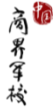# Does Analyst Coverage Increase Firm Productivity?

Xiangyu Ding 1901212474

2022-05-27

Motivation

- **Does analyst coverage increase firm productivity?**

  - The role of the financial market on the real economy is a hot research field;

  - Existing literature shows **opposite** mechanisms:

    - **The positive view (information mechanism):**
      - Financial constraints induced by information asymmetry (Myers & Majluf, 1984; Derrien & Kecskés, 2013; etc.)
      - Underreaction of investors on complex R&D outputs (Hirshleifer et al.,2018; Shu et al.,2022; etc.).

    - **The negative view (managerial pressure mechanism):**
      - Analysts systematically overestimate the earnings (Hong & Kubik,2003; Ke & Yu, 2006; Cao & Zhu, 2011; etc.)
      - Managers, therefore, forego projects with positive long-term NPV (Matsunaga & Park,2001; He & Tian, 2013; etc.)
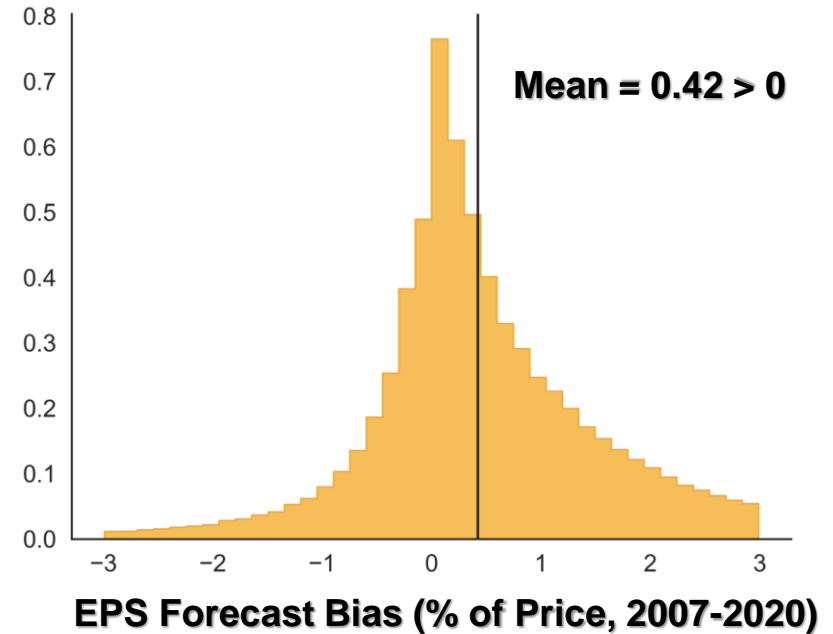
- **What is new?**
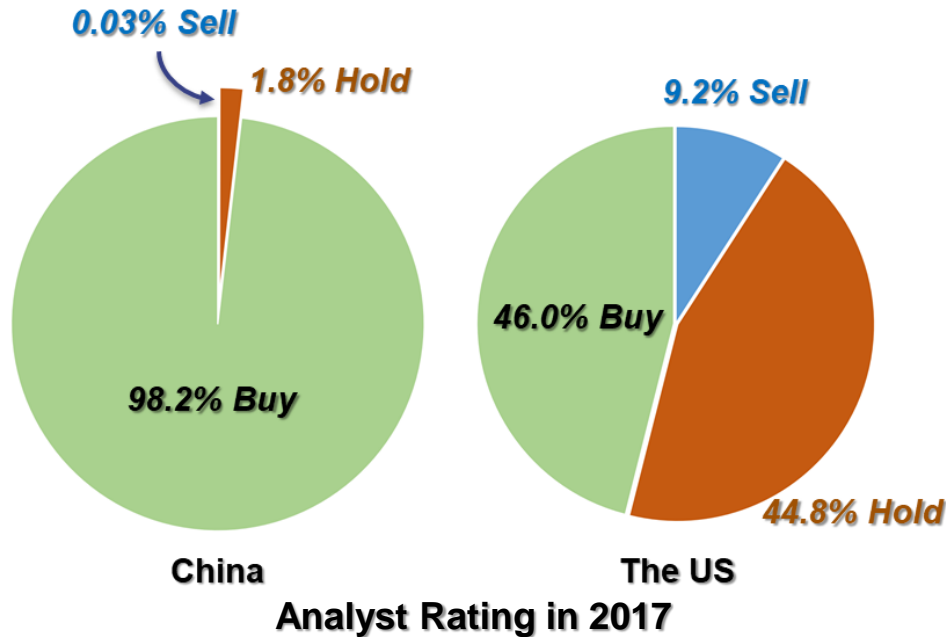
  - More finance and high R&D do not mean high productivity **(Overinvestment and patent bubbles).**

  - To my best knowledge, this is the first research on analyst coverage and firm TFP in China;
    - To et al. (2018) on the US: Their result shows **positive** relationships;
    - My research on China: The result is mixed, both the **positive** side and the **negative** side are detected.

Why Study China?

■ Analysts in China are notoriously known to be overly **optimistic**:

Analyst Rating in 2017

China: 0.03% Sell, 1.8% Hold, 98.2% Buy
The US: 9.2% Sell, 46.0% Buy, 44.8% Hold

EPS Forecast Bias (% of Price, 2007-2020)

Mean = 0.42 > 0

• While short-selling and euphemism might be reasons, **analyst independence** is a problem:
  – For interests of their employer (Cao & Zhu, 2011); clients (Wu et al., 2013), for firms (Zhao et al., 2013)
  – Strict regulation in the EU and US, loose regulation on analysts in China (Xue et al., 2022)

