

Disclosure Regulation, Intangible Capital and the Disappearance of Public Firms

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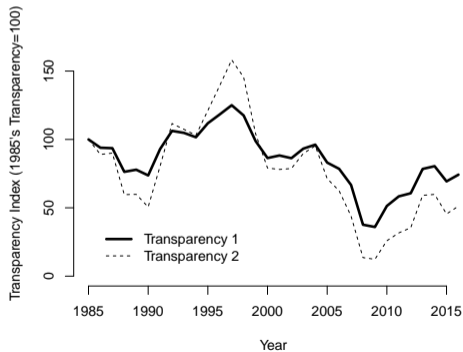
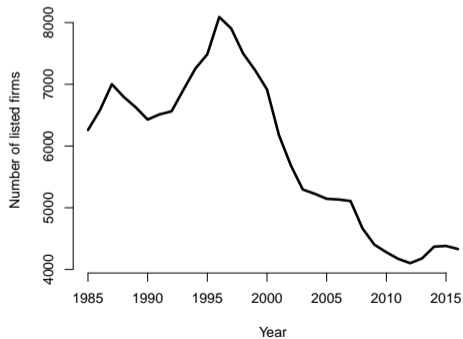
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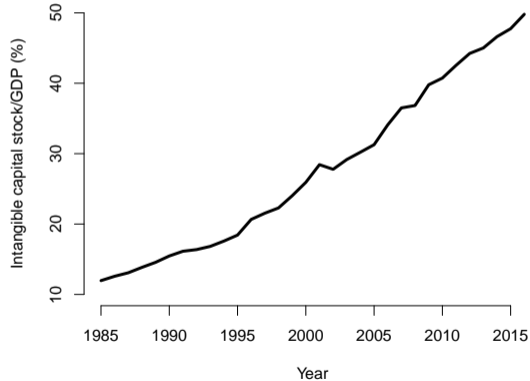
MOTIVATING FACT I

- ▶ The number of listed firms has decreased by half since 1996.
 - ▶ The inverse earnings forecast errors have significantly decreased since 1996.
- ⇒ What are the driving forces? What are the *macroeconomic consequences*?



MOTIVATING FACT II

- ▶ The growth rate of intangibles outweighs the growth of GDP.



RESEARCH QUESTION

1. What *drives* the disappearing listed firms and the rising forecast difficulty in the U.S.?
2. What is the *macroeconomic impact* of the change?

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WHAT THIS PAPER DOES

1. Propose that disclosure regulation and higher intangible adoption are important factors.
2. Develops an *analytic GE theory* of firm-level financing decision: **Go public vs. private**
3. *Quantitatively* decomposes the driving forces and analyzes the macroeconomic consequences.
4. Analyzes the **optimal regulation** of financial disclosure.

WHY INTANGIBLES?

- ▶ Intangible share has been rising rapidly.
- ▶ Intangibles are subject to **limited excludability** (Haskel and Westlake 2017; Crouzet Eberly Eisefeldt; Papanikolaou 2022)
 - Once information about an intangible is revealed, it can be readily copied or imitated:
 - Examples:
 - ▶ Ongoing and wasted investment project.
 - ▶ Business methods and marketing strategies.
 - ▶ Cost and ownership structure.
- ▶ Evidence on the spillover externality:
 - Bushee and Leuz. (2005): Disclosing firms' stock prices ↓ and peer firms' stock price ↑
 - Badertscher et al. (2013), Shroff et al. (2017): Peer information → User cost of capital ↓.

WHAT'S THE ROLE OF POLICY?

- ▶ The mandated disclosure affects the *firm-level* incentive to be listed.
- ▶ At the *macro level*, this affects
 - household's portfolio decision: **welfare**
 - the quality and quantity of the total shared knowledge: **productivity**
- ▶ The SEC's goal:
"The mission of the SEC is *to protect investors, maintain fair, orderly, and efficient markets, and facilitate capital formation.*"

Protecting investors vs. *Facilitating capital formation*

- ▶ Public firms are subject to many mandatory disclosure requirements.
- ▶ U.S. private firms can be informationally opaque.

- ▶ When Google was about to go public, they said

"As a smaller private company, Google kept business information closely held, and we believe this helped us against competitors." The letter continued: "As a public company, we will of course provide you with all information required by law. . . . But we will not unnecessarily disclose all of our strengths, strategies and intentions."

- ▶ Also, there are anecdotes of Apple:

"Apple acquired Siri in early 2010 and integrated it into the iPhone 4s in late 2011."

