The Efficiency of IPO Stocks

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Outline

- Background: The concept of price efficiency
- Research Questions:
  - The price efficiency of IPO VS. Seasoned stocks
  - The role of financial intermediaries (VC, UWs, Syndicate) on the price efficiency in the aftermarket
  - The effect of price efficiency on long-run performance
- Possible mechanism through which price efficiency changes
- Empirical Results
- Conclusion

What is an efficient (informative) price ?

- An efficient price is a price close to its fundamental value
- The price becomes more informative (efficient) as the price moves closer to its fundamental value (Harris, 2003)
- The fundamental value is unobservable, so we cannot directly measure the efficiency of a stock's price
- However, various indirect methods have been developed to estimate the level of efficiency
- I use Hasbrouck's (1993) measure as my main proxy for efficiency
- I also use four other measure of efficiency (auto-correlation, variance ratio, short-term volatility, and price delay)

How does price become efficient?

- Factors that improve price efficiency
  - Broad information dissemination (Grossman and Stiglitz, 1980, Verrecchia, 1982)
    - Low costs of becoming informed
    - Uninformed become better informed
    - More individuals become informed
  - No restrictions on informed trading (Bris et al, 2007, Boehmer and Wu, 2012)
  - Prices determined by market forces (price not manipulated)

Hasbrouck's (1993) measure of efficiency

My main measure of the level of efficiency of a stock is from Hasbrouck (1993)

- Decompose stock price into random walk component and stationary component by Beveridge and Nelson (1981) identification restriction
- The efficient price is assumed to follow a random walk
- The stationary (i.e., non-random) component is labeled as pricing errors
- Standard deviation of the pricing error (SDPE) measures the magnitude of deviation from the efficient price
- SDPE is inversely related to price efficiency

Why is price efficiency important?

- Firm's perspective
  - Accurate estimate of the cost of capital (Harris, 2003)
  - Optimal allocation of capital (Wurgler, 2000)

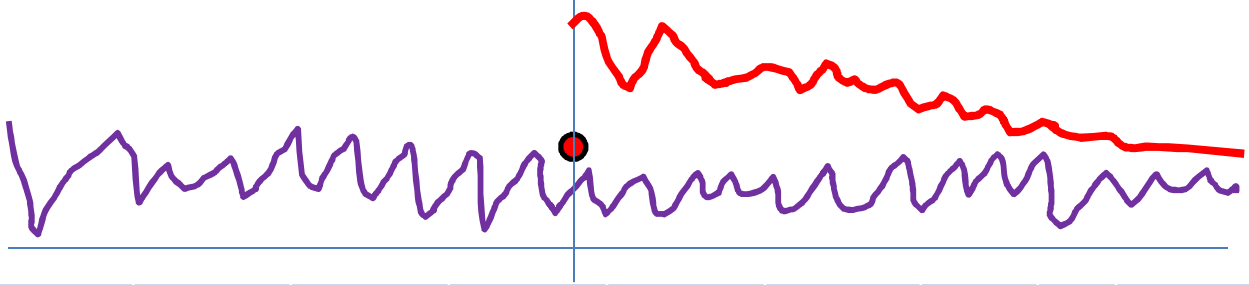
- Shareholder (investor)'s perspective
  - Accurately measure firm performance
  - Allow firm's shareholders and outsiders to monitor management

Research Question 1

- **Are IPO stocks less efficient than matched sample of seasoned stocks?**

Listing date : 2 Jul 1962

Listing date : 10 Nov 1999



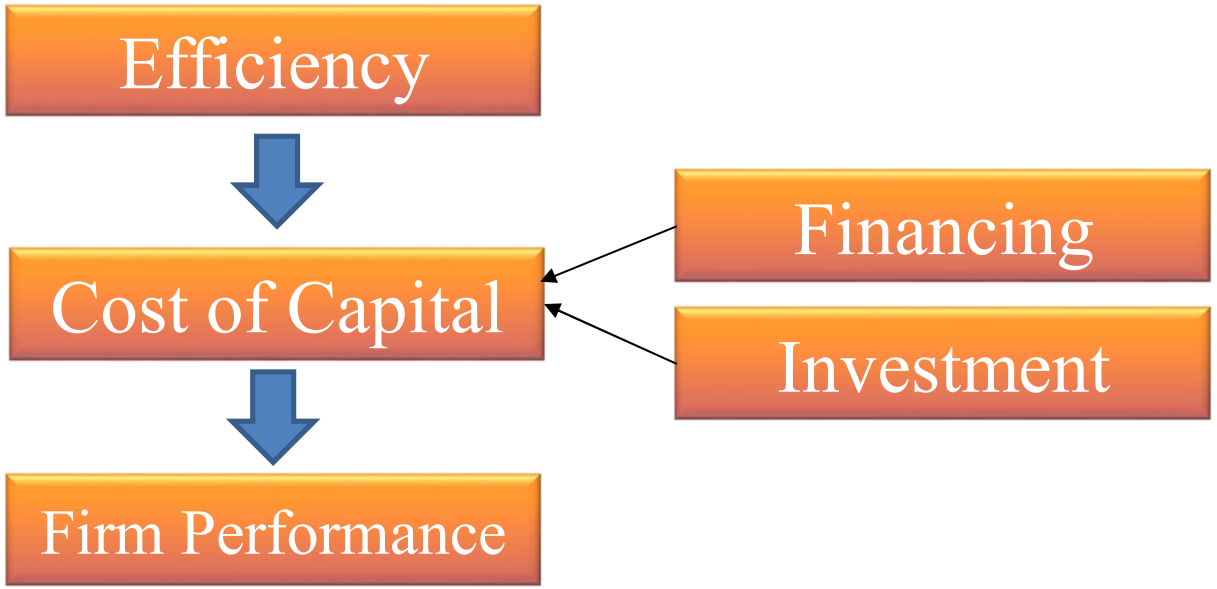
Week	1	2	3	4			35	AVG
CP	0.00141	0.00142	0.00153	0.00157	0.00118	…	…	0.00098
UPS	0.00185	0.00089	0.00078	0.00065	0.0006			0.0010

Research Question 2

- **Do financial intermediaries impact the level of efficiency of IPO stocks?**
  - Underwriters: Prestigious vs. non-prestigious (reputation rank by Loughran and Ritter (2004): prestigious dummy is above 8 on a 0 to 9 point scale)
  - Venture Capital: VC-backed vs. non-VC-backed (SDC dummy variable)
  - Syndicate: Large vs. small (the number of lead, co-lead, and co-managers: large syndicate dummy is above median)

Research Question 3

- **Do IPO stocks with higher efficiency have higher long-term performance?**



- Ritter (1991): IPO stocks underperform seasoned stocks over the three to five years after the IPO date
- My third research question might explain this puzzling phenomenon

Why might IPO stocks be less efficient than seasoned stocks?

