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Insider Trading Restrictions and Corporate Risk-Taking

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Insider trading restrictions and corporate risk-taking☆

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ABSTRACT

This paper examines the effect of insider trading restrictions on corporate risk-taking. Using a cross-country sample of 38 countries over the 1990 to 2003 period, we find that corporate risk-taking is positively related to insider trading restrictions. This finding is robust to alternative regression specifications and sample periods, to the use of alternative measures of insider trading restrictions and risk-taking incentives, and to controls for possible endogeneity. Further investigation suggests that the relation between insider trading restrictions and corporate risk-taking is influenced by cross-sectional differences in stock market development and legal origin, and that the increase in risk-taking is beneficial to firms. In conclusion, this paper highlights the role of insider trading restrictions as an important determinant of corporate risk-taking.

1. Introduction

Recent studies in the accounting and finance literature examine the real and economic effects of insider trading restrictions among firms around the world. Some of the benefits obtained by firms in countries that have enforced insider trading laws include a lower cost of raising external equity capital (Bhattacharya and Daouk, 2002); increases in analyst following (Bushman et al., 2005); less concentrated equity ownership and increases in market liquidity (Beny, 2007); higher firm value (Beny, 2008); increases in the information

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contained in stock prices (Fernandes and Ferreira, 2009); more efficient investment decisions and subsequent improvements in accounting performance (Chen et al., 2013); and increases in timely-loss recognition (Jayaraman, 2012). Moreover, firms in countries with more restrictive insider trading regulations tend to have a lower stock market volatility (Du and Wei, 2004), higher executive compensation and a better equity-based component of the compensation package (Denis and Xu, 2013).

There are also a growing number of studies that explore the role of corporate governance in corporate risk-taking activities (John et al., 2008; Bargeron et al., 2010; Acharya et al., 2011; Boubakri et al, 2013). Specifically, these studies examine the effects of shareholder rights, accounting disclosure rules, law and order indices, regulation change (in the form of the Sarbanes–Oxley Act), creditor rights, and political institutions on corporate risk-taking. However, there is still no empirical study that examines the effect of insider trading restrictions on managerial risk-taking incentives.

A change in insider trading restrictions is described as an exogenous "shock to enforcement" (Jayaraman, 2012, pp. 77) and to the overall level of corporate governance in a particular country. The literature yields mixed findings on the relationship between corporate governance and corporate risk-taking, and thus examining whether insider trading restrictions influence corporate risk-taking is an interesting empirical exercise.[1] This is the main research question that this study seeks to address. We use financial data for non-financial firms across 38 countries for the sample period from 1990 to 2003 and follow existing studies (Du and Wei, 2004; Denis and Xu, 2013) in using the cross-country survey data from the Global Competitiveness Report on the prevalence of insider trading as the measure of insider trading restrictions. Our measure of corporate risk-taking incentives is the volatility of earnings, which is calculated as the country and industry-adjusted standard deviation of the return on assets over 5-year overlapping periods.

The main empirical evidence reveals that firms in countries with more restrictive insider trading regulations exhibit higher earnings volatility than their counterparts in countries with less restrictive regulations. In terms of economic magnitude, a one standard deviation increase in the value of the insider trading restriction index leads to an increase in the value of earnings volatility by about 6.6% relative to the mean value of earnings volatility for the entire sample. This finding corroborates the broader results that studies such as John et al. (2008) and Boubakri et al. (2013) document that more effective corporate governance (in the form of stronger insider trading restrictions) encourages managers to engage in projects that involve more risk-taking and could potentially add to shareholder value. Additional results suggest that our finding is relatively robust to changes in empirical specifications and sample periods.

We further employ two alternative proxies for insider trading restrictions: the insider trading law index (Beny, 2004) and the strictness of the insider trading law index (Durnev and Nain, 2007) and find that the positive relation between insider trading restrictions and corporate risk-taking continues to hold for both alternative measures. Moreover, we also use two alternative measures of managerial risk-taking incentives, namely, the difference between the maximum and minimum return on assets over a 5-year interval and the ratio of research and development expenditure to total assets. The results from these robustness tests do not alter the conclusion that insider trading restrictions are positively associated with both measures of corporate risk-taking.

We also address the issue that our main results could be affected by endogeneity by implementing two separate tests: exploiting an exogenous change in the insider trading restriction index and estimating a two-stage least squares (2SLS) regression model. Both approaches produce robust and consistent results and reinforce the notion that corporate risk-taking incentives are positively related to insider trading restrictions.

Finally, the results of extant studies suggest that the main finding of a positive relationship between insider trading restrictions and managerial risk-taking incentives is not uniform across countries. As a result, we further investigate whether the main result is influenced by cross-sectional differences in stock market development and legal tradition. Our results show that the positive relationship between insider trading restrictions and corporate risk-taking only exists for firms in countries with a high level of stock market development and common law countries, that is, countries with a strong institutional infrastructure. Interestingly, we document the opposite finding for firms in countries with a weak institutional infrastructure, with insider trading restrictions being negatively associated with corporate risk-taking for firms in these countries. These

results bear resemblance to those of Fernandes and Ferreira (2009) and highlight the asymmetric relationship between insider trading restrictions and corporate risk-taking.

In general, the findings of this study contribute to the existing literature by shedding further light on the relationship between corporate governance and corporate risk-taking. In particular, this study provides the first empirical evidence on whether insider trading restrictions influence managerial risk-taking incentives. This research question is relevant not only to academics but also to regulators and corporate managers. A better understanding of the issue will allow regulators to evaluate whether reforms in the rules and regulations (such as insider trading laws) are needed to promote investments and growth. We offer some preliminary evidence that the increase in risk-taking is beneficial due to the more efficient capital allocation decisions that are subsequently made by firms in countries with stricter insider trading laws.

The remainder of this paper is organized as follows. Section 2 provides a brief literature review and develops the main hypotheses. Section 3 describes the sample and the measures of insider trading restrictions and corporate risk-taking. Section 4 analyzes the relationship between insider trading restrictions and corporate risk-taking. Finally, Section 5 concludes the paper.

2. Literature review and hypothesis development

Recent studies focus on the role of corporate governance in influencing managerial risk-taking incentives. Theoretical models argue for both a positive and a negative relationship between corporate governance and managerial risk-taking incentives. The improvement of corporate governance leads to an increase in managerial risk-taking incentives for several reasons. When the level of investor protection is poor, insiders have less motivation to invest in risky projects to safeguard their private benefits, even though the projects maybe value enhancing. This problem becomes more severe if the dominant owners exert their control through a pyramidal ownership structure, dual-class shares, or cross-shareholdings (Morck et al., 2000; Morck et al., 2005; Stulz, 2005). As corporate governance improves, the incentives for insiders to expropriate corporate resources for their private benefits lessen (Shleifer and Wolfenzon, 2003). Thus, insiders become more motivated to take on a more aggressive investment policy and invest in riskier projects.

John et al. (2008) employ an international sample and report findings that are consistent with the prediction that as country-level investor protection improves, managers have more incentive to take on investment projects that are riskier but ultimately value increasing. A related study by Boubakri et al. (2013) also reveals a positive relationship between political institutions and corporate risk-taking.

Several studies identify insider trading as an inefficient private benefit of control that has the potential to aggravate the agency conflicts between insiders and shareholders (Easterbrook, 1985; Beny, 2007). For example, allowing for insider trading only motivates managers to make project selections that increase their trading profits, even if these projects are ultimately inefficient and value reducing (Bebchuk and Fershtman, 1990; Maug, 2002). Furthermore, insider trading discourages outside investors from obtaining private information, and thus has the effect of dampening information-based trading (Fishman and Hagerty, 1992). According to these arguments, more restrictive insider trading regulations in a country should result in a positive shock to that country's legal enforcement and the overall effectiveness of corporate governance (Jayaraman, 2012), which in turn fosters investment in innovative initiatives that stimulates economic growth.