"Apple acquired Authentec in 2012 and included Touch-Id into the iPhone 5s in late 2013."

This news immediately went viral among commentators, leading to competitors' (Samsung) response.

- ▶ What would have happened if Apple had not been a listed firm?

- ▶ **Cost and benefit of information disclosure:** Hirshleifer (1971), Bhattacharya and Ritter (1983), Admati and Pfleiderer (2000), Bushee and Leuz (2005), Badertscher, Shroff, and White (2013), Dambra, Casares Field, and Gustafson (2015), Dang et al. (2017), Minnis and Shroff (2017)
- ▶ **Rising intangible capital:** Atkeson and Kehoe (2005), McGrattan and Prescott (2010), Eisfeldt and Papanikolaou (2014), Peters and Taylor (2017), McGrattan (2020), De Ridder (2021), Chiavari and Goraya (2022), Falato et al. (2022), Celentano and Rempel (2023)
- ▶ **Disappearing listed firms:** Gao, Ritter, and Zhu (2013), Doidge, Karolyi, and Stulz (2017), Ewens and Farre-Mensa (2020)

THIS PAPER

- ▶ provides a unified GE framework to analyze the relationships among *intangibles*, endogenous choice of *going public*, and *information disclosure*.
- ▶ brings to the table a novel policy angle, information regulation, and analyze its macroeconomic trade-off.

+) On the model side, our paper resembles Burdett and Mortensen (1998): endogenous demand and supply form an equilibrium distribution.

THEORY

HOUSEHOLD

A representative household holds an equity portfolio and consumes.

FIRMS

Measure one of ex-ante homogeneous firms decides whether to go public or private

Public firms determine the level of transparency for the disclosure

High transparency gets better financing from the household

GENERAL EQUILIBRIUM

Disclosed intangible is aggregated as an externality

Investment demand and supply determine the price of firms

- ▶ The household is risk-averse, and the utility takes the following **CARA** form:

$$u(C) = -e^{-\Lambda C}$$

where $\Lambda > 0$ is the absolute risk aversion parameter.

- ▶ The household solves the following portfolio choice problem:

$$\begin{aligned} & \max_{x(q), x^N} \mathbb{E}(-e^{-\Lambda C}) \\ \text{s.t. } & C = \int x(\tilde{q}) \tilde{r}(\tilde{q}) d\tilde{q} + x^N \tilde{r}^N, \quad \int x(\tilde{q}) d\tilde{q} + x^N = a \end{aligned}$$

- $x(q)$: the funding supply for firms with transparency level q .
- x^N : the funding supply for non-listed firms.
- a : the household's wealth.

- ▶ In the listed market, the household forms a belief on the return $\tilde{r}(\mathbf{q})$ of a firm with transparency level \mathbf{q} as follows:

$$\tilde{r}(\mathbf{q}) \sim_{iid} N\left(\bar{r}(\mathbf{q}), \frac{1}{\xi + \psi(\bar{\mathbf{q}} + \mathbf{q})}\right), \quad \bar{r}(\mathbf{q}) = \frac{\pi(\mathbf{q})}{P(\mathbf{q})}$$

where $\mathbf{q} \geq \mathbf{0}$ is a transparency level; $\bar{\mathbf{q}}$ is the *mandated transparency*; $\pi(\mathbf{q})$ is the profit of the firm with transparency \mathbf{q} ; $P(\mathbf{q})$ is the price of the firm with transparency \mathbf{q} .

- ▶ Similarly, in the non-listed market,

$$\tilde{r}^N \sim_{iid} N(\bar{r}^N, 1/\xi), \quad \bar{r}^N = \frac{\pi^N}{P^N}$$

- ▶ The belief on the listed firms can be interpreted as the Bayesian information update.
- ▶ The framework naturally maps into the earnings forecast and surprise.

- ▶ A continuum of measure one of homogeneous firms are considered.
- ▶ Two sub-periods: morning and night
 - Morning: choice of where to operate and the transparency level q
 - Night: choice of input levels
- ▶ Listed market with transparency q :

$$\pi(q) := \max_{k_T, k_I} z k_T^\alpha (k_I (1 - \bar{q} - q))^\theta (\Phi^{ex})^\gamma - r k_T - p k_I$$

- $q \in [0, 1 - \bar{q}]$ is a transparency level; \bar{q} is the *mandated transparency* for the listed firms.
 - Φ^{ex} is the shared knowledge: the aggregate productivity z shifter.
- ▶ Non-listed market:

$$\pi^N := \max_{k_T, k_I} z k_T^\alpha (k_I)^\theta (\Phi^{ex})^\gamma - r k_T - p k_I$$

- ▶ A possible heterogeneity in z : later, we show it does not matter in our framework.

