Product Market Competition, Insider Trading

And Stock Market Efficiency

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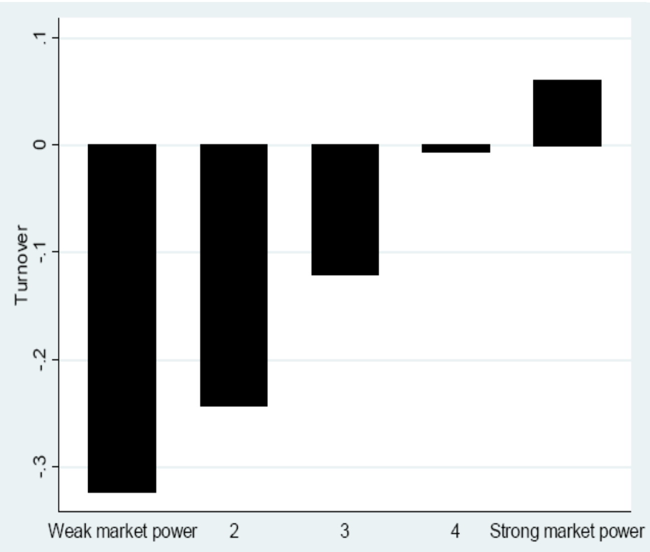
INSEAD

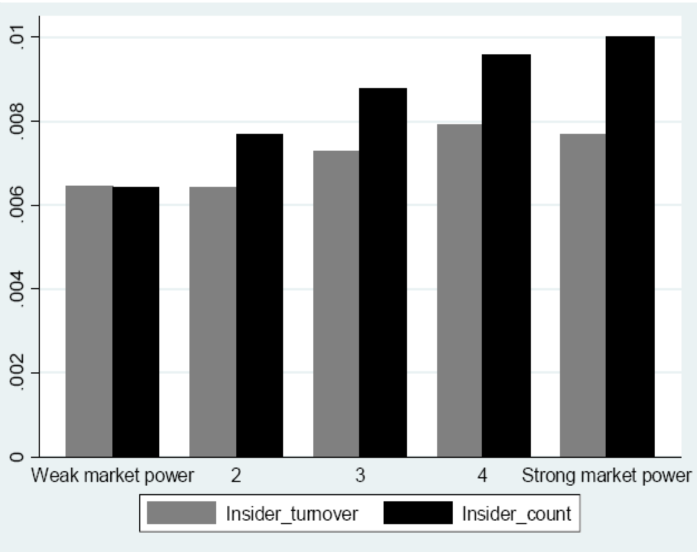
Evidence

Share turnover



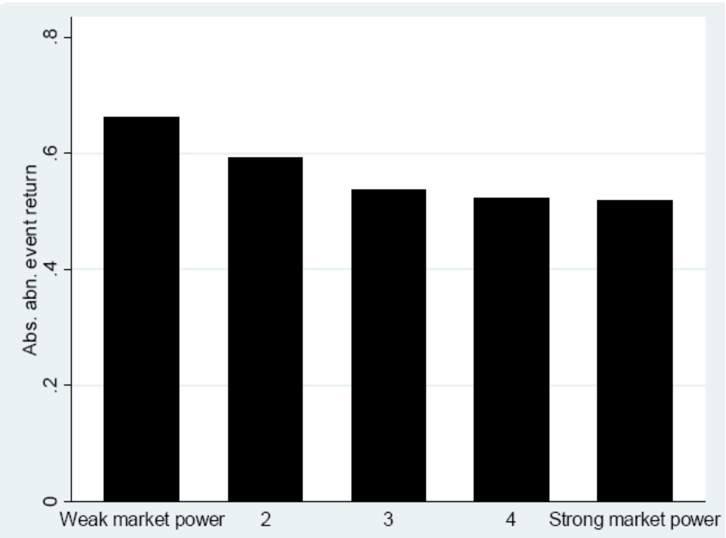
Less competitive →

Insider trading



Less competitive →

Stock price informativeness



Less competitive →

- Panel regressions ➔ statistical significance & robustness to controls (size, mb ratio, leverage, R&D)

- Also: Analysts' earnings forecasts about firms in more competitive industries are more dispersed (Gaspar & Massa (2005))

Related Literature

- IO and financial markets
  - Product markets competition and capital structure: e.g. Brander and Lewis (1986), Titman (1984)...