The compensation package received by top executives can also affect their risk-taking incentives. A recent study by Denis and Xu (2013) finds that more stringent insider trading regulations lead to an increase in the use of equity-based incentives. Several studies (such as Low, 2009; Gormley et al., 2013) provide strong evidence that equity-based compensation is used to alleviate the agency costs associated with managerial risk-aversion and to encourage managers to take on greater risks. Linking these results together also leads to the prediction that insider trading restrictions are ***positively related*** to corporate risk-taking. Thus, the first part of the first hypothesis (*risk-increasing hypothesis*) is stated as follows.

H1a. *There is a positive association between insider trading restrictions and corporate risk-taking.*

Tunneling activities are prevalent among firms organized in a pyramidal ownership structure, especially those located in countries with weak investor protection (Johnson et al., 2000; Friedman et al., 2003). Such activities entail higher risks. Stronger legal protection helps to prevent dominant insiders from engaging in

tunneling activities, which implies that managerial risk-taking incentives are also restricted. Bargeron et al. (2010) and Acharya et al. (2011) document results that are consistent with the prediction of a negative relationship between corporate governance and managerial risk-taking incentives. Specifically, Bargeron et al. (2010) document that the implementation of the Sarbanes–Oxley (SOX) Act in 2002 has curtailed managers' incentives to undertake risky investment projects. Acharya et al. (2011) also document that firms in countries with stronger creditor rights have a lower leverage and cash flow risk, and that managers have more incentives to increase investments in risk-reducing ventures, such as diversifying acquisitions and increasing the acquisition of assets with higher recovery rates.

A seminal study by Manne (1966) argues against the prohibition of insider trading, as the ability to buy and sell insider shares has the positive effect of encouraging insiders to undertake innovative projects that will hopefully increase firm value in the future, thereby enhancing their value in the managerial labor market. Bebchuk and Fershtman (1994) specifically develop a model that explores whether insider trading affects insiders' ex-ante project selection decisions. In particular, they predict that insider trading increases the incentives of insiders to select investment projects that involve higher risks, as it enhances their returns (profits) if they can obtain information about the results of investment projects much earlier than the market. In other words, insider trading provides an "option" for insiders, and the value of this option increases with the cash flow risk associated with the investment project. However, if insider trading is restricted, it is expected to ***decrease*** the incentives of managers to take on risky projects. Thus, the second part of the first hypothesis (*risk-reducing hypothesis*) is stated as follows:

H1b. *There is a negative association between insider trading restrictions and corporate risk-taking.*

The findings from studies that examine the effects of insider trading restrictions on firms' analyst followings (Bushman et al., 2005) and the information contained in stock prices (Fernandes and Ferreira, 2009) contend that the main findings are affected by cross-sectional differences in institutional infrastructure. Specifically, the positive relationship between insider trading restrictions and analyst following (stock price informativeness) is more pronounced for firms in emerging markets (developed countries). In this respect, we conjecture that the effect of insider trading restrictions on corporate risk-taking ***is not uniform*** across all countries. This leads to our second hypothesis:

H2. *The relationship between insider trading restrictions and corporate risk-taking is different for firms in countries with weak institutions than for their counterparts in countries with strong institutions.*

3. Data and variable construction

This section describes the sample data and the construction of the country-level measures of insider trading restrictions; other country-level variables that are used as proxies for investor protection, accounting standards, economic development, law and order, and culture; and firm-level variables that are used as control variables in the regression tests. The detailed descriptions of the main variables are provided in Appendix A. Table 1 shows the sample distribution by country and the summary statistics for the insider trading restriction variables.

3.1. Insider trading restriction variables

The main independent variable of interest in this study is the insider trading restriction (*ITR*) index. For each country in the sample, we follow Denis and Xu (2013) and construct the index from the Global Competitiveness Report for 1996, 1998, and 1999.[2] Essentially, the report contains survey responses from executives around the world to the following question:

Insider trading is not common in the domestic market (1 = strongly disagree, 7 = strongly agree).

We define the insider trading restriction index in a particular country as the mean score of all executives in that country for the survey question. As the index values are only available for three years (1996, 1998, and

[2] This index is also used in two related studies (Du and Wei, 2004; and Beny, 2008).

Table 1
Sample distribution by country.

Country	*N*	*ITR*			*ITL*	*IT_ENF*	*ITS*
		1999	1998	1996			
Argentina	62	3.88	4.05	3.21	2	1995	2
Australia	2627	5.59	5.27	5.04	3	1996	3
Austria	222	4.83	4.80	4.50	2	.	0
Belgium	681	5.41	5.00	4.36	3	1994	3
Canada	787	5.55	5.03	4.45	3	1976	3
Chile	756	4.16	4.56	4.56	.	1996	.
Colombia	13	3.42	3.97	3.36	.	.	.
Denmark	814	6.00	5.79	5.27	3	1996	3
Finland	889	5.53	5.26	4.58	3	1993	3
France	4033	5.17	4.69	3.87	3	1975	3
Germany	3895	5.24	5.80	4.35	3	1995	3
Greece	40	3.41	3.50	3.46	2	1996	2
Hong Kong	3017	3.94	4.32	4.17	2	1994	2
India	494	3.53	3.42	2.49	2	1998	0
Indonesia	1061	3.56	3.33	2.82	2	1996	2
Ireland	568	5.19	5.58	4.40	3	.	0
Israel	214	4.39	4.08	3.48	2	1989	2
Italy	1015	4.38	3.88	2.92	3	1996	3
Japan	10,717	5.26	5.05	4.85	2	1990	2
Korea (South)	1902	4.10	3.73	3.81	3	1988	3
Malaysia	3345	3.42	3.65	3.69	2	1996	2
Mexico	38	3.54	3.49	3.14	1	.	0
Netherlands	1209	5.20	4.62	4.63	3	1994	3
New Zealand	422	5.40	5.52	5.30	2	.	0
Norway	853	4.24	4.67	4.08	1	1990	1
Peru	25	3.99	3.79	3.61	1	1994	1
Philippines	298	3.48	3.32	2.79	3	.	0
Portugal	271	4.37	4.52	3.71	3	.	0
Singapore	2048	5.58	5.54	5.10	3	1978	3
South Africa	1490	3.74	3.87	3.76	2	.	0
Spain	933	4.68	4.42	3.64	2	1998	0
Sweden	1317	5.58	5.48	4.35	2	1990	2
Switzerland	1216	4.67	5.30	4.80	3	1995	3
Taiwan	1161	3.18	3.42	3.10	3	1989	3
Thailand	1069	3.29	3.25	4.24	3	1993	3
Turkey	503	3.58	4.26	3.00	.	1996	.
United Kingdom	12,278	5.85	5.64	4.47	3	1981	3
United States	34,221	5.64	5.13	4.63	3	1961	3
Total	96,504						
Mean	2540	4.53	4.50	4.00	2.46		1.89
Std dev	5871	0.88	0.81	0.75	0.66		1.25

This table presents the distribution of the sample by country and the summary statistics for the measures of the insider trading restrictions. *N* is the number of firm–year observations. The definitions of the variables are described in Appendix A. The sample period covers from 1990 to 2003.

1999) and the sample covers the 1990 to 2003 period, we assign the values of the index in 1996 as the corresponding index values for 1990 to 1995 and for 1997. Likewise, the values of the index in 1999 are used as the corresponding values for 2000 to 2003. Countries with higher *ITR* index values are considered to have more restrictive insider trading regulations.

