The Real Effect of the Initial Enforcement of Insider Trading Laws

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Outline

- Research questions
- Motivation
- Theoretical analysis
- Research design
- Empirical results
- Conclusions and contributions

Research Questions

- How do regulations on insider trading affect a firm's real investment decisions?
  - Use the initial enforcement of insider trading laws (the enforcement) as an exogenous (to firms) shock of insider trading regulations.
- Does the enforcement affect the firm's **investment-to-price sensitivity**?
  - If yes, what are the underlying mechanisms?
- Does the enforcement affect **future firm performance**?
  - If yes, is the enforcement's effect on future performance positively associated with its effect on the investment-to-price sensitivity?

Motivation

- Debates on the benefits and costs of insider trading regulation
  - Financial side (e.g., intensity and profitability of insider trading, cost of equity, etc.)
  - Information side (e.g., information acquisition, price efficiency, financial reporting quality, etc.)
  - **Real side (corporate investment)**
- Understanding the real effect of insider trading regulation is important
  - Investment is the ultimate driving force of value creation
  - Likely to have a first-order effect on welfare.
- There is little empirical evidence.

Preview of the Main Findings

- The sensitivity of investment to price is ***higher*** after the initial enforcement of insider trading laws
- A significant ***jump*** in the investment-to-price sensitivity occurred right after the enforcement.
- The increase in the investment-to-price sensitivity around the enforcement is
  - ***positively*** associated with the increase in the price informativenss for managers around the enforcement.
  - but ***not positively*** associated with the severity of agency problem and financial constraints before the enforcement.
- The accounting performance is improved after the enforcement.
  - The improvement is ***positively*** correlated with the increase in the investment-to-price sensitivity after the enforcement.

The managerial learning hypothesis: the intuition

- **The maintained assumption:**
  - Outside investors have information about investment opportunity that is unknown to managers.
  - Such information is reflected in stock prices when the investors trade and the managers can learn from the stock prices.

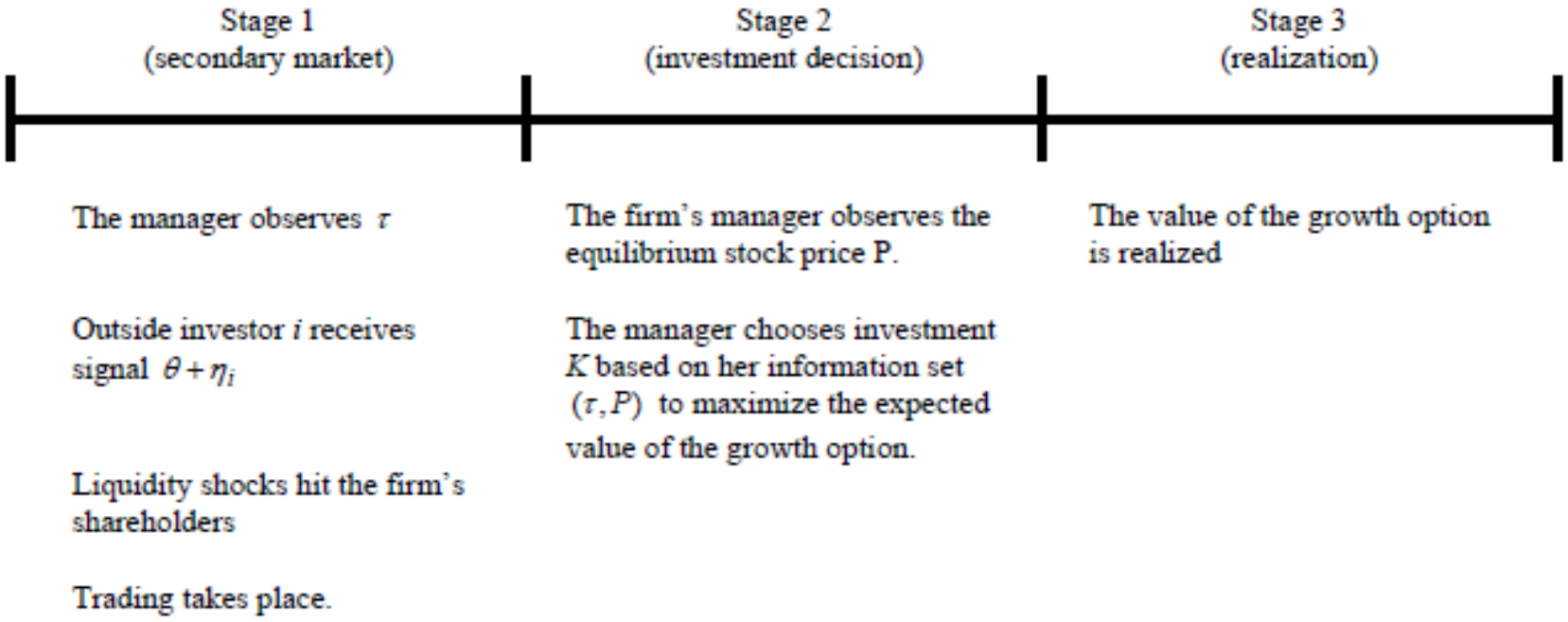
- **The mechanism**
  - Investors have higher incentives to acquire and trade on private information when insider trading is prohibited (i.e., after the enforcement) because they face less competition.
  - Prices contain more information *new* to the managers after the enforcement.
  - Value maximizing managers assign more weights to the stock prices when they estimate the investment opportunities.
  - Corporate investment is more sensitive to the stock prices.
  - Corporate investment is also more efficient.

The managerial learning hypothesis: A Simple Model

- **Three stages**
  - $t = 1$
    - Trading between informed investors, the manager (when insider trading is allowed), liquidity traders, and the market maker takes place in the security market.
    - Equilibrium price is observed by the manager.
  - $t = 2$
    - The manager decide the amount of the investment based on all information available to her.
  - $t = 3$
    - The investment payoff is realized.