The shared knowledge comes from:

$$\Phi^{ex} = \int_0^1 \mathbf{1}_{\{i \in \text{Listed}\}} \times k_{I,i} \left(\underbrace{\bar{q}}_{\text{Disclosure mandated by regulator}} + \underbrace{q_i}_{\text{Voluntary disclosure}} \right) di$$

The shared knowledge is deducted from the owned knowledge:

- ▶ The knowledge is symmetrically shared (no double counting).

A financial market determines the values of the listed firm $P(q)$ and non-listed firm P^N given

- ▶ the household's preference over q
- ▶ the total funding demand: \mathcal{M} , the unnormalized probability density of listed firms over q .

$$P(q) = P(q, \pi(q); \mathcal{M})$$

$$P^N = P^N(\pi^N; \mathcal{M})$$

A firm (manager) chooses where to operate to maximize the firm's price (=value):

$$\max\left\{ \max_{q \in [0, 1-\bar{q}]} P(q), P^N \right\}.$$

Two decision layers: 1) going public vs. private; 2) how much to reveal

The funding market is cleared in terms of *the number (mass) of firms* financed:

	<i>Supply</i>	<i>Demand</i>
[Listed market] :	$\frac{x^*(q)}{P(q)}$	$= \mathcal{M}(q)$
[Non-listed market] :	$\frac{1}{\nu_N} \frac{x^{N*}}{P^N}$	$= M_N$

where $\nu_N > 1$ captures the *congestion effect* in the non-listed financial market.

Definition 1

A collection of functions $(k_T, k_I, q, \mathcal{M}, M_N, p, P, P^N, x^*, x^{N*}, \Phi^{ex})$ is an equilibrium if

1. (x^*, x^{N*}) solves the household's problem.
2. $(k_T(q, \mathcal{M}), k_I(q, \mathcal{M}), q(\mathcal{M}))$ solves the listed firm's problem.
3. The measure of listed firms choosing a transparency level q is consistent with $\mathcal{M}(q)$ for all $q \in [0, 1 - \bar{q}]$.
4. The measure of non-listed firms is M_N and satisfies $\int_0^{1-\bar{q}} \mathcal{M}(q) dq + M_N = 1$.
5. R&D cost of intangible capital p is determined by the following equation: $K^I = \int_0^1 k_{I,i} di$.
6. Aggregate shared knowledge satisfies $\Phi^{ex} = \int_0^1 \mathbf{1}_{\{i \in \text{Listed}\}} \times k_{I,i} (\bar{q} + q_i) di$.
7. Financial market is cleared:

$$\frac{x^*(q)}{P(q)} = \mathcal{M}(q) \quad \text{and} \quad \frac{1}{v_N} \frac{x^{N*}}{P^N} = M_N$$

8. Indifference in the extensive-margin decision: $P(q) = P^N$, for $\forall q \in [0, 1 - \bar{q}]$.

EQUILIBRIUM ANALYSIS

- Recall the household's maximization problem:

$$\begin{aligned} & \max_{x(\tilde{q}), x^N} \mathbb{E}(-e^{-\Lambda C}) \\ \text{s.t. } & C = \int x(\tilde{q}) \tilde{r}(\tilde{q}) d\tilde{q} + x^N \tilde{r}^N, \quad \int x(\tilde{q}) d\tilde{q} + x^N = a \end{aligned}$$

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- Using the CARA utility and the normally distributed returns, we obtain

$$\max_{\int x(\tilde{q}) d\tilde{q} + x^N = a} \int x(\tilde{q}) \frac{\pi(\tilde{q})}{P(\tilde{q})} d\tilde{q} + x^N \frac{\pi^N}{P^N} - \frac{\Lambda}{2} \int x(\tilde{q})^2 (\bar{q} + q)^{-\chi} d\tilde{q} - \frac{\Lambda}{2} (x^N)^2 \frac{1}{\xi}$$

which is a mean-variance portfolio problem. Then, from the FOC,

$$\frac{\pi(q)}{P(q)} - \Lambda x^*(q) \frac{1}{\xi + \psi(\bar{q} + q)} - \mu = 0 \implies x^*(q) = \frac{\pi(q)/P(q) - \mu}{\Lambda/(\xi + \psi(\bar{q} + q))}.$$

Similarly, $x^{N*} = \frac{\pi^N/P^N - \mu}{\Lambda/\xi}$. We assume $\mu = 0$.