- Trading under endogenous and asymmetric information
  - In particular, the real benefits of informational efficiency. Two main channels:
    * Improved incentives through equity-linked compensation contracts: e.g. Fishman and Hagerty (1989), Holmstrom and Tirole (1993) and Dow and Gorton (1997)...
    * Improved capital budgeting: e.g. Leland (1992), Allen (1993), Khanna and Slezak and Bradley (1994), Bernhardt, Hollifield and Hughson (1995), Boot and Thakor (1997), Dow and Gorton (1997), Subrahmanyam and Titman (1999, 2001), Bhattacharya and Nicodano (2001), Dow and Rahi (2003), Vives and Medrano (2004), Foucault and Gehrig (2006)...

Outline

1. Economic environment
2. Stock price
3. Trading volume
4. Stock price informativeness
5. Forecast dispersion
6. Stock returns
7. Liquidity
8. Allocative efficiency
9. Conclusion

Technology: Intermediate Good Sector

- Monopoly m ($m = 1, ..., M$) produces good m: $Y^m \equiv A^m K_0$
  - A^m: firm m-specific technology shock
  - K_0: book value of (endowed) capital stock
- Firm m sells Y^m goods at price $Q^m \Longrightarrow$ Its liquidation value is $\Pi^m = Q^m Y^m$
- Properties of A^m:
  - log-normally distributed and i.i.d.
  - $\ln A^m \equiv a^m z$ where $a^m z \sim N(0, z/h_a)$ and z is scaling factor
  - Model solved around $z \approx 0$: "small risk approximation"

Technology: Final Good Sector

- Perfectly competitive sector:

$$G \equiv \sum_{m=1}^{M} (Y^m)^{\beta} L^{1-\beta}$$

  - Y^m : employment of m'th type of intermediate good, L : labor, G : final output

- $0 < \beta < 1 =$ degree of input substitutability

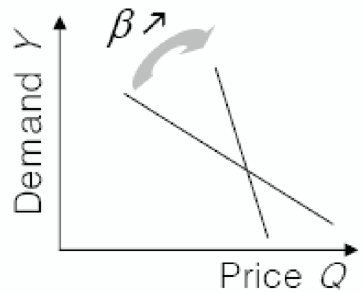
  - Max. profits, $\Pi^m = G - \sum_{m=1}^{M} Q^m Y^m - WL$, taking prices Q and W as given

    $\Longrightarrow$ demand for $m = Y^m = (\beta / Q^m)^{1/(1-\beta)}$

  - Demand elasticity $= -d \ln Y^m / d \ln Q^m = 1/(1-\beta)$, rises with β

β measures degree of product market competition

Bigger $\beta \Leftrightarrow$ More competitive sector



Assets

- Monopolies' equity trades on perfectly competitive stock market

- Number of shares outstanding normalized to one perfectly divisible share

- P^m : price of a share

- Some trades are motivated by noise

  - θ^m aggregate random demand for stock m as a fraction of investors' wealth

  - $\theta^m z \sim N(0, \sigma_\theta^2 z)$ and independent from a^m and across stocks

- A riskless asset in perfectly elastic supply: $R^f = 1 + r^f z$

Agents: Investors

- A continuum of investors indexed by $l \in [0, 1]$
- Derive utility from the consumption of a final good c. CRRA utility with $\gamma \geq 1$:

$$U(c) = \frac{c^{1-\gamma} - 1}{1 - \gamma}$$

- Endowed with a portfolio of assets
  - $f_{0,l}^{m}$: agent l's fraction of wealth initially invested in stock m
  - Initial wealth w assumed identical across agents
  - Choose new portfolio weights f_l^m
- Endowed with private signals
  - Investor $l's$ signal about firm m's productivity shock:

$$s_l^m = a^m + \varepsilon_l^m$$

  - $\varepsilon_l^m z \sim N(0, z/h_s)$ and independent from a^m and across agents

Agents: Workers

- Employed in the final good sector
- Labor supply $L = 1$. Competitive wage W

Equilibrium Concept

- $\mathcal{F}_l \equiv \{s_l, P\}$: investor l's information set
- Separable production function $\Longrightarrow \Pi^m \perp \Pi^{m'}$