As shown in Table 1, the mean value of *ITR* increases from 4.00 (with a standard deviation of 0.75) in 1996 to 4.53 (with a standard deviation of 0.88) in 1999. This suggests that, on average, there is an increase in insider trading regulations over the sample period.[3] The cross-sectional variation of the *ITR* index across the countries is quite wide, with a minimum value of 2.49 (India in 1996) and a maximum value of 6.00 (Denmark in 1999).

[3] Nonetheless, there are six countries with a decrease in *ITR* index values, for example, Hong Kong (from 4.17 in 1996 to 3.94 in 1999) and Thailand (from 4.24 in 1996 to 3.29 in 1999).

We employ two other measures of insider trading restrictions in the robustness tests. *ITL* is the insider trading law index from Beny (2004). It is constructed as the sum of three indicator variables, *Tipee*, *Tipping*, and *Criminal*, which constitute the main elements of insider trading law.[4] *ITL* is only available for 35 out of the 38 countries in our sample, and has a mean value of 2.46 (with a standard deviation of 0.66). Three countries have the minimum *ITL* value (1) and 19 have the maximum value (3).

We also obtain dates for the initial enforcement (*IT_ENF*) of insider trading laws from Bhattacharya and Daouk (2002). As observed from Table 1, insider trading laws are only enforced in 30 out of the 38 countries. Eight countries (Austria, Colombia, Ireland, Mexico, New Zealand, Philippines, Portugal, and South Africa) have never enforced insider trading laws. From these enforcement dates, we further construct two dummy variables: *ENF1* which equals 1 if insider trading laws were enforced for the first time in a particular country by the end of 1996, and 0 otherwise; and *ENF2* which equals 1 for years after and including the first-year of enforcement of insider trading laws in a particular country, and 0 otherwise. Following Durnev and Nain (2007), the strictness of insider trading law index (*ITS*) is calculated as the product of *ITL* and *ENF1*. The mean value of *ITS* is 1.89, with a standard deviation of 1.25. Nine countries have the lowest *ITS* value (0) and 16 countries have the highest value (3).

Denis and Xu (2013) argue that "Because *ITR* has the potential to capture the joint impact of insider trading laws, their enforcements, and other factors such as culture and information environment, it is arguably ***a more complete measure of insider trading restrictions*** than *ITL*." (pp. 96). Nevertheless, one limitation of the *ITR* variable is that it is based on survey data which is subject to more biases. In particular, the respondents to the survey increased from about 2800 executives of firms in 58 countries for the year 1996, to about 4000 executives in 59 countries for the year 1999. Therefore, we acknowledge that the changes in the value of *ITR* may simply reflect the differences in the sample of respondents, and not changes in the insider trading restrictions. We use an instrumental variable approach in one of the robustness test to mitigate this issue.

3.2. Sample

We merge the insider trading restriction variables with firm-specific financial data on international firms from Worldscope (provided by Thomson Reuters). Specifically, for each firm (i) and for each year (t) over the sample period from 1990 to 2003, we obtain data on the book value of total assets; the book value of equity; the market value of equity; research and development expenditure; earnings before interest, taxes, depreciation, and amortization; total sales; and total debt, which includes both short-term debt and long-term debt. We then convert the financial data on the international firms to US$ using the average exchange rate for the respective year. We restrict the data to the year 2003 to be consistent with prior studies, such as Fernandes and Ferreira (2009) and Jayaraman (2012), and because of the global financial crisis that occurred in year 2008.

We further require our sample to have non-missing firm–year observations for the proxies for corporate risk-taking, which are elaborated in more detail in the next sub-section. Consistent with previous studies, we exclude financial firms (SIC 6000 to 6999) and utility firms (SIC 4400 to 5500), firms with a negative book value of equity, and small firms (those with a book value of total assets of less than US$10 million). After these screening procedures, our final sample consists of 96,504 firm–year observations for firms in 38 countries. The United States, United Kingdom, and Japan are the three countries that constitute the largest number of firm–year observations, in contrast to Colombia, Greece, Mexico, and Peru, which each has less than 50 firm–year observations.

3.3. Corporate risk-taking variables

Consistent with recent studies (Faccio et al., 2011; Boubakri et al., 2013), our main measure of corporate risk-taking is earnings volatility (*RISK*), which is calculated as the country and industry-adjusted standard deviation of each firm's return on assets (*ROA*, defined as the ratio of earnings before interest and taxes to total assets) over 5-year overlapping periods. We further require each firm to have at least 5 years of observations for *ROA* to be included in the sample. Moreover, we control for the effect of each country and each industry's

[4] The detailed definitions of these variables are available in Beny (2004).

economic cycle. In other words, for each year t, we first compute the average value of *ROA* across all firms in a particular industry i ($ROA_{i,t}$) as well as the average value of *ROA* across all firms in a particular country c ($ROA_{c,t}$). Then, we calculate the value of the country and industry-adjusted *ROA* of firm a (belonging to industry i in country c) in year t as $ROA_{a,t} - ROA_{c,t} - ROA_{i,t}$.

As an illustration, the value of *RISK* for firm A in 1990 (the first year in the sample period) is calculated as the country and industry-adjusted standard deviation of the *ROA*s for firm A over the 5-year period from 1990 to 1994. The next value of *RISK* (in year 1991) is calculated for the interval 1991 to 1995, and so on. Eventually, the final value of *RISK* (in year 2003) is calculated for the interval 2003 to 2007.

Following Faccio et al. (2011) and Boubakri et al. (2013), we employ 2 other proxies for managerial risk-taking incentives: (i) *RISK2* and (ii) *RISK3*. The first alternative proxy (*RISK2*) is calculated by computing the difference between the maximum and minimum *ROA*s over a 5-year interval. The second alternative proxy is calculated as the ratio of research and development expenditure to total assets.

3.4. Control variables

We use 6 country-level variables as control variables in the regression analysis: *LAWORDER*, *GDPG*, *ANTISELF*, *ACTSTD*, *UA*, and *INDIV*. *LAWORDER* is the law and order index obtained from the International Country Risk Guide (ICRG, 2008), where higher index values represent countries with more effective law and order systems. *GDPG* is the *GDP* growth rate, calculated as the annual percentage change in the gross domestic product, measured in 2005 constant US$, and obtained from the World Bank database. *ANTISELF* is the anti-self-dealing index from Djankov et al. (2008), which has been widely used as a proxy for country-level investor protection. Higher values of the index indicate more effective investor protection. *ACTSTD* is the accounting standard index from La Porta et al. (1998). Higher values of the index suggest more effective accounting disclosure rules. *UA* and *INDIV* are the uncertainty avoidance and individualism index from Hofstede (2001). Higher values on *UA* represent greater tendencies to follow rule and conform to social norm, while higher values on *INDIV* symbolize greater importance of autonomy and egocentric behavior.

Other firm-level control variables include insider ownership (*CLOSE*, defined as the percentage of shares closely held by insiders of the company, obtained from Worldscope); return on assets (*ROA*), leverage (*LEV*, defined as the ratio of total debt to total assets); sales growth (*SALESG*, defined as the average percentage change in total sales over the sample period); and firm size (*SIZE*, defined as the natural logarithm of total assets in millions of US$).

3.5. Summary statistics and correlations analysis

The summary statistics of the main firm-level variables are displayed in Table 2. We report the mean, median, standard deviation, and the 25th and 75th percentile values for each variable. All the firm-level control variables are winsorized at the 1st and 99th percentile levels to mitigate the problem of outliers in the data. The main risk-taking variable, *RISK*, has a mean (median) of 0.065 (0.046), with a standard deviation of 0.062. The other risk-taking variables (*RISK2* and *RISK3*) also display wide cross-sectional variation. The

Table 2
Summary statistics of the main firm-level variables.

