

The Source of Information in Prices and Investment-Price Sensitivity

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Abstract

This paper shows that real decisions depend not only on the *total* amount of information in prices, but the *source* of this information – a manager learns from prices when they contain information not possessed by him. We use the staggered enforcement of insider trading laws across 26 countries as a shock to the source of information that leaves total information unchanged, since enforcement reduces (increases) managers' (outsiders') contribution to the stock price. Enforcement increases investment-Q sensitivity, but does not increase the sensitivity of investment to non-price measures of investment opportunities. This increase is stronger in emerging markets, where total price informativeness is unaffected by enforcement (Fernandes and Ferreira (2009)), and in industries with high concentration and high sales volatility, where the scope for managerial learning is greater (Allen (1993)). These findings suggest that extant measures of price efficiency should be rethought when evaluating real efficiency.

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1. Introduction

Efficient financial markets can promote efficient real decisions. When prices are more informative, outside investors suffer less information asymmetry. As a result, they are more willing to provide capital to firms in primary financial markets, facilitating investment (Stiglitz and Weiss (1981), Bernanke and Gertler (1989), Kiyotaki and Moore (1997)). Under this channel, the extent to which financial markets support capital raising, and thus real investment, depends on the *total* amount of information in prices. In a recent survey, Bond, Edmans, and Goldstein (2012) term this notion Forecasting Price Efficiency (“FPE”), i.e. the extent to which prices predict fundamental values. Due to this conventional view, regulatory changes (e.g. short-sale constraints and transaction taxes) are evaluated according to their likely impact on total price informativeness.

However, Bond et al. (2012) note that the most activity occurs in secondary financial markets, where no new capital is raised by firms. Secondary markets improve real decisions through a different channel: they aggregate the information of millions of investors (Hayek (1945)), which can guide managerial actions. The value of secondary markets for real decisions depends not on total information in prices (FPE), but the amount of information prices reveal for decision-making – i.e., *the amount of information not already possessed by the decision maker*. They term this notion Revelatory Price Efficiency (“RPE”) and propose it as a new measure of financial efficiency. However, RPE has no natural empirical proxy, making it difficult to study empirically.

Our goal is to study whether real decisions depend on RPE, and thus the source of information in prices, rather than only total information (FPE). This question is important, because if RPE indeed matters, standard measures of financial efficiency are not sufficient for gauging real efficiency. We study this question in the context of investment, a major corporate decision. Specifically, we hypothesize that the manager uses the stock price as a signal of his investment

opportunities. Thus, the sensitivity of investment to Tobin's Q will be increasing in the amount of information in prices not possessed by the manager.

We address the absence of a natural measure for RPE by studying a plausible shock to RPE that is unlikely to affect FPE. Such a shock should satisfy three criteria. First, it should increase the amount of outsider information in the stock price. Second, it should not change (or at least not increase) total information, i.e. FPE. To satisfy both criteria simultaneously, the event must also decrease insider information, so that it changes only the source of information, and not the total amount. Satisfying both criteria is difficult, since commonly-used shocks to the information environment (e.g. decimalization) affect both insiders' and outsiders' ability to trade. Third, it should not affect investment-Q sensitivity directly, but only through its effect on RPE.

We study how investment-Q sensitivity is affected by the first-time enforcement of insider trading laws. Insider trading enforcement ("ITE") deters insiders from trading¹, and thus encourages outsiders to do so (Fishman and Hagerty (1992)). Bushman, Piotroski, and Smith (2005) find that analyst coverage rises after ITE, particularly in emerging markets, and Fernandes and Ferreira (2009) find that total price informativeness is unchanged following ITE in emerging markets² (while it rises in developed markets). Thus, ITE plausibly increases the information in prices not possessed by the manager (RPE) without affecting total information (FPE), at least in emerging markets. A separate advantage is that ITE was staggered over time across 26 countries, reducing the risk that any single event was correlated with other factors that drive investment-Q sensitivity.

¹ Bhattacharya and Daouk (2002) find that stock liquidity rises and the cost of capital falls following ITE, suggesting that enforcement is effective in its deterrence of insider trading.

² Fernandes and Ferreira (2009) find that the effect of ITE on price informativeness in emerging markets is insignificantly *negative*, controlling for other country-level variables.

We conduct our difference-in-differences analysis using two methods. The first is a single-stage analysis, where we regress investment on Q, its interactions with ITE, other firm- and country-level determinants of investment, and firm and country-year fixed effects. Investment-Q sensitivity for enforcers rises by 33% (from 0.348 to 0.464) following ITE, significant at the 1% level. The second is a two-stage analysis, where we first estimate investment-Q sensitivity for each country-year, controlling for firm-level determinants of investment, and then regress these estimated sensitivities on ITE indicators, country controls, and country and year fixed effects. The effect of ITE remains robust.

One potential concern is that ITE affects investment-Q sensitivity because it leads to an increase in FPE, rather than RPE. We address this concern in two ways. First, we directly control for stock price non-synchronicity, a standard measure of FPE, and its interaction with Q. Second, we show that the effect of ITE is stronger in emerging countries, where FPE is unchanged.

A second concern is that ITE is not random. Countries choose whether to enforce insider trading laws, and this decision could be correlated with omitted macroeconomic variables that also drive investment-Q sensitivity. For example, if ITE is correlated with improvements to the financial sector that weaken financing constraints, firms would respond more readily to investment opportunities, and so investment-Q sensitivity would rise. Alternatively, it may be correlated with laws that improve governance³, which lead to the manager investing more efficiently, i.e. responding more readily to investment signals (such as Q).

We address the endogeneity of ITE with several findings which, taken together, narrow the range of alternative explanations that would be consistent with our results. First, as described above, the effect of ITE is stronger in emerging markets, consistent with outsider information

³ For example, Bhattacharya and Daouk (2009) find that ITE occurs when the quality of bureaucracy improves and as a response to increasing corruption.

acquisition rising more in emerging countries (Bushman et al. (2005)). Second, the sensitivity of investment to non-price measures of investment opportunities (cash flow, sales growth, and age) is either unchanged or sometimes declines following ITE. This finding is consistent with the manager learning more from prices when they contain more information not known to him, but is inconsistent with him responding more readily to investment opportunities in general after ITE.

Third, the effect of ITE is greater among firms for which the learning channel is likely to be stronger. Allen (1993) predicts that the manager will rely less on price signals in competitive industries: since he can already estimate his firm's production function by observing the actions of his numerous rivals, he has less to learn from the market. Allen (1993) also predicts that learning is higher in industries with greater production function uncertainty. Consistent with both predictions, the effect of ITE is stronger in more concentrated industries and industries with high sales volatility. While the differences in these cross-sectional splits are economically large, they are not always statistically significant. Separately, ITE is greater for firms with low analyst coverage. In such firms, there is most potential for analyst coverage (i.e., outside information acquisition) to rise post-ITE; furthermore, the addition of an extra analyst is more impactful if a firm had few analysts to begin with.

Fourth, if ITE increases investment-Q sensitivity by loosening financial constraints, the effects should be stronger in previously constrained firms. We identify such firms as either small firms, or those unable to raise much external financing (Rajan and Zingales (1998)). Using both measures, we find that the effect of ITE is stronger for *less* constrained firms. This result is instead consistent with our hypothesis that ITE makes the price more informative, since less constrained firms are more able to respond to greater price informativeness.

Fifth, if the effect of ITE arises from correlation with general improvements to the financial sector or governance, then we might expect the announcement of insider trading laws also to

coincide with such improvements and increase investment-Q sensitivity. In contrast, Bhattacharya and Daouk (2002) find that the mere announcement, rather than enforcement, of insider trading laws does not reduce the cost of capital, suggesting that it does not deter insider trading. Similarly, Bushman et al. (2005) find that the announcement of these laws does not increase analyst coverage. Thus, announcement does not change the source of information in prices and should not increase investment-Q sensitivity, which is what we find.

Finally, we show that there are no differential changes in investment-Q sensitivity between enforcers and non-enforcers in the years prior to ITE, addressing concerns that ITE was part of a general trend. A dynamic treatment analysis shows that the increase in investment-Q sensitivity is positive and insignificant in the year of ITE, and only becomes significant from the following year. This result is consistent with outsiders taking time to acquire information post-ITE.

Our paper builds on a recent empirical literature showing that managers learn from prices when making real decisions. In an important paper, Chen, Goldstein, and Jiang (2007) show that investment is particularly sensitive to Tobin's Q for firms with more total information in stock prices. Luo (2005), Bakke and Whited (2010), Edmans, Goldstein, and Jiang (2012), and Foucault and Frésard (2012, 2013) also provide evidence of managerial learning from prices. Our key contribution is the identification of a setting with a shock to RPE *that leaves FPE unchanged* (at least in emerging markets). We are therefore able to show that investment-Q sensitivity depends on RPE, rather than only FPE. Bai, Philippon, and Savov (2015) is the only other empirical paper of which we are aware that recognizes the distinction between RPE and FPE. They use the efficiency of real decisions (the predictability of cash flows from investment, and the cross-sectional dispersion of investment) to infer RPE – i.e. infer from the rise in real efficiency that RPE must have risen. In contrast, we study an event that is likely to increase RPE on *a priori* grounds and *then* study the consequences of this shock on real decisions.