From the market clearing condition, we have

$$P(q) = \frac{x^*(q)}{\mathcal{M}(q)} = \frac{\pi(q)/P(q)}{\mathcal{M}(q)\Lambda/(\xi + \psi(\bar{q} + q))} \quad \text{and} \quad P^N = \frac{\pi^N/P^N}{v_N M_N \Lambda / \xi}$$

where v_N is the *PE market friction (efficiency) parameter*.

Then,

$$P(q) = \sqrt{\frac{\pi(q)}{\Lambda \frac{\mathcal{M}(q)}{\xi + \psi(\bar{q} + q)}}} \quad \text{and} \quad P^N = \sqrt{\frac{\pi^N}{\Lambda \frac{v_N M_N}{\xi}}}$$

- ▶ Both prices increase in the profit and decrease in the return variance.
- ▶ The non-listed price decreases in the frictional parameter.

Each public firm chooses transparency level q to maximize the price of the firm:

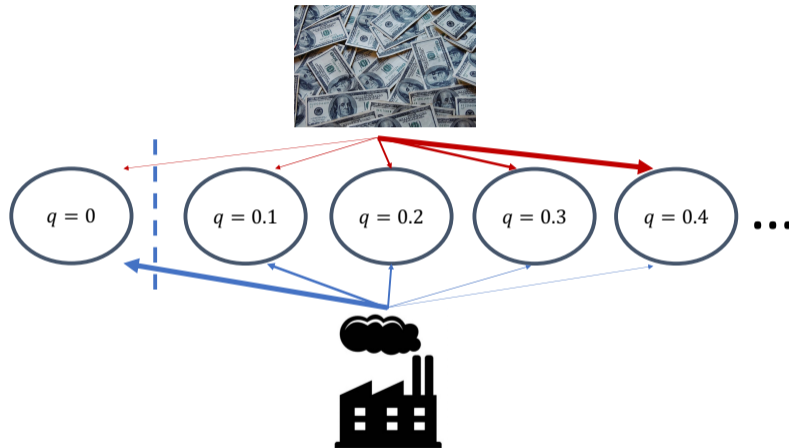
$$\text{[Listed market]} \quad \max_{q \in [0, 1 - \bar{q}]} P(q) \iff \max_{q \in [0, 1 - \bar{q}]} \pi(q) \underbrace{(\xi + \psi(\bar{q} + q)) / \mathcal{M}(q)}_{\text{Net Funding Intensity } \phi^L(q)}$$

$$\text{[Private equity market]} \quad \pi^N \underbrace{(\xi / (v_N M_N))}_{\text{Net Funding Intensity } \phi^N}$$

Trade-off:

- [Funding supply]: Higher transparency q increases funding intensity \rightarrow **higher valuation**
- [Funding demand]: Higher transparency q increases a firm's shared intangible \rightarrow **lower profits**

SIMPLE ILLUSTRATION



► Equilibrium effect:

- Firms understand the funding supply condition (household's preference).
- Household understands the profit difference depending on q .

To summarize the key components that pin down the equilibrium,

$$\text{[Entry decision]} \quad V(\mathcal{M}, M_N) = \max\{J^L(\mathcal{M}), J^N(M_N)\}$$

$$\begin{aligned} \text{[Listed firm's problem]} \quad J^L(\mathcal{M}) &= \max_q \max_{k_T, k_I} \left(z k_T^\alpha (k_I (1 - \bar{q} - q))^\theta (\Phi^{\text{ex}})^\gamma - r k_T - p k_I \right) \phi^L(q) \\ \text{s.t. } \phi^L(q) &= (\bar{q} + q)^\chi / \mathcal{M}(q) \end{aligned}$$

$$\begin{aligned} \text{[Non-listed firm's problem]} \quad J^N(M_N) &= \max_{k_T, k_I} \left(z k_T^\alpha (k_I)^\theta (\Phi^{\text{ex}})^\gamma - r k_T - p k_I \right) \phi^N \\ \text{s.t. } \phi^N &= \xi / M_N^{\nu_N} \end{aligned}$$

And we focus on the equilibrium where $P(q) = P_N$ for $\forall q$: **2 Indifference conditions** holds.

- (1) Public firms become **indifferent among different q levels**.
- (2) Firms become **indifferent between going public or private**.