The Model Setup: The timeline

Figure A1: The timeline of the model



Model Setup: The firm and the information structure

- The firm has an asset in place (AIP) and a growth opportunity (GO).
- The firm shares are claims on the payoff of AIP but not on the payoff of GO (Subrahmanyam and Titman, 1999; Foucault and Gehrig, 2008; Gao and Liang, 2011).
- The payoff of the AIP is determined by $\tau+\theta$.
  - The (risk-neutral) manager perfectly observes τ, but not θ.
  - There are m (risk-neutral) outside investors who observe θ with noise. That is, investor i observes $\theta+\eta_i$.
  - τ, θ, η_i.($i = 1, 2, \ldots, m$) are mutually independent, normally distributed with mean of 0 and variance of σ^2_τ, σ^2_θ, and σ^2_η.
  - $\gamma = \sqrt{\frac{\sigma_\theta{}^2}{\sigma_\theta{}^2+\sigma_\eta{}^2}}$ is the precision of signal $\theta+\eta_i$.
- The payoff of GO is determined by $GO(K, \tau+\theta) = (\tau+\theta)K - \frac{1}{2}K^2$.
  - Optimal investment is $K^*=E(\tau+\theta|\text{manager's information set})$
  - $K^*= \tau + E(\theta|\tau , P)$, where P is the equilibrium price.

The Model Setup: the trading procedure

- Follow Kyle (1985) and Admati and Pfleiderer (1988) to model the trading on the security market.
  - Liquidity traders' demand is modeled as $z \sim N(0,\sigma^2_Z)$, where z is independent of τ, θ, η_i ($i = 1, 2, \ldots, m$).
  - The informed investors, the manager (when insider trading is allowed), and the liquidity traders submit market orders to the market maker.
  - The market maker sets the share price and balances the supply and demand.

- Let *R* denote the regime regarding insider trading
  - $R = I$: insider trading is allowed
  - $R = N$: insider trading is prohibited.
  - Informed investors' linear trading strategy $X_R(\theta+\eta_i) = \beta_R(\theta+\eta_i)$ (x_i is the actual order placed).
  - The manager's linear trading strategy in regime I: $Y(\tau) = \alpha\tau$ (y is the actual order placed).
  - The market maker's linear pricing function: $P_R(\omega) = \lambda_R(\omega)$, where $\omega=\sum x_i+y+z$.

The Model: Characterize the equilibrium

- **The equilibrium**
  - Combination of trading strategy X_R and Y, and a pricing function P_R such that
  - X_R maximizes the expected trading profit of the informed investor: $E[(\tau+\theta-p)x_i|\theta+\eta_i]$.
  - Y maximizes the expected trading profit of the manager: $E[(\tau+\theta-p)y|\tau]$.
  - P_R makes the market maker break even, i.e., $P_R(\omega)=E[\tau+\theta|\omega]$, where $\omega = \sum x_i+y+z$.

The equilibrium

- **Lemma 1**

  Given m outside informed investors, there is a unique equilibrium in which X_R, Y, and P_R (R=I when insider trading is allowed and R=N when insider trading is prohibited) are linear functions and given by

  $$X_R(\theta+\eta_i) = \beta_R(\theta+\eta_i)\ (i = 1, 2, \dots, m)$$

  $$Y(\tau) = \alpha\tau \text{ in regime I, and}$$

  $$P_R(\sum x_i+y+z) = \lambda_R(\sum x_i+y+z),$$

  where

  $$\beta_R = \frac{1}{\lambda_R}\left(\frac{\gamma^2}{2+\gamma^2(m-1)}\right),\ \alpha = \frac{1}{2\lambda_I},\ \text{and}$$

  $$\lambda_R = \frac{1}{\sigma_z}\left(\frac{1}{4}D_{R=I}{\sigma_\tau}^2 + \frac{m\gamma^2{\sigma_\theta}^2}{(2+\gamma^2(m-1))^2}\right)^{\frac{1}{2}},$$

  $D_{R=I}$ is an indicator equals one for Regime I, and zero for Regime N.

The equilibrium

- When insider trading is allowed, the price is more sensitive to the total order flow.
  - $\lambda_I = \frac{1}{\sigma_z}\left(\frac{1}{4}{\sigma_\tau}^2 + \frac{m\gamma^2{\sigma_\theta}^2}{(2+\gamma^2(m-1))^2}\right)^{\frac{1}{2}} > \frac{1}{\sigma_z}\left(\frac{m\gamma^2{\sigma_\theta}^2}{(2+\gamma^2(m-1))^2}\right)^{\frac{1}{2}} = \lambda_R,$
- Each outside investor trades less aggressively on his private information $\theta + \eta_i$.
  - $\beta_I = \frac{1}{\lambda_I}\left(\frac{\gamma^2}{2+\gamma^2(m-1)}\right) < \frac{1}{\lambda_N}\left(\frac{\gamma^2}{2+\gamma^2(m-1)}\right) = \beta_N$
- Less information about θ is incorporated into the stock price in regime I.

The price informativeness for managers

- **Lemma 2**

  Define the informativeness of the stock price about θ *as* $\Omega_R = var(\theta|\tau) - var_R(\theta|\tau, P)$. *Given m outside informed investors, the stock price is more informative about* θ *when insider trading is prohibited, i.e.,* $\Omega_N(m) > \Omega_I(m)$.

- The equilibrium investment level is $K^* = \tau + E(\theta|\tau, P)$
  - When P is more informative about θ, K^* should be more sensitive to P.

Insider trading and the investment-to-price sensitivity

- **Proposition 1**

  The investment-to-price sensitivity is higher when insider trading is prohibited, i.e., $\frac{\partial K_I^*}{\partial P} < \frac{\partial K_N^*}{\partial P}$.

