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Abstract It is generally accepted that creative destruction can increase stock price informativeness, for innovative companies tend to behave more surprisingly. However, we believe the rising of stock price informativeness by enterprise innovation in emerging or developing markets is, in some sense, the result of executive ownership and insider trading. To investigate our proposition, we build a rational expectation framework model and define stock price informativeness (SPI) as the Kolmogorov-Smirnov distance between expected distribution and actual distribution of stock prices. Then we use Chinese listed company data to perform benchmark and mediation effects regressions, along with instrumental variable regression in the empirical sector. After that, we use Thailand and Indonesia listed company data for robustness tests. Finally, we divide Chinese listed companies into developed-economy funded and others to do grouping regression. The main conclusion is: Creative destruction can raise stock price informativeness, while executive ownership plays a partial mediating effect in the path of such influence. However, that mechanism is not significant when we use developed-country-funded enterprises listed in China as the sample for regression. Thus, the effects of creative destruction on stock price informativeness are uneven across countries, and executive ownership plays a vital role in that impact in emerging economies.

Keywords Stock price synchronicity, Enterprise innovation, Inside information, Executive ownership, Rational expectation

1. Introduction and Literature Review

As the certificate of corporate ownership, stock value is the discount of the corporate cash flow. However, the stock price is a result of the free exchange between buyers and sellers in the secondary market. Buyers and sellers trade them based on the information available on the secondary market, the industry, and the enterprise, where the information may be insufficient. Thus, there can be a massive gap between the stock price and the discount of cash flow. For example, even the stock prices of a splendid enterprise could fall under the influence of widespread pessimism in the market.

How adequately do the stock prices reflect corporate fundamental information can be comprehend as stock market effectiveness (Bhattacharya et al, 2010). This type of effectiveness is referred to as “stock price informativeness” in the literature. Stock price informativeness is defined as the amount of fundamental corporate information contained in stock price (Sila et al., 2017).

Roll (1988) proposed that stock price contains three different levels of information. Firstly,

market-level information, such as macroeconomic and policy factors, affects stock prices of all companies throughout a given market. Secondly, industry-level information, such as new industrial policies and economic restructuring both impact changes in stock prices in a particular industry. And thirdly, enterprise-level information, such as the publication of annual financial reports and changes in board members can change the stock price of a particular enterprise. However, the direction and mechanism of these changes in stock price changes depends on the type of information. Market and industry information, as public information, often directly causes changes in the stock price along with the release of this information. Enterprise-level information is mainly private information, which is incorporated into stock prices through the behavior of risk arbitrage actors.

To capture the impact of this variety of information on stock price changes, Roll (1988) decomposes stock earnings into community earnings at the market level, and unique earnings at the enterprise level, each representing market-level public information and enterprise-specific information, respectively. Next, Roll used the capital asset pricing model (CAPM) to obtain market earnings through individual stock earnings. The goodness-of-fit (R^2) of the regression equation can be interpreted as the public informativeness reflected by individual stock earnings, while the remainder ($1-R^2$) is explained as the enterprise-specific informativeness reflected by individual stock earnings among other non-explained variance that is not due to individual stock earnings. Building on this approach, Morck et al. (2000) used the coefficient from the CAPM as the estimates for stock price informativeness. They innovatively empirically analyzed the drivers for country-level variations in stock price synchronization from the perspective of property rights economics, expanding on the original work by Roll in a meaningful way (You, 2017).

Durnev et al. (2003) expanded on this view. However, he believed the release of industry information could impact stock yields across an entire industry, so he added the industry yield to the independent variables of CAPM, still using $1-R^2$ as the measure of stock price informativeness. Piotroski & Roulstone (2004) added lagging stock price growth and the industry yield to independent variables. In addition to market synchronization, stock price informativeness can also be measured by the correlation of stock earnings and future accounting surplus information, future surplus and stock price growth, and the probability of informed transactions (Collins, 1994; Easley, 1996).

