2019, but after a string of controversies around top management withdrew the IPO.
- Reported IPO could not have been priced above \$23-28/share, leaving late stage investors at loss
- CEO ousted; Bond rating cut to junk and sell-off (.85), layoffs expected

Airbnb Series D Valuations by 3 Mutual Funds



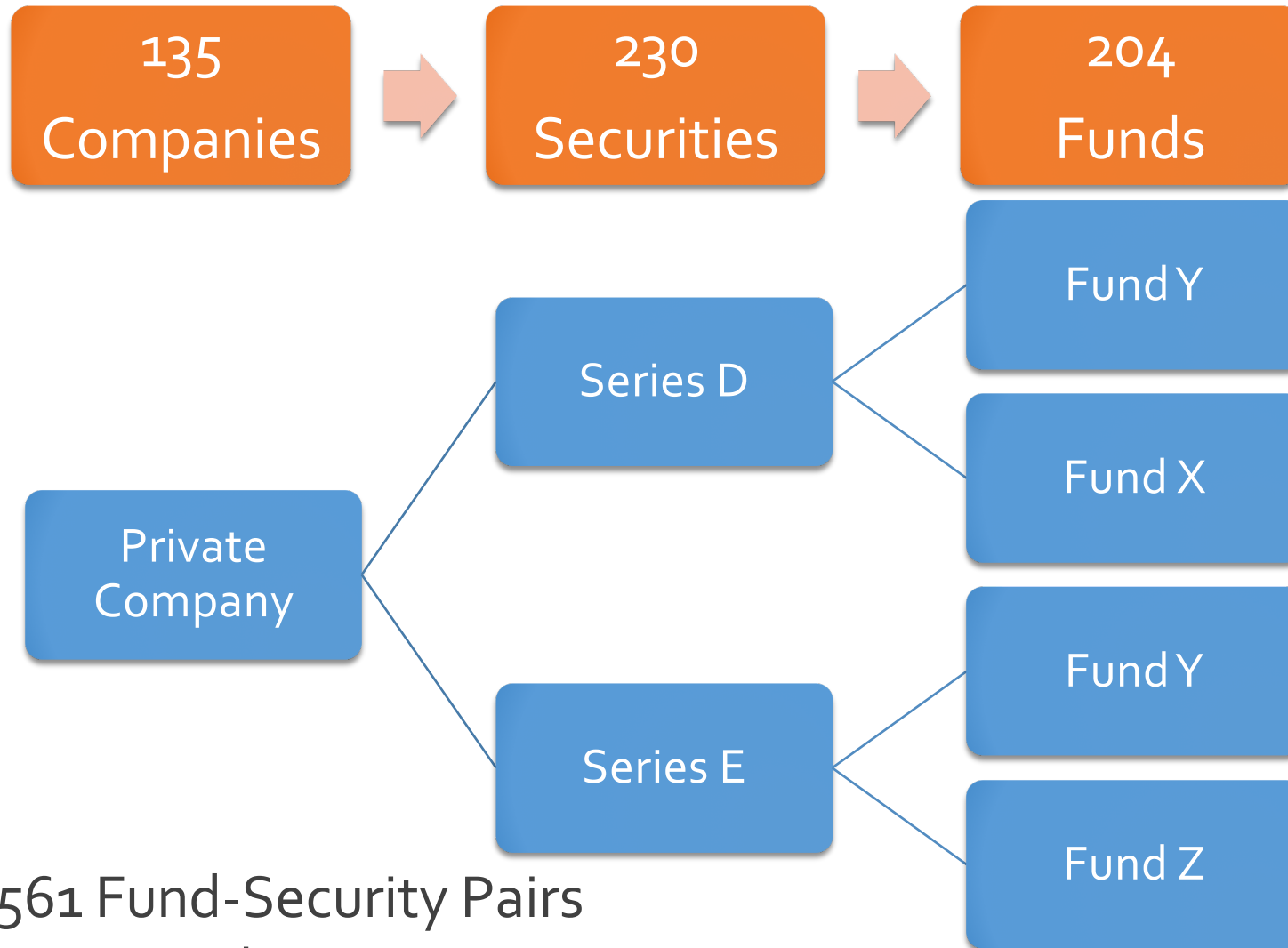
Research Questions

- Do mutual funds report *different simultaneous prices* for the same private security? How are the prices updated?
- Can fund *investors* capitalize on the mutual fund valuation practices? If so, do they trade opportunistically?
- Do fund *families* strategically use valuations to affect fund flows?