Our paper also contributes to the literature on the effects of insider trading on real efficiency, recently reviewed by Bhattacharya (2014)). This literature typically focuses on two channels. First, insider trading increases adverse selection and thus reduces outsiders' incentives to invest in primary markets (Leland (1992)), support real investment by the firm (Manove (1989)) or engage in real investment themselves (Ausubel (1990)). Second, insider trading increases the extent to which an incumbent's stock price reflects industry prospects, and thus guides a newcomer's entry decision (Fishman and Hagerty (1992)). In both channels, what matters is total price informativeness (FPE). Our paper argues that the real effects of insider trading depend not on how it affects total information in prices, but new information not previously known to the manager (RPE). In contrast to this literature, insider and outsider information are not substitutes.

While writing our paper, we became aware of a working paper by Chen et al. (2014) which shares our headline result that ITE increases investment-Q sensitivity. However, our papers address quite different research questions. While they focus specifically on how ITE affects investment-Q sensitivity, we study the broader question of whether investment depends on FPE or RPE, i.e. whether what matters for real decisions is the source of information in prices, rather than the total amount of information in prices. In this context, we use ITE as a shock to RPE that does not affect FPE. These different research questions in turn lead to different supplementary analyses: we show that the sensitivity of investment to non-price measures of investment opportunities either declines or is unchanged, and that our effects are stronger in emerging markets, concentrated industries, and firms with high sales volatility and low prior analyst coverage. In contrast, their supplementary analyses study the total level of price informativeness.

This paper is organized as follows. Section 2 describes the data and empirical specifications, and Section 3 analyzes the results. Section 4 details robustness tests, and Section 5 concludes.

2. Data and Empirical Approach

This section describes our data sources, the calculation of the variables used in the empirical analysis, and our regression specifications.

2.1 Sample and sources

We take ITE dates initially hand-collected by Bhattacharya and Daouk (2002), stock prices from Datastream, financial data from Worldscope, and country-level macroeconomic variables from the World Bank's World Development Indicators ("WDI") database. To construct our sample, we start with the 48 countries in Worldscope used in Fernandes and Ferreira (2009). The Worldscope database starts in 1980; we end in 2010.⁴ We measure investment as of the following year, and so study investment from 1981-2011. Since our two-stage analysis estimates investment-Q sensitivity for each country-year, we require countries to have data on at least 100 firms in each year.⁵ Our final sample comprises 317,187 firm-year observations on 41,546 unique firms that span 533 country-years, 40 non-financial industries, and 38 countries out of which 26 enforced insider trading laws between 1980 and 2010 ("enforcers"), 7 had not enforced by 2010 ("non-enforcers"), and 5 had enforced prior to 1980 ("already-enforcers"). We divide these countries into emerging and developed following the classification of Bhattacharya and Daouk (2002).

Table 1 presents the list of our sample countries and the year in which they first enforced insider trading laws. We also tabulate the year when insider trading laws are first announced,

⁴ We have experimented with different end dates and the results remain robust. One possibility is to include as much data as possible and end in 2015. However, this end date is quite distant from the last enforcement date, 1998. Another possibility is to end in 2003, which is 5 years after the last enforcement date. However, we wish the sample to cover not only upturns but also economic downturns, and thus end in 2010, to include the recent financial crisis. In Section 4.2 we show that the results are robust to studying a narrow window around ITE dates.

⁵ We start with 351,493 non-financial observations for the 48 countries identified in Fernandes and Ferreira (2009). Taiwan is not covered by the WDI database, reducing us to 47 countries and 340,077 observations. The requirement of 100 firms per year further reduces us to 38 countries and 317,193 observations. Our results are unaffected by this restriction: without it, our key coefficient of interest (on $Q*ENF*POST$) remains positive and significant at the 1% level. We lose six observations without an industry affiliation, leading to a final sample of 317,187 observations.

which we use in Section 4.1 as a falsification test. The final two columns present the number of firm-year and country-year observations.

2.2 Hypotheses, variable construction, and regression specifications

Our hypothesis is that ITE increases the amount of information in prices not known to the manager. Thus, his firm's stock price is a more informative signal his investment opportunities, and so investment-Q sensitivity should rise. We test this hypothesis using a difference-in-differences approach that compares changes in investment-Q sensitivity before and after ITE for treated countries (enforcers) to control countries. These control countries include not only non-enforcers, but also countries that previously enforced these laws and those that will subsequently enforce these laws. For example, to identify the effect of ITE on investment-Q sensitivity for Belgium (that enforced insider trading laws in 1994), we compare Belgium's changes in investment-Q sensitivity to four sets of controls – non-enforcers (e.g. China), already-enforcers (e.g. France), enforcers during our sample period before 1994 (e.g. Norway), and enforcers during our sample period after 1994 (e.g. Italy). The staggered enforcement of insider trading laws across the 26 enforcers means that our identification comes from not several events scattered over time, which attenuates (but does not eliminate) concerns that one particular event may be correlated with unobservable factors that also drive investment-Q sensitivity. We implement our approach in two ways, which we describe in greater detail below.

2.2.1 Single-stage specification

Our first specification is a single-stage, firm-level regression where we augment the classical investment-Q regression with interactions for ITE, as in equation (1) below. This design is similar

to Chen, Goldstein, and Jiang (2007) and Foucault and Frésard (2012), except that they interact Q with FPE and a cross-listing dummy, respectively.

$$\begin{aligned}
INV_{i,c,t} = & \alpha + \beta_1 ENF_c + \beta_2 POST_{c,t} + \beta_3 ENF_c * POST_{c,t} + \beta_4 Q_{i,c,t-1} + \beta_5 Q_{i,c,t-1} * ENF_c + \\
& \beta_6 Q_{i,c,t-1} * POST_{c,t} + \beta_7 Q_{i,c,t-1} * ENF_c * POST_{c,t} + \beta_8 IOS_{i,c,t-1} + \beta_9 IOS_{i,c,t-1} * ENF_c + \\
& \beta_{10} IOS_{i,c,t-1} * POST_{c,t} + \beta_{11} IOS_{i,c,t-1} * ENF_c * POST_{c,t} + \beta_{12} FIRM_CTRL_{i,c,t-1} + \\
& \beta_{13} CTRY_CTRL_{c,t-1} + \epsilon_{i,c,t} \quad (1)
\end{aligned}$$

$INV_{i,c,t}$ represents investment, defined as capital expenditures scaled by lagged total assets, for firm i headquartered in country c during year t . ENF is a dummy variable for whether a country enforced insider trading laws during our sample period; it is one for enforcers (e.g., Belgium) and zero for both non-enforcers (e.g., China) and already-enforcers (e.g., France). $POST$ is a dummy variable that equals one on or after ITE for that country and zero otherwise. As a result, $POST$ is zero in all years for non-enforcers, one in all years for already-enforcers, and switches from zero to one for enforcers in the ITE year.

Q represents Tobin's Q , defined as the ratio of market value of assets (market value of equity plus book value of debt) divided by book value of assets. While Q is a price-based measure of a firm's investment opportunity set, IOS is a vector of non-price-based measures. These include CFO (cash flows scaled by total assets), SGR (one-year sales growth)⁶, and AGE (firm age), following Asker et al. (2014). Finally, we include both firm-level ($FIRM_CTRL$) and country-level ($CTRY_CTRL$) controls. The former includes log market equity in US\$ millions (ME), book leverage (LEV) defined as long-term debt divided by total assets, cash and short-term investments

⁶ Cash flow and sales growth also may measure a firm's ability to finance investment.

divided by total assets (*CASH*), and retained earnings scaled by total assets (*RETAINED*). These variables are used in Asker et al. (2015). The country-level controls are macroeconomic variables that capture economic growth and bilateral trade, which could be correlated with the decision to enforce insider trading laws and also drive investment. These variables are log GDP per capita (*GDP*), annual growth in GDP per capita (*GDPGROW*), annual inflation (*INFL*), and global trade (*TRADE*), defined as the log of exports plus imports scaled by annual GDP. These variables are obtained from the WDI database. Detailed variable definitions are in Appendix A.

Our hypothesis is that $\beta_7 > 0$: investment is more sensitive to stock prices after ITE. This hypothesis requires two conditions to hold: managers learn from prices (as found by prior literature), *and* that investment decisions depend on RPE, i.e. the amount of information in prices not already known to the manager (the focus of this paper). We call this the “RPE hypothesis”.

An alternative hypothesis is that the manager does not learn from prices, but already has all information relevant for his investment decisions. If the manager trades on his private information and incorporates it into prices, then investment would be correlated with Q because Q proxies for his private information, rather than the manager learning from Q. This alternative hypothesis would predict $\beta_7 < 0$: after ITE, the manager’s private information is less reflected in prices and so Q is less correlated with investment.

The null hypothesis is that $\beta_7 = 0$. This hypothesis would hold in two scenarios. First, managers do learn from prices, but the extent to which they do only depends on FPE, rather than RPE. Since FPE does not increase in emerging markets after ITE (Fernandes and Ferreira (2009)), this scenario would predict $\beta_7 = 0$ in emerging markets in particular. Second, managers do not learn from prices and ITE does not affect how well Q proxies for the manager’s private information – either because it is ineffective at changing the manager’s trading (we have a “weak event”), or because the manager’s trades have little effect on Q as his trading volumes are small.