Variable	*N*	Mean	Median	Std dev	25%	75%
RISK	96,504	0.065	0.046	0.062	0.027	0.080
RISK2	96,504	0.156	0.110	0.145	0.064	0.191
RISK3	96,504	0.021	0.000	0.055	0.000	0.012
CLOSE	96,504	0.383	0.368	0.252	0.172	0.574
ROA	96,504	0.060	0.073	0.154	0.029	0.120
LEV	96,504	0.236	0.221	0.180	0.082	0.358
SALESG	96,504	0.161	0.068	0.567	−0.023	0.196
SIZE	96,504	5.806	5.637	1.819	4.435	6.990

This table presents the summary statistics of the main firm-level variables. *N* is the number of firm–year observations. The definitions of the variables are described in Appendix A. The sample period covers from 1990 to 2003.

Table 3
Correlations analysis.

Variable	*RISK*	*RISK2*	*RISK3*	*ITR*	*ITL*	*ITS*	*CLOSE*	*ROA*	*LEV*	*SALESG*
RISK2	0.984									
RISK3	0.273	0.272								
ITR	0.123	0.113	0.148							
ITL	0.126	0.120	0.121	0.283						
ITS	0.103	0.100	0.122	0.323	0.757					
CLOSE	−0.059	−0.058	−0.168	−0.208	−0.226	−0.221				
ROA	−0.342	−0.331	−0.198	−0.110	0.009	−0.027	0.024			
LEV	−0.083	−0.082	−0.211	−0.032	−0.073	−0.031	−0.018	−0.079		
SALESG	0.103	0.106	0.137	−0.007	0.043	0.023	0.000	0.000	−0.034	
SIZE	−0.265	−0.263	−0.105	0.075	−0.112	−0.070	−0.220	0.102	0.264	−0.057

This table presents Pearson's correlations of the insider trading restriction variables, corporate risk-taking variables, and other firm-level control variables.

mean (median) of *RISK2* is 0.156 (0.110) and the standard deviation is 0.145. The mean (median) of *RISK3* is relatively smaller at 0.021 (0) and the standard deviation is 0.055.

In terms of the other control variables, insiders hold an average of about 38% (median = 37%) of the shares of the firms, with a standard deviation of 0.25. The earnings of the firms in our international sample are in general positive, as the mean (median) *ROA* is 0.060 (0.073) and the standard deviation is 0.154. The average firm has a leverage of 0.236 (with a standard deviation of 0.180), a sales growth rate of 0.161 (with a standard deviation of 0.567), and a size of 5.81 (with a standard deviation of 1.82).

Table 3 presents Pearson's correlations among the insider trading restriction variables, corporate risk-taking variables, and other firm-specific control variables. All the correlations (except for that between *CLOSE* and *SALESG*) are statistically significant at the 1% level. As expected, all three measures of insider trading restrictions (and corporate risk-taking) are positively and strongly correlated with each another. More importantly, the correlation between *ITR* and *RISK* is positive and statistically significant, which provides preliminary evidence that corporate risk-taking increases with insider trading restrictions.[5]

4. Empirical analysis

4.1. Insider trading restrictions and corporate risk-taking

The first empirical task is to conduct a multivariate regression analysis by examining how insider trading restrictions influence corporate risk-taking. Specifically, we estimate the following baseline regression specification:

$$RISK_{i,t} = a_o + a_1 ITR_{i,t} + a_2 ROA_{i,t} + a_3 LEV_{i,t} + a_4 SALESG_{i,t} + a_5 SIZE_{i,t} + \sum Ctry_i + \sum Ind_i + \sum Yr_t + \varepsilon_{i,t}, \quad (1)$$

where for each firm *i* at time *t*, *RISK* is the primary risk-taking variable of interest (country and industry-adjusted earnings volatility); *ITR* is the country-level insider trading restrictions; *ROA* is the earnings; *LEV* is the leverage; *SALESG* is the average sales growth rate; and *SIZE* is the firm size.

The primary coefficient of interest is the coefficient a_1, which measures the sensitivity of earnings volatility to insider trading restrictions. As theory predicts that the coefficient can be either positive or negative, we do not make any directional prediction about the sign of coefficient a_1. The baseline regression is estimated using an ordinary least-squares (*OLS*) model, which also includes country (*Ctry*), industry (*Ind*), and year (*Yr*) fixed effects. The purpose of using country fixed effects is to control for other country-specific and time-invariant

[5] We also split the sample based on the sample mean value of *ITR* (4.79) and partition the sample into low (below mean) and high (above mean) *ITR* groups. The corresponding values of *RISK* for the low and high sub-samples are 0.062 and 0.070 and the difference (0.008) is statistically significant at the 1% level. The univariate analysis offers further preliminary evidence of the positive relationship between *ITR* and *RISK*.

variables that previous studies have documented as influencing risk-taking incentives (see John et al., 2008).[6] The industry classification follows Fama and French (1997). Following Faccio et al. (2011) and Boubakri et al. (2013), unless otherwise stated, the standard errors of the coefficients in the regression specifications are clustered by firm, to alleviate problems of heteroskedasticity and within-firm serial correlation.

Model (1) in Table 4 presents the results of the estimation of the baseline model (Eq. (1)). The results show that insider trading restrictions are positively associated with corporate risk-taking, as the coefficient a_1 is positive (magnitude = 0.006) and statistically significant (t-statistic = 5.34), at least at the 1% level. This empirical finding supports the ***risk-increasing*** hypothesis (H1a), which suggests that managers of firms in countries in which insider trading is more restricted display greater incentives to engage in risk-taking activities compared with their peers in countries with weaker insider trading restrictions.

We find that the results are not only statistically significant, but are also quite substantial in terms of economic significance. The average value of *RISK* for our sample is 0.065 (see Table 2). Using the coefficient estimate of *ITR* in Model (1) and assuming that the other variables remain constant, an increase in the value of *ITR* by one standard deviation (0.71) leads to an increase in *RISK* of 0.004, or about 6.6% relative to the mean value of *RISK* for the entire sample (0.065, see Table 2).[7]

As the presence of large and concentrated shareholders may affect managerial risk-taking incentives, we include an additional explanatory variable (*CLOSE*) and estimate the following modified baseline regression specification:

$$RISK_{i,t} = a_o + a_1 ITR_{i,t} + a_2 CLOSE_{i,t} + a_4 ROA_{i,t} + a_5 LEV_{i,t} + a_6 SALESG_{i,t} + a_7 SIZE_{i,t} + \sum Ctry_i + \sum Ind_i + \sum Yr_t + \varepsilon_{i,t}, \quad (2)$$

where for each firm i at time t, *CLOSE* is the percentage of closely held shares, and the other variables are as defined earlier. The results of the estimation of Eq. (2) using OLS with country, industry, and year fixed effects are presented in Model (2) of Table 4. The coefficient of *CLOSE* is negatively and significantly associated with *RISK*, indicating that the presence of concentrated shareholders impedes corporate risk-taking initiatives (Stulz, 2005). More importantly, despite the inclusion of *CLOSE*, we continue to find that the coefficient of *ITR* is positive and statistically significant, with a magnitude and significance level similar to those found in Model (1).