■ **Question:**

• Are analyst doing **good** or **evil** to the real economy in a loosely regulated market?
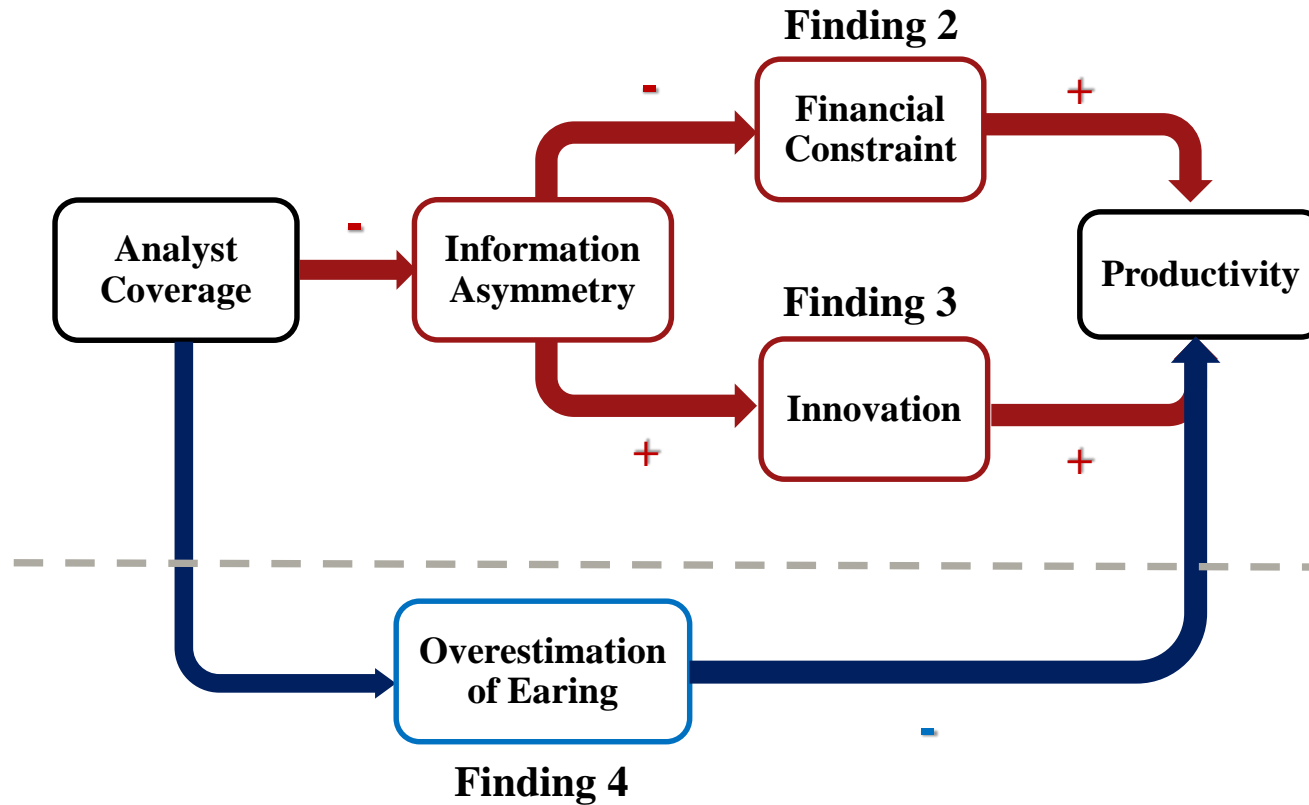
Summary

■ **Research questions and main finding:**

- **Q1:** Does analyst coverage increase firm productivity?
  - **Finding 1:** There is an increase in TFP after coverage;
  - To establish causality:
    - Solving endogeneity problems: IV + Nature Experiment；
    - Alternative measure of TFP, and using ROA as a proxy；

- **Q2:** What are the channels leading to an increase in TFP?
  - **Finding 2 (financial constraints):** KZ index decreases and cash increases after coverage;
  - **Finding 3 (innovation):** Invention patent application and citation increases.

- **Q3:** Do all analyst coverages uniformly increase productivity?
  - **Finding 4:** The positive relationship between analyst coverage and TFP only exists when the EPS forecast of the analyst is not so aggressive.

■ **Contribution**

- To my best knowledge, the first research on analyst coverage and TFP in China;

- Novel measure of firm innovation using data from google patent.

Theoretical Framework

Information Mechanism

Finding 2

Finding 3

Finding 4

Analyst Coverage	Information Asymmetry	Financial Constraint	Productivity
		Innovation	
	Overestimation of Earing		

- Analyst Coverage → − → Information Asymmetry
- Information Asymmetry → − → Financial Constraint → + → Productivity
- Information Asymmetry → + → Innovation → + → Productivity
- Analyst Coverage → Overestimation of Earing → − → Productivity

Managerial Pressure Mechanism

Observations and Variables

■ **Observations:**

- A share stocks from 2007 to 2020 (ST, ST*, PT firms, and financial companies dropped)

■ **Key variables:**

- **Productivity (TFP_OP, TFP_LP):**
  - **TFP_OP** (Olley & Pakes,1996): using investment as a control for unobserved;
  - **TFP_LP** (Levinsohn & Pertin, 2003): using intermediate inputs as a control for unobserved;
    - **Nominal values** are converted to **real values** in 2007 using CPI, PPI, IPI, and estimated age of fixed assets.

- **Analyst Coverage (LnAnalyst):**
  - ln(1 + the number of analysts issuing earnings forecasts for a firm)

- **Financial constraints (KZindex, Cash):**
  - KZ index suggested by Kaplan & Zingales (1997);
  - Cash holding as a ratio of total assets for robustness check.

- **Innovation (LnPatent; LnCite):**
  - LnPatent: Ln(1 + number of invention patents filled);
  - LnCite: Ln(1 + total number of standardized citations received by the invention patents);

Finding 1: Baseline Regression

	TFP_OP t+1	TFP_OP t+1	TFP_LP t+1	ROA t+1
LnAnalyst	**0.153***** **(0.006)**	**0.078***** **(0.005)**	**0.078***** **(0.005)**	**0.008***** **(0.000)**
Observations	28,585	28,585	28,585	28,585
Adj. R-sq	0.388	0.471	0.442	0.138
Controls	NO	YES	YES	YES
Industry FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Longer-Term Productivity
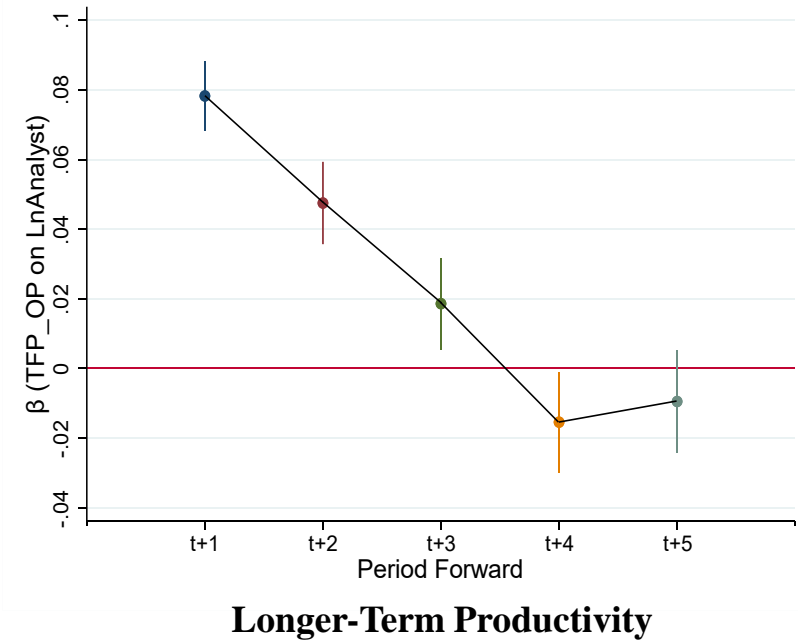
- **Finding:** TFP and ROA of firm significantly increase after analyst coverage;
- However, it is easy to argue that analyst coverage is **endogenous**:
  - **Reverse causality:** Analysts pick up firms with high forecasted TFP to follow;
  - **Omitted variables:** factors that are hard to measure and therefore hard to control.