- The price of IPO stocks may drift away from its fundamental value because of
  - Regulations and restrictions which affect IPO firms
    - Quiet period (Bradley, Jordan, Ritter, and Wolf, 2004)
    - Lock-up period (Field and Hanka, 2001)
  - Price support as manipulative action (Rudd, 1993; Jenkinson and Ljungqvist, 2001)
  - Lack of seasoning of IPO firms (Houge et al, 2000; Krigman et al, 1999; Aggarwal and Conroy, 2000)

The role of financial intermediaries (Underwriter prestige)

- Prestigious underwriters should improve efficiency
  - Draw more informed purchasers (Benveniste and Spindt,1989)
  - Institutional ownership and underwriter prestige (Field and Lowry, 2009)
  - Employ more experienced analysts, resulting in higher-quality a nalyst reports (Gleason and Lee, 2003)

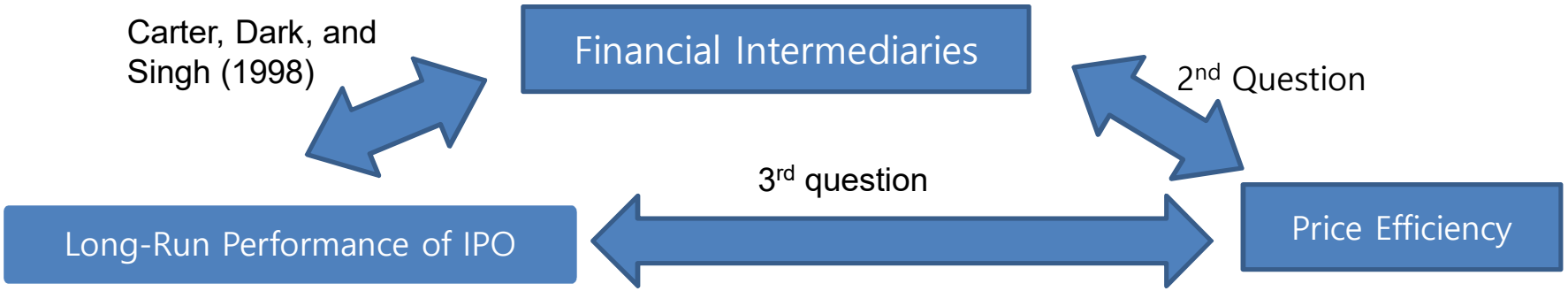
The role of financial intermediaries (VC-backing)

- IPOs backed by venture capitalists (VCs) should have more efficient prices
  - Entice more institutional purchasers
    - *Field and Lowry (2009)*
  - Valuable screening and monitoring role
    - *Meggison and Weiss (1991)*

The role of financial intermediaries (Syndicate size)

- Large managing syndicates should enhance price efficiency
  - IPOs with large managing syndicates generate more information in the premarket
    - *Corwin and Schultz (2005)*
  - IPOs with large managing syndicates produce more analyst coverage and market-making services in the aftermarket
    - *Corwin and Schultz (2005)*

Do IPO stocks with higher efficiency have better long-term performance?



- Why should IPOs with higher level of efficiency have better long-run performance?
  - Firm's perspective: Accurate and timely information → better estimate of cost of capital → optimal allocation of capital
  - Shareholder's perspective: accurate measure of firm performance →good monitoring (reward\discipline)

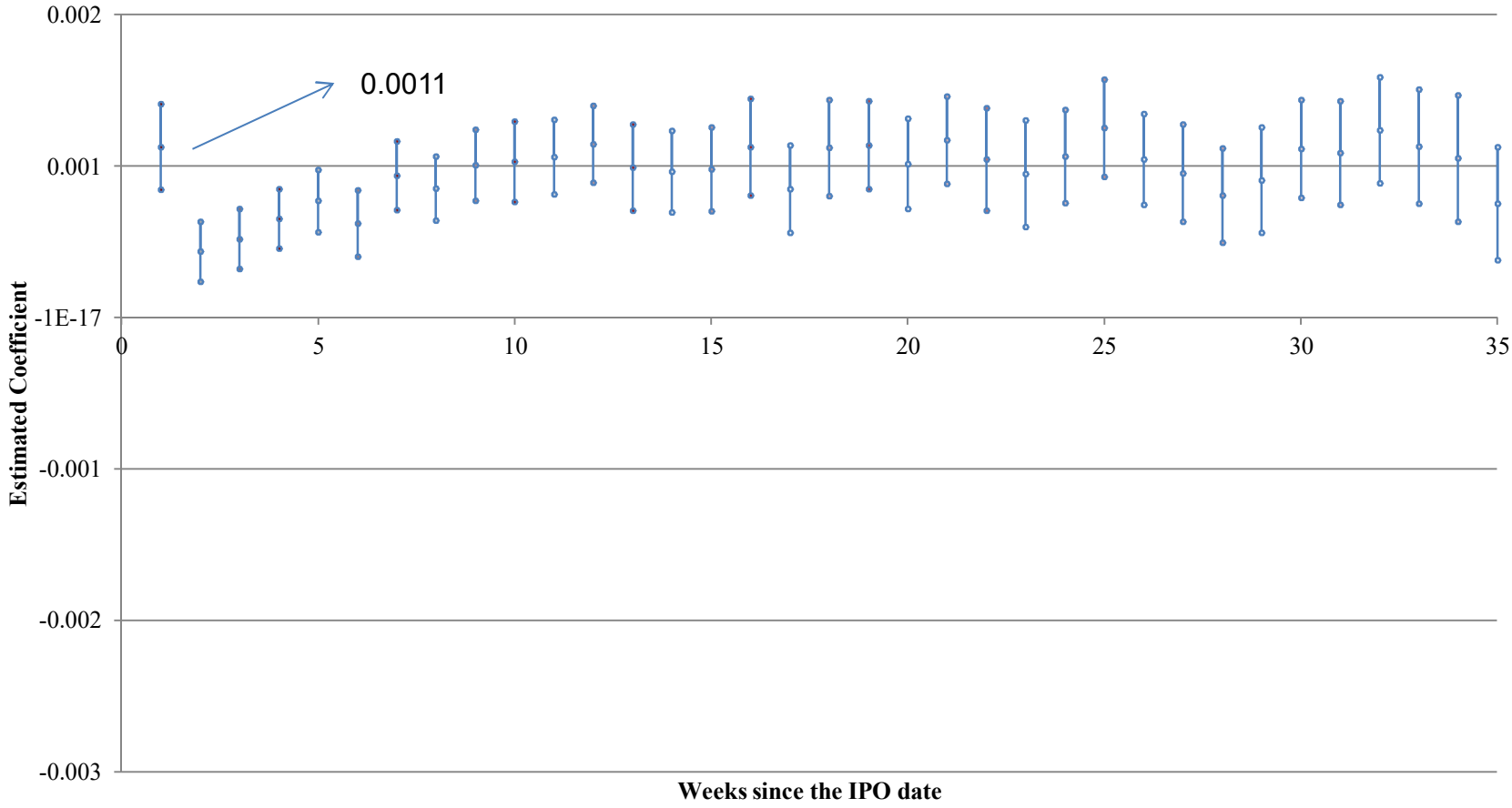
Data

- SDC, CRSP, Jay Ritter's website (underwriter's reputation),
- and TAQ
- IPO stocks between 1993 and 2005
- Criteria for selecting matching seasoned stocks (SS)
  - At least three years before the IPO date, same industry, price of SS within 15% of IPO's closing price on the first day of trading, closest market cap
- 3,486 IPOs and 3,292 seasoned stocks
- 122M trades and 200M quotes for IPOs after screen following TAQ literature
- 117M trades and 294M quotes for seasoned stocks after screen