(i) Demand for input m : $Y^m = (\beta/Q^m)^{1/(1-\beta)}$

(ii) Portfolio weights ($R^m = \Pi^m/P^m =$ gross return on stock m):

$$\max_{\{f_l^m,\ m=1 \text{ to } M\}} E\left[U(c_l) \mid \mathcal{F}_l\right] \text{ subject to } c_l = \left(R^f + \sum_{m=1}^{M} f_l^m \left(R^m - R^f\right)\right) w$$

(iii) Market clearing in intermediate sector:

$$(\beta/Q^m)^{1/(1-\beta)} = A^m K_0 \qquad \text{for } m = 1 \text{ to } M$$

(iv) Market clearing in stock market

$$\int_0^1 \frac{w}{P^m} f_l^m dl + \frac{w}{P^m}\theta^m = 1 \qquad \text{for } m = 1 \text{ to } M$$

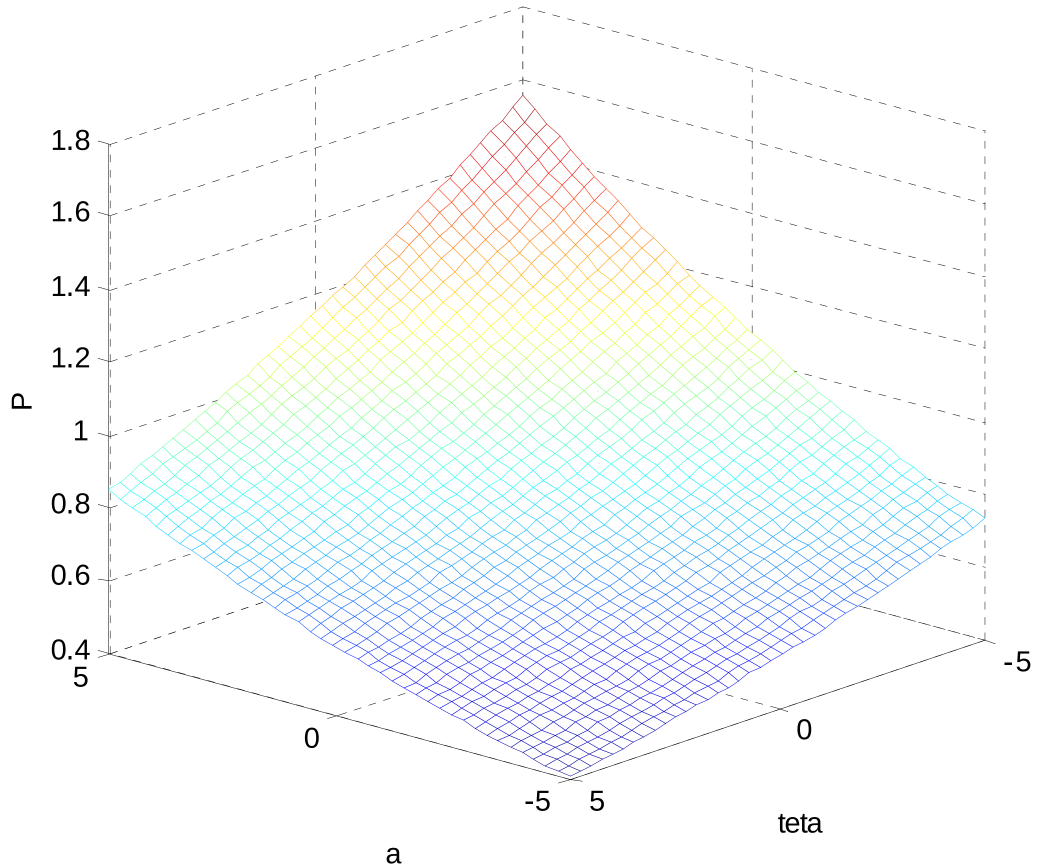
Equilibrium Stock Price

There exists a log-linear rational expectations equilibrium.