Sincerely thank my referee for pointing out a problem in R square

Finding 1: Instrument Variable

- **Expected Coverage (suggested by Yu, 2008):**

$$ExpectedCoverage_{ijt} = \frac{Brokersize_{jt}}{Brokersize_{j0}} * Coverage_{i0j}$$

$$ExpectedCoverage_{it} = \sum_{j=1}^{n} ExpectedCoverage_{ijt}$$

  - $Brokersize_{jt}$: Total number of analyst hired by broker j in year t;
  - $Brokersize_{j0}$: Total number of analyst hired by broker j in the benchmark year;
  - $Coverage_{i0j}$: Take 1 if analyst hired by broker j follow firm i in benchmark year;

- **Why expected coverage is a good IV:**

- **Exclusivity:**
  - Executives of the brokerage firm choose to change the size of its analyst team due to brokerages' business conditions, rather than the characteristics of the firm it covering.

- **Relevance:**
  - When analyst team size become small, analyst cut coverage on firm because they are busy.

Finding 1: Instrument Variable

	LnAnalyst	TFP_OP t+1	TFP_LP t+1
ExpectedCoverage	**0.095*** (0.006)**		
LnAnalyst (Instrumented)		**0.160*** (0. 032)**	**0.156*** (0.031)**
Observations	15,306	15,306	15,306
R-squared	0.340	0.535	0.497
Controls	YES	YES	YES
Industry FE	YES	YES	YES
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

■ **Findings:**

• Coefficient is significantly larger than 0 ⇒ **Finding 1 further supported**

• Similar with To et al. (2018), the coefficient (0.160) is larger than the baseline regression (0.078), **why?**
  – **Omitted variables in baseline regression:** e.g. product complexity, value chain complexity;
  – **Sample selection of IV estimation:** Require at least 1 analyst in the benchmark year.
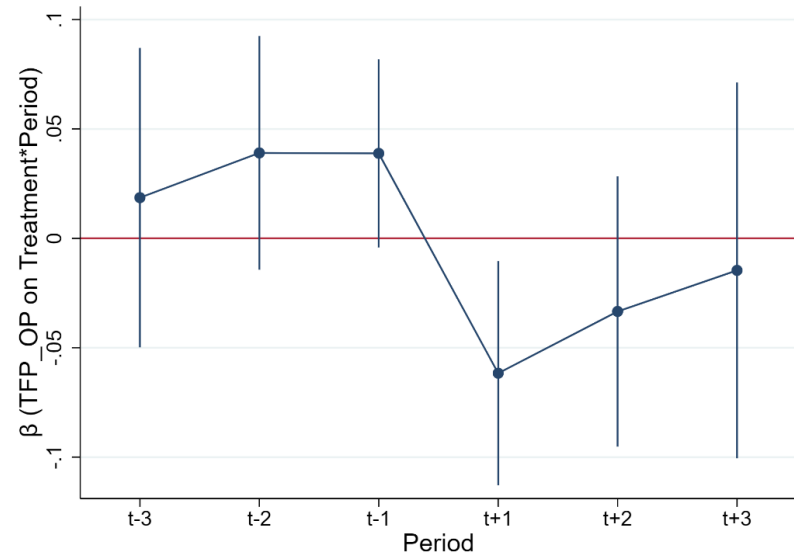
■ **Robustness:**

• Weak IV? Kleibergen-Paap Wald rk F = 269.35 >> 20: strongly rejects weak IV;

• Alternative benchmark year (See section 7.1.3): Overall, Finding 1 is supported.
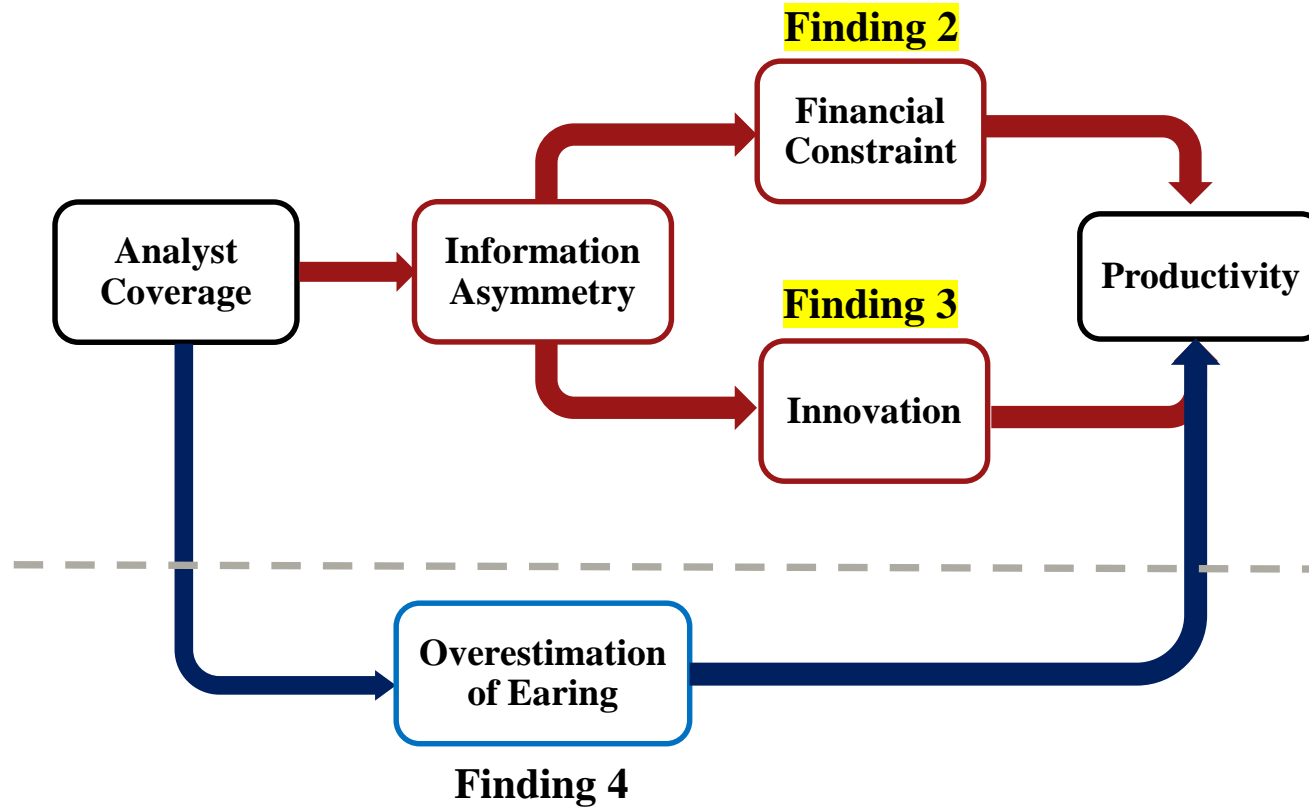
Finding 2: Brokerage Mergers