Q1: Are IPO stocks more or less efficient than seasoned stocks? (DV = SDPE)

	(1)	(2)	(3)	(4) → First week
Intercept	0.0067	0.0009	0.0365	0.0268
	(<.0001)	(<.0001)	(<0.0001)	(<0.0001)
IPO_dummy	0.0013	0.0006	0.0005	0.0011
	(<.0001)	(0.0013)	(0.0035)	(<0.0001)
ln(numtrade)		-0.0016	-0.0011	-0.0005
		(<.0001)	(<0.0001)	(<0.0001)
ln (mktcap)		-0.0016	-0.0017	-0.0016
		(<.0001)	(<0.0001)	(<0.0001)
NYSE		0.0019	0.0020	-0.0004
		(<.0001)	(<0.0001)	(0.2174)
NASDAQ		0.0063	0.0060	0.0021
		(<.0001)	(<0.0001)	(<0.0001)
Year dummies	No	No	Yes	Yes
Industry dummies	No	No	Yes	Yes
Adj. R2	0.0059	0.3530	0.3566	0.5439
No. of Obs.	6778	6778	6778	4982

Figure 1 (The estimated coefficient of IPO dummy for the 35 weeks after the IPO offer date



My first research question was …

- Are IPO stocks less efficient than a matched sample of seasoned stocks?
  - **IPO stocks** are **less** efficient than seasoned stocks during my 175 trading day testing period

Q2: Do financial intermediaries impact the level of efficiency of IPO stock? (DV = SDPE)

	(1)	(2)	(3)	(4)
Intercept	0.0311	0.0346	0.0327	0.0304
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
High-rep	-0.0019			-0.0013
	(<0.0001)			(0.0004)
VC back		-0.0004		0.0001
		(0.2267)		(0.8267)
Large Syndicate			-0.0034	-0.0030
			(<0.0001)	(<0.0001)
Ln(numtrades)	-0.0015	-0.0016	-0.0015	-0.0015
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Ln(mktcap)	-0.0010	-0.0013	-0.0010	-0.0008
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
NYSE	0.0035	0.0032	0.0033	0.0035
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
NASDAQ	0.0073	0.0074	0.0074	0.0074
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Adj. R2	0.3344	0.3288	0.3407	0.3430
No. of Obs	3486	3486	3486	3486

Figure 2 (The estimated coefficient of high-rep dummy for IPO stocks for the 35 weeks after the IPO offer date)

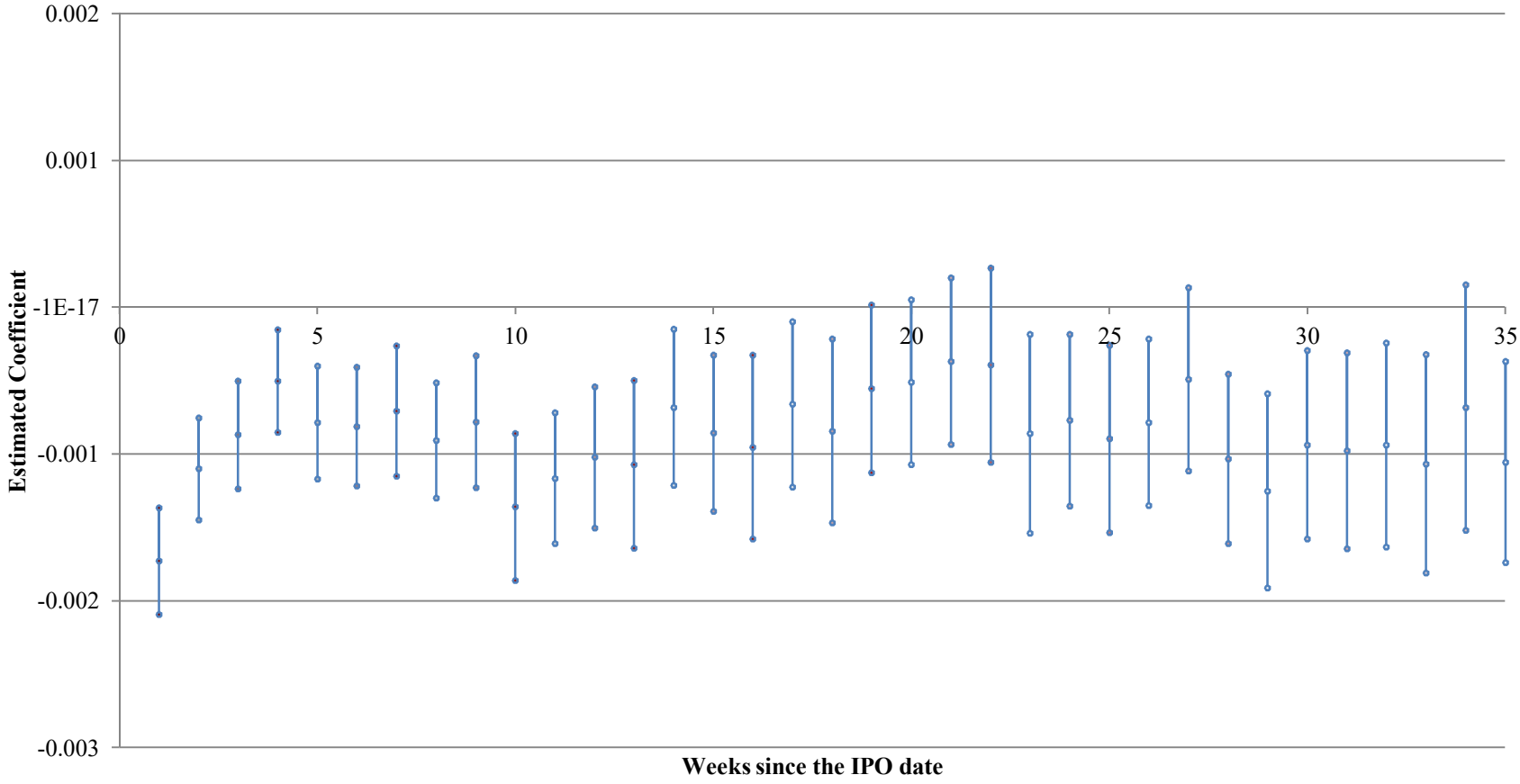


Figure 3 (The estimated coefficient of VC back dummies for IPO stocks for the 35 weeks after the IPO offer date)