- **Proposition 2**

  The relative increase in the investment-to-price sensitivity from regime I to regime N is equal to the relative increase in the stock price informativeness about θ*, i.e.,* $\frac{\frac{\partial K_N^*}{\partial P}}{\frac{\partial K_I^*}{\partial P}} = \frac{\Omega_N(m)}{\Omega_I(m)}$.

Insider trading and the investment efficiency

- *Defined excess expected payoff of GO as the expected payoff of GO when the manager observes τ and P and that when the manager only observes τ.*

  $V_R(GO)=E[K_R^*(\tau+\theta) - \frac{1}{2}K_R^{*2}] - \frac{1}{2}\sigma_\tau^{*2}$

- **Proposition 3**

  The excess expected payoff of GO is higher when insider trading is prohibited, i.e., $V_N(GO) > V_I(GO)$.

- **Proposition 4**

  The relative increase in the excess payoff of GO from regime I to regime N is equal to the relative increase in the investment-to-price sensitivity, i.e., $\frac{V_N(GO)}{V_I(GO)} = \frac{\Omega_N(m)}{\Omega_I(m)} = \frac{\frac{\partial K_N^*}{\partial P}}{\frac{\partial K_I^*}{\partial P}}$.

Empirical Model Specification

$$INVEST_{c,f,t} = a_1 ITENF_{c,t-1} + b_1 Q_{c,f,t-1} + b_2 Q_{c,f,t-1} \times ITENF_{c,t-1} + c_1 CF_{c,f,t} + \mu_c + \mu_i + \mu_t + \varepsilon_{c,f,t}$$

INVEST: change in PPE plus change in inventories and plus R&D, scaled by lagged total assets.

ITENF: =1 if year≥ initial enforcement year; =0 otherwise

Q: Tobin's Q, defined as market value of equity plus total assets minus book value of equity, scaled by total assets.

CF: operating cash flows, defined as net income before extraordinary items plus depreciation and amortization expenses, scaled by lagged total assets.

μ_c, μ_i, and μ_t: fixed effects of country, industry (2-digit SIC code) and year.

Adjust for the trend in the investment-to-price sensitivity (Basic Idea)

- There might be a time-trend in the investment-to-price sensitivity in the absence of the enforcement.
  - $INVEST_t = b_0 Q_{t-1} + \boldsymbol{b_t Q_{t-1}} + b_1 ITENF \times Q_{t-1} + CONTROLS + \varepsilon$
  - Failing to control for this trend may result in erroneous inference.

- Empirical approach to control for such trend
  - $\boldsymbol{INVEST_t - b_t Q_{t-1}} = b_0 Q_{t-1} + b_1 ITENF \times Q_{t-1} + CONTROLS + \varepsilon$
    - Define $Adj.INVEST_{c,f,t} = INVEST_{c,f,t} - b_t Q_{c,f,t-1}$ and use Adj.INVEST as the dependent variable.
    - Requires an estimate of b_t for each year in the sample period.

Adjust for the trend in the investment-to-price sensitivity (Empirical Implementation)

- Use the observations in the 6 countries that have enforced their insider trading laws before 1982 (Brazil, Canada, France, Singapore, U.K. and U.S.) to estimate $\boldsymbol{b_t}$ (t = 1982 to 2003).

  - $INVEST_{c,f,t} = \sum_{t=1982}^{2003} b_t Q_{c,f,t-1} + cCF_{c,f,t} + \mu_c + \mu_i + \mu_t + \varepsilon_{c,f,t}$
  - $Adj.INVEST_{c,f,t} = INVEST_{c,f,t} - \hat{b}_t Q_{c,f,t-1}$

  - Consistent with the spirit of the existing literature
    - Bushman et al. (2005)
    - Fernandes and Ferreira (2009)

Data and Sample Selection

- The data of the initial enforcement of insider trading laws is from Bhattacharya and Daouk (2002, JF)

- All firm year observations over 1982-2003 in 45 countries covered in WorldScope database.
  - Delete financial institutions
  - Require total assets and market value of equity greater than $10 mil US dollar
  - Delete observations missing INVEST, Q and CF.
  - 175,968 firm-year observations (24,149 firms)
    - 153,066 firm-year observations (19,713 firms) in 23 developed markets
    - 22,902 firm-year observations (4,436 firms) in 22 emerging markets.

Sample Distribution (Table 1)

Country	N	IT enforcement year	IT existence year	Country	N	IT enforcement year	IT existence year
Developed markets				Emerging markets			
Australia (AUS)	3,485	1996	1991	Argentina (ARG)	287	1995	1991
Austria (AUT)	946		1993	Brazil (BRA)	1,370	1978	1976
Belgium (BEL)	1,248	1994	1990	Chile (CHL)	860	1996	1981
Canada (CAN)	7,045	1976	1966	Colombia (COL)	155		1990
Denmark (DNK)	1,590	1996	1991	Egypt (EGY)	47		1992
Finland (FIN)	1,185	1993	1989	India (IDN)	967	1998	1992
France (FRA)	7,013	1975	1967	Indonesia (IND)	2,059	1996	1991
Germany (DEU)	6,331	1995	1994	Israel (ISR)	423	1989	1981
Greece (GRC)	1,463	1996	1988	Jordan (JOR)	24		
Hong Kong (HKG)	3,255	1994	1991	South Korea (KOR)	3,298	1988	1976
Ireland (IRL)	705		1990	Malaysia (MYS)	3,410	1996	1973
Italy (ITA)	2,424	1996	1991	Mexico (MEX)	916		1975
Japan (JPN)	29,294	1990	1988	Pakistan (PAK)	391		1995
Netherlands (NLD)	2,176	1994	1989	Peru (PER)	231	1994	1991
New Zealand (NZL)	630		1988	Philippines (PHL)	532		1982
Norway (NOR)	1,324	1990	1985	South Africa (ZAF)	2,346		1989
Portugal (PRT)	607		1986	Sri Lanka (LKA)	68	1996	1987
Singapore (SGP)	2,201	1978	1973	Taiwan (TWN)	3,218	1989	1988
Spain (ESP)	1,670	1998	1994	Thailand (THA)	1,462	1993	1984
Sweden (SWE)	2,180	1990	1971	Turkey (TUR)	698	1996	1981
Switzerland (CHE)	2,320	1995	1988	Venezuela (VEN)	95		1998
United Kingdom (GBR)	16,073	1981	1980	Zimbabwe (ZWE)	45		
United States (USA)	57,901	1961	1934				