While finding that $\beta_7 > 0$ would support the RPE hypothesis, it would also be consistent with ITE leading to firms responding more to investment opportunities in general (rather than just to price-based measures of investment opportunities) – because ITE is correlated with improvements in external capital markets, which facilitate the financing of investment, or improvements in governance, which induce the manager to respond more to investment signals. Thus, we wish to show that investment does not also become more sensitive to non-price measures of investment opportunities (*IOS*). We therefore interact these variables also with *ENF* and *POST*. Our hypothesis is that these interactions β_{11} are all non-positive.

We estimate equation (1) at the firm level, including industry fixed effects. In alternative specifications, we include additional fixed effects. In one model, we estimate a generalized difference-in-differences by including country fixed effects (that subsume *ENF*) to control for unobservable, time-invariant differences in investment between countries, and year fixed effects (that subsume *POST*) to control for time trends in investment. This is the baseline specification used in Foucault and Fresard (2012) and Chen et al. (2014). This specification excludes firm fixed effects because Roberts and Whited (2011) argue that, since investment is the first difference of capital stock, the fixed effect has already been differenced out of the regression and so adding firm fixed effects reduces efficiency. However, in our most stringent specification, we verify robustness to including two-dimensional fixed effects (firm and country-year fixed effects), as recommended by Gormley and Matsa (2014).⁷ The inclusion of country-year fixed effects attenuates, but does not eliminate, the concern that ITE is endogenous: countries choose when to enforce insider trading laws, and this choice could be correlated with unobservable country-level, time-varying macroeconomic factors that drive investment. We cluster standard errors at the firm

⁷ We operationalize this by first demeaning each variable by firm, and then including country-year fixed effects in this demeaned specification. We prefer this specification to using the “reg2hdfe” command in Stata that directly includes two-dimensional fixed effects, as the latter does not allow for clustering.

level, and cluster at the country level in a robustness check. We use the former as our main specification because the consistency of clustering hinges on having a sufficient number of clusters (Petersen (2009)), and we have only 38 countries.

2.2.2 Two-stage specification

The benefit of the single-stage specification is that it allows for country-year fixed effects. However, the drawback is that all controls (including fixed effects) control for investment, rather than investment-Q sensitivity, since the former is the dependent variable. We thus address this issue with the two-stage specification below:

$$INV_{i,c,t} = \alpha + \beta_{c,t-1}^Q Q_{i,c,t-1} + \beta_{c,t-1}^{IOS} IOS_{i,c,t-1} + \epsilon_{i,c,t} \quad (2)$$

$$\hat{\beta}_{c,t-1}^Q = \alpha + \gamma_1 ENF_c + \gamma_2 POST_{c,t} + \gamma_3 ENF_c * POST_{c,t} + \gamma_4 CTRY_CTRL_{c,t-1} + \epsilon_{c,t-1} \quad (3)$$

The first stage (equation (2)) is a firm-level regression that estimates investment-Q sensitivities $\hat{\beta}_{c,t-1}^Q$ for each country and in each year. While (2) controls for *IOS*, we verify robustness to also including firm controls. We run both specifications to be consistent with related studies – Chen et al. (2014) do not include firm-level controls, and Foucault and Fresard (2012) control only for firm size.⁸ The second stage is a country-level regression that regresses these (predicted) investment-Q sensitivities on our ITE indicators, country-level controls, and year fixed effects. We cluster standard errors at the country level. The controls and fixed effects now capture their impact on

⁸ The single-stage specification of both Chen et al. (2014) and Foucault and Fresard (2012) includes country, year and industry fixed effects. Thus, to be consistent, we estimate the first stage by country and year, which is tantamount to including country times year fixed effects.

investment-Q sensitivity, rather than investment. Our hypothesis is that $\gamma_3 > 0$, i.e. investment-Q sensitivity rises post-ITE.

Equation (3) includes year fixed effects in addition to *POST*; the year fixed effects capture time trends for all firms, while *POST* identifies the difference in investment-Q sensitivity between non-enforcers (where *POST*=0 throughout) and already-enforcers (where *POST*=1 throughout). We also estimate a generalized difference-in-differences by adding country fixed effects to equation (3). These fixed effects subsume *ENF* and also *POST*, since already-enforcers exhibit *POST* = 1 throughout the sample period and therefore do not have any within-country variation. Since the coefficient of interest in equation (3) is on *ENF*POST*, rather than *Q*ENF*POST* as in equation (1), we cannot include country-year fixed effects. We thus undertake additional analyses, described in the introduction, to address the concern that ITE is correlated with omitted country-year variables. We also estimate equation (3) replacing investment-Q sensitivity $\hat{\beta}_{c,t-1}^Q$ with $\hat{\beta}_{c,t-1}^{IOS}$, the sensitivity of investment to non-price measures of investment opportunities.

One concern with both specifications is that a rise in investment-Q sensitivity post-ITE could result from FPE, rather than RPE, increasing post-enforcement. We address this issue in two ways. First, we control for FPE directly in the single stage specification by adding a firm-level measure of total price informativeness (and its interaction with Q): firm-specific return variation, *FPE*. This measure is one minus the R-squared of a regression of firm-level monthly equity excess returns on value-weighted local market excess returns and US market excess returns. Second, we can study whether investment-Q sensitivity increases in emerging countries in particular. Fernandes and Ferreira (2009) find that FPE does not rise in emerging countries post-ITE, while it rises in developed ones. In addition, Bushman et al. (2005) find that analyst coverage increases post-ITE in emerging countries but not in developed ones, suggesting that RPE increases in the former.

They argue that this differential effect arises because there is greater opacity in emerging markets and thus more private information to trade on.

Table 2 provides summary statistics for our sample firms. The median investment rate is 3.7% of total assets, and the median Tobin's Q is 1.3. Market equity for the median firm is \$83 million.

3. Results

3.1 Investment-Q sensitivity

Table 3 presents results of the single-stage specification. Our simplest regression in column (1) has Q , the ITE indicators, and their interactions as explanatory variables. We also include cash flow but not yet the other investment opportunity measures, to match the specification in Foucault and Frésard (2012) and also to use the full sample of 317,187 observations (adding sales growth reduces observations since it requires an additional year of data). Consistent with the RPE hypothesis, we find that ITE leads to an increase in investment-Q sensitivity and a decrease in investment-cash flow sensitivity. Both are significant at the 1% level. These results suggest that the manager is shifting weight away from cash flow and towards price as a measure of investment opportunities, consistent with the price containing more relevant information. Column (2) adds the other investment opportunity measures (age and sales growth) as additional controls; the coefficients on $Q*ENF*POST$ ($CFO*ENF*POST$) remains positive (negative) and significant. In addition, the coefficient on $AGE*ENF*POST$ is positive and significant at the 1% level. Since age should be a negative measure of investment opportunities (indeed, standalone AGE is negative and significant), this result also suggests that the manager is shifting weight away from non-price measures of investment opportunities. The sensitivity of investment to sales growth is unchanged. Column (3) adds both year and country fixed effects in a generalized difference-in-differences

specification. The coefficients on the interactions of $ENF*POST$ with Q and cash flow remain significant, but the interaction with age is no longer significant.

In column (4) we add both firm-level and country-level controls, including the firm-level measure of FPE . Theories such as Stiglitz and Weiss (1981), Bernanke and Gertler (1989), and Kiyotaki and Moore (1997) argue that standalone price efficiency should increase the level of investment; we will shortly also interact FPE with Q . The coefficient on $Q*ENF*POST$ remains positive and significant at the 1% level, although $CFO*ENF*POST$ now becomes insignificantly negative. FPE is also insignificant.

Column (5) represents our most stringent specification, which includes both country-year and firm fixed effects; the former subsume the country-level controls.⁹ The coefficient on $Q*ENF*POST$ is positive and significant at the 5% level, and $AGE*ENF*POST$ now becomes positive and significant again. In terms of economic significance, investment-Q sensitivity for enforcers in the pre-ITE period is 0.348 (0.594 (coefficient on Q) - 0.246 ($Q*ENF$)). This sensitivity increases after ITE by 0.116 (-0.245 ($Q*POST$) + 0.361 ($Q*ENF*POST$)), which corresponds to a 33% increase. Overall, our results suggest that ITE leads to firms increasing their sensitivity of investment to price-based, but not non-price-based, measures of investment opportunities.

While the results of Table 3 are supportive of the RPE hypothesis, they could also be consistent with FPE rising post-ITE. We address this concern by enhancing the specification in Table 3, column (5), in two ways. First, in column (6), in addition to controlling for FPE as Table 3, we also control for its interaction with Q . Consistent with Chen, Goldstein, and Jiang (2007), the coefficient on $Q*FPE$ is positive and significant, suggesting that investment-Q sensitivity is higher

⁹ As discussed before, we first demean each variable by firm and then include the country-year fixed effects – which also explains the lower adjusted r-square of this specification.

in firms with greater total price informativeness. However, the coefficient on $Q*ENF*POST$ remains positive and significant, suggesting that investment-Q sensitivity depends not only on total information in prices, but also the source of this information.

Second, in Table 4, we decompose our ENF indicator into ENF_EM (ENF_DV), dummies for whether an emerging (developed) country enforced insider trading laws. In column (1) we control for FPE and in column (2) we also add $Q*FPE$. In both specifications, we find that the investment-Q sensitivity rises significantly post-ITE in both emerging and developed countries. The coefficients are significantly higher in the former, with p-values of 0.048 and 0.054, respectively. Thus, the effects of ITE are particularly strong in emerging countries, in which FPE did not increase post-ITE (Fernandes and Ferreira (2009)) but RPE does (Bushman et al. (2005)).