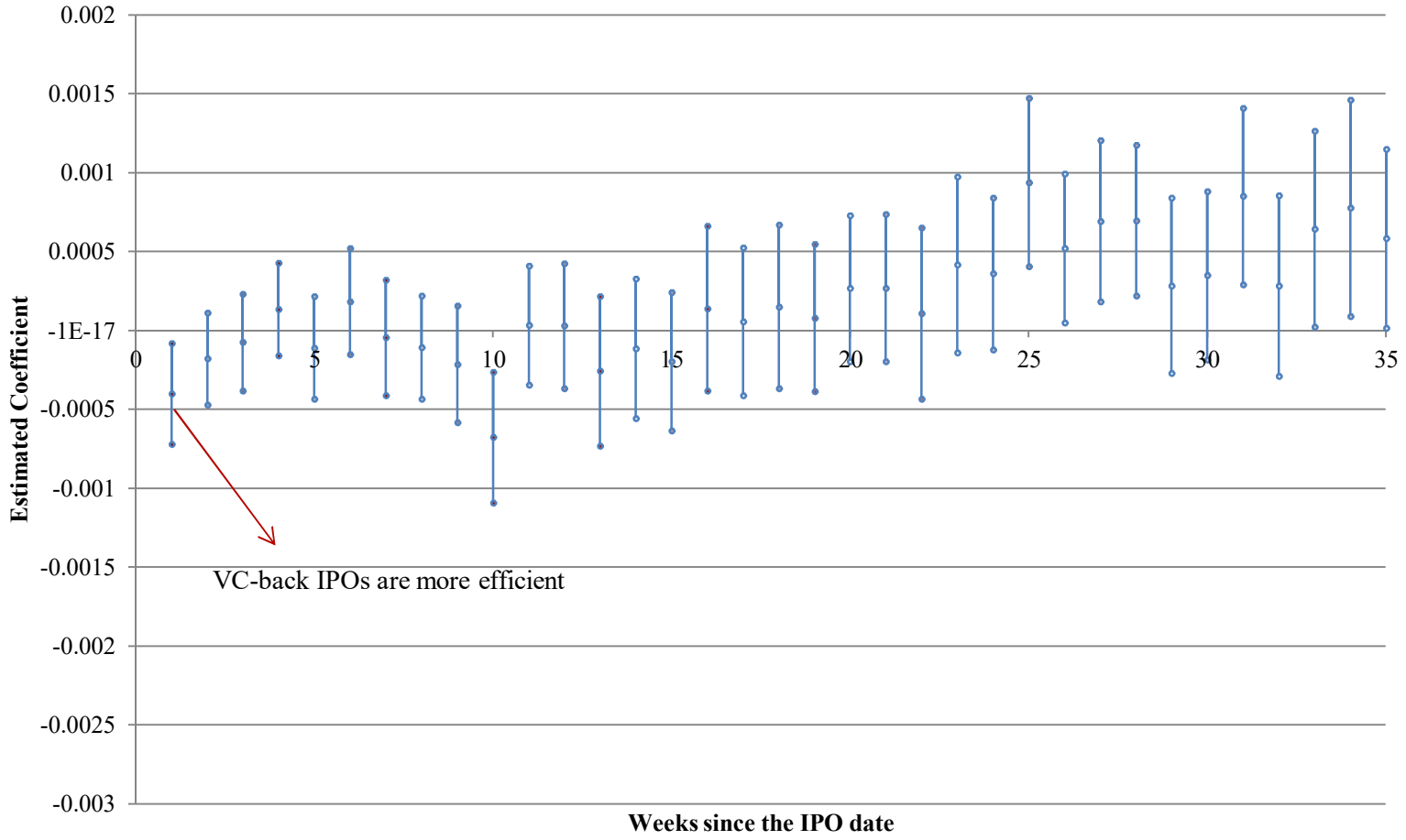
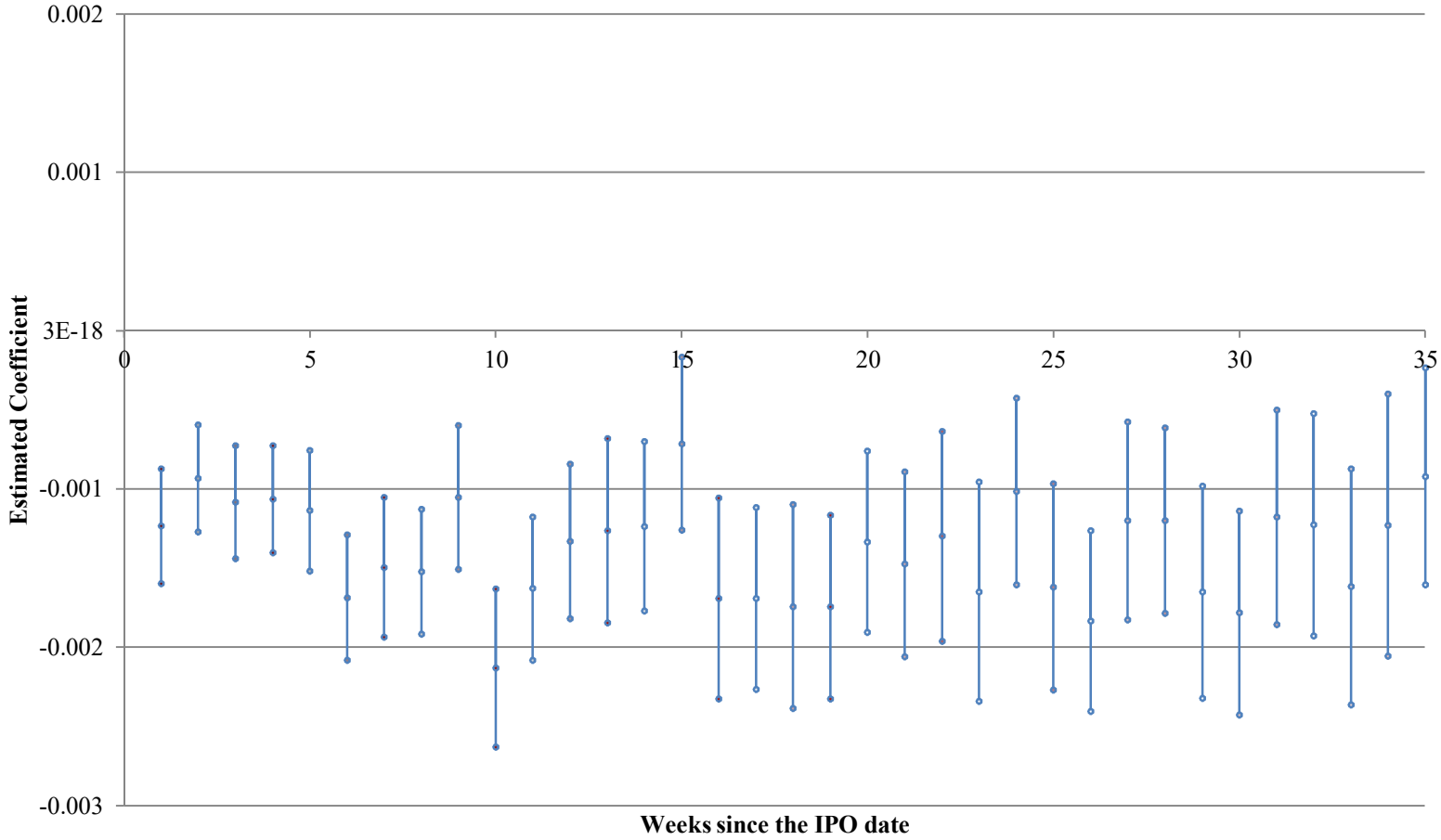