Proposition 1 (Intangibles and the forecast error)

Given $\alpha + \theta < 1$, the household's forecast error is positively associated with $k^l(q, \mathcal{M}; \bar{q})$.

- ▶ From the first-order condition, we get

$$k_l = \left(\left(\frac{\alpha z (\Phi^{ex})^\gamma}{r} \right)^{\frac{1}{1-\alpha-\theta}} \left(\frac{r\theta}{\rho\alpha} \right)^{\frac{1-\alpha}{1-\alpha-\theta}} \right) (1 - \bar{q} - q)^{\frac{\theta}{1-\alpha-\theta}} = A(1 - \bar{q} - q)^{\frac{\theta}{1-\alpha-\theta}},$$

where $A := \left(\left(\frac{\alpha z (\Phi^{ex})^\gamma}{r} \right)^{\frac{1}{1-\alpha-\theta}} \left(\frac{r\theta}{\rho\alpha} \right)^{\frac{1-\alpha}{1-\alpha-\theta}} \right)$.

As $\alpha + \theta < 1$, the proposition is immediate from the last equation.

- ▶ An *empirically supported* setup: the cross-sectional evidence.

Proposition 2 (Transparency distribution)

The probability density function \mathcal{M} of transparency q has the following closed form:

$$\mathcal{M}(q) = \underbrace{\xi + \psi(\bar{q} + q)}_{\text{funding supply}} \underbrace{(1 - \bar{q} - q)^{\frac{\theta}{1-\alpha-\theta}}}_{\text{funding demand}} \underbrace{\frac{1}{\phi^N}}_{\text{private equity market efficiency}}$$

- ▶ The endogenous distribution supports the *indifference* condition among public firms.
- ▶ We show this is actually a translated version of the *Beta distribution*.
 - The endogenous distribution has the analytic form: $q + \bar{q} \sim \frac{\mathbb{I}\{q \in [0, 1 - \bar{q}]\}}{1 - M_N} \times \text{Beta}\left(\frac{1 - \alpha}{1 - \alpha - \theta}, 2\right)$
- ▶ The negative effect of transparency regulation on the transparency density through the funding demand channel becomes steeper as θ becomes larger
- ▶ The distribution is *independent* of Φ , p and z .

THE NUMBER OF LISTED FIRMS AND MANDATED TRANSPARENCY

The equilibrium mass of private firms is determined from the following characteristic eq.:

$$\psi \frac{\nu_N}{\xi} M_N \int_0^{1-\bar{q}} \left(\frac{\xi}{\psi} + (\bar{q} + q) \right) (1 - \bar{q} - q)^B dq = 1 - M_N$$

where $B = \frac{\theta}{1-\alpha-\theta}$.

- ▶ The equation is from the total mass condition: $\int M(q) di = 1 - M_N$
- ▶ The equation is *completely isolated* from Φ and p .
- ▶ By replacing $y := q + \bar{q}$, we can reshape it using the *Beta function*, $\mathcal{B}(B+1, 2)$:

$$M_N = \frac{1}{1 + \psi \frac{\nu_N}{\xi} \left(1 + \frac{\xi}{\psi}\right)^{B+2} \mathcal{B}(B+1, 2) F\left(\frac{1-\bar{q}}{1+\xi}; B+1, 2\right)}$$

where F is the CDF of Beta distribution; \mathcal{B} is the beta function.

Proposition 3 (The the measure of listed firms and the structural parameters)

M_N strictly increases in $\bar{q} \in (0, 1)$ and $\theta > 0$.

Proposition 4 (The aggregate transparency and the intangible share)

The aggregate transparency \mathcal{T} decreases in θ , where $\mathcal{T} := \int_0^{1-\bar{q}} (q + \bar{q}) \mathcal{M}(q; \theta) dq$.

- ▶ As intangible share increases, the incentive to disclose a transparent information declines

⇒ Aggregate transparency ↓ ⇒ **Welfare loss**

SUMMARY OF THE THEORY PREDICTION

The theory predicts that

- ▶ The intangible demand is negatively correlated with "*transparency + regulation intensity*."
- ▶ The negative correlation becomes stronger when the intangible becomes more important.
- ▶ The number of listed firms decline in "*regulation intensity*."

On the other hand,

- ▶ "*regulation intensity*" improves listed firms' transparency.