Thus far, the empirical results are supportive of the notion that stronger insider trading restrictions have a positive impact on managerial risk-taking incentives, after controlling for other time-invariant country-specific variables that may also be correlated with the dependent variable (proxies for corporate risk-taking) using specifications that include country fixed effects.[8]

To mitigate the concern that the main variable of interest (insider trading restrictions) captures the effect of other country-specific variables, we follow Boubakri et al. (2013) and include two additional country-level explanatory variables (*GDPG* and *LAWORDER*) and estimate the following modified regression specification:

$$RISK_{i,t} = a_o + a_1 ITR_{i,t} + a_2 CLOSE_{i,t} + a_3 ROA_{i,t} + a_4 LEV_{i,t} + a_5 SALESG_{i,t} + a_6 SIZE_{i,t} + a_7 GDPG_{i,t} + a_8 LAWORDER_{i,t} + \sum Ind_i + \sum Yr_t + \varepsilon_{i,t}, \quad (3)$$

where *GDPG* is the annual growth in the real Gross Domestic Product (GDP) in 2005 constant US$ from the World Bank Development Indicator and *LAWORDER* is the law and order index, obtained from the International Country Risk Guide (ICRG, 2008). Both variables are included to control for the level of economic development and for the efficacy of rules and regulations across the countries included in the sample.

The results of the estimation of Eq. (3) using the OLS model with industry and year fixed effects are presented in Model (3) of Table 4.[9] We find that the main finding of a positive relation between insider trading

[6] The country fixed-effects completely absorb those variables, and any such variables are automatically dropped by the model. Nevertheless, we also include these country-level variables in the regression model jointly in a subsequent robustness test, and obtain similar results.

[7] The increase in *RISK* is computed as $0.71 \times 0.006 = \mathbf{0.004} = \mathbf{6.6\%} \times 0.065$.

[8] We also estimate Eq. (2) using several alternative specifications, such as the weighted least-squares (WLS) regression (with the weight attached to each firm-year set to be equal to the inverse of the total number of firm-year observations in the country to which the firm belongs) and an OLS regression with standard errors that are clustered at the country-level. The results (unreported) confirm that insider trading restrictions are positively associated with corporate risk-taking.

[9] We exclude country fixed-effects in the estimation of Eq. (3) due to the inclusion of the time-invariant country-level variable *LAWORDER*.

Table 4
Insider trading restrictions and corporate risk taking.

	(1)	(2)	(3)
ITR	0.006***	0.006***	0.005***
	(5.34)	(5.34)	(5.02)
CLOSE		−0.007***	−0.007***
		(−5.00)	(−4.99)
GDPG			0.021**
			(2.53)
LAWORDER			0.004
			(1.11)
ROA	−0.118***	−0.117***	−0.117***
	(−32.46)	(−32.37)	(−32.37)
LEV	−0.001	−0.001	−0.001
	(−0.45)	(−0.36)	(−0.31)
SALESG	0.006***	0.006***	0.006***
	(10.86)	(10.93)	(10.89)
SIZE	−0.006***	−0.006***	−0.006***
	(−31.22)	(−31.54)	(−31.55)
Country FE	Yes	Yes	No
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Adjusted R-squared	0.299	0.299	0.299
Number of observations	96,504	96,504	96,504

This table presents the ordinary least squares (*OLS*) regression results of earnings volatility (*RISK*) on insider trading restrictions (*ITR*) and other control variables. The definitions of the variables are described in Appendix A. The *t*-statistic for each coefficient is reported in the parenthesis and is based on White's heteroskedasticity corrected standard errors, clustered by firm.

* Denotes statistical significance at the 0.10 level.
** Denotes statistical significance at the 0.05 level.
*** Denotes statistical significance at the 0.01 level.

restrictions and corporate risk-taking remains unaltered, despite the inclusion of the two additional country-level variables. The signs of the coefficients of both *GDPG* and *LAWORDER* are positive, but only *GDPG* is statistically significant at the 5% level. This suggests that economic development also fosters risk-taking activities, which are supportive of the finding in John et al. (2008).

For the other firm-level control variables, we find that *ROA* and *SIZE* are negatively associated with *RISK*, and that *SALESG* is positively associated with *RISK* in all three specifications. However, *LEV* is not related with *RISK*. These findings (with the exception of that for *LEV*) are consistent with other recent studies that examine the cross-country variations in corporate risk-taking (Faccio et al., 2011; Boubakri et al, 2013). In general, the empirical findings in Table 4 provide evidence that stronger insider trading restrictions encourage corporate risk-taking.

4.2. Alternative measures of corporate risk-taking and controlling for country-level institutions

In this sub-section, we perform several sensitivity analyses. We employ alternative measures of corporate risk-taking as the dependent variable in the regression, estimate a cross-sectional rather than panel regression, exclude observations from the three largest countries, and control for various country-specific variables that other findings show affect corporate risk-taking.

First, we follow Faccio et al. (2011) and Boubakri et al. (2013) in replacing *RISK* with two alternative firm-level measures of risk-taking: *RISK2* and *RISK3*. The definitions of these alternative proxies are described in the earlier section. We replace the dependent variable in Eq. (3) with the two alternative proxies and present the results of the regression estimates in Models (1) and (2) of Table 5. The findings reveal that the coefficient of *ITR* remains positive and significant at least at the 1% level in both specifications. This implies that higher values of *ITR* are associated with greater difference between the maximum and minimum values of *ROA* (computed over a 5-year interval) and higher investment in research and development, which confirms the main finding that corporate risk-taking activities are more prevalent among firms in countries with

Table 5
Alternative measures for risk-taking and controlling for country-level institutions.

Variable	(1)	(2)	(3)	(4)	(5)
	RISK2	*RISK3*	Cross-sectional regression	Excluding U.S., U.K., and Japan	Controlling for *ANTISELF*, *ACTDISC*, *UA*, & *INDIV*
ITR	0.012***	0.009***	0.008***	0.004***	0.002**
	(7.02)	(15.09)	(8.89)	(4.68)	(2.38)
CLOSE	−0.043***	−0.021***	−0.015***	−0.012***	−0.006***
	(−14.63)	(−16.39)	(−8.42)	(−6.44)	(−4.60)
GDPG	0.226***	−0.015**	0.345***	−0.006	0.083***
	(9.77)	(−2.50)	(10.38)	(−0.61)	(8.84)
LAWORDER	−0.007***	−0.004***	−0.002*	−0.003***	−0.000
	(−3.17)	(−5.86)	(−1.67)	(−2.86)	(−0.15)
ANTISELF					0.008***
					(3.87)
ACTDISC					−0.000***
					(−5.22)
UA					−0.031***
					(−15.89)
INDIV					0.018***
					(9.04)
ROA	−0.260***	−0.056***	−0.152***	−0.116***	−0.117***
	(−32.40)	(−13.48)	(−26.17)	(−23.68)	(−32.67)
LEV	−0.007	−0.042***	−0.004	0.004	−0.001
	(−1.53)	(−25.09)	(−1.63)	(1.39)	(−0.31)
SALESG	0.017***	0.010***	0.009***	0.004***	0.006***
	(13.88)	(14.29)	(5.89)	(6.98)	(11.57)
SIZE	−0.018***	−0.001***	−0.008***	−0.006***	−0.006***
	(−40.53)	(−2.70)	(−32.18)	(−22.26)	(−33.09)
Country FE	No	No	No	No	No
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	Yes	Yes
Adjusted	0.262	0.317	0.357	0.200	0.290
Number of Observations	96,504	96,504	14,099	39,288	95,418

This table presents the ordinary least squares (*OLS*) regression results of risk taking incentives on insider trading restrictions (*ITR*) and other control variables. Models (1) and (2) use *RISK2* and *RISK3* as alternative measures of risk-taking, respectively. Model (3) presents the results of cross-sectional regression. Model (4) excludes observations from the U.S., U.K., and Japan. Model (5) controls for additional country-level variables. The definitions of the variables are described in Appendix A. The *t*-statistic for each coefficient is reported in the parenthesis and is based on White's heteroskedasticity corrected standard errors, clustered by firm.

* Denotes statistical significance at the 0.10 level.
** Denotes statistical significance at the 0.05 level.
*** Denotes statistical significance at the 0.01 level.

more restrictive insider trading regulations than among their counterparts in countries with less restrictive regulations.