Table 5 presents the two-stage specification. In Panel A, we estimate investment-Q sensitivities in the first stage (column (1)), controlling for IOS . Column (2.1) presents the second-stage, country-year panel regression of investment-Q sensitivity on the ITE interactions, country controls, and year fixed effects. Consistent with the results of Table 3, the coefficient on $ENF*POST$ is positive and significant at the 5% level. Columns (2.2)-(2.4) decomposes ENF into ENF_EM and ENF_DV and interacts each of these with $POST$. Column (2.3) also adds country fixed effects (which subsume ENF_EM and ENF_DV), and column (2.4) adds the firm-level controls in the first stage. In all three specifications, the effect of ITE on investment-Q sensitivity is positive and significant with a significance of at least 5% in emerging countries, but not developed ones. The p-value on the difference between the coefficients on $ENF_EM*POST$ and $ENF_DV*POST$ ranges from 0.02 to 0.12.

Panel B studies the effect of ITE on the sensitivity of investment to non-price measures of investment opportunities. In columns (2.1), (2.3), and (2.5), we run a similar specification to column (2.1) of Panel A, i.e. with $ENF*POST$ as the key explanatory variable, and without firm-

level controls in the first stage or country fixed effects. The sensitivity of investment to all three non-price measures of investment opportunities does not change following ITE. Columns (2.2), (2.4), and (2.6) are similar to column (2.4) of Panel A, i.e. with $ENF_EM*POST$ and $ENF_DV*POST$ as the key explanatory variables, and including firm-level controls and country fixed effects. The only significant coefficient is a negative one on $ENF_EM*POST$ where $\hat{\beta}_{c,t-1}^{AGE}$ is the dependent variable. However, combined with the insignificant coefficients for the other IOS measures in Table 5, Panel B, and the positive coefficients on $AGE*ENF*POST$ in a number of specifications in Table 3, the overall results do not provide systematic evidence that the increase in investment-Q sensitivity arises because ITE is correlated with macroeconomic trends that raised the sensitivity of investment to growth opportunities more generally.

3.2 *Cross-sectional analyses*

This section performs cross-sectional analyses of the RPE hypothesis, to investigate whether the effect of ITE on investment-Q sensitivity is stronger in situations where the manager is particularly likely to learn from prices.

3.2.1 *Industry concentration and sales volatility*

Allen (1993) argues that managers are more likely to rely on stock prices as a source of information in more concentrated industries. In competitive industries, managers can already learn about their production function by observing competitors' behavior, since there are several competitors to learn from. In concentrated industries, there are fewer rivals to learn from; these rivals are of different size and likely have different production functions.

Following this argument, we hypothesize that the effect of ITE on investment-Q sensitivity is stronger in concentrated industries. We use column (5) of Table 3 – the full specification with

firm and country-year fixed effects. The regressions control for FPE , but not $Q*FPE$ because we are interested in comparing the coefficient on $Q*ENF*POST$ between high and low concentration groups. Inclusion of $Q*FPE$ would mean that the coefficient on $Q*ENF*POST$ represents firms with $FPE = 0$, and so we would only be undertaking this comparison for such firms. However, including $Q*FPE$ does not change any of the inferences. We compute industry concentration using the sales-based Herfindahl index for each industry-country-year. We split our sample into high and low concentration groups, comparing industry concentration in a particular country-year with the median level for the entire sample and estimate the single-stage regression individually for each subsample.¹⁰

Panel A of Table 5 presents these results. Consistent with Allen (1993), we find that the effect of ITE on investment-Q sensitivity is indeed stronger in concentrated industries. The coefficient on $Q*ENF*POST$ is positive and significant at the 5% level in concentrated industries but insignificant in competitive industries. While the coefficient in concentrated industries is over double that in competitive industries (0.529 versus 0.223), the difference is not statistically significant. In terms of economic significance, investment-Q sensitivity increases by 42% $((0.529 - 0.389)/(0.753 - 0.420))$ in concentrated industries, versus 22% in competitive industries.

Allen (1993) also predicts that managerial learning from the stock price is likely to be stronger in firms where the production function changes frequently so that learning is particularly valuable. To test this hypothesis, Panel B stratifies industries according to sales volatility. We calculate the standard deviation of log sales within each industry-country pair, and split the sample based on the median sales volatility in each country. Panel B shows that the effect of ITE on investment-Q sensitivity is greater in industries with high sales volatility. In particular, the coefficient on

¹⁰ This split-sample design allows the control variables and fixed effects to vary with industry concentration.

$Q*ENF*POST$ is positive and significant at the 5% level in volatile industries, and insignificant in less volatile industries. The coefficients are statistically different, with a p-value of 0.08. In terms of economic significance, investment-Q sensitivity increases by 49% (26%) in more (less) volatile industries. Overall, the results of Panels A and B are consistent with Allen's (1993) theoretical arguments, and provide further evidence in favor of the RPE hypothesis.

3.2.2 *Analyst coverage*

Our next split exploits variation in analyst coverage. We predict that the effect of ITE on investment-Q sensitivity will be stronger in firms with low prior analyst coverage.¹¹ First, these firms have the greatest scope to enjoy an increase in analyst coverage, and thus RPE, post-ITE. Second, the impact of one additional analyst is stronger if a firm had few analysts to begin with. To test our prediction, we quantify the number of analysts in Institutional Broker Estimates Services ("I/B/E/S") that follow our sample firms in the pre-enforcement period.¹² We split the sample based on the country median, and estimate our single-stage specification separately within each of these subsamples.¹³

Columns (1) and (2) of Panel C show that ITE increases investment-sensitivity for firms with low pre-enforcement analyst coverage (the coefficient on $Q*ENF*POST$ is 0.420 and significant at the 1% level), but not for firms with high pre-period analyst coverage.¹⁴ These coefficients are significantly different from each other at the 1% level.

¹¹ An alternative would be to examine institutional ownership. We are aware of only one publicly available database (Factset) with institutional ownership for international firms. Unfortunately, Factset data coverage only starts in 1998.

¹² Since the pre-period is only defined for enforcers, we use the entire sample period for non-enforcers and for already-enforcers. Time trends in analyst coverage within these two control groups will be purged by the year fixed effects.

¹³ The low-coverage group includes firms without analyst coverage in the pre-period. Results are stronger when excluding these firms, since firms without prior analyst coverage continue not to have coverage in the post-period.

¹⁴ The coefficient on high-coverage firms is negative and significant at the 10% level. While this negative coefficient is unexpected, our key prediction is the difference in coefficients between the high- and low-coverage groups. One potential reason for the negative coefficient might be that analysts have a limit to the number of stocks they can cover.

3.2.3 *Financing constraints*

Our final split concerns financing constraints. The RPE hypothesis is that price informativeness increases investment-Q sensitivity through a secondary markets channel – the price contains more information not known to the manager, and thus his investment decisions respond more readily to it. An alternative explanation is a primary markets channel. ITE coincides with a loosening of financial constraints, which allows firms to vary investment more readily in response to Q. Under this channel, the effect of ITE should be stronger in firms that are more financially constrained to begin with, since the loosening of financial constraints is more relevant for such firms. In contrast, the RPE channel predicts that the effect is stronger in unconstrained firms. If ITE operates through making price signals more informative, the effects should be stronger in unconstrained firms that can respond more readily to these signals.

We use two measures of financial constraints. The first is the main measure of financial constraints used in the international finance literature: the balance between external and internal financing (Rajan and Zingales (1998)). It is defined at the industry-level as the difference between capital expenditures and cash flows scaled by capital expenditures, where higher (lower) values indicates industries with greater external (internal) financing and thus lower (higher) financial constraints. The second is firm size, as used by Bakke and Whited (2010), where low size indicates higher financial constraints.

Consistent with the RPE hypothesis, and inconsistent with the alternative explanation, columns (1) and (2) show that the coefficient on $Q*ENF*POST$ is positive and significant at the 10% level in firms with high external financing (i.e. low financial constraints), but insignificant in

If ITE reduces insider trading in (say) firm A more than firm B, an analyst may choose to shift coverage from firm A towards firm B. We acknowledge that this explanation is speculative, however.

constrained firms. Columns (3) and (4) similarly show that the coefficient on $Q*ENF*POST$ is positive and significant at the 5% level in large (i.e. unconstrained) firms, but insignificant in small firms. While the differences between the coefficients are not statistically significant, they are economically different. For example, the coefficient is twice as high for firms with high (0.440) vs. low (0.221) external financing, and close to zero (0.012) for small firms vs. 0.440 for large firms.

4. Robustness tests

4.1 Effect of insider trading announcement

Our main concern is that the association between ITE and increases in investment-Q sensitivity arises because ITE coincides with general improvements to the financial sector or other laws that improve corporate governance. If so, we might expect the announcement of insider trading laws to be also correlated with such improvements, and also raise investment-Q sensitivity. However, under the RPE hypothesis, the mere announcement, rather than enforcement, of insider trading laws should have no effect on RPE and thus investment-Q sensitivity. Bhattacharya and Daouk (2002) find only enforcement, not announcement, reduces the cost of capital (which they argue arises from the deterrence of insider trading), and Bushman et al. (2005) find that only enforcement increases outside information acquisition as measured by analyst coverage.