Shares trade at a price $P = \beta K_0^{\beta} \exp(pz)$ where $p = p_0(\beta) + p_a(\beta)a + p_\theta(\beta)\theta$

- Elasticity of stock price to tech. shock : $p_a(\beta) \equiv \beta \left(1 - \frac{h_a}{h(\beta)}\right) \geq 0$
- Elasticity of stock price to noise shock : $p_\theta(\beta) \equiv \frac{\gamma\beta}{h_s} p_a(\beta)$
- Stock price informativeness: $h_p(\beta) \equiv \frac{h_s^2}{\gamma^2 \beta^2 \sigma_\theta^2}$
- Total precision of investor's information: $h(\beta) \equiv h_a + h_p(\beta) + h_s$

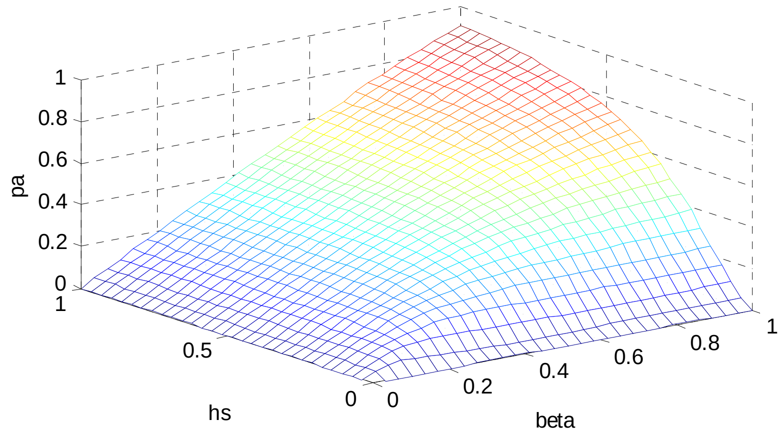
Equilibrium Stock Price

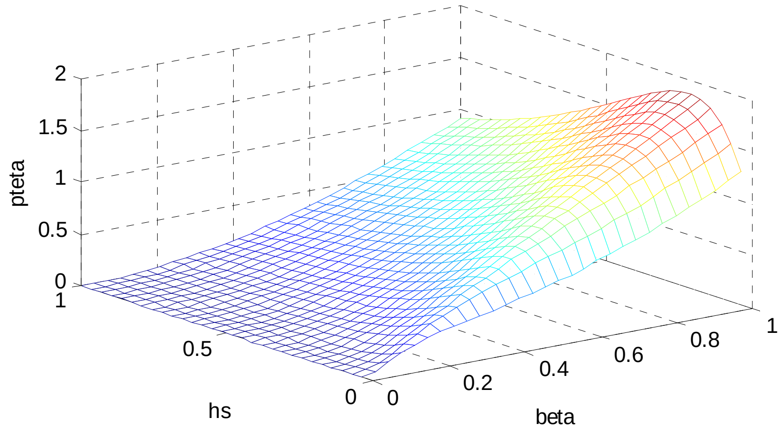


$$P = \beta K_0^{\beta} \exp(pz) \quad \text{where} \quad p = p_0(\beta) + p_a(\beta)a + p_\theta(\beta)\theta$$

Sensitivities of Stock Price to Technology and Noise Shocks

$$p_a(X, \beta) \equiv p_a(\beta) \equiv \beta \left(1 - \frac{h_a}{h(\beta)}\right) \quad \text{and} \quad p_\theta(\beta) \equiv \frac{\gamma \beta}{h_s} p_a(\beta)$$





Trading Volume

Trading volume is lower for firms operating in more competitive sectors.

- Intuition: Market power allows firms to stabilize their profits $\Longrightarrow$ Profits of more competitive firms are more risky $\Longrightarrow$ Investors scale down their trades:
  - $r^m z = \ln(R^m) = \ln(\Pi^m / P^m) = \beta a^m z - p^m z$
  - $E(r^m z \mid \mathcal{F}_l) = \beta E(a^m z \mid \mathcal{F}_l) - p^m z$ and $Var(r^m z \mid \mathcal{F}_l) = \beta^2 Var(a^m z \mid \mathcal{F}_l)$
  - $f_l^m = \dfrac{E(r^m z \mid \mathcal{F}_l) - r^f z + Var(r^m z \mid \mathcal{F}_l)/2}{\gamma Var(r^m z \mid \mathcal{F}_l)}$

$$= \frac{\beta E(a^m z \mid \mathcal{F}_l) - p^m z - r^f z}{\gamma \beta^2 Var(a^m z \mid \mathcal{F}_l)} + \frac{1}{2\gamma}$$

$\Longrightarrow$Expected returns $\nearrow$ by a factor β while their variance $\nearrow$ by a factor β^2

Informational Efficiency

Competition in the product market reduces the informativeness of stock prices.