- Brokerage mergers leads to **exogenous** coverage decline (Hong & Kacperczyk, 2010);
  - **Relevance:** Mergers causes analyst redundancy of coverage if two analysts cover one firm;
    - On average, there is 0.84 decreases on *lnanalyst* for the treated firms
  - **Exogenous:** Brokerage firms merge due to their own strategies.

- Estimation strategy: PSM-DID
  - Nearest neighbor matching with a caliper of 0.05 using covariates one year before the event;
  - Covariates: Firm size, book-to-market ratio, operation cashflow, and number of analysts.

	TFP_OP t+1	TFP_LP t+1
Treated	**-0.065*** (0.024)**	**-0.068*** (0.024)**
Observations	3,094	3,094
R-squared	0.466	0.437
Controls	YES	YES
Industry FE	YES	YES
Firm FE	YES	YES
Year FE	YES	YES

Parallel Trend Test

Potential Channels

Information Mechanism

```
                    ┌─────────────┐
          Finding 2 │  Financial  │
                    │ Constraint  │──────────┐
┌──────────┐   ┌─────────────┐    └─────────────┘          ┌──────────────┐
│ Analyst  │──▶│ Information │                              │ Productivity │
│ Coverage │   │ Asymmetry  │    Finding 3                  │              │
└──────────┘   └─────────────┘    ┌─────────────┐          └──────────────┘
                                  │ Innovation  │──────────┘
                                  └─────────────┘
```

Finding 2 — Financial Constraint

Finding 3 — Innovation

Overestimation of Earing

Finding 4

Managerial Pressure Mechanism

- **Classical three-step regression (Baron & Kenny, 1986)**

$$KZindex_{it+1} = \beta_0 + a\, LnAnalyst_{it} + X'_{it}\delta + \mu_i + \theta_t + \epsilon_{it} \qquad (M1)$$

$$TFP_{it+1} = \beta_0 + c\, LnAnalyst_{it} + X'_{it}\delta + \mu_i + \theta_t + \epsilon_{it} \qquad (M2)$$

$$TFP_{it+1} = \beta_0 + c'\, LnAnalyst_{it} + b\, KZindex_{it+1} + X'_{it}\delta + \mu_i + \theta_t + \epsilon_{it} \qquad (M3)$$

	M1 KZindex t+1	M1 (IV) KZindex t+1	M2 TFP_OP t+1	M3 TFP_OP t+1
LnAnalyst	-0.167*** (0.014)		0.078*** (0.021)	0.064*** (0.005)
LnAnalyst (Instrumented)		-0.266*** (0.110)		
Kzindex t+1				-0.084*** (0.003)
Observations	28,585	15,306	28,585	28,585
Adj. R-squared	0.222	0.135	0.471	0.503
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Finding 3: Financial Constraints

■ **Classical three-step regression (Baron & Kenny, 1986)**

$$KZindex_{it+1} = \beta_0 + a\ LnAnalyst_{it} + X'_{it}\delta + \mu_i + \theta_t + \epsilon_{it} \qquad (M1)$$

$$TFP_{it+1} = \beta_0 + c\ LnAnalyst_{it} + X'_{it}\delta + \mu_i + \theta_t + \epsilon_{it} \qquad (M2)$$

$$TFP_{it+1} = \beta_0 + c'\ LnAnalyst_{it} + b\ KZindex_{it+1} + X'_{it}\delta + \mu_i + \theta_t + \epsilon_{it} \qquad (M3)$$

	M1 KZindex t+1	M1 (IV) KZindex t+1	M2 TFP_OP t+1	M3 TFP_OP t+1
LnAnalyst	-0.167*** (0.014)		0.078*** (0.021)	0.064*** (0.005)
LnAnalyst (Instrumented)		-0.266*** (0.110)		
Kzindex t+1				-0.084*** (0.003)
Observations	28,585	15,306	28,585	28,585
Adj. R-squared	0.222	0.135	0.471	0.503
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

- **Classical three-step regression (Baron & Kenny, 1986)**

$$KZindex_{it+1} = \beta_0 + a\, LnAnalyst_{it} + X'_{it}\delta + \mu_i + \theta_t + \epsilon_{it} \tag{M1}$$

$$TFP_{it+1} = \beta_0 + c\, LnAnalyst_{it} + X'_{it}\delta + \mu_i + \theta_t + \epsilon_{it} \tag{M2}$$

$$TFP_{it+1} = \beta_0 + c'\, LnAnalyst_{it} + b\, KZindex_{it+1} + X'_{it}\delta + \mu_i + \theta_t + \epsilon_{it} \tag{M3}$$

	M1 KZindex t+1	M1 (IV) KZindex t+1	M2 TFP_OP t+1	M3 TFP_OP t+1
LnAnalyst	-0.167***		0.078***	0.064***
	(0.014)		(0.021)	(0.005)
LnAnalyst (Instrumented)		-0.266***		
		(0.110)		
Kzindex t+1				-0.084***
				(0.003)
Observations	28,585	15,306	28,585	28,585
Adj. R-squared	0.222	0.135	0.471	0.503
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

■ **Classical three-step regression (Baron & Kenny, 1986)**

	M1 LnPatent t+1	M1 (IV) LnPatent t+1	M2 TFP_OP t+1	M3 TFP_OP t+1
LnAnalyst	**0.057*****		**0.078*****	**0.077*****
	(0.010)		**(0.005)**	**(0.005)**
LnAnalyst (Instrumented)		**0.209*****		
		(0.075)		
LnPatent t+1				**0.018*****
				(0.005)
Observations	28,444	15,306	28,444	28,444
Adj. R-squared	0.268	0.232	0.471	0.471
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

■ **Findings:**

• Empirical finding suggests **financial constraints** and **innovation** might be two different channels.