There are extensive empirical studies on stock prices informativeness. Fernandes & Ferreira (2009) found that, from the perspective of institutional economics, the soundness of the legal system is associated with increases in stock price informativeness. Fresard (2012) identified that the greater the stock price informativeness, the more sensitive the enterprise's cash savings were to stock price changes. He et al. (2013) saw a significant positive correlation between sizeable foreign ownership and stock price informativeness within China. Su (2013) concluded that stock price informativeness

determines the impact of stock liquidity on CEO pay-performance sensitivity. Ben-Nasr (2016) illustrated that stock price informativeness affects labor investment efficiency. Sila et al. (2017) analyzed the relationship between the number of independent directors and stock price informativeness, finding highly ranked directorates have higher informativeness. Furthermore, Yuan (2019) found that accounting information comparability can significantly improve stock price informativeness. Grewal (2020) discovered that disclosure of sustainable information by listed companies increased stock price informativeness.

Creative destruction or innovation is one of the essential factors affecting stock price informativeness. Chun et al. (2008) noted the decision-making behaviors of innovative companies were often beyond market expectations. It is difficult for the market to incorporate all the innovative activities of such companies into the pricing mechanism. Due to this, prices of these companies often do not follow the market index during the same period. In other words, as the stock price changes, a corporation's innovative characteristics will be incorporated into the stock price as enterprise-specific information, resulting in a decline in synchronization between the two indicators. Based on the above analysis, Chun et al. (2008) performed empirical tests of US-listed companies using R^2 as a proxy for enterprise-specific information. They found that industry-level R^2 was closely related to total factor productivity (TFP). The lower the R^2, the higher its TFP, which supported Schumpeter's famous assertion that creative destruction is an important source of economic growth. Mathers et al. (2017) also verified the positive correlation between corporate innovative decisions and stock price informativeness. Benjamin et al. (2020) held that a regime market with higher stock price informativeness would endow companies with better innovative performance.

However, existing research on enterprise innovation and stock price informativeness only explored their positive relationship using empirical evidence from developed countries, while the mechanism of this relationship in emerging economies has not been fully investigated (Banerjee et al.,2022). This paper will present a new point of view: in developing economies, enterprise innovation increases the amount of executive ownership, acting as a driver for the impact of enterprise innovation on stock price informativeness. Executives are a group with a large amount of internal information (Hoitas & Mkrtchyan, 2021). Thus, the increase of stocks held by them will let the corporate fundamental information be embodied in the secondary market, which can raise stock price informativeness.

The present research on executive ownership focuses on principal-agent relationships and information asymmetry. The greater the degree of separation between enterprise ownership and corporate control, the more dispersed the equity structure and the greater the agency cost of a shareholder to supervise managers' business behavior. Generally, shareholders would choose a

free-riding approach; lacking the enthusiasm to supervise managers(Le et al.,2022). To a certain extent, executive ownership can turn the external incentive and restraint of shareholders into self-incentive and self-restraint (Senbet, 1981), allowing daily business activities to consider both short- performance and long-term performance (Sanyal & Bulan, 2010). Morck et al. (2004) found that executives holding certain shares can better align their interests with that of shareholders, producing an "interest convergence" effect. Giving managers equity incentives, such as residual proceeds, can help solve agency problems between managers and shareholders. Wu et al. (2007) studied the relationship between executive ownership and R&D investment from the perspective of behavioral change, finding that equity incentives play a significant role in R&D investment within enterprises with greater surplus resources and better business performance. Rudiger et al. (2019) found that managers are more likely to significantly reduce ownership when businesses run well, while increasing ownership when the business is financially struggling. Goranova et al. (2014) held that executive ownership is negatively related to enterprise diversification. Dixon et al. (2015) noted that the export tendency and export intensity of enterprises increase with the ratio of management ownerships. Vijayakumaran (2020) found that executive holdings had a positive impact on the effectiveness of corporate investment decisions and the degree of financial constraints. In summary, existing literature suggests that executive ownership has substantial impacts on the behavior and valuation of firms, but the impacts of ownership on the enterprise innovation and stock price informativeness relationship is not clear.