- Intuition: Profits of more competitive firms are more risky $\Longrightarrow$ Investors trade less aggressively on their private signals:
  - $E(a^m z \mid \mathcal{F}_l) = c_p p^m z + c_s s_l^m z$ where $c_s z \equiv h_s Var(a^m z \mid \mathcal{F}_l)$
  - $f_l^m = \dfrac{E(r^m z \mid \mathcal{F}_l) - r^f z + Var(r^m z \mid \mathcal{F}_l)/2}{\gamma Var(r^m z \mid \mathcal{F}_l)}$

$$= \frac{\beta E(a^m z \mid \mathcal{F}_l) - p^m z - r^f z}{\gamma \beta^2 Var(a^m z \mid \mathcal{F}_l)} + \frac{1}{2\gamma} = ... + \frac{\beta h_s}{\beta^2 \gamma} s_l^m + ...$$

$\Longrightarrow$The dependence of trades f_l^m on private signals s_l^m falls with β

Dispersion of Investors' Forecasts

- Dispersion of investors' forecasts: $Var\left[E(a \mid \mathcal{F}_l) \mid a, \theta\right]$, $Var\left[E(\ln \Pi \mid \mathcal{F}_l) \mid a, \theta\right]$ and $Var\left[E(r \mid \mathcal{F}_l) \mid a, \theta\right]$

> Investors make more dispersed forecasts about the productivity, profit and return of firms in more competitive sectors.

- Intuition: Less accurate stock prices $\Longrightarrow$ investors rely less on stock prices and more on their private signals

Stock Returns

- Volatility of stock returns, unconditionally and conditional on public information: $Var(r)$ and $Var(r \mid P)$
- Average Sharpe ratio: $\dfrac{E(R) - R^f}{\sqrt{Var(R \mid \mathcal{F}_l)}}$

Firms operating in more competitive sectors have more volatile returns, unconditionally and conditional on public information, larger expected returns and higher Sharpe ratios.

Their return volatility, expected return and Sharpe ratio are magnified by the deterioration of the informativeness of their stock price.

- Intuition: Less informative stock prices $\Longrightarrow$ Prices track payoffs less closely $\Longrightarrow$ Return needs to absorb larger fraction of tech. shock

Stock Liquidity

- Liquidity = the sensitivity of stock prices to (uninformative) noise shocks, $p_\theta = \dfrac{\partial \ln P}{\partial(\theta z)}$

Stock prices of more competitive firms are more sensitive to noise shocks.

The liquidity loss is magnified by the deterioration in stock price informativeness

- Intuition: Firms use their market power to shield their profits from shocks, including noise shocks
  - Informational effect: Less informative stock prices $\Longrightarrow$ More sensitive to noise shocks

Allocative Efficiency: Economic Environment

- How does competition influence investors' ability to allocate capital when firms raise fresh capital through an equity issuance?
  - α new shares issued $\Longrightarrow K = \alpha P$ capital raised
  - Dilution factor $\delta = \frac{\alpha \overline{P}}{K_0 + \alpha \overline{P}}$ where $\overline{P} = \left(\frac{K_0}{1-\delta}\right)^{\beta} \left(\beta - \delta \left(\frac{K_0}{1-\delta}\right)^{1-\beta}\right)$ is price when $z = 0$

- There exists a log-linear rational expectations equilibrium.
  - Stock price $P = \overline{P} \exp(pz)$ such that $p = p_0(\beta, \delta) + p_a(\beta, \delta)a + p_\theta(\beta, \delta)\theta$
  - Elasticity of stock price to tech. shock : $p_a(\beta, \delta) \equiv \frac{\beta}{1-\delta\beta} \left(1 - \frac{h_a}{h(\beta)}\right) \geq 0$
  - Elasticity of stock price to noise shock : $p_\theta(\beta, \delta) \equiv \frac{\gamma\beta}{h_s} p_a(\beta, \delta)$
  - Firms raise $K = \alpha \overline{P} \exp(pz)$ units of capital.

Allocative Efficiency: Impact of Signal Precision

Capital is more efficiently allocated when information is more accurate.