Extensive margin **vs.** Intensive margin

EMPIRICAL EVIDENCE

- ▶ The firm-level data is the U.S. Compustat.
- ▶ Following Corrado, Hulten, and Sichel (2009), we use the perpetual inventory method.

$$\begin{aligned} \text{Knowledge}_{it} &= (1 - \delta^G) \text{Knowledge}_{it-1} + R\&D_{it} \\ \text{Organizational}_{it} &= (1 - \delta^O) \text{Organizational}_{it-1} + \gamma^O \text{SG\&A}_{it} \\ \text{Acquired}_{it} &= \text{Acquired}_{it-1} + \text{netIntan}_{it} \end{aligned}$$

- $\delta^G = \delta^O = 0.15$ (Corrado, Hulten and Sichel), $\gamma^O = 0.20$ (Falato, et al., 2022)
- All deflated by the IPP deflators (base year = 2012).

Then, we obtain the **intangible** capital stock:

$$\text{Intangible}_{it} = \text{Knowledge}_{it} + \text{Organizational}_{it} + \text{Acquired}_{it}$$

MEASUREMENT OF TRANSPARENCY

- ▶ Data on analysts' forecasts: the Institutional Brokers' Estimate System (I/B/E/S).
- ▶ Following Dellavigna and Pollet (2009), we calculate the *earnings surprise* (forecast error):

$$ES_{i,j,t} := \frac{\epsilon_{i,j,t} - e_{i,t}}{P_{i,t}}$$

- t is the indicator of a quarter; i and j are firm and analyst indicators, respectively;
 - $e_{t,j}$: Firm i 's announced actual earnings per share
 - $\epsilon_{i,j,t}$: Firm i 's the earnings forecast per share
 - $P_{i,t}$ is the stock price.
- ▶ We define *transparency* measures:

$$Transparency_{i,t}^1 := \frac{1}{\text{var}(ES_{i,j,t})} \quad (\text{disagreement})$$

$$Transparency_{i,t}^2 := \frac{1}{\text{median}(|ES_{i,j,t}|)} \quad (\text{accuracy})$$

CROSS-SECTION: TRANSPARENCY AND INTANGIBLES

- ▶ The regression of forecast error measures on the intangible capital.

$$\text{Transparency}_{it} = \beta \text{Intangible}_{it} + \text{Controls} + \text{FE} + \epsilon_{it}$$

- ▶ The greater intangible a firm holds, the greater the forecast error is.

	Transparency 1		Transparency 2	
	(1)	(2)	(3)	(4)
Intangible	-0.6386 (.0871)	-0.3117 (.0971)	-0.3191 (.0414)	-0.1529 (.0497)
Year FE	✓	✓	✓	✓
Industry FE	✓		✓	
Firm FE		✓		✓
Adj. R^2	0.295	0.649	0.289	0.634
Observations	78878	77944	76959	76014

Table: Cross-sectional relationship between the forecast error and intangibles

STRUCTURAL ANALYSIS

We are interested in

$$\{\bar{q}, \theta, \xi, \psi, \nu_N\}$$

- ▶ \bar{q} : Mandated transparency
- ▶ θ : Intangible share
- ▶ ξ : Baseline information level
- ▶ ψ : Transparency's contribution to listed firms information
- ▶ ν_N : PE market friction

We estimate these parameters using SMM for 2 separate periods:

- ▶ Baseline: 1992 - 1996
- ▶ Post-change: 2012 - 2016

SIMULATED METHOD OF MOMENTS: EXACT IDENTIFICATION

Moments	Data	Model	Reference
Baseline (1992 ~ 1996)			
Fraction of listed after M&A adj. (%)	11.08	11.08	Compustat & BDS
<i>(cf. without M&A adj. (%))</i>	(8.30)		
Intangible Exp./Sale (%)	2.906	2.906	Compustat
Average $sd(\tilde{r})$ (%)	12.53	12.53	Compustat
Average $sd(\tilde{r})$ of top 1% (%)	25.52	25.52	Compustat
Portion of funded non-listed firms (%)	30.30	30.00	Ewens and Farre-Mensa (2020)
Post-change periods (2012 ~ 2016)			
Fraction of listed after M&A adj. (%)	7.60	7.60	Compustat & BDS
<i>(cf. without M&A adj. (%))</i>	(4.01)		
Intangible Exp./Sale (%)	5.356	5.356	Compustat
Average $sd(\tilde{r})$ (%)	28.00	28.00	Compustat
Average $sd(\tilde{r})$ of top 1% (%)	84.81	84.81	Compustat
Portion of funded non-listed firms (%)	34.30	34.00	Ewens and Farre-Mensa (2020)