We thus perform a falsification test implementing our difference-in-differences design around insider trading announcement rather than enforcement. We start with column (6) of Table 3, with firm and country-year fixed effects plus FPE and $FPE*Q$. We replace $POST$ with a new variable, $POSTANN$, that denotes the post-announcement period, and replace ENF with ANN , a dummy variable for whether the country announced insider trading laws in our sample period. These

results are presented in column (1) of Table 7, Panel A. The coefficient on $Q*ANN*POSTANN$ is insignificantly negative.

4.2 *Alternative specifications*

This section presents the results of robustness tests which again use model (1) of Table 4 as a starting point, unless otherwise stated. The first two robustness tests use alternative measures of Tobin's Q . In column (2), we calculate Q using the higher-order cumulants estimator of Erickson, Jiang, and Whited (2014) to address measurement error in Q .¹⁵ Since the code does not allow for fixed effects, we first demean by firm before running the regression. The coefficient on $Q*ENF*POST$ remains positive and significant at the 1% level. The same is true if we first demean by country-year.

Thus far, we have clustered standard errors at the firm level. This is because the consistency of clustering hinges on having a sufficient number of clusters (Petersen (2009)). However, to be conservative, we cluster at the country level in columns (3) and (4). Column (3) shows that the coefficient on $Q*ENF*POST$ is no longer significant. However, consistent with the RPE hypothesis, column (4) divides countries into emerging and developed and shows that the coefficient for $Q*ENF_{EM}*POST$ is positive and significant at the 1% level, while $Q*ENF_{DV}*POST$ is insignificant.¹⁶

Columns (5) and (6) use a narrower event window around ITE, to focus on the years most affected by ITE and address concerns that our results are driven by general trends unrelated to the

¹⁵ This estimator is the Erickson and Whited (2000) measurement error correction, but in closed form. We thank Toni Whited for making the code available on her website.

¹⁶ We also ran bootstrapped standard errors on specification (5) of Table 3 and specification (1) of Table 4 using 50 replications. The coefficients on $Q*ENF*POST$ and $Q*ENF_{EM}*POST$ are positive and significant at the 1% level. These results are without firm-level clustering. With firm-level clustering, the bootstrapping converges for far fewer iterations for the first specification (and has a p-value of 0.06) and none for the second specification.

ITE event. We consider a 10-year window that begins five years before and ends five years after ITE, and delete all observations where the country is an enforcer and the current year is outside this window; all observations for already-enforcers and non-enforcers are retained. Column (5) shows that the coefficient on $Q*ENF*POST$ remains positive and significant at the 5% level, and column (6) shows that the coefficient is higher for $Q*ENF_EM*POST$ than for $Q*ENF_DV*POST$ (0.756 vs. 0.288, with a p-value of 0.024 for the difference).

4.3 Time trends around ITE

As stated previously, our main concern is that ITE is endogenous and correlated with other macroeconomic variables that drive investment-Q sensitivity. Thus, our ITE dummies may simply be capturing ongoing time trends in investment-Q sensitivity that may have started prior to the enforcement date. To address these concerns, we follow Bertrand and Mullainathan (2003) and examine the dynamic effect of ITE. In particular, we create a new indicator *BEFORE1*, which equals one in the year before ITE and zero in all other years. For example, for Belgium, which enforced insider trading laws in 1994, this variable is one only in 1993. We also create *BEFORE2*, which equals one two years before ITE (in 1992, in the above example).

Column (1) of Panel B regresses investment-Q sensitivity on the standard variables *ENF*, *POST*, and *ENF*POST*, plus the new interactions *ENF*BEFORE1* and *ENF*BEFORE2*. We conduct this test on the two-stage specification as it would be unwieldy in the single-stage specification, since we would have to interact *ENF*, *POST*, *ENF*POST*, *Q*, *IOS* etc. with *BEFORE1* and *BEFORE2* also. Both new interactions are insignificant. To understand these results, consider $t = 1994$. Investment-Q sensitivity in 1994 is regressed on covariates in year $t-1$, i.e. 1993. $POST_{1993}$ will be zero, since *POST* is one only from 1994. $BEFORE1_{1993}$ will be one, since *BEFORE1* is one only in 1993, while $BEFORE2_{1993}$ is zero. Recall that, if investment-Q

sensitivity is measured in 1994, Q is measured in 1993, i.e. prior to ITE. The insignificant coefficient on *BEFORE1* shows that investment-Q sensitivity does not rise one year prior to ITE. Using the same reasoning, the insignificant coefficient on *BEFORE2* shows that it does not rise two years prior to ITE. Thus, these results suggest that there are no pre-event trends in investment-Q sensitivity, satisfying the parallel trends assumption.

In column (2), we study how long it takes for ITE to affect investment-Q sensitivity. We define the new indicator *AFTER0*, which equals one in the year of ITE (1994, in the Belgium example) and zero in other years. (This variable contrasts *POST*, which equals one in the year of ITE and all future years). We also create *AFTER1*, which equals one in the year after ITE (1995, in the above example), *AFTER2*, which equals one two years after ITE (1996), and *AFTER3+*, which equals one three years after ITE and in all future years (from 1997 onwards). Column (2) interacts *ENF* with all before and after indicators. We find that the coefficient on *AFTER0* is positive but insignificant, while the coefficients on *AFTER1* and *AFTER2* are significant at the 10% and 5% levels, respectively. The insignificance of *AFTER0* suggests that investment-Q sensitivity does not rise immediately in the year of ITE. In the Belgium example, after ITE in 1994, the sensitivity of investment in 1995 to Q in 1994 is not markedly higher than the sample average. This result suggests that Q in 1994 does not suddenly become more relevant for investment in the year of ITE, which is reasonable since it may take time for outsiders (e.g. analysts) to start gathering information about a firm. In contrast, the significance of *AFTER1* and *AFTER2* suggests that investment-Q sensitivity does rise after ITE. Thus, the results of column (2) confirm the absence of pre-event trends, and suggest that it takes a year after ITE before investment responds more strongly to Q. The coefficient on *AFTER3+* is also significant, but only at the 10% level, potentially because we are now further from the ITE event.

5. Conclusion

This paper tests the hypothesis that the real effects of financial markets – the effect of stock prices on real decisions – depend not on the total amount of information in prices (forecasting price efficiency) but the amount of information in prices not already known to the decision maker (revelatory price efficiency). Using the staggered enforcement of insider trading laws as a negative (positive) shock to insiders' (outsiders') incentives to gather and incorporate information into the stock price, we find that such enforcement significantly increases the sensitivity of investment to Q, but reduces or does not change its sensitivity to non-price measures of investment opportunities. These results are particularly strong for emerging markets, in which information acquisition by outsiders rises most strongly post-ITE, but total price informativeness is unchanged. They are also stronger in situations in which managerial learning from the stock price is likely more important (concentrated and volatile industries), as well as firms with lower pre-enforcement analyst coverage (a measure of information acquisition by outsiders) and financial constraints (that would restrict their ability to respond to more informative prices). While the differences are economically significant, they are not always statistically significant.

Overall, these results suggest that it is not only the total amount of information in prices that matters for real efficiency, but the source of information in prices – whether this information is already known to the decision maker. As a result, measures of total price informativeness may be insufficient for measuring the contribution of financial markets to the efficiency of real decisions. For example, the results suggest a new cost of insider trading that is absent from prior literature. Previous research studies the effect of insider trading on total price informativeness (e.g. Manove (1989), Ausubel (1990), Fishman and Hagerty (1992), Leland (1992)), under the assumption that outsider and insider information are substitutes. However, this paper suggests that it is outsider information that matters for investment decisions. Thus, even if the decrease in outsider

information in prices, that results from allowing insider trading, is offset by the increase in insider information, real efficiency may still decline.

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Appendix A: Definition of variables

This appendix describes the calculation of variables used in the core analysis. Variables within brackets refer to variable names within Worldscope.