Theoretical Framework

Information Mechanism

Finding 2

Analyst Coverage → **-** → **Information Asymmetry**

- → **Financial Constraint** → **+** → **Productivity**

Finding 3

Innovation → **+**

+

Overestimation of Earing

Finding 4

-
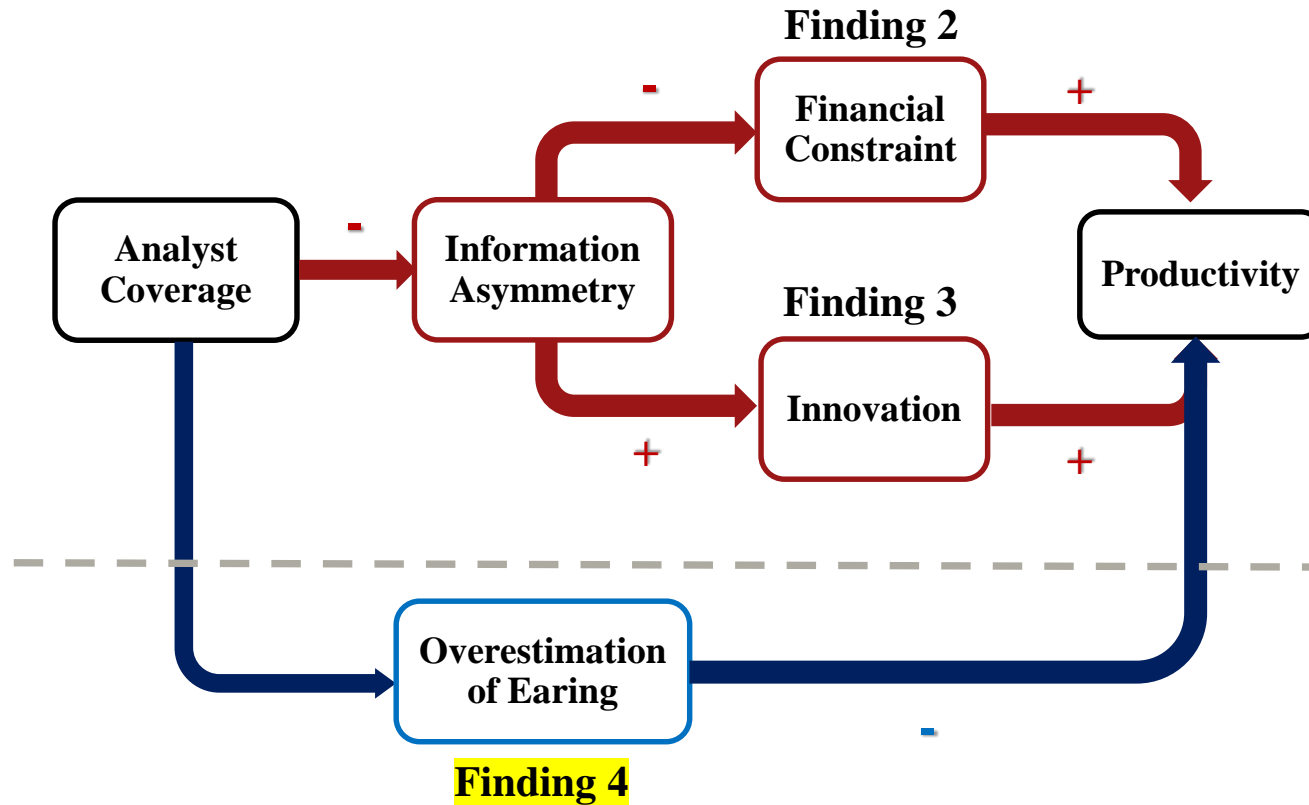
Managerial Pressure Mechanism

Finding 5: Managerial Pressure Mechanism

- **Two methods to test evidence 5:**

  - **Method 1: Product of mean forecasted bias and analyst coverage**

    - $TFP_{it+1} = \beta_0 + \beta_1 LnAnalyst_{it} + \beta_2 MeanError_{it} + \beta_3 LnAnalyst_{it} * MeanError_{it} + X'_{it}\delta + \mu_i + \theta_t + \epsilon_{it}$

  - **Method 2: Divide the analysts into overestimating analyst and underestimating analysts**

    - $TFP_{it+1} = \beta_0 + \beta_1 LnAnaHigh_{it} + \beta_2 LnAnaLow_{it} + X'_{it}\delta + \mu_i + \theta_t + \epsilon_{it}$

$$Error_{kit} = \frac{ForecastEPS_{kit} - RealizedEPS_{it}}{StockPrice_{it}}$$

$$MeanError_{jt} = \frac{1}{K}\sum_k Error_{kjt}$$

- **Finding**

  - **The coefficient of product is significantly negative:**
    - The more the analyst overestimates the earning per share (EPS) of firms, the less good analyst does on TFP;
  - **The coefficient of overestimating analyst is negative:**
    - The benefit of analysts only exists in those analysts who do not overestimate the earnings of firms.

	TFP_OP t+1	TFP_OP t+1
LnAnalyst	0.089***	
	(0.023)	
MeanError	-0.395	
	(0.654)	
LnAnalyst* MeanError	**-0.960***	
	(0.288)	
LnAnaHigh		**-0.018***
		(0.004)
LnAnaLow		0.055***
		(0.005)
Observations	18,595	19,067
Adj. R-squared	0.507	0.517
Controls	YES	YES
Industry FE	YES	YES
Firm FE	YES	YES
Year FE	YES	YES

Research Finding and Conclusion

- **Main research finding:**
  - **Finding 1:** In the Chinese A-share market, the overall effect of analysts on TFP is positive;
  - **Finding 2:** Financial constraints and innovation might be two channels.
  - **Finding 3:** When analysts significantly overestimated the EPS, TFP decreases rather than increases.

- **Policy Implications**
  - **Strengthen the regulation of analyst independence**
    - Unbundled payment required by EU law *MiFID II* might be helpful (Guo & Mota, 2021)

- **Shortcomings & Perspectives:**
  - **Better methods in estimation of TFP;**
  - **Better identification strategies on mechanism analysis;**
  - **Are analyst coverage more powerful when an asset bubble burst?**
    - In the Chinese stock market, there are two major bear markets after the burst of asset bubbles;
    - Firm may face severer financial constraints during these periods.
  - **General equilibrium effect: Does analyst coverage squeeze out other firms' finance?**
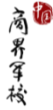
It is my honor to participate in this defense.