Data Collection

- Private companies have multiple funding rounds and issue multiple *distinct* securities.
 - Need to identify by series, not just issuer name
- Security names not standardized and no reliable identifier provided
- CRSP Survivor-Bias Free Mutual Fund Database
- SEC Mutual Fund N-CSR and N-Q Filings
- Certificate of Incorporation, S-1 Filings from Genesis; TechCrunch, web search
- Sample: U.S. active equity mutual funds, 2010 to 2016

Sample: Security-Funds



1,561 Fund-Security Pairs
12,007 Fund-Security-Quarters

Measuring Price Dispersion

- $DispPrc_Avg_{s,q} = \frac{\sigma_{s,q}}{\bar{P}_{s,q}}$
 - $\sigma_{s,q}$: standard deviation of prices on security s across funds (in quarter q , with the same ending month)
 - $\bar{P}_{s,q}$: average price on security s across funds
- $DispPrc_Med_{s,q}$: replace average price with median price

Descriptive Statistics: Security-Quarters

	No. Firm	No. Security	Security-Quarter Obs.	Mean	Std. Dev.	10%	25%	Median	75%	90%
<i>Panel A: Security-Quarters (Full Sample)</i>										
NumFd	106	170	1,359	8.435	6.547	2	3	7	11	18
<i>Panel B: Security-Quarters (with same ending month) (Full Sample)</i>										
DispPrc_Avg	106	170	2,274	0.039	0.084	0.000	0.000	0.000	0.049	0.130
DispPrc_Med	106	170	2,274	0.040	0.090	0.000	0.000	0.000	0.048	0.128
StdPrc	106	170	2,274	0.719	2.034	0.000	0.000	0.000	0.440	1.900
AvgPrc	106	170	2,274	16.153	23.367	2.566	4.581	8.467	16.730	32.390
MedPrc	106	170	2,274	16.232	23.547	2.565	4.581	8.432	16.860	33.300

Dispersion Within and Across Fund Families

	No. Firm	No. Security	Security-Quarter Obs.	Mean	Std. Dev.	10%	25%	Median	75%	90%
<i>Panel C: Within Family, Family-Security-Quarters</i>										
NumFd	98	154	2,463	2.970	1.483	2	2	3	3	5
DispPrc_Avg	98	154	2,463	0.003	0.031	0.000	0.000	0.000	0.000	0.000
DispPrc_Med	98	154	2,463	0.003	0.030	0.000	0.000	0.000	0.000	0.000
<i>Panel D: Across Families, Security-Quarters</i>										
NumFam	50	84	860	3.103	1.510	2	2	2	4	5
DispPrc_Avg	50	84	860	0.100	0.133	0.000	0.002	0.060	0.143	0.246
DispPrc_Med	50	84	860	0.103	0.155	0.000	0.002	0.058	0.143	0.251

Stale Pricing

	No. Security	Obs.	Mean	Std. Dev.	10%	25%	Median	75%	90%
<i>Panel A: Family-Security-Quarter Return Characteristics</i>									
Return	229	4,286	0.033	0.257	-0.162	-0.015	0.000	0.044	0.229
<i>Panel B: Family-Security Return Characteristics</i>									
%Zero Return_PVT	229	474	0.486	0.332	0.000	0.200	0.467	0.750	1.000
Qtr to Update	229	474	2.485	1.976	1	1	2	3	5
%Zero Return_PUB	6,416	18,373	0.003	0.052	0	0	0	0	0

- Fund families report **zero returns** in **49%** of all quarters and on average take **2.5 quarters** to update the price.