Variable	Definition	Source
<i>AGE</i>	Firm age in years, defined as one plus current year minus the first year that the firm appears on Worldscope (“Base_Date”).	Worldscope
<i>ANN</i>	Indicator variable that equals 1 for countries that announced insider trading laws for the first time in 1980-2010, and zero otherwise.	Bhattacharya and Daouk (2002)
<i>CASH</i>	Cash and short-term investments (WC02001) scaled by total assets.	Worldscope
<i>CFO</i>	Cash flows, defined as operating income (WC01250) scaled by total assets.	Worldscope
<i>ENF</i>	Indicator variable that equals 1 for countries that enforced insider trading laws for the first time in 1980-2010, and zero otherwise.	Bhattacharya and Daouk (2002)
<i>FPE</i>	Forecasting price efficiency, defined as firm-specific stock return variation. This measure is defined at the firm-year level.	Datastream
<i>GDP</i>	Natural log of GDP per capita in current US\$.	WDI
<i>GDPGROW</i>	One-year growth in GDP per capita expressed in percentage terms.	WDI
<i>INFL</i>	One-year rate of inflation expressed in percentage terms.	WDI
<i>INV</i>	Capital expenditures (WC04601) scaled by lagged total assets (WC02999).	Worldscope
<i>LEV</i>	Book leverage, defined as long term debt (WC03251) scaled by total assets.	Worldscope
<i>ME</i>	Natural log of market value of equity (in \$ millions), defined as shares outstanding (WC05301) times closing share price (WC05001). The exchange rate for converting local currency to USD is obtained from WDI.	Worldscope and WDI

<i>POST</i>	Indicator variable that equals 1 for the post-enforcement period and is defined for both enforcers and already-enforcers.	N/A
<i>Q</i>	Tobin's Q defined as the ratio of market value of assets (market equity plus book debt) to book value of assets. Market value of equity is defined as shares outstanding (WC05301) times closing share price (WC05001).	Worldscope
<i>RETAINED</i>	Retained earnings, defined as the ratio of retained earnings (WC03495) to total assets (WC02999).	Worldscope
<i>SGR</i>	Sales growth, defined as the one-year growth in total revenues (WC01001).	Worldscope
<i>TRADE</i>	Natural log of global trade, defined as the sum of merchandise exports and imports scaled by annual GDP.	WDI

Table 1: List of countries

The list of first-time enforcers and non-enforcers is from Bhattacharya and Daouk (2002). ITE year (ITA year) denotes the year of first-time enforcement (announcement) of insider trading laws. Firm-years denotes the number of firm-year observations on Worldscope within each country, while country-years represents the number of country-year (predicted) observations of investment-Q sensitivity. Countries with fewer than 100 observations per year are excluded from both samples. The sample period is 1981-2010. Emerging markets are denoted by an asterisk (*)

Country	ITE year	ITA year	Firm-years	Country-years	Country	ITE year	ITA year	Firm-years	Country-years
Australia	1996	1991	14,278	21	Netherlands	1994	1989	2,652	20
Belgium	1994	1990	324	3	New Zealand	–	1988	534	5
Brazil*	1978	1976	377	3	Norway	1990	1985	1,710	13
Canada	1976	1966	20,247	25	Pakistan*	–	1995	622	5
Chile*	1996	1981	1,608	11	Peru*	1994	1991	101	1
China	–	1993	14,090	13	Philippines*	–	1982	1,786	11
Denmark	1996	1991	1,969	17	Poland*	1993	1991	1,342	7
Finland	1993	1989	1,120	10	Russia*	–	1996	865	4
France	1975	1967	10,417	22	Singapore	1978	1973	5,999	16
Germany	1995	1994	13,528	22	South Africa*	–	1989	4,063	18
Greece*	1996	1988	1,367	6	South Korea*	1988	1976	12,213	17
Hong Kong	1994	1991	10,000	18	Spain	1998	1994	1,568	14
India*	1998	1992	11,902	18	Sri Lanka*	1996	1987	703	5
Indonesia*	1996	1991	3,512	15	Sweden	1990	1971	3,458	15
Israel*	1989	1981	2,020	6	Switzerland	1995	1988	2,591	16
Italy	1996	1991	3,125	21	Thailand*	1993	1984	8,741	19
Japan	1990	1988	42,868	29	Turkey*	1996	1981	1,569	9
Malaysia*	1996	1973	10,230	19	U.K.	1981	1980	29,443	29
Mexico*	–	1975	104	1	U.S.A.	1961	1934	74,141	29
					Total			317,187	533

Table 2: Descriptive statistics

The sample comprises 317,187 firm-year observations on 41,546 unique firms that span 38 countries and 40 non-financial industries over 1980-2010. Detailed variable definitions are in Appendix A.

Variable	Obs.	Mean	Median	S.D.	Min	Max
<i>AGE</i>	317,187	11.227	9.000	7.943	1.000	36.000
<i>CASH</i>	317,187	0.168	0.098	0.195	0.000	0.906
<i>CFO</i>	317,187	-0.054	0.040	0.453	-3.309	0.332
<i>FPE</i>	312,992	0.667	0.675	0.068	0.443	0.937
<i>GDP (US\$)</i>	317,187	9.802	10.267	1.137	5.628	11.444
<i>GDPGROW (%)</i>	317,187	2.200	2.092	3.175	-14.321	13.605
<i>INFL (%)</i>	317,187	2.563	2.192	3.609	-6.663	75.271
<i>INV</i>	317,187	0.073	0.037	0.113	0.000	0.743
<i>LEV</i>	317,187	0.135	0.067	0.174	0.000	0.855
<i>ME (\$m)</i>	317,187	4.519	4.424	1.963	0.642	9.470
<i>Q</i>	317,187	2.351	1.273	4.422	0.406	36.728
<i>RETAINED</i>	281,398	-1.174	0.059	5.730	-45.663	0.717
<i>SGR</i>	266,558	0.192	0.071	0.704	-0.916	5.061
<i>TRADE</i>	317,187	0.398	0.331	0.295	0.127	1.514

Table 3: Investment-*Q* sensitivity after ITE: single-stage specification

The dependent variable is investment (*INV*). *ENF* is an indicator variable that equals 1 for insider trading enforcers, while *POST* is an indicator variable that equals 1 for the post-enforcement period for both enforcers and already-enforcers. All other variables are as defined in Appendix A. Robust standard errors, clustered by firm, are in parentheses. *** (**) (*) indicates significance at 1% (5%) (10%) two-tailed levels. The sample period is 1981-2010.

	(1)	(2)	(3)	(4)	(5)	(6)
<i>ENF</i>	0.023 [0.003]***	0.028 [0.005]***	–	–	–	–
<i>POST</i>	0.012 [0.002]***	0.004 [0.003]	–	–	–	–
<i>ENF*POST</i>	-0.039 [0.003]***	-0.041 [0.005]***	-0.011 [0.004]***	-0.013 [0.004]***	–	–
<i>Q</i>	0.349 [0.071]***	0.332 [0.082]***	0.348 [0.084]***	0.316 [0.085]***	0.594 [0.107]***	0.396 [0.121]***
<i>Q*ENF</i>	-0.387 [0.075]***	-0.389 [0.084]***	-0.373 [0.086]***	-0.369 [0.087]***	-0.246 [0.152]	-0.246 [0.151]
<i>Q*POST</i>	-0.107 [0.075]	-0.055 [0.088]	-0.076 [0.090]	-0.072 [0.090]	-0.245 [0.110]**	-0.261 [0.112]**
<i>Q*ENF*POST</i>	0.607 [0.083]***	0.547 [0.095]***	0.469 [0.096]***	0.462 [0.097]***	0.361 [0.150]**	0.369 [0.150]**
<i>CFO</i>	0.033 [0.009]***	0.042 [0.009]***	0.039 [0.009]***	0.043 [0.009]***	0.030 [0.009]***	0.030 [0.009]***
<i>CFO*ENF</i>	0.105 [0.021]***	0.068 [0.021]***	0.056 [0.021]***	0.023 [0.023]	0.033 [0.021]	0.033 [0.021]
<i>CFO*POST</i>	-0.025 [0.010]***	-0.025 [0.010]***	-0.027 [0.009]***	-0.031 [0.009]***	-0.022 [0.009]**	-0.023 [0.010]**
<i>CFO*ENF*POST</i>	-0.083 [0.022]***	-0.052 [0.021]**	-0.043 [0.021]**	-0.014 [0.023]	-0.025 [0.022]	-0.025 [0.022]
<i>SGR</i>		0.008 [0.002]***	0.007 [0.002]***	0.007 [0.002]***	0.004 [0.001]***	0.004 [0.001]***
<i>SGR*ENF</i>		0.003 [0.003]	0.003 [0.003]	-0.002 [0.003]	-0.001 [0.003]	-0.001 [0.003]
<i>SGR*POST</i>		0.002 [0.002]	0.002 [0.002]	0.002 [0.002]	0.000 [0.001]	0.000 [0.001]
<i>SGR*ENF*POST</i>		-0.004 [0.003]	-0.006 [0.003]*	-0.001 [0.003]	-0.001 [0.003]	-0.001 [0.003]
<i>AGE</i>		-0.001 [0.000]***	-0.001 [0.000]***	-0.002 [0.000]***	0.000 [0.000]	0.000 [0.000]
<i>AGE*ENF</i>		0.000 [0.000]	0.000 [0.000]	0.000 [0.000]	-0.002 [0.000]***	-0.002 [0.000]***
<i>AGE*POST</i>		0.000 [0.000]	0.001 [0.000]***	0.001 [0.000]***	-0.002 [0.000]***	-0.002 [0.000]***
<i>AGE*ENF*POST</i>		0.001 [0.000]**	0.000 [0.000]	0.000 [0.000]	0.003 [0.000]***	0.003 [0.000]***
<i>ME</i>				0.002 [0.000]***	-0.003 [0.000]***	-0.003 [0.000]***
<i>LEV</i>				0.007 [0.002]***	-0.046 [0.003]***	-0.046 [0.003]***
<i>CASH</i>				-0.007 [0.002]***	0.048 [0.003]***	0.048 [0.003]***

<i>RETAINED</i>				0.000 [0.000]**	-0.001 [0.000]***	-0.001 [0.000]***
<i>FPE</i>				-0.002 [0.003]	0.000 [0.003]	-0.005 [0.003]*
<i>GDP</i>				-0.002 [0.002]	–	
<i>GDPGROW</i>				0.179 [0.013]***	–	
<i>INFL</i>				-0.001 [0.008]	–	
<i>TRADE</i>				0.022 [0.007]***	–	
<i>Q*FPE</i>						0.312 [0.138]**
Adj. R^2	0.10	0.10	0.13	0.14	0.06	0.06
Obs.	317,187	266,558	266,558	233,938	233,938	233,938
Industry FE	Yes	Yes	Yes	Yes	No	No
Year FE	No	No	Yes	Yes	No	No
Country FE	No	No	Yes	Yes	No	No
Country-year FE	No	No	No	No	Yes	Yes
Firm FE	No	No	No	No	Yes	Yes

Table 4: Developed versus emerging countries

The dependent variable is investment (*INV*). *ENF_EM* and *ENF_DV* split the *ENF* indicator based on whether the enforcing country is emerging or developed, while *POST* is an indicator variable that equals 1 for the post-enforcement period for both enforcers and already-enforcers. All other variables are as defined in Appendix A. Robust standard errors, clustered by firm, are in parentheses. *** (**) (*) indicates significance at 1% (5%) (10%) two-tailed levels. The sample period is 1981-2010.