Thank You for Listening!

Xiangyu Ding 1901212474

2022-05-27
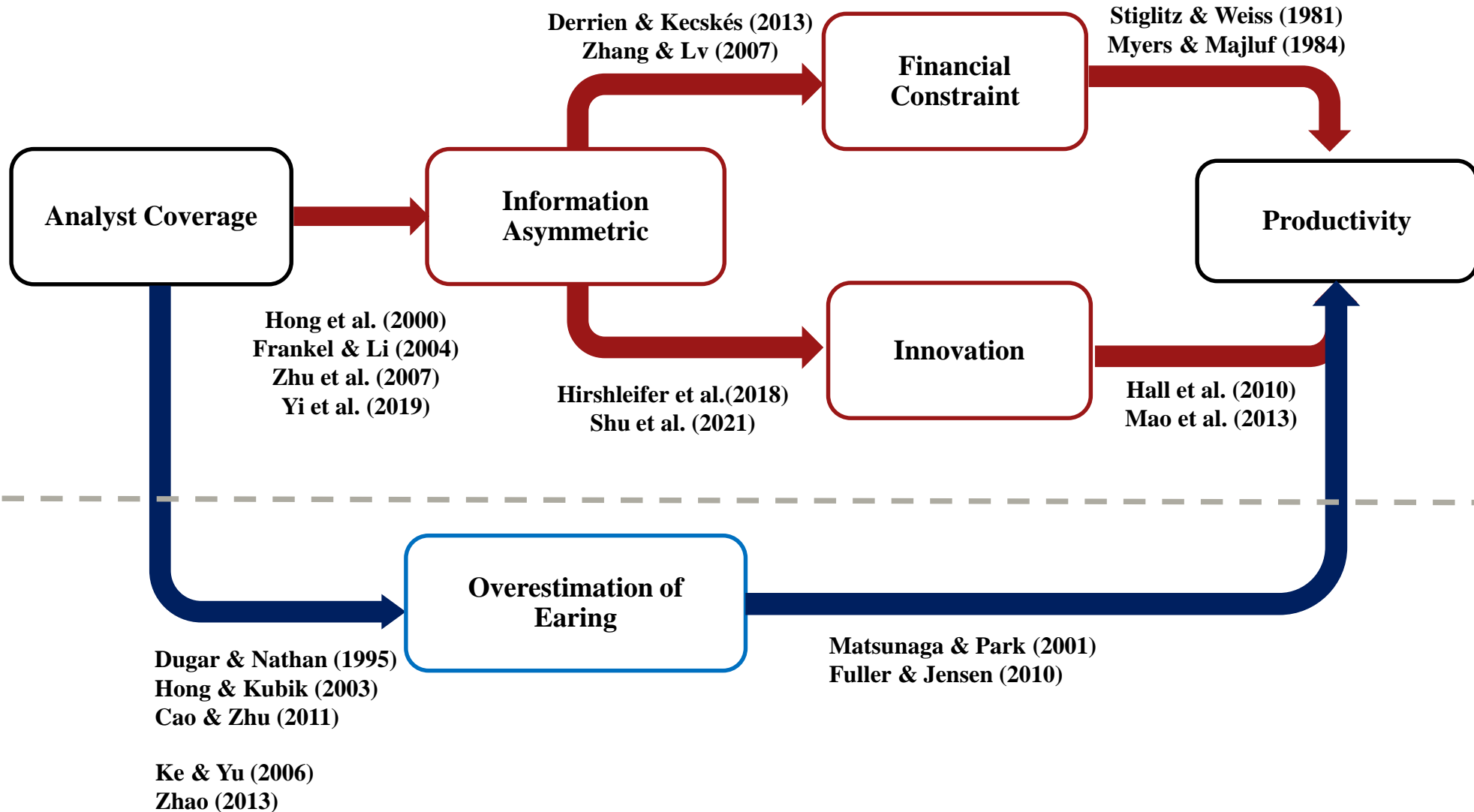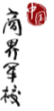
Appendix 1: Literature Review

- ■ **Information Mechanism:**
  - • **Channel 1:** Financial friction can be induced by information asymmetry:
    - – **Theory:** Stiglitz & Weiss (1981); Myers & Majluf (1984), etc.
    - – **Empirical findings:** Brennan & Subrahmanyam (1995); Derrien and Kecskés (2013); etc.

  - • **Channel 2:** Underreaction of investor on complex information (e.g. innovation outputs):
    - – **Empirical findings:** Hirshleifer et al.(2018); Shu et al. (2021);

- ■ **Managerial Pressure Mechanism:**
  - • Analysts systematically tend to over-estimate earning of firm:
    - – **Why?**
      - - For interest of employer: Dugar & Nathan (1995); Hong & Kubik (2003); Cao & Zhu (2011);
      - - Collude with the manager for private information: Ke & Yu (2006); Zhao (2013).

  - • Over-estimated earning post high pressure on the management team, inducing myopic problem:
    - - **Empirical findings:** Matsunaga & Park (2001); Fuller & Jensen (2010); He & Tian (2013).

Appendix 1: Literature Review

Analyst Coverage

Information Asymmetric

Financial Constraint

Innovation

Productivity

Overestimation of Earing

Derrien & Kecskés (2013)
Zhang & Lv (2007)

Stiglitz & Weiss (1981)
Myers & Majluf (1984)

Hong et al. (2000)
Frankel & Li (2004)
Zhu et al. (2007)
Yi et al. (2019)

Hirshleifer et al.(2018)
Shu et al. (2021)

Hall et al. (2010)
Mao et al. (2013)

Dugar & Nathan (1995)
Hong & Kubik (2003)
Cao & Zhu (2011)

Ke & Yu (2006)
Zhao (2013)

Matsunaga & Park (2001)
Fuller & Jensen (2010)