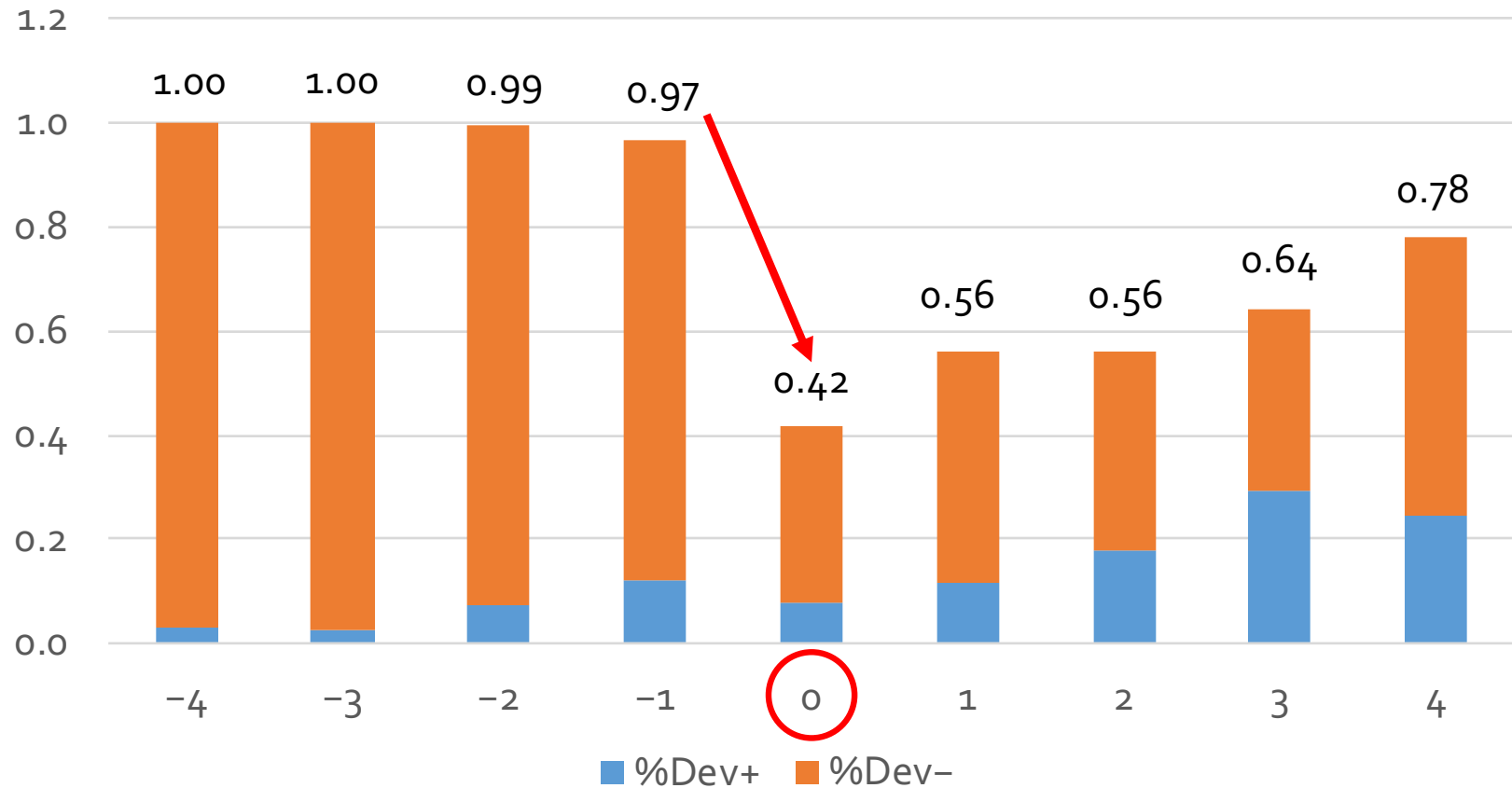
Deviation from Benchmark Price

- Dev = family valuation/benchmark valuation – 1
- Dummy (Dev) = 1 if |Dev| > 1% and 0 otherwise