	(1)	(2)
<i>Q</i>	0.595 [0.107]***	0.378 [0.120]***
<i>Q*ENF_EM</i>	-0.441 [0.237]*	-0.411 [0.232]*
<i>Q*ENF_DV</i>	-0.259 [0.150]*	-0.266 [0.150]*
<i>Q*POST</i>	-0.244 [0.109]**	-0.262 [0.111]**
<i>Q*ENF_EM*POST</i> (1)	0.763 [0.214]***	0.759 [0.211]***
<i>Q*ENF_DV*POST</i> (2)	0.347 [0.149]**	0.360 [0.150]**
<i>CFO</i>	0.030 [0.009]***	0.030 [0.009]***
<i>CFO*ENF_EM</i>	0.075 [0.062]	0.077 [0.061]
<i>CFO*ENF_DV</i>	0.020 [0.022]	0.019 [0.022]
<i>CFO*POST</i>	-0.022 [0.009]**	-0.023 [0.009]**
<i>CFO*ENF_EM*POST</i>	-0.049 [0.062]	-0.051 [0.062]
<i>CFO*ENF_DV*POST</i>	-0.014 [0.022]	-0.014 [0.022]
<i>SGR</i>	0.004 [0.001]***	0.004 [0.001]***
<i>SGR*ENF_EM</i>	-0.003 [0.006]	-0.003 [0.005]
<i>SGR*ENF_DV</i>	-0.001 [0.003]	-0.001 [0.003]
<i>SGR*POST</i>	0.000 [0.001]	0.001 [0.001]
<i>SGR*ENF_EM*POST</i>	0.000 [0.006]	0.000 [0.006]
<i>SGR*ENF_DV*POST</i>	0.000 [0.003]	0.000 [0.003]
<i>AGE</i>	-0.003 [0.000]***	-0.003 [0.000]***
<i>AGE*ENF_EM</i>	0.003 [0.001]**	0.003 [0.001]**
<i>AGE*ENF_DV</i>	0.001 [0.000]***	0.001 [0.000]***

<i>AGE*POST</i>	0.000 [0.000]*	0.000 [0.000]*
<i>AGE*ENF_EM*POST</i>	-0.003 [0.001]**	-0.003 [0.001]**
<i>AGE*ENF_DV*POST</i>	0.000 [0.000]***	0.000 [0.000]***
<i>ME</i>	-0.003 [0.000]***	-0.003 [0.000]***
<i>LEV</i>	-0.046 [0.003]***	-0.046 [0.003]***
<i>CASH</i>	0.048 [0.003]***	0.048 [0.003]***
<i>RETAINED</i>	-0.001 [0.000]***	-0.001 [0.000]***
<i>FPE</i>	0.000 [0.003]	-0.005 [0.003]*
<i>Q*FPE</i>		0.342 [0.139]**
<i>p. value of (1) = (2)</i>	0.048	0.054
Adj. <i>R</i> ²	0.06	0.06
Obs.	233,938	233,938
Industry, year, country FE	No	No
Country-year FE	Yes	Yes
Firm FE	Yes	Yes

Table 5: Investment- Q sensitivity after ITE: two-stage specification

The first stage regresses INV on Q and the other IOS proxies. The second stage regresses these estimated investment- Q sensitivities ($\hat{\beta}_{c,t}^Q$ and $\hat{\beta}_{c,t}^{Q-FC}$) for each country-year on country-level controls and ITE indicators. $\hat{\beta}_{c,t}^Q$ ($\hat{\beta}_{c,t}^{Q-FC}$) denote predicted IQ sensitivity estimated based on excluding (including) firm-level controls in the first stage. ENF_EM and ENF_DV split the ENF indicator based on whether the enforcing country is emerging or developed. All other variables are as defined in Appendix A. Robust standard errors, clustered by country, are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) two-tailed level, respectively. The sample period is 1981-2010.

Panel A: Main results

Dependent variables	(1) INV	(2.1) $\hat{\beta}_{c,t}^Q$	(2.2) $\hat{\beta}_{c,t}^Q$	(2.3) $\hat{\beta}_{c,t}^Q$	(2.4) $\hat{\beta}_{c,t}^{Q-FC}$
Q	0.298 [0.052]***				
CFO	0.021 [0.004]***				
SGR	0.011 [0.002]***				
AGE	-0.001 [0.000]***				
ENF		-0.839 [0.370]**			
ENF_EM			-1.361 [0.425]***		
ENF_DV			-0.913 [0.472]*		
$POST$		-0.627 [0.235]**	-0.884 [0.242]***		
$ENF*POST$		0.925 [0.433]**			
$ENF_EM*POST$ (1)			1.850 [0.449]***	1.057 [0.519]**	4.397 [1.962]**
$ENF_DV*POST$ (2)			0.880 [0.552]	-0.031 [0.461]	-0.754 [0.822]
GDP		0.096 [0.059]	0.192 [0.079]**	-0.380 [0.578]	-0.067 [1.453]
$GDPGROW$		-0.969 [1.866]	-1.261 [1.732]	0.033 [2.598]	4.641 [4.775]
$INFL$		1.150 [0.913]	0.822 [0.908]	0.183 [1.140]	1.434 [2.283]
$TRADE$		0.451 [0.118]***	0.448 [0.146]***	-0.341 [1.503]	-1.226 [2.392]
p . value of (1) = (2)			0.118	0.105	0.019
Adj. R^2		0.08	0.11	0.21	0.11
Obs.	266,558	533	533	533	524
Firm-level controls in first stage		No	No	No	Yes
Year FE	No	Yes	Yes	Yes	Yes
Country FE	No	No	No	Yes	Yes

Panel B: Sensitivity of investment to non-price measures of investment opportunities

The first stage regresses INV on Q , the other IOS proxies and the firm-level controls. The second stage regresses these estimated sensitivities of investment to cash flow ($\hat{\beta}_{c,t-1}^{CFO}$), sales growth ($\hat{\beta}_{c,t-1}^{SGR}$), and age ($\hat{\beta}_{c,t-1}^{AGE}$) on country-level controls and ITE indicators. All other variables are as defined in Appendix A. Robust standard errors, clustered by country, are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) two-tailed level, respectively. The sample period is 1981-2010.

Dependent variables	$\hat{\beta}_{c,t-1}^{CFO}$		$\hat{\beta}_{c,t-1}^{SGR}$		$\hat{\beta}_{c,t-1}^{AGE}$	
	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)
<i>ENF</i>	0.026 [0.040]		0.435 [0.732]		0.056 [0.045]	
<i>POST</i>	0.019 [0.030]		0.923 [0.613]		-0.041 [0.045]	
<i>ENF*POST</i>	-0.008 [0.056]		-1.253 [0.867]		-0.032 [0.050]	
<i>ENF_EM*POST</i> (1)		-0.065 [0.154]		1.285 [0.979]		-0.409 [0.172]**
<i>ENF_DV*POST</i> (2)		0.018 [0.058]		1.121 [1.164]		-0.094 [0.106]
<i>GDP</i>	-0.026 [0.005]***	0.016 [0.095]	-0.248 [0.104]**	-0.044 [1.170]	0.033 [0.011]***	0.097 [0.191]
<i>GDPGROW</i>	0.257 [0.222]	0.530 [0.516]	-6.838 [4.590]	1.898 [9.228]	-1.647 [0.464]***	-0.465 [0.638]
<i>INFL</i>	-0.019 [0.087]	0.195 [0.242]	-2.578 [1.227]**	3.857 [2.925]	0.207 [0.169]	0.213 [0.306]
<i>TRADE</i>	-0.050 [0.026]*	-0.692 [0.323]**	-0.649 [0.313]**	-5.021 [4.302]	-0.083 [0.024]***	0.227 [0.432]
<i>p. value of (1) = (2)</i>		0.627		0.918		0.050
Adj. R^2	0.24	0.33	0.20	0.08	0.23	0.03
Obs.	533	524	533	524	533	524
Firm-level controls in first stage	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	Yes	No	Yes	No	Yes

Table 6: Cross-sectional analyses

Panel A: Industry concentration

This panel uses the single-stage specification. The dependent variable is investment (*INV*). Industry concentration is defined using the sales-based Herfindahl index within each industry-country-year. Low and High subsamples are formed based on the median across the entire sample. Average value corresponds to the mean value of industry concentration within each subsample. Only the coefficients on *Q*, *Q*ENF*, *Q*POST* and *Q*ENF*POST* are reported for parsimony; all other variables are as defined in Appendix A. Robust standard errors, clustered by firm, are in parentheses. *** (**) (*) indicates significance at 1% (5%) (10%) two-tailed levels. The sample period is 1981-2010.