To better understand this relationship, we do our investigation through the following three approaches: First, we analyze the correlation between enterprise innovation and stock price informativeness and the mediating effect of executive ownership on this relationship, as existing literature lacks a deep discussion of this mechanism. Second, we build a model of rational expectation framework measuring stock price informativeness as Kolmogorov-Smirnov distance between expected and actual distribution of stock prices, which makes it possible to incorporate stock price informativeness into theoretical equilibrium framework. Third, we use executive compensation and income per capita of cities where the companies are located in as instrumental variables for executive ownership, the number of enterprise appearance design patent authorization and dummy variables of the industry in which the enterprise is located as instrumental variables for enterprise innovation, which partially alleviated endogeneity. Forth, this paper analyzed the robustness of our proposition by using evidence from different parts of China, Indonesia and Thailand. Finally, we do grouping regression of Chinese-funded and developed country funded enterprises, and prove that the executive ownership is not the mediating variable of the impact of creative destruction on stock price informativeness.

The first section of this paper is the model, applying the technique as proposed by Admati

(1985) called noisy rational expected equilibrium models (noisy REE models) to study how enterprise innovation affects stock price informativeness and the mediating effect of executive ownership. Enterprise innovation will affect a firm's performance, which will promote executives, a group with internal information, to purchase stock in the firm. The second section is the empirical methodology establishment, selection of variables and the data description. The third part performs a benchmark regression of enterprise innovation on stock price informativeness. The fourth part investigates the mediating effect and robustness tests of executive ownership, along with grouping analyses by dividing samples into different categories and regress them separately. The final part includes conclusions and discussion of implications from this work.

2. The Model

The rational expectation hypothesis states that people have rational expectations for a particular economic phenomenon. They will make full use of the adequate information they obtain to take certain actions, so that mistakes will be random and not systematic in nature. Generally speaking, a rational expectation of an economic index will be equal to its statistical expectation (Muth, 1961). However, in reality, information is not absolutely effective and complete. One is very likely to incorporate invalid information or incomplete information into decision-making, so one's reasoning is noisy (Verrecchia, 1982). Radner (1979) applied this rational expectation to asset trading, finding that when traders come to the market with different transaction information, the resulting market price may reveal the information previously only available to select traders. The possibility of this inference depends on the mental "model" inside the trader and their "expectations" about how equilibrium price relates to initial information. This framework is widely used in research of micro-financial assets and macro-financial systems (Breon-Drish, 2015; Detemple, 2020). Therefore, this paper will study how enterprise innovation affects stock price informativeness and the mediating effect of executive ownership using this noisy rational expectation balance framework.

2.1 Model Foundation

2.1.1 Market participants

Referring to Goldstein & Yang (2015) and Zhang (2020), we suppose stock development trends consist of two independent fundamentals, $v=v_1+v_2$, where v is the clearing price of the stock, namely the discount of future cash flow. The two fundamentals are independent of each other and thus obey a normal distribution:

$$v_i \sim \mathrm{N}(\overline{v_i}, \sigma_v) \qquad i=1,2 \tag{1}$$

Informed traders can get only one set of information from v_1 and v_2. Paul (1993) proposed that a single investor or investment institution usually cannot obtain all information about the valuation of risky assets. In addition to two types of informed traders, we assume there are noisy traders trading for consumption or realization which cannot get any information. Assumed noisy trader's demand u also obeys a normal distribution:

$$u \sim \mathrm{N}(0, \sigma_u) \tag{2}$$

We further assume that noisy traders cannot observe any information and never refer to any information, and that they conduct only noisy dealings. Suppose there are two types of informed traders. The first one is the management personnel of the enterprise, with a more informative advantage over the other. The information sets of the two types of informed traders are v_1 and v_2 separately. The current stock price is p. We do not compare the value of v_1 and v_2. But in reality, corporate management personnel are more confident in the capital market than other investors, and they would hold that other investors underestimate the risk securities of the enterprise (Heaton, 2002; Martin et al., 2015). Without a loss of generality, suppose that the quantity of these three types of traders is λ_1, λ_2, and 1. The utility of all informed traders follows the constant coefficient risk aversion (CARA) function:

$$U_i = -e^{[-\gamma(v-p)X_i]}, \quad i = 1,2 \tag{3}$$

Where γ is the risk aversion coefficient; X_i refers to the number of purchases made by Class i informed traders, and it is a function of v_i and p.