	No. Firm	No. Security	Σ Dummy (Dev)	Family-Security-Quarter Obs.	%Dev
Any Prior Deal Price	139	229	2,972	4,796	0.620
Latest Deal Price	139	229	3,008	4,763	0.632
Acquisition Price	137	224	3,560	4,653	0.765
Family-Firm Average Price	39	132	588	2,413	0.244

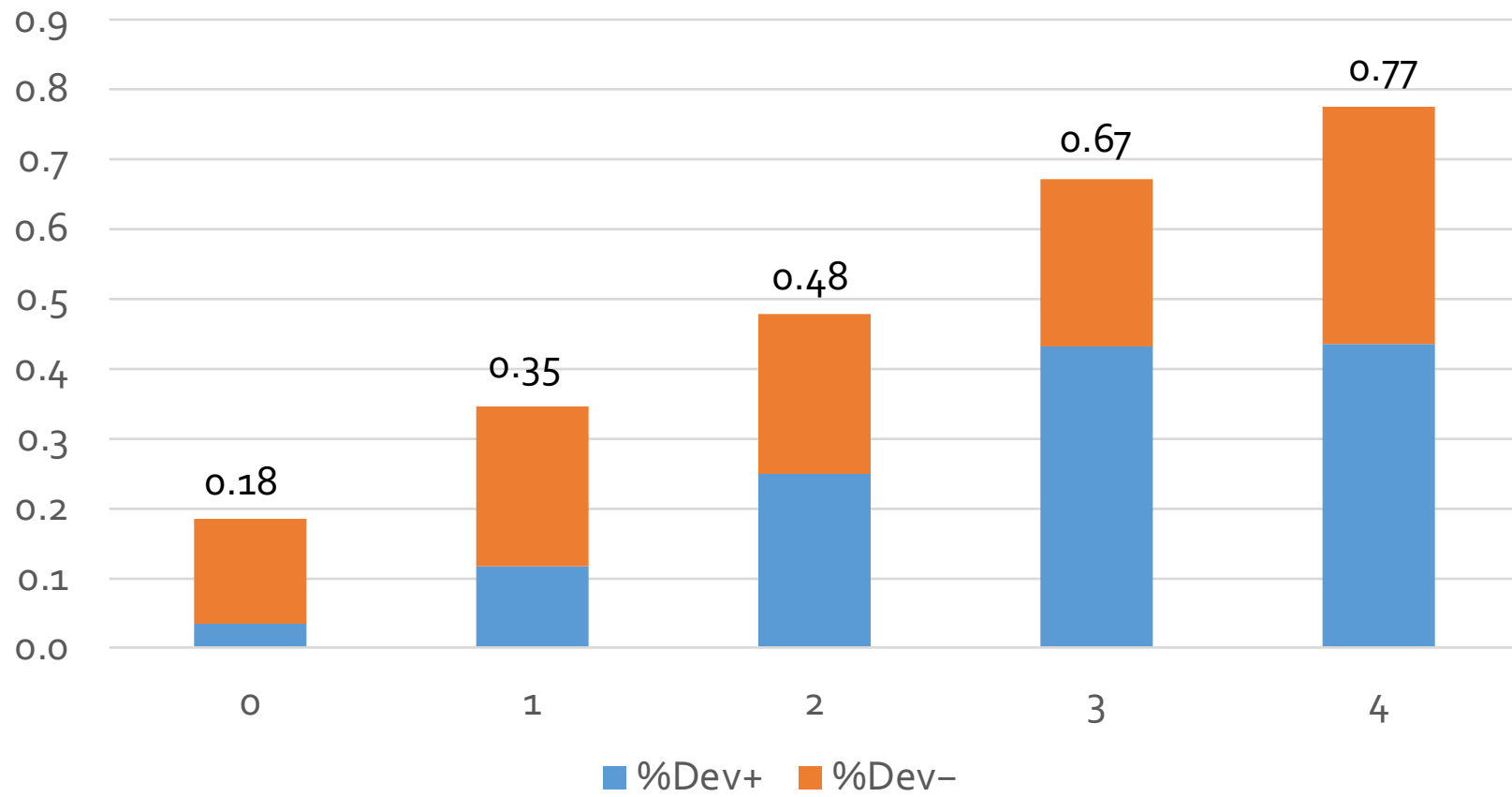
- Frequent deviation from deal price and acquisition price.
- Most fund families price different securities on the same company at the same price.