Summary Statistics (Table 2)

Panel A: The pooled sample

				Percentiles		
Variable	N	Mean	Std Dev	25%	50%	75%
$INVEST_t$	175,968	0.074	0.165	-0.014	0.042	0.125
$Adj.INVEST_t$	84,365	-0.005	0.150	-0.084	-0.024	0.045
Q_{t-1}	175,968	1.600	0.999	1.011	1.257	1.773
CF_t	175,968	0.077	0.121	0.035	0.081	0.134

Panel B: The pre-enforcement period

				Percentiles		
Variable	N	Mean	Std Dev	25%	50%	75%
$INVEST_t$	25,025	0.075	0.172	-0.021	0.044	0.136
$Adj.INVEST_t$	25,025	0.010	0.172	-0.087	-0.019	0.073
Q_{t-1}	25,025	1.476	0.789	1.016	1.231	1.654
CF_t	25,025	0.098	0.084	0.052	0.090	0.137

Panel C: The post-enforcement period

				Percentiles		
Variable	N	Mean	Std Dev	25%	50%	75%
$INVEST_t$	150,943	0.074	0.164	-0.013	0.042	0.123
$Adj.INVEST_t$	59,340	-0.011	0.138	-0.083	-0.026	0.037
Q_{t-1}	150,943	1.621	1.028	1.010	1.262	1.798
CF_t	150,943	0.073	0.126	0.032	0.079	0.133

Pooled Sample Regression (Table 3)

	The dependent variable is INVEST		The dependent variable is Adj.INVEST	
Independent variable	(1)	(2)	(3)	(4)
ITENF	-0.038***	0.004	0.004	0.018***
	(-13.16)	(1.00)	(1.14)	(4.76)
ITEXIST			-0.001	
			(-0.26)	
Q	0.025***	-0.028***	-0.029***	-0.035***
	(15.48)	(-15.64)	-(9.99)	(-18.46)
Q×ITENF	**0.015***	**0.007***	**0.007***	**0.014***
	(9.88)	**(4.39)**	**(3.54)**	**(8.00)**
Q×ITEXIST			0.001	
			(0.43)	
CF	0.165***	0.338***	0.338***	0.561***
	(23.23)	(30.44)	(30.48)	(23.84)
CF×ITENF				-0.289***
				(-11.27)
Fixed effects of country, industry and year	Yes	Yes	Yes	Yes
Adjusted.R^2	0.131	0.116	0.116	0.121
N	175,968	84,365	84,365	84,365

Event Window Analysis

- The pooled sample analysis includes observations far after the initial enforcement and thus allow other confounding factors to take effect.

- Only include observations in [T–2, T+3]
  - Year T is the actual enforcement year.
    - [T–2, T] is the pre-enforcement period (ITENF=0)
    - [T+1, T+3] is the post-enforcement period (ITENF=1).
    - The country has at least one observation in both the pre- and the post-enforcement periods.
    - 19293 firm-year observations (5023 firms).
  - Repeat the regression in Table 3.

Event Window Analysis (Table 4)