2.1.2 Creative Destruction

Under equilibrium, if there are opportunities and no barrier to enterprise innovation, enterprises are free to choose whether to innovate or not (Levasseur et al.,2022). Namely, enterprise innovation does not affect the utility of enterprise owners directly. Therefore, the effect of enterprise innovation on the mean and variance of cash flow discount is rather related to the risk aversion coefficient. The endogenous growth model of Romer (2006) contains the hypothesis that workers are free to choose whether or not to produce knowledge. On the one hand, enterprise innovation will improve enterprise performance and increase the average of future cash flow discounts (Yang et al., 2020). On the other hand, innovation has risks and could increase corporate uncertainty (Sunder et al., 2017), increasing the variance of future cash flow discounts. Therefore, in the model, enterprise innovation increases the mean and variance of stock clearing price v. Corporate executives have an information advantage, so for convenience, we assume that enterprise innovation only increases the mean of v_1 without changing v_2 or affecting the variance of either term. The reason is that if different values are simultaneously added to the variance and mean, we can utilize the ratio of the newly obtained variance to the original variance, which is equivalent to changing only the mean and the

number of some type of insider traders.

2.1.3 Stock Price Informativeness

Another question is how to incorporate stock price informativeness into the model. Kyle (1985) believed that price informativeness could be expressed by the reciprocal of price variance. The less the potential price fluctuation, the more informativeness contained in the price. Following these authors, the reciprocal of the variance of stock price is also used in stock price informativeness (Xu, 2016). However, this paper proposes that stock price informativeness should be how much information on enterprise fundamentals the stock price contains, but not all information. We cannot simply measure stock price informativeness by the reciprocal of the variance of stock price alone.

We believe that how much information on enterprise fundamentals can be reflected in stock price can be defined as the similarity between the distribution function of the future cash flow discount and the stock price distribution function. Assuming that the risk-free interest rate is 0, that is, the expectation of stock price on settlement day and purchasing day with the other conditions unchanged, stock price informativeness is the similarity between the distribution functions of v and p. Therefore, to obtain the similarity between the two distributions, this paper refers to the Kolmogorov-Smirnov test to quantify the degree of difference between the two distributions. This test, initially proposed by Kolmogorov (1933) and Smirnov (1948), is now generally accepted as a method to test whether two empirical distributions are different or whether an empirical distribution is different from an ideal distribution (Otsu & Taniguchi, 2020). Herein we denote the expected distribution as Pe, the actual distribution as P, random variable as cf. The Kolmogorov-Smirnov distance is D=supcf|$Pe(cf)$-$P(cf)$|. The larger the supremum of absolute value, the greater the difference between the two functions. Specifically, in this model, the larger the supremum of the absolute value of the difference between v's and p's distribution functions, the lower the stock price informativeness.

2.2 The Equilibrium and Dynamic

2.2.1 Equilibrium

The equilibrium of this model is maximization of the utility of informed traders under the market clearing:

$$X_i(v_i, p) \in \arg\max_x \mathrm{E}\left[U_i(v-p)\, x_i \middle| v_i, p\right] \quad (i=1,2) \tag{4}$$

$$\lambda_1 X_1 + \lambda_2 X_2 + u = 0 \tag{5}$$

To simplify the analytical solution, a usual approach is to adopt the assumption of linear normality (Kyle, 1985; Lambert et al., 2018). In fact, under the framework of rational expectation, only two types of strategies may obtain analytical solutions: one is normal linear structure, another

is ordinary elastic log-normal structure (Zhang et al., 2020). We also adopt this approach, as in Zhang et al. (2020). Assume the number of purchases by the two types of informed traders is linear normal with the information set. And suppose, under equilibrium, the investment strategy of informed traders v_1 is $X_1 = \alpha v_1 - \alpha_p p + \alpha_0$; for v_2 is $X_2 = \beta v_2 - \beta_p p + \beta_0$.

$$p = \frac{\lambda_1 \alpha v_1 + \lambda_2 \beta v_2 + u + \lambda_1 \alpha_0 + \lambda_2 \beta_0}{\lambda_1 \alpha_p + \lambda_2 \beta_p} \tag{6}$$