Allocative Efficiency: Impact of Product Market Competition

- Direct effect: well known underinvestment problem
- Focus on indirect effect through the informativeness of stock prices
- Measure capital efficiency relative to perfect-information benchmark as

$$p_a/p_a^{\mathcal{P}} = 1 - \frac{h_a}{h(\beta)}$$

Capital is less efficiently allocated across more competitive firms.

- Competition (rather than the lack thereof) generates an inefficiency !

Empirical Evidence: Data

- 5,000 U.S. firms (NYSE, AMEX and NASDAQ) over 1996-2005.
- Starting from CRSP-Compustat Merged database, retain stocks with sharecodes 10 or 11 and remove financial companies and regulated industries.
- Winsorize variables at the 1% level.
- 28,172 firm-year observations, 5,497 different firms with an average of 5 years of data for each firm.
- Corporate data and earnings announcement dates from Compustat, daily stock returns from CRSP, and insider trades from the Thomson Financial Insider Filling database.

Empirical Evidence: Variables

- Market power proxied using "excess price-cost margin"
  - Firm's operating profit margin (sales minus costs divided by sales)
  - Subtract industry average price-cost margin (industries defined using two-digit SIC classifications)
  - Captures a firm's ability to price goods above marginal cost, adjusting for industry-specific factors unrelated to market power
- Trading volume measured as turnover = Log of the ratio of the number of shares traded during a year to the number of shares outstanding

Descriptive statistics

		Mean	Median	Std. Dev.	Min	Max	N
Number of years per firm		5.1	4	3.3	1	10	5 497
Mkt Power		0.142	0.115	0.119	-0.107	3.614	26 264
Size		5.607	5.516	1.891	0.501	11.740	26 946
Market-to-book		-0.380	1.922	555.300	-90022	6365	26 495
Leverage		0.191	0.143	0.207	0.000	3.862	26 816
R&D		0.055	0.025	0.098	-0.006	2.583	15 695
Turnover		-0.127	-0.076	1.006	-6.529	10.310	26 405
Number of insider trades		1.669	1.609	1.377	0.000	7.731	28 172
Insider turnover		0.007	0.001	0.026	0.000	1.051	26 862
Abs. 5-day return earnings annoncements	Raw return	0.149	0.133	0.078	0.009	0.855	24 827
	Abn. return relative to the 3 factor model	0.151	0.135	0.078	0.000	0.845	24 827

Market power and turnover

	Turnover				
Mkt Power	1.321*	1.049*	1.077*	1.044*	1.751*
	(0.098)	(0.091)	(0.092)	(0.092)	(0.098)
Size	--	0.191*	0.191*	0.213*	0.209*
		(0.006)	(0.006)	(0.006)	(0.007)
Market-to-book	--	--	0.534	-0.877	2.143
			(2.244)	(2.53)	(57.479)
Leverage	--	--	--	-0.669*	-0.664*
				(0.039)	(0.054)
R&D	--	--	--	--	1.688*
					(0.17)
Intercept	-0.301*	-1.269*	-1.272*	-1.257*	-1.280*
	(0.018)	(0.035)	(0.035)	(0.034)	(0.047)
Overall R2	0.01	0.06	0.06	0.08	0.14
Between R2	0.00	0.03	0.03	0.06	0.14
Within R2	0.02	0.09	0.09	0.09	0.08
Observations	25,798	25,791	25,519	25,446	14,691
Firms	5,039	5,035	5,010	5,004	2,990

Empirical Evidence: Insider Trading

- Open market transactions, excluding sells, initiated by the top five executives of a firm (CEO, CFO, COO, President and Chairman of board).
  - Insider turnover = Log of the ratio of a firm's annual total insider trading dollar volume to the firm's market capitalization
  - Number of insider trades = Log of the firm's annual number of insider trades