Figure 4 (The estimated coefficient of large syndicate dummy for IPO stocks for the 35 weeks after the IPO offer date)



My second research question was…

- Do financial intermediaries play an important role in enhancing the level of efficiency in IPO stocks?
  - IPOs with prestigious underwriters, VC-backing, and large syndicates play a role in enhancing the efficiency of IPO stocks.
  - IPOs with prestigious underwriters and those with large managing syndicates have a higher level of efficiency throughout most of the first 35 weeks of trading
  - IPOs with VC-backing have a higher level of efficiency only through the first week

Q3:Do IPO stocks with lower efficiency have lower long-term performance? (Logistic regression, DV= Delist dummy)

Delist dummy is equal to one If the IPOs (SS) delists due to poor performance within five years of the IPO date, 0 otherwise

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-2.145	-2.2732	-2.4991	2.2647	-0.1530	0.9439	0.5524	-0.2999
	(<.0001)	(<.0001)	(<.0001)	(0.0005)	(0.8880)	(0.3739)	(0.6033)	(0.7835)
IPO_Dummy	0.4678		0.4221	0.4051				
	(<.0001)		(<.0001)	(<0.0001)				
SDPE		49.7710	48.3425	49.231	47.829	51.270	43.681	41.938
		(<.0001)	(<.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Highrep					-0.5679			-0.4830
					(<0.0001)			(0.0006)
VC-back						-0.0674		0.0501
						(0.5691)		(0.6806)
Large Syndicate							-0.6516	-0.5365
							(<0.0001)	(0.0005)
Ln(numtrades)				0.3802	0.1971	0.1736	0.1813	0.1992
				(<0.0001)	(0.0025)	(0.0076)	(0.0052)	(0.0023)
Ln(mktcap)				-0.6985	-0.4138	-0.5221	-0.4539	-0.3752
				(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
NYSE				0.0153	-0.7580	-0.8467	-0.8196	-0.7458
				(0.9436)	(0.0571)	(0.0335)	(0.0404)	(0.0644)
NASDAQ				-0.1386	-0.2473	-0.2263	-0.1907	-0.2090
				(0.4695)	(0.4425)	(0.4822)	(0.5575)	(0.5199)
Year dummies	No	No	No	Yes	Yes	Yes	Yes	Yes
Industry dummies	No	No	No	Yes	Yes	Yes	Yes	Yes
-2 log likelihood	5245	5137	5105	4612	2572	2590	2572	2590
No. of Obs	6778	6778	6778	6778	3486	3486	3486	3486

Only IPOs

Research question 3 was…

- Do IPO firms or seasoned firms with lower efficiency delist from their current exchange due to poor performance during the five years after the IPO date?
  - IPO stocks underperform seasoned stocks (column 1, 3, and 4)
  - Stocks with a lower level of efficiency underperform stocks with a high level of efficiency (all columns)
  - IPO stocks with prestigious underwriters or large managing syndicates are less likely to be delisted (outperform) over five years relative to IPO stocks with low reputation underwriters or small syndicates (column 5, 7, and 8)

Other Efficiency Measures

- |AR30|: Absolute value of the thirty-minute quote midpoint returns autocorrelation
- |1 − VR(30,60)|: Absolute value of one minus the variance ratio calculated over 30 and 60 minute intervals
- Short term volatility: The quote midpoint return volatility over the thirty-minute interval
- Price delay (Hou and Moskowitz, 2005): calculate the average delay with which information is impounded into stock prices.

Are IPO stocks more or less efficient than seasoned stocks? (other efficiency measures)

	SDPE	|AR30|	|1 − VR(30,60)|	STVOL	PD
Intercept	0.0368	0.3826	0.6821	0.0548	1.385
	(<.0001)	(<.0001)	(0.0004)	(<.0001)	(<.0001)
IPO_Dummy	0.0005	0.0012	0.0210	0.0035	0.0165
	(0.0035)	(0.7215)	(0.0065)	(<.0001)	(0.0343)
Ln(numtrades)	-0.001	-0.0391	-0.072	0.004	-0.0435
	(<.0001)	(<.0001)	(<.0001)	(0.0534)	(<.0001)
Ln(mktcap)	-0.002	0.0066	0.016	-0.004	-0.0448
	(<.0001)	(0.0008)	(0.0005)	(<.0001)	(<.0001)
NYSE	0.0002	0.0434	0.0669	0.001	-0.0030
	(<.0001)	(<.0001)	(<.0001)	(0.4272)	(0.8815)
NASDAQ	0.006	0.0505	0.1853	0.0048	0.040
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(0.0313)
Year dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
Adj. R2	0.3566	0.2120	0.2235	0.1154	0.1512
No. of Obs	6778	6547	6572	6763	6765

Do financial intermediaries impact the level of efficiency of IPO stocks? (other efficiency measures)

	SDPE	|AR30|	|1 − VR(30,60)|	STVOL	PD
Intercept	0.030	0.368	0.8592	0.0460	1.3248
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
Highrep dummy	-0.0013	-0.006	-0.0044	-0.0009	-0.0237
	(0.0004)	(0.3230)	(0.8032)	(0.017)	(0.0653)
VC-back dummy	0.00007	-0.008	0.0210	0.0007	-0.0125
	(0.8267)	(0.098)	(0.1222)	(0.4009)	(0.2575)
Large Syndicate dummy	-0.0030	-0.020	-0.0554	-0.0063	-0.0499
	(<.0001)	(0.0133)	(0.0365)	(0.0072)	(0.0020)
Ln(numtrades)	-0.0015	-0.0379	-0.0827	-0.0005	-0.0682
	(<.0001)	(<.0001)	(<.0001)	(0.2945)	(<.0001)
Ln(mktcap)	-0.0008	0.0104	0.0217	-0.0014	-0.0198
	(<.0001)	(0.0004)	(0.007)	(0.0001)	(0.0032)
NYSE	0.0035	0.0376	0.0573	-0.0015	-0.0013
	(0.0006)	(0.0129)	(0.0406)	(0.3319)	(0.9728)
NASDAQ	0.0074	0.0565	0.1818	0.0030	0.0642
	(<.0001)	(<.0001)	(<.0001)	(0.0285)	(0.0574)
Year dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
Adj. R2	0.3430	0.2489	0.2532	0.1175	0.2166
No. of Obs	3486	3347	3367	3475	3484

Do stocks with lower efficiency have lower long-term performance? (other efficiency measures, Logistic regression, DV= Delist dummy)