Price is the known information for the two types of traders. Traders v_i can only use p and v_i to infer v_j, $i \neq j$. Therefore, v_j can be written as a function of v_i and p (Heffetz, 2011):

$$\left(\lambda_1 \alpha_p + \lambda_2 \beta_p\right) p - \lambda_1 \alpha v_1 - \lambda_1 \alpha_0 - \lambda_2 \beta_0 = \lambda_2 \beta v_2 + u$$

$$\left(\lambda_1 \alpha_p + \lambda_2 \beta_p\right) p - \lambda_2 \beta v_2 - \lambda_1 \alpha_0 - \lambda_2 \beta_0 = \lambda_1 \alpha v_1 + u$$

Then Formula (1) can be rewritten as

$$X_i\left(v_i, p\right) \in \arg\max_x \mathrm{E}[U_i\left(v - p\right) x_i | v_j] \quad \left(i, j = 1,2; i \neq j\right) \tag{7}$$

Zhang et al. (2020) proved that the coefficients in the investor trading strategy of Formula (6) are constant and unique in the real number field under equilibrium. Then obtain the distribution of p:

$$p \sim \mathrm{N}\left(\frac{\lambda_1 \alpha \overline{v_1} + \lambda_1 \alpha_0}{\lambda_1 \alpha_p + \lambda_2 \beta_p}, \frac{\lambda_1^2 \alpha^2 \sigma_v}{(\lambda_1 \alpha_p + \lambda_2 \beta_p)^2}\right) + \mathrm{N}\left(\frac{\lambda_2 \beta \overline{v_2} + \lambda_2 \beta_0}{\lambda_1 \alpha_p + \lambda_2 \beta_p}, \frac{\lambda_2^2 \beta^2 \sigma_v}{(\lambda_1 \alpha_p + \lambda_2 \beta_p)^2}\right) + N\left(0, \frac{1}{(\lambda_1 \alpha_p + \lambda_2 \beta_p)^2}\right)$$

Depending on the additivity of normal distribution, the distribution of p can be rewritten as

$$p \sim \mathrm{N}\left(\frac{\lambda_1 \alpha \overline{v_1} + \lambda_1 \alpha_0 + \lambda_2 \beta \overline{v_2} + \lambda_2 \beta_0}{\lambda_1 \alpha_p + \lambda_2 \beta_p}, \frac{\lambda_1^2 \alpha^2 \sigma_v + \lambda_2^2 \beta^2 \sigma_v + 1}{(\lambda_1 \alpha_p + \lambda_2 \beta_p)^2}\right)$$

And the distribution of v is:

$$v \sim N\left(\overline{v_1} + \overline{v_2}, 2\sigma_v\right)$$

2.2.2 Stock Price informativeness

In this paper, stock price informativeness is defined as the supremum of the absolute value of the difference between the distribution functions of corporate stock price p and of future cash flow discount v, shown as Formula (8).

$$\sup_x \left| \frac{1}{\sqrt{\frac{\lambda_1^2 \alpha^2 \sigma_v + \lambda_2^2 \beta^2 \sigma_v + 1}{(\lambda_1 \alpha_p + \lambda_2 \beta_p)^2}}} \mathrm{e}^{-\frac{\left(x - \frac{\lambda_1 \alpha \overline{v_1} + \lambda_1 \alpha_0 + \lambda_2 \beta \overline{v_2} + \lambda_2 \beta_0}{\lambda_1 \alpha_p + \lambda_2 \beta_p}\right)^2}{\frac{\lambda_1^2 \alpha^2 \sigma_v + \lambda_2^2 \beta^2 \sigma_v + 1}{(\lambda_1 \alpha_p + \lambda_2 \beta_p)^2}}} - \frac{1}{\sqrt{2\sigma_v}} \mathrm{e}^{-\frac{\left(x - \overline{v_1} - \overline{v_2}\right)^2}{2\sigma_v}} \right| \tag{8}$$

It can also be denoted as $\sup_x |\mathrm{F}|$.

2.2.3 The Influence of Creative Destruction

According to Part 2.1.2, enterprise innovation will increase the mean of v_1, but will not impact v_2. Therefore, the impact mechanism of enterprise innovation on stock price informativeness is to increase the average of v_1.Therefore, we present the following two propositions:

Proposition 1: Creative Destruction can affect stock price informativeness.