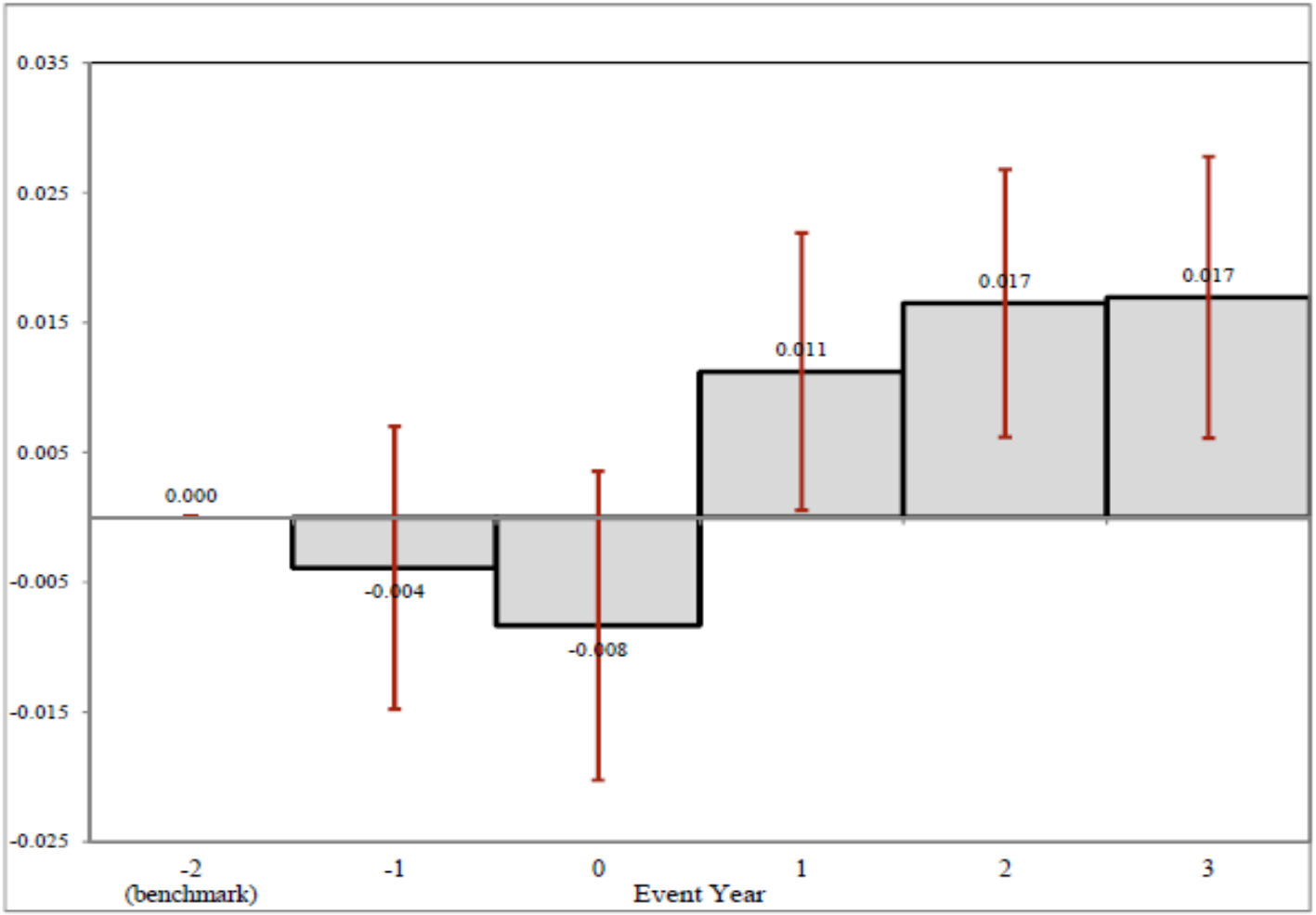
Independent Variable	The dependent variable is Adj.INVEST	
	(1)	(2)
ITENF	-0.045***	-0.044***
	(-6.07)	(-5.68)
Q	-0.043***	-0.043***
	(-14.97)	(-13.94)
Q×ITENF	**0.013***	**0.013***
	(4.31)	**(3.92)**
CF	0.434***	0.444***
	(17.55)	(10.49)
CF×ITENF		-0.015
		(-0.31)
Fixed effects of country, industry and year	Yes	Yes
Adjusted R-square	0.109	0.109
N	19293	19293

Year by year change of the Investment-to-Price sensitivity in the event window

$$Adj.INVEST_{c,f,t} = \sum_{\tau=-1}^{+3} YEAR_{c,t,\tau} + bQ_{c,f,t-1} + \sum_{\tau=-1}^{+3} b_\tau Q_{c,f,t-1} \times YEAR_{c,t,\tau} + cCF_{c,f,t} + \mu_c + \mu_i + \varepsilon_{c,f,t}$$

- $YEAR_{c,t,\tau}$: dummy variable equals one for all firms in country *c* if year *t* is τ years ($\tau \in$[-1,+3]) relative to country *c*'s initial enforcement year, and zero otherwise.
  - Event year -2 (τ = -2) serves as the benchmark year.
  - The investment-to-price sensitivity in year -2 is captured by coefficient *b*.
- Coefficient estimates of $\boldsymbol{b}_\tau$ ($\tau \in$[-1,+3]) measure the difference in the trend-adjusted investment-to-price sensitivity between event year τ and event year -2.

The change in the *trend-adjusted* investment-to-price sensitivity around the initial enforcement of insider trading laws (Figure 1)



Benchmark against the empirical distribution based on pseudo-enforcement events

- For each country, randomly select a year *t* as a pseudo enforcement year.
  - Use the observations in [*t*-2, *t*+3] to repeat the analysis of Table 5 and Figure 1.
    - [*t*-2, *t*]: pre-pseudo-enforcement period. ITENF=0.
    - [*t*+1, *t*+3]: post-pseudo-enforcement period. ITENF=1.
    - Estimate the coefficients of Q×ITENF and Q×YEAR1–Q×YEAR0.
  - $t \notin$ [T-3, T+3], where T is the actual enforcement year
    - The pseudo-event sample period does not overlap with the actual enforcement year.

- Repeat the random sampling for 1000 times.
  - Use the empirical distribution of the coefficients of **Q×ITENF** and **Q×YEAR1–Q×YEAR0** to gauge the corresponding coefficient estimates in Table 4 and Figure 1.

Benchmark against empirical distribution based on pseudo-enforcement events

	Coefficient of Q×ITENF (dependent variable is Adj.INVEST)
Estimate in model (1) of Table 4	0.013
99% confidence interval (i.e., [0.5th percentile, 99.5th percentile] based on the empirical distribution	[-0.014, 0.011]

	Coefficient of Q×YEAR1–Q×YEAR0 (dependent variable is Adj.INVEST)
Estimate in Figure 1	0.019 (0.011 + 0.008)
99% confidence interval (i.e., [0.5th percentile, 99.5th percentile] based on the empirical distribution	[-0.015, 0.017]

Economic Significance
(based on the pooled sample regression results)

	The dependent variable is Adj.INVEST
Independent variable	(2)
ITENF	0.004
	(1.00)
ITEXIST	
Q	-0.028***
	(-15.64)
Q×ITENF	**0.007*** **
	(4.39)
Q×ITEXIST	
CF	0.338***
	(30.44)
CF×ITENF	
Fixed effects of country, industry and year	Yes
Adjusted.R^2	0.116
N	84,365

- Define the *excess* investment-to-price sensitivity as the raw sensitivity of the sample firms minus that of the *six benchmark countries* in the same year.
- The excess sensitivity is increased by 0.007, or **25%** (0.007/0.028).
- Compared with the six benchmark countries, in the sample countries,
  - Before the enforcement, the increase in the investment associated with one-standard-deviation increase in Q (0.999) is 0.028 smaller,
  - The discrepancy is reduced to 0.021 (0.028 – 0.007) after the enforcement.
- The difference is about **9.5%** of the mean investment (0.007/0.074).