ESTIMATED PARAMETERS

Param.	Description	Baseline (1992 ~ 1996)	Post-change (2012 ~ 2016)
\bar{q}	Mandated transparency	0.981	0.995
θ	Intangible share	0.029	0.054
ξ	Baseline information level	25.520	1.390
ψ	Transparency's contribution to public info.	38.539	11.394
ν_N	PE market friction	3.300	2.915

Welfare

$$\begin{aligned} \text{Welfare} &= \int x(\tilde{q}) \frac{\pi(\tilde{q})}{p(\tilde{q})} d\tilde{q} + x^N \frac{\pi^N}{P^N} - \frac{\Lambda}{2} \int x(\tilde{q})^2 \frac{1}{\xi + \psi(\bar{q} + q)} d\tilde{q} - \frac{\Lambda}{2} (x^N)^2 \frac{1}{\xi} \\ &= \frac{1}{2} \int \mathcal{M}(\tilde{q}) \pi(\tilde{q}) d\tilde{q} + \frac{\nu_N}{2} M^N \pi^N. \end{aligned}$$

Productivity (externality)

$$\text{Productivity} = (\Phi^{\text{ex}})^\gamma = \left(\int_0^{1-\bar{q}} (\bar{q} + q) k_I(q, \mathcal{M}; \bar{q}) \mathcal{M}(q) dq \right)^\gamma$$

Output

$$\text{Output} = \int_0^{1-\bar{q}} z k_T(q)^\alpha (k_I(q)(1 - \bar{q} - q))^\theta (\Phi^{\text{ex}})^\gamma M(q) + z k_{DT}^\alpha k_{DI}^\theta (\Phi^{\text{ex}})^\gamma M^N$$

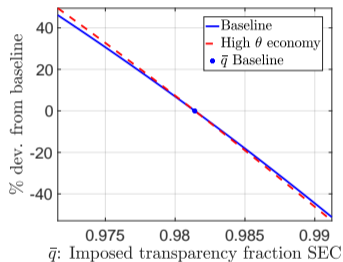
- ▶ Stricter regulation on disclosure and the increased intangible capital share are the key drivers of the observed patterns.
- ▶ The *sluggish productivity growths* in the U.S. and U.K. are partly accounted for by these changes.

Table: Decomposition of the channels in the post-change changes

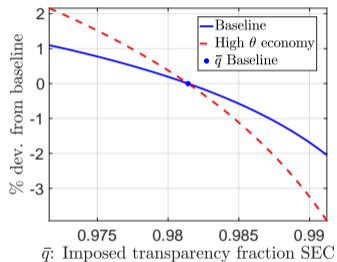
Param.	Channel	Contribution to the change (p.a.):			
		#listed	transparency	productivity	welfare
	Total change	-1.88	-1.85	-0.42	-1.42
\bar{q}	SEC regulation	-6.22	-6.18	-0.25	0.20
θ	Rising intangible share	-0.89	-0.89	-0.37	-0.81
ξ	Baseline information level	8.62	8.62	0.34	-0.92
ψ	Harder to forecast public firms	-3.72	-3.72	-0.16	0.16
ν_N	PE market friction	-0.56	-0.56	-0.02	-0.59

DISCLOSURE POLICY AND THE INTANGIBLE SHARE

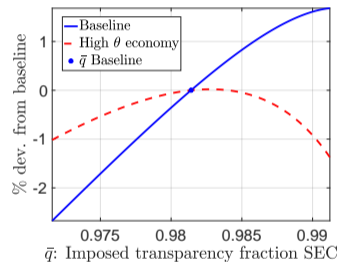
- ▶ The intangible share change affects the macroeconomy through the channel of the effectiveness of disclosure policy