Proposition 2: The amount of shares held by executives with greater corporate insider information is essential for the effects of enterprise innovation to stock price informativeness.

In other words, enterprise innovation will affect the distribution of stock prices by increasing future cash flow discount, and by influencing the expectations of traders v_1 on the discount, which further affects the stock price informativeness. Therefore, the impact on informativeness varies with the proportion of diverse types of traders and with the weights of different variables in investment strategy. However, it is worth emphasizing that this influence mechanism on stock price informativeness content originates from insider trading behavior based on information asymmetry. Insider trading refers to the purchase or sale of securities of a particular listed company by a person with inside information. Inside information is information relating to specific facts of the company that is not known to the public but which, if known to the public, would impact the price of the company's listed securities. In developed countries with highly perfect securities markets, such insider trading costs are very high (Panetsidou et al.,2022).

On the one hand, the legal system and supervision system in developed markets are better than emerging economies (Chung et al.,2012); on the other hand, the degree of digital technology in developed countries makes insider trading more manifest (Gomber et al.,2017). Therefore, if insider trading costs are high enough, Type 1 traders will not respond to buying in the event of creative destruction. But in emerging economies, such insider trading is quite common. For example, in China's practice, even after the Chinese government began to implement the new securities law on March 1, 2020, doubling the penalties for insider trading, this kind of behavior of relying on insider information for huge profits is still prohibited repeatedly. Thus, in emerging economies Type 1 traders (executives) have more motivation to do insider trading after an enterprise doing creative destruction, which can increase stock price informativeness.

Proposition 3: Executive stock ownership is a vital mediating variable for creative destruction to increase the information content of stock prices in emerging economies.

In the next part, using Chinese mainland listed companies as a sample, we are going to conduct an empirical analysis on the relevant relationship between stock price informativeness and enterprise innovation, and the mediating effect of executive ownership.

3. The Data and Empirical Methodology

3.1 Empirical Method Foundation

Another key goal of this paper is to quantify the mediating effect of executive ownership on the impact mechanism of enterprise innovation on stock price informativeness in emerging economies. The empirical models we construct include: (1) baseline regression, to verify the correlation between enterprise innovation and stock price informativeness, and (2) a mediating effect test to study whether enterprise innovation impacts stock price informativeness through management ownership.

3.1.1 Baseline Regression

Before verifying the mediating effect of executive ownership, we need to show the promotion effect of enterprise creative destruction on stock price informativeness also exists in Chinese listed companies. The baseline regression model we established is as follows:

$$Spi_{it} = \beta_0 + \beta_1 Eni_{it} + \boldsymbol{\beta Control}_{it} + \varepsilon_{it} \tag{9}$$

where *Spi* is stock price informativeness; *Eni* is enterprise innovation; ***Control*** refers to a series of control variables; β is coefficient and ε is a random error, the same below.

3.1.2 Mediating Regression

There are numerous tests for mediating effects, and they have their own advantages and disadvantages in efficacy. A single method is of low applicability (Mackinnon et al., 2002). Wen (2004), but combining different test methods as proposed by Judd and Kenny (1981), Sobel (1982), Baron & Kenny (1986), can create a comprehensive mediation effect test procedure. This procedure can help control the probability of Class I and Class II errors. Therefore, this test procedure will be used for mediation effect testing. Based on the benchmark regression model, our model is established as follows:

$$Exo_{it} = \lambda_0 + \lambda_1 Eni_{it} + \boldsymbol{\lambda Control}_{it} + \varepsilon_{it} \tag{10}$$

$$Spi_{it} = \delta_0 + \delta_1 Exo_{it} + \boldsymbol{\delta Control}_{it} + \zeta_{it} \tag{11}$$

$$Spi_{it} = \beta_0' + \beta_1' Eni_{it} + \rho Exo_{it} + \boldsymbol{\beta' Control}_{it} + \varepsilon_{it}' \tag{12}$$

where *Exo* refers to executive ownership.