Deviation of **Early** Round Security Valuation from the New Round Deal Price



- 55% of early round securities' valuation gets matched to new deal price upon follow-on round.

Deviation of **New** Round Security Valuation from the New Round Deal Price



- Among families reporting lower prices, the median discount is **-10%** for up to three quarters.

Performance of Private Securities

$$\bullet (R_{F,s,q} - RF_q) = \alpha + \beta(R_{m,q} - RF_q) + \varepsilon_{F,s,q}$$

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Alpha	0.029** (2.23)	0.005 (0.38)	0.014 (0.94)	0.009 (0.73)	-0.015 (-1.22)	-0.005 (-0.33)
Follow-on Dummy				0.351*** (4.94)	0.350*** (5.18)	0.333*** (5.01)
MKTRET	0.317 (1.62)	0.440** (2.21)	0.567** (2.61)	0.403** (2.11)	0.525*** (2.94)	0.562*** (2.78)
MKTRET _{t-1}		0.604*** (3.33)	0.663** (2.41)		0.601*** (3.99)	0.630*** (2.80)
MKTRET _{t-2}		0.467* (1.88)	0.252 (1.09)		0.455** (2.17)	0.282 (1.44)
HML and SMB	No	No	Yes	No	No	Yes
Market Beta	0.317 (1.62)	1.511*** (3.33)	1.482** (2.64)	0.403** (2.11)	1.581*** (4.16)	1.474*** (3.19)
HML Tilt			-1.098** (-2.54)			-0.766* (-1.91)
SMB Tilt			1.717*** (4.44)			1.399*** (3.62)

Predictability of Fund Returns

- Stale pricing + price updating upon new funding rounds
- Change in deal price is large: mean **51%**; 75th 102%
- Examine k -day CARs of fund returns around follow-on round of financing

Mutual Fund Returns around Follow-On Rounds

	[-10, -1]	[-5, -1]	[-3, -1]	[0, 3]	[0, 5]	[0, 10]	[11, 15]	[16, 20]
<i>Panel A: Benchmark-adjusted CAR (CAR_{BMK})</i>								
All Funds	0.095 (0.73)	0.043 (0.55)	0.037 (0.62)	0.141* (1.95)	0.311*** (2.70)	0.429** (2.62)	-0.129 (-1.43)	-0.042 (-0.54)
Big 5	0.187 (1.32)	0.095 (0.95)	0.037 (0.47)	0.123 (1.48)	0.197** (2.56)	0.300*** (2.84)	-0.055 (-0.67)	0.009 (0.09)
Non-Big 5	0.000 (0.00)	-0.011 (-0.11)	0.036 (0.49)	0.159 (1.56)	0.428** (2.33)	0.561* (1.95)	-0.205 (-1.41)	-0.093 (-0.96)

- Big 5 Fund Families: Fidelity, T. Rowe Price, Hartford, American Funds, and Blackrock
- Benchmark-adjusted CAR: 3-day **14 bps**, 5-day **31 bps**
- Similar results for market-adjusted CAR and among funds without redemption fee

Fund Exposure To Private Securities

- **Investment weight** of private security (WTPE)
- **Valuation change**
 - Change in fund valuation (ΔValue)
 - Change from fund valuation to current deal price (Update)
- $CAR_BMK_{f,s} = \alpha + \beta \Delta\text{Value}_{f,s} \times WTPE_{f,s} + \varepsilon_{f,s}$

	[0, 3]		[0, 5]		[0, 10]	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
$\Delta\text{Value} \times \text{WTPE}$	0.375***		0.432***		0.788**	
	(3.49)		(3.74)		(2.46)	
Update \times WTPE		0.384***		0.410***		0.812**
		(3.51)		(3.33)		(2.44)

- β is reliably positive, despite downward bias from measurement imprecision in WTPE and ΔValue

Fund Flows around Follow-on Rounds

- Stale pricing + price updating upon new funding rounds → predictable abnormal fund returns
- Do fund investors exploit this trading opportunity?