Economic Significance
(based on the event window regression results)

Independent Variable	The dependent variable is Adj.INVEST (1)
ITENF	-0.045*** (-6.07)
Q	-0.043*** (-14.97)
Q×ITENF	**0.013*** (4.31)**
CF	0.434*** (17.55)
CF×ITENF	
Fixed effects of country, industry and year	Yes
Adjusted R-square	0.109
N	19293

- The excess sensitivity is increased by 0.013, or **30%** (0.013/0.043).
- Compared with the six benchmark countries, in the sample countries,
  - Before the enforcement, the increase in the investment associated with one-standard-deviation increase in Q (0.999) is 0.043 smaller,
  - The discrepancy is reduced to 0.03 (0.043 – 0.013) after the enforcement.
- The difference is about **18%** of the mean investment (0.013/0.074).

Robustness Tests: alternative model specifications (Table 5)

Column	Robustness tests
(1)	Firm fixed effects regression
(2)	Exclude the Asian financial crisis period (year 1997 and 1998).
(3)	Exclude influential countries (Germany and Japan).
(4)	Cluster standard errors by country.
(5)	Controlling for investor protection and per capita GDP.
(6)	Country level analysis.

Country level analysis

- Two-step regressions
  - First step, estimate the following annual regression for each country-year with at least 50 firms

$$Adj.INVEST_{c,f,t} = b_{c,t} Q_{c,f,t-1} + c_{c,t} CF_{c,f,t} + \text{industry fixed effects} + \varepsilon_{c,f,t}$$

  - Second step, estimate the following regression

$$b_{c,t} = \phi_0 + \phi_1 ITENF_{c,t-1} + \mu_c + \varepsilon_{c,t}$$

Alternative Model Specification: pooled sample regression (Table 5, Panel A)

Independent variable	Firm fixed effect regression (1)	Excluding the Asian financial crisis period (2)	Excluding influential countries (3)	Clustering standard errors by country (4)	Controlling for per capita GDP and investor protection (5)	country-level analysis (6)
ITENF	0.008**	0.000	-0.015***	0.004	0.005	**0.017***
	(2.09)	(0.09)	(-3.31)	(0.25)	(1.34)	**(2.97)**
Q	-0.027***	-0.029***	-0.026***	-0.028***	-0.065***	
	(-13.19)	(-15.44)	(-11.90)	(-8.65)	(-8.26)	
Q×ITENF	**0.004****	**0.008****	**0.007****	**0.007****	**0.006****	
	(2.12)	**(4.77)**	**(3.50)**	**(2.22)**	**(3.27)**	
Q×ln(GDP)					0.003***	
					(4.64)	
Q×PROTECT					0.012**	
					(2.16)	
CF	0.545***	0.327***	0.352***	0.338***	0.337***	
	(32.71)	(28.27)	(26.29)	(11.09)	(30.27)	
Fixed effects	Firm and year	Country, industry and year	Country, industry and year	Country, industry and year	Country, industry and year	Country
Adjusted R^2	0.186	0.113	0.102	0.116	0.116	0.047
N	84,365	72,945	48,740	84,365	83,738	328

Alternative Model Specification: event-window regression (Table 5, Panel B)

Independent variable	Firm fixed effect regression (1)	Excluding the Asian financial crisis period (2)	Excluding influential countries (3)	Clustering standard errors by country (4)	Controlling for per capita GDP and investor protection (5)	country-level analysis (6)
ITENF	-0.043***	-0.060***	-0.032***	-0.045*	-0.043***	**0.017***
	-(4.87)	(-7.12)	-(3.62)	(-1.87)	(-5.76)	**(1.96)**
Q	-0.037***	-0.045***	-0.041***	-0.043***	-0.100***	
	(-7.69)	(-14.83)	(-11.27)	(-7.41)	(-7.53)	
Q×ITENF	**0.014***	**0.013***	**0.011***	**0.013***	**0.011***	
	(3.85)	**(4.06)**	**(3.18)**	**(1.89)**	**(3.78)**	
Q×ln(GDP)					0.006***	
					(5.01)	
Q×PROTECT					0.011	
					(1.01)	
CF	0.736***	0.411***	0.461***	0.434***	0.436***	
	(14.96)	(14.30)	(15.32)	(10.05)	(17.69)	
Fixed effects	Firm and year	Country, industry and year	Country, industry and year	Country, industry and year	Country, industry and year	Country
Adjusted R^2	0.198	0.117	0.108	0.108	0.110	0.110
N	19,293	15,076	11,700	19,293	19,293	99

Robustness Tests: alternative measure of investment (Table 6)

Column	Definition of investments
(1)	Change in *PPE* divided by lagged total assets.
(2)	(Change in *PPE* plus *R&D*) divided by lagged total assets.
(3)	(Change in PPE plus R&D plus change in inventory) divided by current period total assets.
(4)	(Change in PPE plus R&D plus change in inventory) divided by lagged PPE.
(5)	Capital expenditure (CAPX) divided by lagged PPE.