3.2 Variables

3.2.1 Independent Variable

There are many variables which could be used to quantify enterprise creative destruction, such as the total number of people engaged in research and development (R&D), the number of

published papers, total factor productivity (TFP), etc. However, the amount of invention patent grants has always been the most representative factor measuring enterprise innovation. Enterprise innovation generally brings about improvements of enterprise performance. Neoclassical economics suggests that the input of factors is the source of the final output. With the input of factors unchanged, the part of the output that cannot be explained by input is called TFP (Sickles & Zelenyuk, 2019). Endogenous growth theory holds that the improvement of TFP is not a "free lunch", but lies in the investment required for knowledge production. Moreover, one important output of knowledge production are patents (Fan et al., 2021). For example, Iwaisako & Futagami (2013) established a theoretical model containing patent protection, factor agglomeration, and economic growth. Thus, this paper uses the number of enterprise invention patent grants as an independent variable to measure enterprise innovation (Table 1).

3.2.2 Dependent Variable

The dependent variable in this paper is stock price informativeness. According to previous work, the primarily method to quantify stock price informativeness is stock price synchronization. Morck et al. (2000), Durnev et al. (2003), and Piotroski & Roulstone (2004) respectively added different control variables to the CAPM model to measure stock price informativeness that is controlled by industry heterogeneity. Since this method is constantly improving, new research findings should be used. We use the method of Piotroski & Roulstone (2004) to quantify stock price informativeness:

$$RET_{it} = \beta_0 + \beta_1 \cdot MARET_{i,t-1} + \beta_2 \cdot MARET_{it} + +\beta_3 \cdot INDRET_{it} + \beta_4 \cdot INDRET_{i,t-1} + \varepsilon_{it} \quad (13)$$

Where *RET* is the yield rate of a particular stock; *MARET* is the market yield rate; *INDRET* is the yield rate of a specific industry. The inspection period is one week. We denote the goodness of fit of the model above as R^2. The stock price informativeness can then be written as

$$Spi_{it} = \ln\left(\frac{1-R^2}{R^2}\right) \quad (14)$$

3.2.3 Mediator Variable

The mediator variable selected is executive ownership. We use two methods to measure it: (1) Through the directors, using the sum of the total holdings held by the board of supervisors and all senior managers, denoted as *Exo*. (2) Considering the managers at the top level, using the weighted mean of the shareholding amounts of chairman of the board, chairman of the board of supervisors, and general manager. Considering that board chairman is second only to the board of directors in power in the enterprise, the weights of the three are set to be 0.4, 0.3 and 0.3, respectively. The

variable measured by the second method is denoted as *Exo'*. To weaken the hetero-variance effect by dimensional inconsistency, we use their logarithmic form.

3.2.4 Control Variables

Enterprise age. According to life cycle theory, when an enterprise is first built or young in age, it has vital flexibility making it easier to change. However, is the firm's controllability may be poor, and its behavior is difficult to predict (Adizes, 1989). Therefore, its stock speculation is high in the secondary market, which may reduce stock price informativeness. When the enterprise has entered an aging period, its controllability is strong, raising the stock price informativeness.

Enterprise scale. There are different risks borne by enterprises on different scales (Brown and Kapadia, 2007). Therefore, the stock investment behaviors in the secondary market will also be heterogeneous. Noisy investors may be more willing to invest in enterprises on the smaller scale and with greater uncertainty, so expanding the enterprise scale may reduce the number of noisy investors, thus increasing the stock price informativeness. Here we choose the log of the total assets of the enterprise as the quantification of enterprise scale.

The robustness of enterprise finance. The increasing robustness of enterprise finance will increase the enterprise's ability to resist financial crises caused by exogenous shocks, thus increasing the sustainability of cash flow and affecting the flow of enterprise stock in the secondary market, specifically manifested in the debt ratio and the use efficiency of funds. We choose the capital turnover rate and total liability ratio as control variables.

Enterprise investment efficiency. Generally, the rise of stock price informativeness means an associated increase in the amount of effective information that enterprise managers can judge from the stock price. So, stock price informativeness is positively related to enterprise investment efficiency (Deng et al., 2020). We use return on assets (ROA) and investment yield as control variables.