[-30, -1] [-20, -1] [-10, -1] [-5, -1] [-3, -1] [0, 3] [0, 5] [0, 10] [0, 20] [0, 30]

Panel C: Benchmark-adjusted Flow around Follow On Round (without Redemption Fee)

0.093	0.088	0.078	0.070*	0.057	-0.068	-0.013	-0.041	-0.031	-0.029
(1.19)	(1.23)	(1.16)	(2.01)	(1.66)	(-0.85)	(-0.29)	(-0.56)	(-0.65)	(-0.75)

Panel D: Z-Score on Flow around Follow On Round (without Redemption Fee)

0.002	-0.005	-0.007	0.048	0.031	-0.026	-0.029	-0.062	-0.046	-0.033
(0.09)	(-0.25)	(-0.32)	(1.07)	(0.78)	(-0.91)	(-1.14)	(-1.32)	(-1.63)	(-1.41)

- Investors do not trade opportunistically by timing their entry into and exit from funds.

Determinants of Within Family Allocation (%)

- $Allocation_{f,s,q} = \alpha + \beta_1 FamVal_{f,q-1} + \beta_2 Experience_{f,q-1} + \varepsilon_{f,s,q}$

		Model 1	Model 3
High Family Value	RETBMK	0.094*** (3.11)	0.011 (0.73)
	Dollar Fee	28.802*** (2.85)	-2.084 (-0.21)
PE Experience	PE	5.228*** (4.96)	3.383*** (3.48)
	RETBMK × PE		0.489*** (2.87)
	Dollar Fee × PE		35.235** (2.23)
	Controls	Yes	Yes
	Family-Quarter FE	Yes	Yes

- Past performance and fee revenue mostly matter for funds that already hold private securities.

Strategic Year End Pricing

- Convexity in fund flow-performance relation and spillovers in cash inflows between funds within a family
- We conjecture that private securities held by funds that outperformed in first 3 quarters are marked up more aggressively in 4th quarter.
- Diff-in-diff around follow-on rounds between:
 - Q1-3 vs. Q4
 - Top 20% performers (in Q1-3) vs. rest

Strategic Year End Pricing: CAR

Rank of Fund Performance	[0, 3]			[0, 5]			[0, 10]		
	Q1-3	Q4	Q4 – Q1-3	Q1-3	Q4	Q4 – Q1-3	Q1-3	Q4	Q4 – Q1-3
<i>Panel A: Benchmark-adjusted CAR (CAR_BMK)</i>									
Bottom 80%	0.260*** (2.94)	-0.059 (-0.95)	-0.319*** (-2.84)	0.315*** (4.05)	0.025 (0.31)	-0.290** (-2.54)	0.573*** (3.82)	0.080 (0.88)	-0.493** (-2.59)
Top 20%	0.106 (1.60)	0.536*** (6.93)	0.430*** (4.23)	0.269*** (3.94)	0.492*** (5.80)	0.223* (2.03)	0.343*** (4.45)	0.724*** (5.45)	0.382** (2.73)
Top – Bottom	-0.154 (-1.39)	0.595*** (6.02)	0.749*** (4.95)	-0.046 (-0.44)	0.467*** (4.00)	0.513*** (3.23)	-0.230 (-1.37)	0.644*** (4.00)	0.874*** (3.71)