Appendix 2: Main Variables

Table: Main Variables

Variable	Name	Description	Source
TFP_OP	OP method TFP	Estimated following Olley and Pake (1996)	Estimated
TFP_LP	LP method TFP	Estimated following Levinsohn and Pertin (2003)	Estimated
ROA	Return on assets	2*net income / (year-beginning total assets + year-end total assets)	Wind
LnAnalyst	Log analyst	ln(1 + the number of analysts issuing EPS forecasts)	CSMAR
LnReport	Log report	ln(1 + the number of research reports)	CSMAR
LnAnaHigh	Log overestimating analyst	ln(1 + the number of analysts whose biases are higher than the mean)	CSMAR
LnAnaLow	Log underestimating analyst	ln(1 + the number of analysts whose biases are lower than the mean)	CSMAR
MeanError	Average optimistic bias	Average of analysts' overestimation of corporate earnings forecasts	CSMAR
KZindex	Cash ratio	Defined as Kaplan and Zingales (1997)	CSMAR
CashRatio	KZ index	Cash and cash equivalents/total assets	Wind
LnPatent	Log patent	ln(1 + number of invention patents filled)	CNRDS
LnCite	Log Patent citation	ln(1 + number of standardized citations of invention patents filled)	CNRDS
MeanError	Average optimistic bias	Average of analysts' overestimation of corporate earnings	CSMAR

Appendix 3: Control Variables

Table： Control Variables

Variable	Name	Description	Source
Size	Firm size	ln(1 + total assets) total assets in thousand RMB yuan	Wind
Age	Firm age	ln(1 + years since the establishment of the firm)	CSMAR
BM	Book-to-market ratio	Total assets / total market cap	Wind
Growth	Revenue growth	Growth of total revenue comparing to last year	Wind
CapEx	Investment expenditures	Cash for fixed, intangible and other long-term assets / Total revenue	Wind
Cashflow	Cashflow from operations	Cash flow from operating activities / total assets	Wind
PPEratio	Fixed assets ratio	Fixed assets / total assets	Wind
SOE	State-owned enterprises	1 for state-owned enterprises, 0 otherwise	CSMAR
FirstOwn	Control shareholding	Shares owned by largest shareholder / total shares	Wind
InstOwn	Institutional shareholding	Share owned by institutional investor / total shares	Wind
HHI	Herfindahl-Hirschman Index	The sum of squared revenue share of each listed firm in an industry	CSMAR
HHI_sq	HHI Squared	Squared HHI	CSMAR
LnSubsidy	Log government subsidies	ln(1 + subsidy) subsidy in thousands of RMB yuan	Wind
LnSubsidy_sq	LnSubsidy squared	Squared LnSubsidy	Wind

Table： Control Variables for Robustness Check

Variable	Name	Description	Source
Leverage	Debt to asset ratio	Total debts/ Total assets	Wind
ROA	Return on assets	2*net income / (year-beginning total assets + year-end total assets)	Wind

Appendix 4: Using Alternative Channel Variables

Table: Cash Ratio as a Measurement of Financial Constraints

	M1 CashRatio t+1	M2 TFP_OP t+1	M3 TFP_OP t+1
LnAnalyst	**0.008*** (0.001)	**0.078*** (0.005)	**0.076*** (0.005)
CashRatio t+1			**0.293*** (0.047)
Observations	28,585	28,585	28,585
Adj. R-squared	0.168	0.471	0.472
Controls	YES	YES	YES
Industry FE	YES	YES	YES
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

Table: Log Cite as a Measurement of Innovation Outputs

	M1 LnCite t+1	M2 TFP_OP t+1	M3 TFP_OP t+1
LnAnalyst	**0.047*** (0.010)	**0.070*** (0.007)	**0.069*** (0.007)
LnCite t+1			**0.013** (0.006)
Observations	19,464	19,464	19,464
Adj. R-squared	0.164	0.388	0.388
Controls	YES	YES	YES
Industry FE	YES	YES	YES
Firm FE	YES	YES	YES
Year FE	YES	YES	YES

■ Finding

- Channels are supported using alternative measurements of financial constraints and innovation

Appendix 5: Robustness of Natural Experiments

Table：Robustness of Quasi-Natural Experiments

	Stricter Experimental Group		Looser Experimental Group		DID without PSM		Placebo Test	
	TFP_OP t+1	TFP_LP t+1	TFP_OP t+1	TFP_LP t+1	TFP_OP t+1	TFP_LP t+1	TFP_OP t+1	TFP_LP t+1
Treated	-0.101**	-0.097**	-0.084***	-0.087***	-0.065***	-0.066***	-0.058	-0.048
	(0.042)	(0.041)	(0.027)	(0.027)	(0.019)	(0.018)	(0.061)	(0.055)
Observations	980	980	4,505	4,505	33,816	33,816	2,834	2,834
Adj. R-squared	0.574	0.544	0.700	0.676	0.567	0.547	0.607	0.580
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Note:
- **Benchmark selection of experimental group (see page 10):** coverage at least once in 2 years before event and 2 years after event;

- **Stricter experimental group:** coverage at least once in 1 year before event and 1 year after event;
- **Looser experimental group:** coverage at least once in 3 years before event and 3 years after event;
- **Placebo test:** shifting the shock event forward three years

Appendix 6: Why both firm and industry FEs?

■ **Many companies change their industry:**

- **Reason 1: Change of business because of strategy:**
  - e.g. ZJBC Co. Ltd. (中嘉博创; 000889.SZ): from real estate to communication

- **Reason 2: Shell listing:**
  - e.g. 360 Security Technology (三六零; 601360.SH; a software company), listed using shell of SJEC (江南嘉捷; 601360.SH; a former elevator manufacturer)

Table：Number of Firm with Industry Changes

Listed Cohort	Number of Firms	Number of Firms with Industry Changed during 2007-2020	Ratio of Industry Changes (%)
Before 2000	985	468	47.51
From 2000 to 2005	327	121	37.00
From 2005 to 2010	698	224	32.09
From 2010 to 2015	777	118	15.19
After 2015	1,115	21	1.88
All firm	**3,902**	**952**	26.13

- **No industry fixed effects can lead to problems as TFP can vary widely between industries.**

Appendix 7: OP Method TFP Estimation
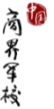
Table：Variables for OP Method TFP Estimation

Variable	Description	Unit	Source
Real Output	Nominal output = operating profit + depreciation and amortization + income tax + finance costs + cash paid to and for employees Then adjust nominal output to real output using 2007 as benchmark year: For firms in manufacture industry, PPI is used; otherwise, CPI is used.	Thousand RMB	Wind
Real Capital Input	Notional capital input = book value of fixed assets Based on the age of fixed assets, the investment price index for fixed assets was used to adjust to the nominal capital input using 2007 as the benchmark year. The age of fixed assets is the firm's accumulated depreciation/current depreciation, taken as a three-year moving average, and then winsorize at the 5% and 95% quartiles.	Thousand RMB	Wind
Labor Input	Number of employees	1	Wind
Real Investment	Notional investment = Cash paid for forming fixed assets, intangible assets and other long-term assets Use the investment price index to adjust nominal investment to real investment using 2007 as benchmark year.	Thousand RMB	Wind
Exit the Market	Delist, or both abbreviation and industry change in same year		Wind