	SDPE	|AR30|	|1 − VR(30,60)|	STVOL	PD
Intercept	2.2647	4.0342	4.1205	3.4288	3.5176
	(0.0005)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
Efficiency proxies	49.2310	0.6783	0.7640	15.6051	0.6154
	(<.0001)	(0.0176)	(0.0417)	(<.0001)	(<.0001)
IPO dummy	0.4051	0.3797	0.4044	0.3560	0.4072
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
Ln(numtrades)	0.3802	0.3409	0.3227	0.3119	0.3390
	(<.0001)	(0.0305)	(<.0001)	(<.0001)	(<.0001)
Ln(mktcap)	-0.6985	-0.7933	-0.7849	-0.7379	-0.7658
	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
NYSE	0.0153	0.0757	0.0981	0.1188	0.1236
	(0.9436)	(0.7248)	(0.6472)	(0.5810)	(0.5641)
NASDAQ	-0.1386	0.1440	0.1477	0.1113	0.1638
	(0.4695)	(0.4422)	(0.4288)	(0.5528)	(0.3783)
Year dummies	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
-2 log likelihood	4611	4533	4683	4647	4661
No. of Obs	6778	6547	6572	6763	6765

Calendar Time Portfolio Approach (control for dependence of multiyear AR for event firms)

- Alternative way to examine the relation between efficiency and long-run performance
- For each month over the period of 1993-2005, I form IPO calendar-time portfolios by including IPOs starting from the 2nd month, up until 9th months after the month of the IPO date
- I develop a time series of portfolio returns to run the three (four) factor model
  - $r_{p,t} - r_{f,t} = \alpha + \beta(r_{m,t} - r_{f,t}) + sSMB_t + hHML_t$
  - $r_{p,t} - r_{f,t} = \alpha + \beta(r_{m,t} - r_{f,t}) + sSMB_t + hHML_t + uUMD_t$

Abnormal return

Abnormal returns (alpha) of portfolios sorted by SDPE (one-way sort)

Different models	EW 3-Factor	VW 3-Factor	EW 4-factor	VW 4-factor
SDPE				
Q1 (most efficient)	1.56%	1.07	1.27%	0.88%
t-statistics	(3.73)	(2.15)	(3.36)	(1.85)
Q2	1.47%	0.96%	1.21%	0.71%
t-statistics	(2.75)	(1.55)	(2.36)	(1.18)
Q3	-0.16%	-1.49%	-0.11%	-1.42%
t-statistics	(-0.30)	(-2.63)	(-0.21)	(-2.59)
Q4 (least efficient)	-2.91%	-3.09%	-2.72%	-2.80%
t-statistics	(-5.64)	(-4.39)	(-5.33)	(-4.09)
Q4 – Q1	4.54%	4.12%	4.13%	3.71%
t-statistics	(7.32)	(5.31)	(5.31)	(5.14)

Abnormal returns of portfolio sorted by SDPE and UW's rank (Two-way sort)

Holding period = 9 months			
	Low SDPE	High SDPE	Low - High SDPE
UW-rep (high)	1.12% (1.82)	-1.80% (-2.96)	2.94%*** (3.98)
UW-rep (low)	-0.03% (-0.03)	-2.08% (-3.40)	1.91% (1.51)
Highrep – Lowrep	1.29% (0.95)	0.29% (0.44)	3.47%*** (4.60)

Winner/Loser

Abnormal returns of portfolio sorted by SDPE and VC-backing (Two-way sort)

Holding period = 9 months			
	Low SDPE	High SDPE	Low - High SDPE
VC-Back	1.40% (1.96)	-1.74% (-2.54)	3.26%*** (4.09)
Non-VC-Back	0.78% (2.08)	-1.28% (-2.15)	2.68%*** (3.82)
vcback – nvcback	0.76% (1.03)	-0.46% (-0.75)	2.81%*** (3.43)

Winner/loser

Abnormal returns of portfolio sorted by SDPE and syndicate size (Two-way sort)

Holding period = 9 months			
	Low SDPE	High SDPE	Low - High SDPE
SYN2 (large)	1.38% (2.18)	-2.11% (-3.19)	3.35%*** (4.83)
SYN1 (small)	-0.24% (-0.22)	-2.94% (-3.51)	2.82%** (2.41)
SYN1 – SYN2	0.26% (0.19)	0.94% (0.97)	4.49%*** (4.56)

Winner/loser

Are better intermediaries bringing IPO firms to the market more likely to have efficient stock prices?

- Ideal setting for testing the role of financial intermediaries on efficiency:
  - Financial intermediaries are randomly matched with IPO firms
- However, IPO firms brought to the market by better intermediaries (high-reputation underwriters and large syndicate size) may have higher efficiency to begin with
  - Fernando, Gatchev, and Spindt (2005): firms and underwriters choose each other mutually.
- To circumvent this selection bias, I use propensity-scoring method (Lowry, Schwert, and Officer, 2010)

Maximum likelihood estimate of the logit model to explain the characteristics to distinguish IPOs with prestigious UW from IPOs with non-prestigious UW

- $Highrep\ dummy_i = a_0 + a_1 initial\ return + a_2 prcupdate + a_3\ ln(numtrades) + a_4\ ln(mktcap) + a_5 age + a_6 VC - back\ dummy + a_7 large\ syndicate\ dummy$
- $\text{Large syndicate dummy} = a_0 + a_1 initial\ return + a_{22}\text{prcupdate} + a_3\ \ln(numtrades) + a_4\ \ln(mktcap) + a_5\text{age} + a_6 VCbackdummy + a_7 High\ reputation\ dummy$

Logit regression of FI for propensity-scoring method

The logistic regression of high-rep dummy

Intercept	**-18.30 (<0.0001)**
Initial return	-0.9171 (<0.0001)
Prcupdate	1.3383 (0.0002)
Ln(numtrades)	-0.1531 (0.0010)
Ln(mktcap)	1.5978 (<0.0001)
age	0.0066 (0.0213)
VC-back dummy	0.8187 (<0.0001)
Large syndicate dummy	0.3550 (<0.0001)
-2 log likelihood	2708.211
No. of Obs	2,232

The logistic regression of large syndicate dummy

Intercept	**-12.89 (<0.0001)**
Initial return	-0.5950 (0.0249)
Prcupdate	2.2433 (<0.0001)
Ln(lnumtrades)	0.3107 (<0.0001)
Ln(lmktcap)	0.9905 (<0.0001)
age	0.0025 (0.5277)
VC-backdummy	0.5024 (0.0009)
High-rep dummy	1.5264 (<0.0001)
-2 log likelihood	2679.342
No. of Obs	2,842

The effect of financial intermediaries on the efficiency after controlling for selection bias

	(1)	(2)	(3)	(4)
Intercept	0.0190	0.0202	0.0277	0.0317
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
High-rep dummy	-0.0003	-0.0003		
	(0.0011)	(0.0009)		
Large Syndicate dummy			-0.0005	-0.0005
			(0.0108)	(0.0113)
Ln(numtrades)	-0.0013	-0.0014	-0.0013	-0.0017
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Ln(mktcap)	-0.0002	-0.0001	-0.0011	-0.0010
	(0.0100)	(0.0395)	(<0.0001)	(<0.0001)
NYSE	0.0005	0.0008	0.0016	0.0024
	(0.1773)	(0.0513)	(0.0058)	(0.0017)
NASDAQ	0.0055	0.0053	0.0063	0.0064
	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	No	Yes	No	Yes
Adj. R2	0.5615	0.5801	0.4094	0.4875
No. of Obs	6696	6696	8526	8526

Conclusion

- IPO stocks are less efficient than seasoned stocks during my testing period (175 trading days)
- Prestigious lead underwriters, VC-backing, and large managing syndicates enhance efficiency of IPO stocks
  - The effect of prestigious underwriters and large syndicates on the level of efficiency are not affected by selection bias
- IPO stocks (stocks) with lower efficiency underperform IPO stocks (stocks) with higher efficiency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Thank You !