Market power and insider trading

Insider turnover						Number of insider trades					
0.006*	0.008*	0.008*	0.008*	0.018*	0.014*	1.922*	1.378*	1.371*	1.370*	2.434*	1.953*
(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.134)	(0.117)	(0.118)	(0.117)	(0.153)	(0.157)
--	-0.001*	-0.001*	-0.001*	-0.001*	-0.002*	--	0.248*	0.252*	0.282*	0.281*	0.237*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)		(0.007)	(0.007)	(0.007)	(0.009)	(0.01)
--	--	0.075*	0.074*	1.009	0.76	--	--	11.773^	10.014^	272.303*	265.701*
		(0.014)	(0.014)	(0.906)	(0.673)			(5.141)	(4.842)	(73.085	(76.34)
--	--	--	0	-0.001	0	--	--	--	-0.935*	-0.899*	-0.715*
			(0.001)	(0.002)	(0.002)				(0.053)	(0.076)	(0.075)
--	--	--	--	-0.009^	-0.015*	--	--	--	--	0.492^	-0.158
				(0.004)	(0.004)					(0.195)	(0.191)
--	--	--	--	--	0.002*	--	--	--	--	--	0.257*
					(0.001)						(0.014)
0.006*	0.011*	0.011*	0.011*	0.013*	0.015*	1.294*	0.046	0.031	0.046	-0.022	0.271*
(0)	(0.001	(0.001	(0.001	(0.001	(0.001	(0.022	(0.037	(0.037	(0.037	(0.051	(0.053
0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.12	0.13	0.15	0.17	0.18
0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.15	0.16	0.18	0.21	0.22
0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.04	0.04	0.04	0.05	0.07
26,107	26,098	25,799	25,720	14,952	14,653	26,264	26,248	25,888	25,809	14,990	14,691
5,069	5,063	5,033	5,027	3,009	2,988	5,080	5,074	5,037	5,031	3,011	2,990

Empirical Evidence: Stock Price Informativeness

- Absolute abnormal return (relative to the FF 3 factor model) over a 5-day window centered on days earnings are announced $= \sum_{t=-2}^{+2} |u_t^m|$ where
  - $t = -2, -1, 0, +1$ and $+2$ count trading days relative to the announcement day 0
  - $u_t^m = R_t^m - (\alpha_0^m + \alpha_{mkt}^m MKT_t + \alpha_{SMB}^m SMB_t + \alpha_{HML}^m HML_t)$
  - R_t^m is the return on firm m's stock on day t
  - MKT_t, SMB_t and HML_t are the returns on the market, the size and the book-to-market factors on day t
  - Coefficients α_0^m, α_{mkt}^m, α_{SMB}^m and α_{HML}^m are estimated for every firm over a window ranging from $t = -250$ to $t = -5$
  - Average the absolute abnormal returns estimates obtained from each announcement during a year

Market power and stock price informativeness

	Stock price informativeness					
Mkt Power	-0.077*	-0.048*	-0.047*	-0.046*	-0.033*	-0.071*
	(0.008)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)
Size	--	-0.017*	-0.017*	-0.019*	-0.017*	-0.021*
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Market-to-book	--	--	0.416*	0.492*	0.124	-0.608
			(0.132)	(0.109)	(4.265)	(3.42)
Leverage	--	--	--	0.034*	0.023*	0.039*
				(0.004)	(0.005)	(0.005)
R&D	--	--	--	--	0.107*	0.063*
					(0.013)	(0.013)
Turnover	--	--	--	--	--	0.020*
						(0.001)
Intercept	0.166*	0.254*	0.254*	0.254*	0.246*	0.269*
	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Overall R2	0.02	0.20	0.20	0.21	0.23	0.32
Between R2	0.03	0.30	0.30	0.31	0.34	0.42
Within R2	0.00	0.01	0.01	0.01	0.01	0.04
Observations	23,432	23,417	23,115	23,042	13,406	13,133
Firms	4,817	4,811	4,776	4,769	2,859	2,838

Summary

- Profits of more competitive firms are more risky

$\Longrightarrow$ Investors scale down their trades $\Longrightarrow$ Trading volume is lower

$\Longrightarrow$ Investors trade less aggressively on their private signals $\Longrightarrow$ Stock prices are less informative

$\Longrightarrow$ Capital is less efficiently allocated within more competitive sectors $\Longrightarrow$ Competition generates a social inefficiency (misinvestment problem)

$\Longrightarrow$ Investors' forecasts are more dispersed

$\Longrightarrow$ Return volatility, expected return and Sharpe ratio are magnified by the deterioration of the informativeness of their stock price.

$\Longrightarrow$ Stocks are less liquid

- The evidence on trading volume, stock price informativeness and the dispersion of analyst forecasts supports these findings