- Top 20% funds mark up more in Q4 than
 - First 3 quarters
 - Bottom 80% funds

Strategic Year End Pricing: Δ Value \times WTPE

Rank of Fund Performance	$(V_q/V_{q-1} - 1) \times \text{WTPE}$			$\text{Ln}(V_q/V_{q-1}) \times \text{WTPE}$		
	Q1-3	Q4	Q4 - Q1-3	Q1-3	Q4	Q4 - Q1-3
Bottom 80%	0.104** (2.23)	0.121*** (8.10)	0.017 (0.43)	0.076** (2.41)	0.099*** (8.27)	0.023 (0.88)
Top 20%	0.154*** (4.40)	0.280*** (5.83)	0.126*** (2.74)	0.120*** (4.27)	0.217*** (5.96)	0.097*** (2.96)
Top - Bottom	0.050 (0.86)	0.159*** (3.16)	0.109* (1.79)	0.044 (1.05)	0.118*** (3.08)	0.074* (1.75)

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$$\bullet \frac{V_q}{V_{q-1}} = \frac{V_q}{DEAL_S} \times \frac{DEAL_S}{DEAL_{S-1}} \times \frac{DEAL_{S-1}}{V_{q-1}}$$

$$\bullet \ln\left(\frac{V_q}{V_{q-1}}\right) = \ln\left(\frac{V_q}{DEAL_S}\right) + \ln\left(\frac{DEAL_S}{DEAL_{S-1}}\right) - \ln\left(\frac{V_{q-1}}{DEAL_{S-1}}\right)$$

markup after
the new deal

deal price
change

markup since
the prior deal

Strategic Year End Pricing: Δ Value \times WTPE

Rank of Fund Performance	$\text{Ln}(V_q/\text{DEAL}_s) \times \text{WTPE}$			$\text{Ln}(\text{DEAL}_s/\text{DEAL}_{s-1}) \times \text{WTPE}$			$\text{Ln}(V_{q-1}/\text{DEAL}_{s-1}) \times \text{WTPE}$		
	Q1-3	Q4	Q4 - Q1-3	Q1-3	Q4	Q4 - Q1-3	Q1-3	Q4	Q4 - Q1-3
Bottom 80%	-0.022*** (-4.85)	-0.024*** (-4.51)	-0.002 (-0.32)	0.101*** (3.23)	0.130*** (11.63)	0.029 (1.07)	0.003 (0.63)	0.007 (0.68)	0.003 (0.33)
Top 20%	-0.029** (-2.72)	-0.015 (-1.48)	0.014 (0.89)	0.197*** (6.34)	0.219*** (7.05)	0.022 (0.66)	0.048*** (3.08)	-0.013 (-0.71)	-0.061*** (-2.91)
Top - Bottom	-0.007 (-0.58)	0.010 (0.86)	0.016 (0.95)	0.095** (2.16)	0.089** (2.70)	-0.006 (-0.15)	0.045*** (2.71)	-0.019 (-0.95)	-0.064*** (-2.77)

markup after the
new deal

deal price change

markup since the
prior deal

- Top 20% funds enter Q4 with low markup w.r.t. the prior deal price \rightarrow more “dry powder” to strategically time the markup at year ends.

Conclusion

- Material variation in the prices of private securities: **10%** across families; Stale pricing
- Fund **investors** can capitalize on stale pricing but do not trade opportunistically.
 - Predictable abnormal fund returns around follow-on rounds: 5-day CAR **31 bps**
 - No abnormal fund flows (yet)
- Fund **families** capitalize on stale pricing.
 - Favor experienced and high family value funds
 - Strategically time the markup after the year-end follow-on rounds

Final remark

- Current results may be biased by the sample period 2010-2016 that only includes a huge tech boom and bullish market
- Conflicts become acute in downward markets and fund outflows
- Anecdote 1: The Firsthand Fund held ~10% of fund assets in SoloPower at 400% of purchase price in 2010. After a 70% write down & large fund outflows, the fund converted to a closed-end fund
- Anecdote 2: A multi-billion dollar UK Woodford Equity fund had to suspend withdrawals this summer after poor public stock performance & outflows induced their private holding % to hit 10%
- We are updating our sample period & adding down exit analysis