Alternative Measures of Investment: Pooled sample regression (Table 6, Panel A)

Independent Variable	Investment in PPE (1)	Investment in PPE + R&D (2)	Scaled by current TA (3)	Scaled by lagged PPE (4)	CAPX scaled by lagged PPE (5)
ITENF	0.007**	0.002	0.007**	-0.076**	-0.061***
	(2.48)	(0.82)	(2.55)	(-2.41)	(-5.89)
Q	-0.010***	-0.024***	-0.017***	-0.269***	-0.040***
	(-7.23)	(-16.23)	(-13.86)	(-20.01)	(-7.52)
Q×ITENF	**0.002***	**0.005*****	**0.005*****	**0.103*****	**0.030*****
	(1.64)	**(3.33)**	**(4.00)**	**(6.23)**	**(5.48)**
CF	0.240***	0.226***	0.275***	0.719***	0.338***
	(30.79)	(24.71)	(32.66)	(6.74)	(12.70)
Fixed effects of country, industry and year	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.098	0.093	0.139	0.070	0.094
N	85,011	85,011	84,365	84,365	72,897

Alternative Measures of Investment: Event window regression (Table 6, Panel B)

Independent variable	Investment in PPE (1)	Investment in PPE + R&D (2)	Scaled by current TA (3)	Scaled by lagged PPE (4)	CAPX scaled by lagged PPE (5)
ITENF	-0.027***	-0.032***	-0.035***	-0.199***	-0.074***
	(-4.68)	(-5.30)	(-6.19)	(-3.42)	(-4.38)
Q	-0.017***	-0.034***	-0.030***	-0.369***	-0.088***
	(-7.91)	(-14.87)	(-16.20)	(-19.06)	(-11.60)
Q×ITENF	**0.005****	**0.008*****	**0.009*****	**0.112*****	**0.037*****
	(2.48)	**(3.51)**	**(4.50)**	**(4.23)**	**(4.46)**
CF	*0.013*	*0.000*	*0.000*	*0.000*	*0.000*
	0.309***	0.316***	0.352***	1.403***	0.631***
Fixed effects of country, industry and year	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.101	0.098	0.142	0.089	0.079
N	19,348	19,348	19,293	19,293	15,100

The managerial learning hypothesis

- **Proposition 2**
  - The increase in the investment-to-price sensitivity should be positively associated with the relative increase in the price informativeness for managers around the enforcement year.

- Price informativeness for managers is not directly observable.
  - Use firm characteristics that suggest a greater increase in price informativeness for managers.

Empirical Design

- Proxy for *price informativeness for manager* (INFO) by *price non-synchroncity*.
  - $RET_{c,f,t} = \alpha + \beta_1 {R_{c,t}}^M + \beta_2 R_{US,t} + \varepsilon_{c,f,t}$
  - $RET_{c,f,t}$: stock return of firm *f* of country *c* in week *t*.
  - ${R_{c,t}}^M$: value-weighted weekly market returns for country *c* in week *t*.
  - $R_{US,t}$: value-weighted weekly return of NYSE/AMEX/NASDAQ in week *t*.
  - The regression is estimated for each firm year. We require at least 24 weekly observations in estimating the regression.
  - INFO is defined as $ln\frac{1-R^2}{R^2}$, where R^2 is the R-squared of the regression.
- We compute ΔINFO as the mean value of INFO over year 0 to +2 minus the mean value of INFO over year -3 to -1.
- Sort the firms into quartiles based on ΔINFO.
- Estimate the baseline regression within each ΔINFO quartile.
- Compare the coefficient of Q×INFO.

The managerial learning hypothesis: further evidence (Table 7, Panel A)

Independent variable	ΔINFO quartiles Q1 Low (1)	Q2 (2)	Q3 (3)	Q4 High (4)	Emerging markets (5)	Developed markets (6)
ITENF	-0.015	-0.034	-0.044**	-0.053***	-0.059***	-0.041***
	(-0.56)	(-1.64)	(-2.41)	(-3.38)	(-5.87)	(-6.39)
Q	-0.037***	-0.035***	-0.047***	-0.057***	-0.047***	-0.046***
	(-6.78)	(-6.14)	(-6.22)	(-9.37)	(-10.59)	(-12.75)
Q×ITENF	**-0.002**	**0.008**	**0.018****	**0.026*****	**0.005**	**0.023*****
	(-0.28)	**(1.05)**	**(2.31)**	**(3.45)**	**(1.13)**	**(6.08)**
CF	0.334***	0.407***	0.414***	0.566***	0.446***	0.457***
	(4.86)	(6.05)	(7.34)	(9.86)	(12.61)	(14.12)
Fixed effects of country, industry and year	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.171	0.104	0.115	0.159	0.119	0.079
N	3,698	3,692	3,690	3,685	4,337	14,956

P-value = 0.003

P-value = 0.037

The change in public information quality and the enforcement effect

- INFO may proxy for public information quality.
  - Jin and Myers (2006, JFE); Hutton, Marcus, and Tehranian (2009, JFE)
- ΔINFO may capture the change in public information quality
- To address this concern, we partition the sample based on a more direct measure of public information quality.
  - Measure public information quality by the *negative of the absolute value discretionary accruals* (FRQ).
  - Higher FRQ implies better financial reporting quality and thus better public information quality.
  - Compute ΔFRQ as the mean value of FRQ over year 0 to +2 minus the mean value over year -3 to -1.
  - Partition the sample based on ΔFRQ.

Public information quality and the effect of the enforcement (Table 7, Panel B)

	ΔFRQ quartiles			
Independent variable	Q1 Low (1)	Q2 (2)	Q3 (3)	Q4 High (4)
ITENF	-0.029 (-1.52)	-0.054*** (-3.39)	-0.044*** (-2.68)	-0.046*** (-2.62)
Q	-0.053*** (-8.53)	-0.052*** (-7.53)	-0.054*** (-9.82)	-0.042*** (-5.04)
Q×ITENF	**0.023***** **(2.78)**	**0.013**** **(2.11)**	**0.020***** **(2.69)**	**0.008** **(1.05)**
CF	0.436*** (7.01)	0.492*** (6.47)	0.542*** (6.54)	0.480*** (7.44)
Fixed effects of country, industry and year	Yes	Yes	Yes	Yes
Adjusted R^2	0.12	0.147	0.134	0.145
N	2581	2580	2582	2575

Alternative Explanation: The market friction hypothesis

- The enforcement reduces market frictions by mitigating moral hazard and/or adverse selection problems.
- The enforcement reduces the cost of external finance and relaxes the external financing constraints.
- If this is the case, then the effect of the enforcement should be more pronounced
  - when firms have more severe agency problems before the enforcement
  - when firms are more financially constrained before the enforcement.