Rather than estimating a panel data regression, Model (3) of Table 5 displays the results for a cross-sectional regression using the aggregate value of the variables for each firm (computed as the mean value of the variables across the sample period), which results in 14,099 unique observations (firms). Similar to the other specifications, the cross-sectional regression is estimated with additional industry fixed effect. We find that the positive relation between *ITR* and *RISK* is stronger in the cross-sectional regression, with the coefficient of *ITR* (magnitude = 0.008) being statistically significant at the 1% level (*t*-statistic = 8.89).

Given that observations from the U.S., U.K., and Japan dominate the sample, we drop observations from these countries and re-estimate Eq. (3) for the smaller sub-sample. The results, as shown in Model (4) of Table 5, reveal that the main findings still remain unchanged, even for the smaller sub-sample of countries, with the coefficient of *ITR* (magnitude = 0.004) still being statistically significant at the 1% level (*t*-statistics = 4.68). Hence, the finding of a positive relation between insider trading restrictions and corporate risk-taking is not driven by firms in the three largest countries.

Finally, we further include four additional country-level explanatory variables that proxy for investor protection (*ANTISELF*), accounting disclosure (*ACTDISC*), and culture (*UA* and *INDIV*) and estimate Eq. (4):

$$RISK_{i,t} = a_o + a_1 ITR_{i,t} + a_2 CLOSE_{i,t} + a_3 ROA_{i,t} + a_4 LEV_{i,t} + a_5 SALESG_{i,t} + a_6 SIZE_{i,t} + a_7 GDPG_{i,t} + a_8 LAWORDER_i + a_9 ANTISELF_i + a_{10} ACTSTD_i a_{11} UA_i + a_{12} INDIV_i + \sum Ind_i + \sum Yr_t + \varepsilon_{i,t}, \quad (4)$$

where *ANTISELF* is the anti-self-dealing index from Djankov et al. (2008); *ACTSTD* is the accounting disclosure index from La Porta et al. (1998); and *UA* and *INDIV* are the uncertainty avoidance and individualism index, respectively, both obtained from Hofstede (2001). These additional country-level variables are included to control for the effect of country-level investor protection, accounting disclosure rules, and culture; which John et al. (2008) and Li et al. (2013) document as being important determinants of managerial risk-taking incentives. If the effect of insider trading restrictions is already captured in these country-level variables, then we should not expect the coefficient of *ITR* to be significant.

Once again, Eq. (4) is estimated using the OLS regression model with additional industry and year fixed effects. The results, as shown in Model (5) of Table 5, suggest that insider trading restrictions have ***a significant incremental effect*** on corporate risk-taking, independent of the effects of other country-level variables that are jointly included in the regression specification. Most of the country-level variables are associated with corporate risk-taking in the expected manner. Specifically, positive growth in real GDP and individualism encourage managers to engage in risk-taking activities, while strong accounting disclosures and uncertainty avoidance mitigate risk-taking incentives. These findings are consistent with that found by Boubakri et al. (2013) and Li et al. (2013).

4.3. Alternative measures of insider trading restrictions and samples

In this sub-section, we conduct further robustness checks by employing alternative measures of insider trading restrictions and estimating the regression using alternative samples. First, the results in Table 4 are based on the time-varying values of *ITR*. We use the average *ITR* value computed over 1996, 1998, and 1999 and re-estimate Eq. (3) with industry and year fixed effects exclusively for the 1996 to 1999 period. The results (unreported) reveal that the positive sign (magnitude = 0.003) and significance (t-statistic = 1.66) of the coefficient of *ITR* persist.[10]

The main insider trading restriction measure *ITR* is compiled from survey data, and could thus be subject to the behavioral biases of the survey respondents (Denis and Xu, 2013). To provide robustness tests on the measures of insider trading restrictions, we employ two alternative measures, *ITL* (the insider trading law index) and *ITS* (the strictness of insider trading law index); and re-estimate Eq. (3) by replacing *ITR* with the two alternative measures. Models (1) to (2) of Table 6 present the results based on *ITL* and *ITS*, respectively. We find that the results for *ITL* and *ITS* are consistent with that found using *ITR*, as both coefficients are positive (magnitudes = 0.010 and 0.004, respectively) and statistically significant at the 1% level (t-statistics = 13.62 and 8.98, respectively). The magnitude and significance of the other firm-level control variables (again, with the exception of *LEV*) are similar to those shown in Table 4.

The first enforcement of insider trading law can be viewed as an exogenous shock to insider trading restrictions. In fact, 22 out of the 38 countries in the sample enforced insider trading law for the first time during the sample period, including 3 countries (Japan, Norway, and Sweden) that did so in the first year of the sample (year 1990). We find that corporate risk-taking has ***increased*** after those countries (excluding the 3 countries mentioned above) enforce insider trading law for the first time. Specifically, *RISK* increases from 0.045 prior to enforcement to 0.065 after the enforcement. The difference is significant at the 1% level.

[10] We also re-estimate Eq. (3) for the sub-period covering the years after 1999 only and the results (unreported) still indicate a positive and significant relation between *ITR* and *RISK*.

Table 6
Alternative measures of insider trading restrictions, samples, and controlling for endogeneity.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ITL	*ITS*	*ENF2*	Financial crisis years	Non-financial crisis years	Change in *ITR*	2SLS
ITR				0.006***	0.005***		0.002**
				(5.71)	(5.42)		(2.20)
CH_ITR						0.005***	
						(4.28)	
ITL	0.010***						
	(13.62)						
INS		0.004***					
		(8.98)					
ENF2			0.003*				
			(1.80)				
CLOSE	−0.016***	−0.017***	−0.009***	−0.022***	−0.014***	−0.020***	−0.019***
	(−12.22)	(−13.37)	(−2.65)	(−13.86)	(−9.44)	(−8.57)	(−15.01)
GDPG	0.097***	0.117***	0.053***	0.132***	0.047***		
	(9.81)	(11.48)	(3.36)	(11.59)	(2.99)		
LAWORDER	0.001	0.002**	−0.008***	−0.005***	0.002*		
	(1.02)	(2.57)	(−6.62)	(−5.00)	(1.93)		
ROA	−0.117***	−0.116***	−0.124***	−0.140***	−0.098***	−0.156***	−0.115***
	(−32.79)	(−32.78)	(−10.66)	(−28.38)	(−24.64)	(−20.06)	(−32.90)
LEV	−0.004**	−0.004**	0.006	−0.007***	−0.002	−0.002	−0.004**
	(−1.97)	(−2.30)	(1.21)	(−3.04)	(−0.77)	(−0.70)	(−2.00)
SALESG	0.006***	0.007***	0.002	0.007***	0.005***	0.008***	0.007***
	(12.11)	(12.36)	(1.63)	(10.30)	(6.73)	(6.21)	(12.94)
SIZE	−0.007***	−0.007***	−0.007***	−0.008***	−0.007***	−0.008***	−0.008***
	(−36.99)	(−38.78)	(−12.27)	(−32.72)	(−35.13)	(−22.78)	(−40.38)
Country FE	No	No	No	No	No	No	No
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.274	0.271	0.168	0.285	0.260	0.319	0.268
Number of Observations	95,232	95,232	10,092	54,283	42,221	14,976	96,504

This table presents the regression results of earnings volatility (*RISK*) on insider trading restrictions (*ITR*) and other control variables. The definitions of the variables are described in Appendix A. Models (1) to (3) present the results using insider trading law (*ITL*), strictness of insider trading laws (*ITS*), and first time enforcement of insider trading laws (*ENF2*), respectively. Models (4) and (5) include observations using *ROA* during the financial crisis years and during non-financial crisis years, respectively. Model (6) considers only the period when there is a change in the insider trading restriction index, calculated as *CH_ITR*. Model (7) uses the corruption perception index from Transparency International (2003) as an instrument for the insider trading restriction. The *t*-statistic for each coefficient is reported in the parenthesis and is based on White's heteroskedasticity corrected standard errors, clustered by firm.