From here

- All slides below are appendix materials.

Descriptive statistics (Table 2)

	IPO stocks			Seasoned stocks			IPO – Seasoned stock
	Mean	Std. dev	Median	Mean	Std. dev	Median	Difference in means
Panel A: TAQ variables							
Standard deviation of pricing error (SDPE)	0.0076	0.0092	0.0054	0.0062	0.0095	0.0040	0.0013 (<0.0001)
Absolute spread	0.3070	0.178	0.266	0.273	0.326	0.209	0.0343(<.0001)
Relative spread	0.0253	0.021	0.019	0.024	0.023	0.017	0.0012 (0.032)
Effective spread	0.2812	1.441	0.219	0.219	1.211	0.146	0.0625 (0.053)
Panel B: Firm characteristics							
Market capitalization (in million)	472.61	1,296.87	171.39	482.031	1,237.93	179.161	-9.421 (0.76)
The number of trades	27,775	70,355	7,051	33,391	125,904	5,907	-5616.4 (0.021)
Underwriter's rank	7.27	2.24	8.000				
VC dummy	0.442	0.497	0				
Syndicate size	2.877	1.769	3.000				
NYSE	0.137	0.344	0.000	0.252	0.434	0.000	0.1152 (<.0001)
NASDAQ	0.843	0.364	1.000	0.634	0.482	1.000	-0.2094 (<.0001)
AMEX	0.020	0.141	0.000	0.076	0.265	0.000	0.0558 (<.0001)
Bubble	0.213	0.409	0.000				

Breakdown of IPO stocks by years

Year	# IPOs	Offer price ($)	Rank	VC dummy	Syndicate size	IPO SDPE	# of SS	SS SDPE	p-value
1993	245	12.79	6.972	0.386	2.213	0.0155	193	0.0101	0.0061
1994	327	10.85	6.462	0.369	1.971	0.0118	272	0.0110	0.3549
1995	418	12.30	6.905	0.438	2.241	0.0110	375	0.0093	0.0027
1996	601	12.12	6.967	0.396	2.400	0.0105	559	0.0088	0.0004
1997	405	12.19	6.951	0.310	2.500	0.0066	382	0.0061	0.2409
1998	258	12.31	7.088	0.291	2.688	0.0056	239	0.0062	0.1255
1999	426	14.78	7.973	0.608	3.444	0.0045	418	0.0032	0.0000
2000	328	14.67	8.211	0.707	3.646	0.0052	319	0.0031	0.0000
2001	68	13.73	8.104	0.559	4.000	0.0026	67	0.0025	0.6296
2002	60	14.61	8.084	0.350	4.317	0.0023	55	0.0023	0.9959
2003	63	14.82	7.840	0.419	3.903	0.0017	60	0.0015	0.3361
2004	168	13.81	7.779	0.533	4.383	0.0018	163	0.0013	0.0004
2005	165	14.42	7.251	0.329	4.285	0.0017	158	0.0016	0.6862
Total	3,532	12.97	7.270	0.442	2.876	0.0077	3,374	0.0068	(<.0001)

Delist Code

- Mergers (200-290)
- Exchanges (300-390)
- Liquidations (400-490)
- Dropped (500-802): 501- 505, Move to better exchange

Link: delist code

http://www.crsp.com/products/documentation/delisting-codes

The measure of Standard Deviation of Pricing Error (SDPE)

$$r_t = a_1 r_{t-1} + a_2 r_{t-2} + \cdots . + b_1 x_{t-1} + b_2 x_{t-2} + \cdots . v_{1,t}$$
$$x_t = c_1 r_{t-1} + c_2 r_{t-2} + \cdots . + d_1 x_{t-1} + d_2 x_{t-2} + \cdots . v_{2,t}$$

VAR

where r_t is the difference in (log) prices p_t, and x_t is a column vector of trade-related variables: a trade sign indicator, signed trading volume, and signed square root of trading volume to allo w for concavity between prices and trades. $v_{1,t}$ and $v_{2,t}$ are zero-mean, serially uncorrelated dist urbances from the return equation and the trade equation, respectively.

$$r_t = a_0^* v_{1,t} + a_1^* v_{1,t-1} + a_2^* v_{1,t-2} + \cdots . + b_0^* v_{2,t} + b_1^* v_{2,t-1} + b_2^* v_{2,t-2} + \cdots$$
$$x_t = c_0^* v_{1,t} + c_1^* v_{1,t-1} + c_2^* v_{1,t-2} + \cdots . + d_0^* v_{2,t} + d_1^* v_{2,t-1} + d_2^* v_{2,t-2} + \cdots$$

VMA

The pricing error under the Beveridge and Nelson (1981) identification restriction can be expressed as:

$s_t = a_0 v_{1,t} + a_1 v_{1,t-1} + \cdots . + \beta_0 v_{2,t} + \beta_1 v_{2,t-1} + \cdots$ where $\alpha_j = -\sum_{k=j+1}^{\infty} a_k^*$, $\beta_j = -\sum_{k=j+1}^{\infty} b_k^*$

The variance of the pricing error is then computed as $\sigma_{(s)}^2 = \sum_{j=0}^{\infty} [\alpha_j, \beta_j] Cov(v) \begin{bmatrix} \alpha_j \\ \beta_j \end{bmatrix}$

SDPE = Square root of $\sigma_{(s)}^2$

Boehmer and Kelly's (2009) interpretation of SDPE

The unobservable random walk component, or the efficient price, represents the expectation of security value. Its innovations reflect new public information, as well as the information content of order flow. The pricing error, which captures temporary deviations from the efficient price, may arise from the noninformation-related portion of transaction costs, order imbalances, price discreteness, and dealer inventory effects. It is assumed to follow a zero-mean covariance-stationary process but may be serially correlated or correlated with the random walk innovation of the efficient price process.

Because the pricing error has a mean of zero, its standard deviation, $\sigma_{(s)}$, is a measure of its magnitude. Intuitively, $\sigma_{(s)}$ describes how closely transaction prices follow the efficient price over time, and can therefore be interpreted as an (inverse) measure of informational efficiency.