Controlling shareholders' incentives and the effect of the enforcement (Table 8)

	Partitioned by WEDGE		Partitioned by KZ4			
	WEDGE≤0	WEDGE>0	Q1 (Low)	Q2	Q3	Q4 (High)
Variable	(1)	(2)	(3)	(4)	(5)	(6)
ITENF	-0.075***	-0.057***	-0.038**	-0.050***	-0.023	-0.017
	(-3.79)	(-2.77)	(-2.47)	(-2.92)	(-1.23)	(-1.01)
Q	-0.046***	-0.033***	-0.053***	-0.043***	-0.030***	-0.024***
	(-6.71)	(-4.01)	(-16.54)	(-7.53)	(-3.26)	(-3.36)
Q×ITENF	**0.017****	**0.008**	**0.014*****	**0.013***	**-0.001**	**-0.005**
	(2.16)	**(0.89)**	**(3.60)**	**(1.72)**	**(-0.08)**	**(-0.51)**
CF	0.400***	0.448***	0.520***	0.539***	0.552***	0.563***
	(7.22)	(7.38)	(8.73)	(8.62)	(9.14)	(9.44)
Fixed effects of country, industry and year	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.141	0.170	0.168	0.124	0.129	0.142
N	3,652	3,186	3,633	3,601	3,623	3,633

The effect of the enforcement on accounting performance

- We proxy the expected value of growth by future accounting performance

- **Proposition 3**
  - Future accounting performance improves after the enforcement.
- **Proposition 4**
  - The improvement in future accounting performance is positively associated with the increase in the investment-to-price sensitivity after the enforcement.

The effect of the enforcement on accounting performance

$$PERFORM_{c,f,[t+1,t+3]} = a_1 ITENF_{c,t} + a_2 ITENF_{c,t} \times \Delta QSENS_c + CONTROLs + \varepsilon_{c,f,t}$$

PERFORM: ROA (return on assets), MARGIN (profit margin), TURNOVER (assets turnover), and SGRW (sales growth). We use the average value of PERFORM of year t+1 to t+3.

$\Delta QSENS_c$: the effect of the enforcement on the investment-to-price sensitivity in country *c*.

$$\frac{\partial PERFORM}{\partial ITENF} = a_1 + a_2 \boldsymbol{\Delta QSENS_c}$$

$$Adj.INVEST_{c,f,t} = \sum_c a_c COUNTRY_c \times ITENF_{c,t-1} + \sum_c b_c Q_{c,f,t-1} \times COUNTRY_c +$$
$$\sum_c \Delta QSENS_c Q_{c,f,t-1} \times COUNTRY_c \times ITENF_{c,t-1} +$$
$$cCF_{c,f,t} + \mu_c + \mu_i + \varepsilon_{c,f,t}.$$

The Initial Enforcement of Insider Trading Laws and Accounting Performance (Table 9)

	Average ROA over [*t*+1, *t*+3]		Average MARGIN over [*t*+1, *t*+3]		Average TURNOVER over [*t*+1, *t*+3]		Average SGRW over [*t*+1, *t*+3]	
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ITENF	**0.005*** (2.95)**	-0.011*** (-2.65)	**0.010** (2.04)**	-0.012 (-0.97)	**0.015*** (2.80)**	-0.031** (-2.22)	**0.008* (1.88)**	0.012 (1.14)
ITENF×ΔQSENS		**0.026*** (4.22)**		**0.035** (2.23)**		**0.075*** (3.74)**		**-0.005 (-0.35)**
Ln(SALE)	-0.019*** (-5.32)	-0.019*** (-5.15)	-0.005 (-0.44)	-0.004 (-0.36)	-0.025*** (-2.67)	-0.023** (-2.50)	-0.168*** (-11.97)	-0.168*** (-11.94)
KZ4	0.004*** (2.70)	0.004*** (2.67)	0.004 (1.41)	0.004 (1.39)	0.010** (2.04)	0.009** (2.03)	-0.003 -(-0.80)	-0.003 -(-0.79)
Q	0.011*** (7.13)	0.011*** (6.56)	0.016*** (4.66)	0.015*** (4.30)	0.013*** (2.91)	0.010*** (2.31)	0.019*** (5.78)	0.019*** (5.74)
HERFINDAHL	0.029*** (3.28)	0.026*** (2.91)	0.013 (0.57)	0.009 (0.39)	0.091*** (3.12)	0.081*** (2.82)	0.017 (0.74)	0.018 (0.76)
Firm and year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted. R^2	0.807	0.808	0.729	0.729	0.960	0.960	0.642	0.642
N	16282	16282	16248	16248	16844	16844	16889	16889

Conclusions and contributions

- Investment becomes ***more*** sensitive to prices after the enforcement.
- A significant ***jump*** in the investment-to-price sensitivity occurred right after the enforcement.
- The ***managerial learning hypothesis*** seems best explain the results.
- Improvement in accounting performance after the enforcement is ***positively*** associated with the increase in the investment-to-price sensitivity.

Conclusions and contributions

- The first large sample empirical study on the real-side effect of insider trading regulation.
  - Shed light on the long-lasting analytical debates on the real effect of insider trading regulation.
  - Extend the studies on insider trading regulation from financial side, information side to the real side of the economy.
  - Identify the channel.

- Contribute to the effect of country-level legal, institutional and regulatory factors on corporate investment.
  - Most other country level factors affect corporate investment primarily by mitigating adverse selection and moral hazard problems.
  - Insider trading regulation takes effect by a different channel.

- Contribute to the learning literature.
  - Document how insider trading regulation affects managerial learning in an international setting.