* Denotes statistical significance at the 0.10 level.
** Denotes statistical significance at the 0.05 level.
*** Denotes statistical significance at the 0.01 level.

We also replace *ITR* by *ENF2* and further re-estimate Eq. (3) around the years of enforcement (from $t-3$ to $t+3$). We obtain similar results, as the coefficient of *ENF2* is positive and statistically significant at the 10% level (*t*-statistics = 1.80), as presented in Model (3) of Table 6.

We further acknowledge that many important events occurred during the sample period, such as the 1997–1998 East Asian financial crisis and the 2000 dot com bubble. There could be confounding effects as *ROA* may change substantially due to these events, implying a higher value for the corporate risk-taking (*RISK*) variable. Thus, a positive relation between *ITR* and *RISK* may not be related to insider trading restrictions, but reflect the volatile nature of *ROA* during the crisis-periods. We attempt to control for these events by splitting the sample into two: the first sub-sample includes observations that use *ROA* during the crisis years (observations in the year 1993–2000) and the second sub-sample includes observations that use *ROA*s during the non-crisis years (1990–1992 and 2001–2003). We re-estimate Eq. (3) for both sub-samples and present the results in Models (4) and (5) of Table 6. The coefficient of *ITR* retains its positive sign in both specifications, which suggests that the main finding is relatively robust, even after removing observations that use *ROA* during the crisis years.

4.4. Controlling for endogeneity

In this sub-section, we explicitly control for the issue of endogeneity by implementing two tests. First, we exploit the time-series variation in insider trading restrictions and consider the effect of an exogenous change in the index on managerial risk-taking incentives. For this purpose, we compute the change in the index score in the two years in which the index experiences changes (in 1998 and 1999). We compute *CH_ITR* as the change in the insider trading index between 1998 and 1997 and between 1999 and 1998. We then replace *ITR* with *CH_ITR* and re-estimate Eq. (2) for the shorter sample (14,976 firm–year observations) using an OLS regression model with country, industry, and year fixed effects. The results, as presented in Model (6) of Table 6, reveal that changes in insider trading restrictions are positively associated with corporate risk-taking, as the coefficient of *CH_ITR* is positive and statistically significant at the 5% level.

Second, Du and Wei (2004) find a positive association between legal corruption and insider trading. We thus estimate a two-stage least-squares (2SLS) regression and use the corruption perception index (*CPI*) from Transparency International (2003) as an instrument for the insider trading restriction index in the first-stage regression. The index ranges from 0 to 10, with the lowest score of 1.9 for Indonesia and the highest score of 9.7 for Finland. Higher scores for the index indicate less corruption. The results of the first-stage regression (unreported) show that the corruption perception index is positively and strongly associated with the insider trading index (magnitude = 0.257, *t*-statistics = 16.14), suggesting that insider trading is more restricted in countries that are perceived to have less corruption. In the second-stage regression, we replace *ITR* with the predicted values from the first-stage regression and re-estimate Eq. (3) using the OLS regression model with industry, and year fixed effects. Model (7) of Table 6 shows that the main results are robust to controlling for endogeneity, as the predicted values of insider trading restrictions are still positively and significantly associated with corporate risk-taking.

Table 7
Cross-sectional differences in stock market development and legal origin.

Variable	(1)	(2)	(3)	(4)
	Low *TRADE*	High *TRADE*	Civil Law	Common Law
ITR	−0.009***	0.010***	−0.004***	0.005***
	(−6.06)	(11.55)	(−4.66)	(3.56)
CLOSE	−0.001	−0.018***	−0.004**	−0.014***
	(−0.54)	(−10.89)	(−2.09)	(−7.23)
GDPG	0.106***	−0.030***	0.035***	−0.036***
	(4.34)	(−2.78)	(2.63)	(−2.63)
LAWORDER	0.006***	−0.004***	0.001	0.004***
	(3.93)	(−3.02)	(1.06)	(2.73)
ROA	0.014***	0.012***	0.017***	0.010***
	(4.80)	(4.74)	(7.10)	(3.63)
LEV	0.005***	0.006***	0.005***	0.006***
	(4.41)	(10.51)	(5.92)	(9.46)
SALESG	−0.007***	−0.009***	−0.007***	−0.008***
	(−18.48)	(−34.88)	(−23.39)	(−30.14)
SIZE	−0.009***	0.010***	−0.004***	0.005***
	(−6.06)	(11.55)	(−4.66)	(3.56)
Country FE	No	No	No	No
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	22,994	73,510	33,924	62,580
R-squared	0.179	0.187	0.173	0.182

This table presents the cross-sectional differences in the regression results of earnings variability (*RISK*) on insider trading restrictions (*ITR*) and other control variables. The definitions of the variables are described in Appendix A. The *t*-statistic for each coefficient is reported in parentheses and is based on the White's heteroskedasticity corrected standard errors, clustered by firm.

* Denotes statistical significance at the 10% level.
** Denotes statistical significance at the 5% level.
*** Denotes statistical significance at the 1% level.

4.5. Cross-sectional variations in country-level institutions

In this sub-section, we examine the influence of country-level institutions on the effect of insider trading restrictions on corporate risk-taking. Consistent with other cross-country studies, we employ two country-level variables to proxy for the strength of institutional infrastructure: *TRADE* and *LO*. *TRADE* is defined as the average value of stocks traded as a percentage of GDP for the 1996 to 2000 period, obtained from La Porta et al. (2006). *LO* is a legal origin dummy variable that equals 1 for common-law countries and 0 for civil-law countries, and is obtained from La Porta et al. (1998).

We further partition the sample into two groups comprising *Low* and *High TRADE* (based on the median value of *TRADE*) and *Civil Law* and *Common Law* countries to investigate whether the results are driven by countries with weak or strong institutions. Models (1) to (2) and (3) to (4) of Table 7 present the estimation results of Eq. (3) using an OLS regression model with industry and year fixed effects for the four smaller sub-samples (*Low* vs *High Trade*; *Civil* vs *Common Law*). Interestingly, we document that *ITR* exhibits an asymmetric relationship with *RISK*, depending on the institutional strength. To be more specific, we continue to find a positive and significant association between *ITR* and *RISK* in the *High TRADE* and *Common Law* sub-samples (Models (2) and (4)), which is consistent with our main findings in Table 4. However, the relationship becomes negative in the *Low TRADE* and *Civil Law* sub-samples (Models (1) and (3)).[11] These results reinforce the notion that changes in managerial incentives to undertake risky investment ventures due to more restrictive insider trading regulations are ***different*** among firms in countries with strong versus weak institutions, which supports H2.