Other Efficiency Measures (Micro-structure levels)

- Autocorrelation:
  - Null (random walk): The return autocorrelation coefficients are zero at various leads and lags if prices follow a random walk
  - |AR30|: Absolute value of the thirty-minute quote midpoint returns autocorrelation.
- Variance ratio:
  - Under the random walk hypothesis, the variance of the sum must equal the sum of the variances
  - Var(r(t) + r(t-1)) = Var(r(t)) + Var(r(t-1)) = 2Var(r(t)) (linearity property)
  - |1 − VR(30,60)|:variance ratio of the sixty-minute quote midpoint return variance divided by twice the variance of the thirty-minute quote midpoint return minus one.
- Short term volatility: The quote midpoint return volatility over the thirty-minute interval
- Price delay (Hou and Moskowitz, 2005): calculate the average delay with which information is impounded into stock prices by first regressing stock returns for each firm on contemporaneous (restricted model) and four lagged weekly market returns (unrestricted model) as follows:
  - $r_{i,t} = \alpha_i + \beta_i R_{m,t} + \Sigma_{n=1 \text{ to } 4} \delta_{i,n} R_{m,t-n} + \varepsilon_{i,t}$ ---------- ($R^{\wedge 2}$ from Unrestricted regression)
  - $r_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t}$ ---------- ($R^{\wedge 2}$ Restricted regression)
  - $PD = 1 - (R^2\text{restricted} / R^2\text{unrestricted})$

Fama French 48 industry code for transportation

```
*40 Trans  Transportation;
      if &sic ge 4000 and &sic le 4013   then FF_IND='TRANS';
      if &sic ge 4040 and &sic le 4049   then FF_IND='TRANS';
      if &sic ge 4100 and &sic le 4100   then FF_IND='TRANS';
      if &sic ge 4110 and &sic le 4119   then FF_IND='TRANS';
      if &sic ge 4120 and &sic le 4121   then FF_IND='TRANS';
      if &sic ge 4130 and &sic le 4131   then FF_IND='TRANS';
      if &sic ge 4140 and &sic le 4142   then FF_IND='TRANS';
      if &sic ge 4150 and &sic le 4151   then FF_IND='TRANS';
      if &sic ge 4170 and &sic le 4173   then FF_IND='TRANS';
      if &sic ge 4190 and &sic le 4199   then FF_IND='TRANS';
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      if &sic ge 4210 and &sic le 4219   then FF_IND='TRANS';
      if &sic ge 4230 and &sic le 4231   then FF_IND='TRANS';
      if &sic ge 4240 and &sic le 4249   then FF_IND='TRANS';
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      if &sic ge 4500 and &sic le 4599   then FF_IND='TRANS';
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      if &sic ge 4700 and &sic le 4700   then FF_IND='TRANS';
      if &sic ge 4710 and &sic le 4712   then FF_IND='TRANS';
      if &sic ge 4720 and &sic le 4729   then FF_IND='TRANS';
      if &sic ge 4730 and &sic le 4739   then FF_IND='TRANS';
      if &sic ge 4740 and &sic le 4749   then FF_IND='TRANS';
      if &sic ge 4780 and &sic le 4780   then FF_IND='TRANS';
      if &sic ge 4782 and &sic le 4782   then FF_IND='TRANS';
      if &sic ge 4783 and &sic le 4783   then FF_IND='TRANS';
      if &sic ge 4784 and &sic le 4784   then FF_IND='TRANS';
      if &sic ge 4785 and &sic le 4785   then FF_IND='TRANS';
      if &sic ge 4789 and &sic le 4789   then FF_IND='TRANS';
            if FF_IND='TRANS' then &ind_code=40;
```
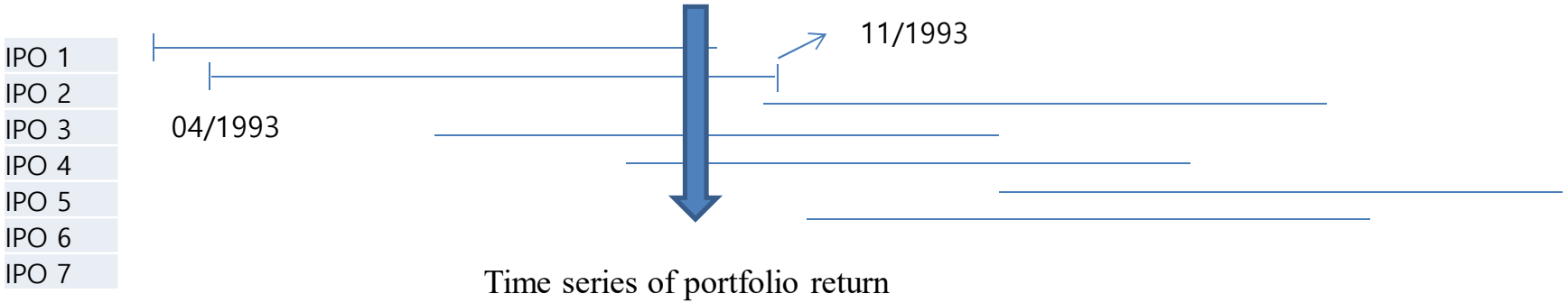

Sic code-
UPS: 4513
CP: 4011

How does calendar time portfolio event work?

IPO stocks	IPO date	Portfolio formation period
IPO 1	2/8/1993	03/1993 – 10/1993
IPO 2	3/9/1993	04/1993 – 11/1993
IPO 3	10/3/1993	11/1993-06/1994
IPO 4	5/6/1993	06/1993-01/1994
IPO 5	8/7/1993	09/1993-04/1994
IPO 6	1/8/1994	02/1994-09/1994
IPO 7	11/1/1993	12/1993-07/1994

Mitchell and Stafford (2000):
A rapidly growing literature claims to reject the efficient market hypothesis by producing large estimates of long-term abnormal returns following major corporate events. The preferred methodology in this literature is to calculate average multiyear **buy-and-hold abnormal returns** and conduct inferences via a bootstrapping procedure. We show that **this methodology is severely flawed because it assumes independence of multiyear abnormal returns for event firms**, producing test statistics that are up to four times too large. After accounting for the positive cross correlations of event firm abnormal returns, we find virtually no evidence of reliable abnormal performance for our samples.



Time series of portfolio return

Propensity Scoring Method (PSM)

- I select the two IPO firms that choose a non-prestigious underwriter (i.e., rank less than 8) that have the closest-propensity scores (predictions from the logit model) to the propensity score of IPO firms that choose a prestigious underwriter (rank of 8 or greater)

- Specifically, I sort all IPOs by the propensity score and match each high reputation IPO to the closest low reputation IPO with propensity score higher than the high reputation IPO and to the closest low reputation IPO with propensity score lower than the high reputation IPO. By selecting low reputation IPOs with slightly higher and slightly lower propensity scores, the average propensity score for the matched low reputation IPO sample (0.1957) is very close to the average propensity score in the high reputation IPO sample (0.1955)