■ **Estimation program:**

– *oprg* command written by Yasar et al. (2008)

Appendix 8: LP Method TFP Estimation

Table：Variables for LP Method TFP Estimation

Variable	Description	Unit	Source
Real Output	Nominal output = operating profit + depreciation and amortization + income tax + finance costs + cash paid to and for employees Then adjust nominal output to real output using 2007 as the benchmark year: For firms in the manufacturing industry, PPI is used; otherwise, CPI is used.	Thousand RMB	Wind
Real Capital Input	Notional capital input = book value of fixed assets Based on the age of fixed assets, the investment price index for fixed assets was used to adjust to the nominal capital input using 2007 as the benchmark year. The age of fixed assets is the firm's accumulated depreciation/current depreciation, taken as a three-year moving average, and then winsorize at the 5% and 95% quartiles.	Thousand RMB	Wind
Labor Input	Number of employees	1	Wind
Real Intermediate Input	Nominal intermediate inputs = cash paid for goods and services. Adjusted to real intermediate inputs using the PPI using 2007 as benchmark year	Thousand RMB	Wind
Exit the Market	Delist, or both abbreviation and industry change in same year		Wind

■ **Estimation program:**

– *levpet* command written by Petrin et al. (2004)

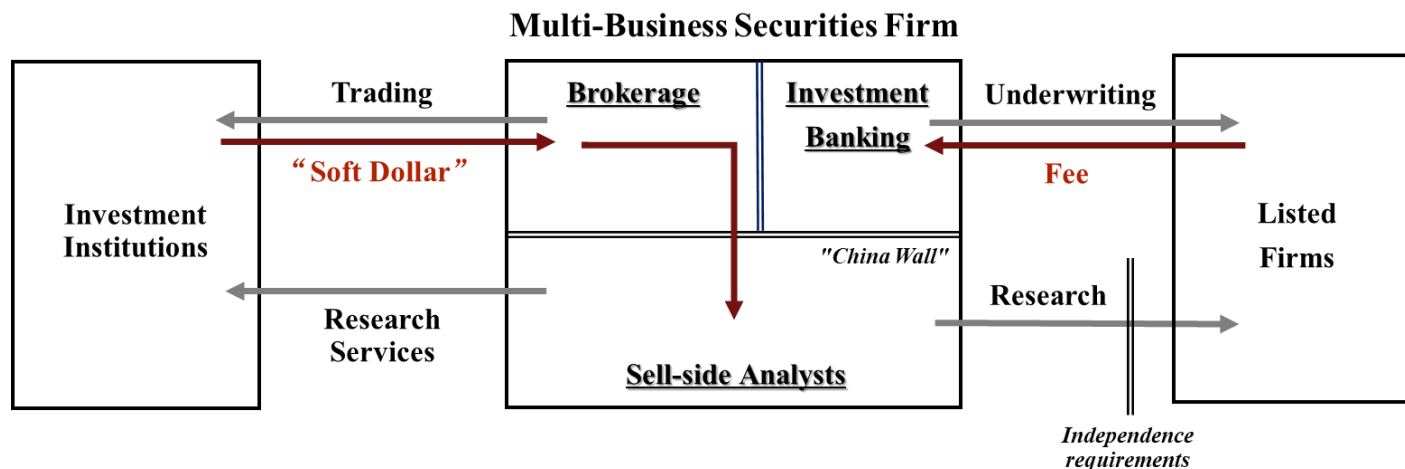# Appendix 9: Business Model of Sell-side Analyst

Multi-Business Securities Firm

Trading · **Brokerage** · **Investment Banking** · Underwriting

"Soft Dollar"

Investment Institutions · Fee · Listed Firms

"China Wall"

Research Services · Research · **Sell-side Analysts**

Independence requirements

Figure: Business Model of Sell-side Analysts in China

Multi-Business Securities Firm

Trading · **Brokerage** · **Investment Banking** · Underwriting

Commission · Fee

Investment Institutions · Listed Firms

"China Wall"

Analyst Fee · Research

Research Services · **Sell-side Analysts**
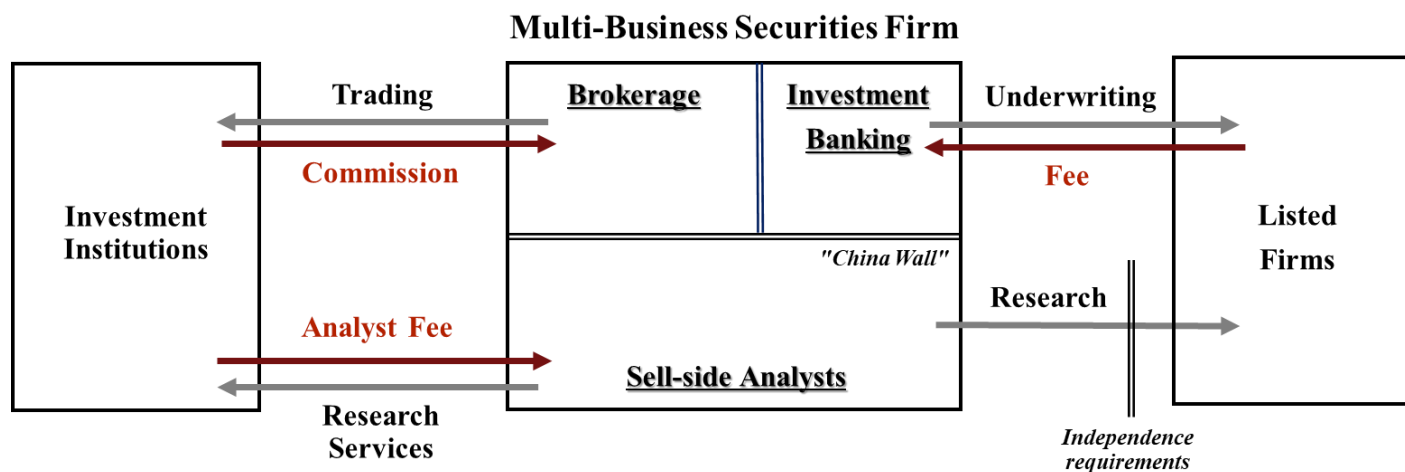
Independence requirements

Figure: Business Model of Sell-side Analysts in the EU after *MiFID II*

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