4.6. Effect of insider trading restrictions on capital allocation decisions

Thus far, our main findings have highlighted the positive relationship between insider trading restrictions and corporate risk-taking. In this sub-section, we examine whether the increase in risk-taking is beneficial or harmful to firms, which is also an important question to investors and regulators. Although there is no formal model that allows us to examine such a relationship, we adopt the approach taken by Faccio et al. (2012) and further analyze the role of *ITR* on the efficiency of capital allocation decision. Specifically, we estimate Eq. (5) below, which is essentially a *q*-model of investment that is based on Fazzari et al. (1988):

$$CAPEX_{i,t} = a_o + a_1 ITR_{i,t} + a_2 Q_{i,t} + a_3\left(Q_{i,t} \times ITR_{i,t}\right) + a_4 CF_{i,t} + a_5\left(CF_{i,t} \times ITR_{i,t}\right) + \sum Ctry_i + \sum Ind_i + \sum Yr_t + \varepsilon_{i,t}, \quad (5)$$

where *CAPEX* is the capital expenditures (computed as the ratio of the changes in net fixed assets from year $t-1$ to year t to net fixed assets at year $t-1$); *Q* is Tobin's *Q* (computed as the ratio of market value of equity plus book value of liabilities at year t to total assets at year t); and *CF* is the cash flow (computed as the ratio of net income plus depreciation at year t to net fixed assets at year $t-1$).[12]

Eq. (5) is estimated using the OLS model with country, industry, and year fixed-effects; and the results are presented in Model (1) of Table 8. We find that *ITR* is positively and significantly associated with capital investment decision. This finding is consistent with our main result and suggests that one possible channel through which managers in countries with higher insider trading restrictions take more risks is by increasing capital expenditures. Moreover, the interaction coefficient $ITR \times Q$ ($ITR \times CF$) is positive (negative) and statistically significant at the 1% level. Since *Q* is normally used as a measure of investment opportunity, the results imply that firms in countries with stricter insider trading laws will invest more when managers anticipate that there are good investment opportunities in the market. Therefore, there is some preliminary evidence to support the notion that managers in countries with stricter insider

[11] Fernandes and Ferreira (2009) also document an asymmetric relationship between the initial enforcement of insider trading laws and stock price informativeness. In particular, stock prices are more informative after insider trading laws are first enforced only in countries with strong institutions (developed countries). The relationship does not exist or becomes negative in countries with weak institutions (emerging countries).

[12] The definitions of these variables are similar to Faccio et al (2012).

Table 8
Efficiency of capital allocation decisions.

	(1)
ITR	0.091***
	(14.70)
Q	−0.017
	(−1.44)
Q × *ITR*	0.012***
	(5.13)
CF	1.904***
	(16.23)
CF × *ITR*	−0.332***
	(−13.60)
Country FE	Yes
Industry FE	Yes
Year FE	Yes
Observations	96,328
R-squared	0.172

This table presents the regression results of capital expenditures (*CAPEX*) on insider trading restrictions (*ITR*) and other control variables. *CAPEX* is the ratio of the changes in net fixed assets from year $t-1$ to year t to net fixed assets at year $t-1$. *Q* is the ratio of market value of equity plus book value of liabilities at year t to total assets at year t, *CF* is the ratio of net income plus depreciation at year t to net fixed assets at year $t-1$. The *t*-statistic for each coefficient is reported in parentheses and is based on the White's heteroskedasticity corrected standard errors, clustered by firm.

* Denotes statistical significance at the 10% level.
** Denotes statistical significance at the 5% level.
*** Denotes statistical significance at the 1% level.

trading laws make more efficient capital allocation decisions (see Baker et al., 2003; McLean et al., 2012).[13]

To summarize, the results of our empirical analyses indicate that the finding of a positive relationship between insider trading restrictions and corporate risk-taking is robust to alternative measures of insider trading restrictions, and alternative measures of risk-taking incentives and alternative specifications, and is influenced by country-level institutions. Moreover, there is some evidence to suggest that the increase in risk-taking is beneficial to firms.

5. Conclusions

We employ international survey data on the prevalence of insider trading from the Global Competitiveness Report as a measure of insider trading restrictions and examine their impact on corporate risk-taking in an international sample that covers 38 countries over the 1990 to 2003 period. We provide evidence that managers in countries with more restrictive insider trading regulations engage in more risk-taking initiatives than their counterparts in countries with less restrictive regulations. More relevantly, our findings indicate that insider trading restrictions have a significant incremental influence on corporate risk-taking, which is independent of the effects of other country-level variables (such as investor protection, law and order, accounting disclosures, and culture) as documented by the existing studies in the literature.

Our empirical results are also robust to changes in regression specifications and sample periods. Furthermore, when we use two alternative measures of insider trading restrictions (insider trading law index and the strictness of insider trading laws) and corporate risk-taking, our main findings remain unchanged. We also address the issue of endogeneity, and the main results persist.

[13] A closely related paper by Chen et al. (2013) examines whether the initial enforcement of insider trading laws affects firms' investment efficiency. They find that firms' investment becomes more efficient (as measured by increases in investment-*Q* sensitivity) after insider trading laws are enforced. This positive association is more prominent in countries with strong institutions such as investor protection and disclosure quality requirements. Consequently, future accounting performance is also enhanced due to the improvement in investment efficiency.

Finally, the relationship between insider trading restrictions and corporate risk-taking is not uniform across all countries. Although the main result exists for firms in countries with more developed stock markets and common law countries, we find the opposite result for countries with less developed stock markets and civil law countries. As such, our results demonstrate strong evidence of an asymmetric relationship that depends on the strength of the country-level institutional infrastructure.

Overall, our study extends the debate on insider trading laws in the finance and accounting literature. In particular, the empirical findings highlight that more restrictive insider trading laws encourage managers to engage in initiatives that involve higher risks. Moreover, our findings have important implications to investors and regulators as there is some preliminary evidence to suggest that the increase in risk-taking is beneficial to firms as the subsequent capital allocation decisions become more efficient.

Appendix A

Definitions of the main variables and data sources.

Variable name	Definition	Source
Corporate risk-taking incentives		
RISK	Earnings volatility, calculated as the country and industry-adjusted standard deviation of a firm's return on assets (*ROA*) over 5-year overlapping periods.	Worldscope
RISK2	Difference between the maximum and minimum of a firm's *ROA* over a 5-year interval.	Worldscope
RISK3	Research and development, calculated as the ratio of research and development expenditure to total assets.	Worldscope
Country-level variables		
ITR	Insider trading restriction index.	Global Competitiveness Report (1996, 1998, 1999)
CH_ITR	Change in the insider trading restriction index.	Global Competitiveness Report (1996, 1998, 1999)
ITL	Insider trading law index.	Beny (2004)
IT_ENF	Indicates the first year in which insider trading law was enforced.	Bhattacharya and Daouk (2002)
ENF1	A dummy variable that equals 1 if a country enforced insider trading laws for the first time by 1996, and 0 otherwise.	Bhattacharya and Daouk (2002)
ENF2	A dummy variable that equals 1 for years after and including the first-year of enforcement of insider trading laws for a particular country, and 0 otherwise.	Bhattacharya and Daouk (2002)
ITS	Strictness of insider trading laws, calculated as a product of *ITL* and *ENF1*.	Durnev and Nain (2007)
LAWORDER	Law and order index.	ICRG (2008)
GDPG	*GDP* growth rate, calculated as the annual percentage change in the gross domestic product (*GDP*), measured in 2005 constant US$.	World Bank
ANTISELF	Anti-self-dealing index.	Djankov et al. (2008)
ACTSTD	Accounting standard index.	La Porta et al. (1998)
UA	Uncertainty avoidance index.	Hofstede (2001)
INDIV	Individualism index.	Hofstede (2001)
CPI	Corruption perception index.	Transparency International (2003)
TRADE	Average value of stocks traded as a percentage of GDP for the 1996–2000 period.	La Porta et al. (2006)
LO	A dummy variable that equals 1 for common-law countries, or 0 otherwise.	La Porta et al. (1997)
Firm-level variables		
CLOSE	Insider ownership, calculated as the percentage of shares closely held by insiders.	Worldscope
ROA	Return on assets, calculated as the ratio of earnings before interest, taxes, depreciation, and amortization to total assets.	Worldscope
LEV	Leverage, defined as total debt (short-term plus long-term) scaled by the book value of total assets.	Worldscope
SALESG	Sales growth, defined as the average percentage change in total sales over the sample period.	
SIZE	Firm size, defined as the natural logarithm of total assets (in millions of US$).	Worldscope

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