	Low concentration	High concentration
Average value	641	3,083
	(1)	(2)
<i>Q</i>	0.476 [0.104]***	0.753 [0.198]***
<i>Q*ENF</i>	-0.114 [0.183]	-0.420 [0.242]*
<i>Q*POST</i>	-0.141 [0.107]	-0.389 [0.204]*
<i>Q*ENF*POST</i>	0.223 [0.175]	0.529 [0.244]**
<i>p.</i> value of diff. in <i>Q*ENF*POST</i>	0.299	
Adj. <i>R</i> ²	0.07	0.06
Obs.	123,559	110,379
Firm- and country-level controls	Yes	Yes
<i>CFO</i> , <i>SGR</i> , <i>AGE</i> and interactions	Yes	Yes
Controls for <i>FPE</i>	Yes	Yes
Fixed effects	Firm, country-year	Firm, country-year

Panel B: Sales volatility

This panel uses the single-stage specification. The dependent variable is investment (*INV*). Sales volatility is defined at the industry level using the standard deviation of (log of) sales within each industry-country. Low and High subsamples are formed based on the median across the entire sample. Average value corresponds to the mean value of sales volatility within each subsample. Only the coefficients on *Q*, *Q*ENF*, *Q*POST* and *Q*ENF*POST* are reported for parsimony; all other variables are as defined in Appendix A. Robust standard errors, clustered by firm, are in parentheses. *** (**) (*) indicates significance at 1% (5%) (10%) two-tailed levels. The sample period is 1981-2010.

	Low volatility	High volatility
Average value	1.489	2.506
	(1)	(2)
<i>Q</i>	0.468 [0.104]***	0.872 [0.229]***
<i>Q*ENF</i>	-0.130 [0.160]	-0.558 [0.312]*
<i>Q*POST</i>	0.060 [0.163]	-0.518 [0.230]**
<i>Q*ENF*POST</i>	0.027 [0.196]	0.671 [0.315]**
<i>p.</i> value of diff. in <i>Q*ENF*POST</i>	0.080	
Adj. <i>R</i> ²	0.06	0.07
Obs.	118,145	115,786
Firm- and country-level controls	Yes	Yes
<i>CFO</i> , <i>SGR</i> , <i>AGE</i> and interactions	Yes	Yes
Controls for <i>FPE</i>	Yes	Yes
Fixed effects	Firm, country-year	Firm, country-year

Panel C: Analyst coverage

This panel uses the single-stage specification. The dependent variable is investment (INV). Analyst coverage is obtained from I/B/E/S and defined based on the pre-enforcement period for enforcers and the entire sample period for non-enforcers and already-enforcers. Low and High groups are formed based on the median pre-enforcement analyst coverage in each country. Firms with no analyst coverage are included in the Low group. Only the coefficients on Q , $Q*ENF$, $Q*POST$ and $Q*ENF*POST$ are reported for parsimony; all other variables are as defined in Appendix A. Robust standard errors, clustered by firm, are in parentheses. *** (**) (*) indicates significance at 1% (5%) (10%) two-tailed levels. The sample period is 1981-2010.

	Low Coverage	High Coverage
Average value	0.155	5.245
	(1)	(2)
Q	0.602 [0.116]***	0.412 [0.150]***
$Q*ENF$	-0.293 [0.158]*	0.574 [0.294]*
$Q*POST$	-0.268 [0.119]**	0.279 [0.250]
$Q*ENF*POST$	0.420 [0.157]***	-0.534 [0.288]*
p . value of diff. in $Q*ENF*POST$	0.003	
Adj. R^2	0.06	0.07
Obs.	209,107	24,831
Firm- and country-level controls	Yes	Yes
CFO , SGR , AGE and interactions	Yes	Yes
Controls for FPE	Yes	Yes
Fixed effects	Firm, country-year	Firm, country-year

Panel D: Financial constraints

This panel uses the single-stage specification. The dependent variable is investment (*INV*). Columns (1) and (2) use external financing as an (inverse) measure of financing constraints while columns (3) and (4) use firm size as an (inverse) measure of financing constraints. External versus internal financing follows the methodology of Rajan and Zingales (1998) and is defined at the industry-level as the difference between capital expenditures and cash flows scaled by capital expenditures, where higher (lower) values indicates industries with greater external (internal) financing. Low and High groups are based on the median pre-enforcement values for each country. Small and Large firms are defined based on the median *MV* in each country. Only the coefficients on *Q*, *Q*ENF*, *Q*POST* and *Q*ENF*POST* are reported for parsimony; all other variables are as defined in Appendix A. Robust standard errors, clustered by firm, are in parentheses. *** (**) (*) indicates significance at 1% (5%) (10%) two-tailed levels. The sample period is 1981-2010.

	External Financing		Firm size	
	Low	High	Small	Large
Average value	-0.161	1.153	\$37m	\$1,211m
	(1)	(3)	(4)	(6)
<i>Q</i>	0.423 [0.131]***	0.751 [0.152]***	0.474 [0.129]***	0.806 [0.134]***
<i>Q*ENF</i>	-0.134 [0.178]	-0.309 [0.224]	0.051 [0.413]	-0.404 [0.186]**
<i>Q*POST</i>	-0.072 [0.136]	-0.402 [0.155]***	-0.196 [0.132]	-0.272 [0.141]*
<i>Q*ENF*POST</i>	0.221 [0.173]	0.440 [0.226]*	0.012 [0.417]	0.440 [0.186]**
<i>p. value of diff. in Q*ENF*POST</i>	0.440		0.356	
Adj. <i>R</i> ²	0.07	0.06	0.05	0.08
Obs.	125,548	108,384	112,152	121,786
Firm- and country-level controls	Yes	Yes	Yes	Yes
<i>CFO</i> , <i>SGR</i> , <i>AGE</i> and interactions	Yes	Yes	Yes	Yes
Controls for <i>FPE</i>	Yes	Yes	Yes	Yes
Fixed effects	Firm, country- year	Firm, country- year	Firm, country- year	Firm, country- year

Table 7: Robustness tests

This panel uses the single-stage specification. The dependent variable is investment (*INV*). Only the coefficients on *Q*ENF*POST*, *Q*ENF_EM*POST* and *Q*ENF_DV*POST* are reported for parsimony. All other variables are as defined in Appendix A. Robust standard errors in parentheses are clustered by firm (except in Column (1)). *** (**) (*) indicates significance at 1% (5%) (10%) two-tailed levels. The sample period is 1981-2010.

Panel A: Single-stage specification

	IT announce- ment	Higher order cumulants estimator	Clustering by country		10 year event window	
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Q*ANN*POSTANN</i>	-0.063 [0.044]					
<i>Q*ENF*POST</i>		3.382 [0.610]***	0.361 [0.243]		0.364 [0.153]**	
<i>Q*ENF_EM*POST</i> (1)				0.763 [0.241]***		0.756 [0.208]***
<i>Q*ENF_DV*POST</i> (2)				0.347 [0.249]		0.288 [0.155]*
<i>p. value of (1)=(2)</i>				0.009		0.024
Adj. <i>R</i> ²	0.06	N/A ¹⁷	0.06	0.06	0.07	0.07
Obs.	233,938	233,938	233,938	233,938	114,978	114,978
Firm- and country-level controls	Yes	Yes	Yes	Yes	Yes	Yes
<i>IOS</i> and <i>Q*IOS</i>	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Firm, ctry- yr	Firm	Firm, ctry-yr	Firm, ctry-yr	Firm, ctry-yr	Firm, ctry-yr

¹⁷ The Stata code for the higher order cumulants estimator does not provide an *R*² or allow for two-dimensional fixed effects, so we demean at the firm level. The results remain robust to demeaning at the country-year level.

Panel B: Dynamic treatment effect

The dependent variable is investment- Q sensitivity (i.e., the second stage). Column (1) studies the effect of enforcement prior to the enforcement year, while Column (2) examines both the pre and the post enforcement periods. Only the coefficients on the ITE indicators are reported for parsimony; all other variables are as defined in Appendix A. Robust standard errors, clustered by country, are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) two-tailed level, respectively. The sample period is 1981-2010.

Dependent variables	Dynamic treatment effect	
	(1) $\hat{\beta}_{c,t}^Q$	(2) $\hat{\beta}_{c,t}^Q$
<i>ENF</i>	-0.909 [0.402]**	-0.957 [0.469]**
<i>POST</i>	-0.628 [0.236]**	-0.618 [0.241]**
<i>ENF*BEFORE2</i>	0.085 [0.366]	0.173 [0.374]
<i>ENF*BEFORE1</i>	0.286 [0.363]	0.381 [0.452]
<i>ENF*POST</i>	0.997 [0.468]**	
<i>ENF*AFTER0</i>		0.249 [0.418]
<i>ENF*AFTER1</i>		1.115 [0.578]*
<i>ENF*AFTER2</i>		1.584 [0.662]**
<i>ENF*AFTER3+</i>		1.007 [0.562]*
Adj. R^2	0.09	0.09
Obs.	533	533
Country controls	Yes	Yes
Firm-controls in first stage	No	No
FE	Year	Year