(a) Measure of listed firms



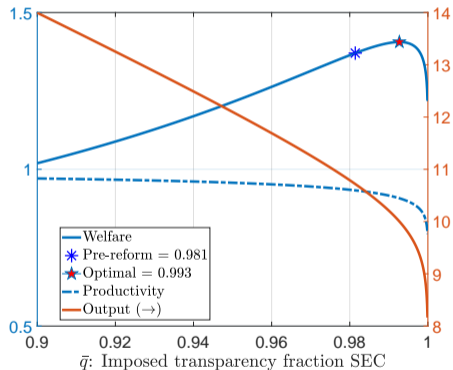
(b) Productivity



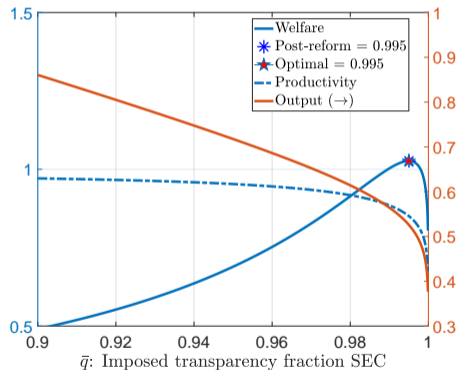
(c) Welfare

Figure: Macro-level sensitivities to the disclosure policy changes: Baseline vs. High intangible share economy

- ▶ The disclosure policy leads to the *inverted-U* shaped macro targets. (Laffer-type tax on knowledge?)
- ▶ A policy maker's **dilemma** between maximizing productivity and welfare.



(a) Baseline



(b) Post change

CONCLUDING REMARKS

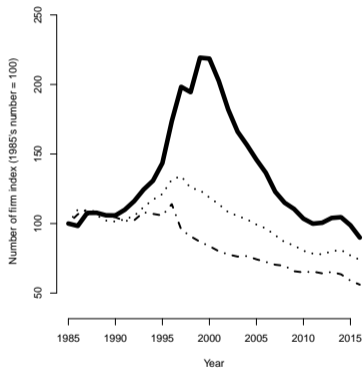
- ▶ **Stricter regulation on disclosure and rising intangible capital contributed to the two trends:**
 - disappearing public firms.
 - declining average transparency.

- ▶ **These changes led to a drop in productivity and welfare (net).**

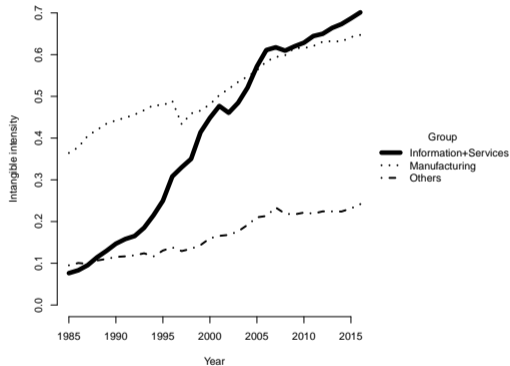
- ▶ **The macroeconomic outcomes nonlinearly respond to the disclosure policy:**
 - inverted U-shaped welfare and output.
 - policy maker's dilemma between productivity and welfare.
 - the recent policy changes have been welfare-improving at the cost of productivity.

APPENDIX

- ▶ The declining trend in the number of listed firms is starker in “*intangible-intense*” industries.



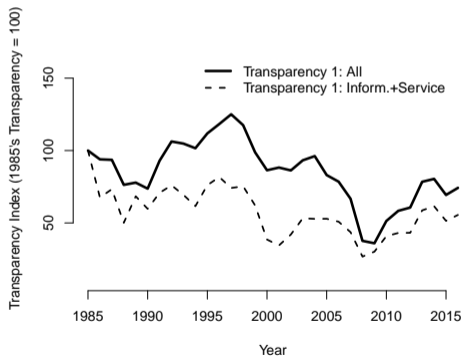
(a) Number of listed firms



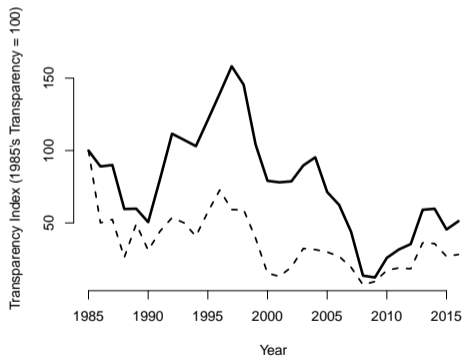
(b) Intangibles intensity

INDUSTRY-LEVEL ANALYSIS: TRANSPARENCY

- ▶ The trend of declining transparency is in all industries.
- ▶ In the long run, "*intangible-intense*" industries have shown a greater decline in transparency.
- ▶ In recent years, other industries, including manufacturing, has shown a sharp decline in transparency.



(a) Transparency 1



(b) Transparency 2

Table: Fixed parameters

Parameters	Description	Value
α	Capital share	0.30 $-\theta$
γ	Public intangible share	$= \theta$
r	Rental rate tangible capital plus depreciation	0.10
K^I	Total intangible supply	1
z	TFP level	1