Enterprise ownership structure. The differences in enterprise ownership structure could lead to different possibilities of insider trading (Brockman & Yan, 2009), thus affecting stock price informativeness. We choose the dummy variable "whether the top ten shareholders are related" and the largest shareholder's shareholding ratio as control variables.

3.3 Sample and Data

Since the dependent variable selected in this paper is stock price informativeness, to ensure consistent data quality, we choose all listed companies listed within the Chinese mainland, priced in RMB, and registered in the Chinese mainland as our sample. The basic data are obtained from GTA's CSMAR database, Class ST is excluded, and companies with missing data are also removed, with the time interval being from 2000-2019.

Table 1 Variable Description

Type	Symbol	Definition
Dependent variable	*Spi*	Stock price informativeness: quantified by the method of Piotroski and Roulstone(2004).
Independent variable	*Eni*	Enterprise innovation: the amount of enterprise invention patent grants during a certain year as a proxy for creative destruction
Mediator variable	*Exo*	Executive ownership: the natural logarithm of the sum of the total holdings held by the board of supervisors and all senior managers.
	Exo'	Executive ownership: the natural logarithm of the weighted mean of the shareholding amounts of chairman of the board, chairman of the board of supervisors and general manager; the weights are 0.4, 0.3 and 0.3, respectively.
Control variable	*Ena*	Enterprise age: the difference between the year of the inspection period and the year of the listing.
	Ens	Enterprise scale: the natural logarithm of enterprise total assets.
	Tur	Turnover ratio of capital: the ratio of the total turnover to capital stock issued of an enterprise in a certain year.
	Dar	Debt asset ratio: the ratio of total debt on total asset.
	Roa	Return on total assets: the ratio of net margin on average total assets.
	Inr	Rate of return on investment: the ratio of investment return on investment cost.
	Shc	Whether the top 10 shareholders are correlated: If yes then *Shc*=1, otherwise *Shc*=0.
	Fsr	The ratio of largest shareholder on shareholding: the ratio of the number of shares of the largest shareholder on the number of the whole shares.

The data shows that (Table 2), firstly the arithmetic average of enterprise stock price informativeness is -0.1739, far lower than that of developed countries, which is because China's first stock exchange was officially established in 1990. The stock market is a place to allocate resources effectively, with a main function to allocate funds to enterprises or individuals who can create wealth effectively. However, this function is conditional on information for the effective allocation of resources. Suppose the market system is not perfect, or the external system is problematic. In that case, the stock market cannot perform this function effectively, at worst even producing "reverse allocation" to less-effective enterprises. At present, in China's stock market, the government is the main decision-maker to determine the allocation of listing resources, and the government has great say and approval power on rights offering, acquisitions and mergers, and asset reorganization. Government decisions are mainly subject to the political and economic tasks within

a given period, while the function and efficiency of the market itself usually occupies a secondary position. Besides, market segmentation due to departmental interests also affects the functioning of market efficiency, and additionally affects the function of resource allocation. For example, the unreasonable division of within the interbank bond market, the bank counter market, and exchange market hinders capital flow, distorts the capital price signal, and raises the cost and reduces efficiency.

Secondly, after removing the samples without invention patent data, the average number of invention patent applications for Chinese listed companies reaches 9.8, which is a staggering number. According to the latest report released by World Intellectual Property Organization, China applied for 58,990 patents in 2019, more than 1,000 more than the United States, thus breaking its 40-year dominance of patent applications. Chinese enterprises have already entered a period of active innovation. The central performances are: firstly, the enterprises have strong innovation potential, and entrepreneurship has become the most crucial driving force enhancing innovation potential; secondly, entrepreneurs have a strong willingness to invest in innovation; thirdly, the market environment and cultural environment of innovation are supportive, and enterprises pay attention to medium and long-term development planning and diversified innovation information channels. Moreover, Chinese enterprises have shown rich, innovative results, and innovation plays a prominent role in improving product quality, enhancing the environment, and developing new markets.

Table 2 Variable Description

Variable	Mean	Variance	Min	Max
Spi	-0.1739	0.8341	-5.8436	2.4762
Eni	9.8111	28.3081	0	574
Exo	15.39046	3.213814	0	20.92212
Exo'	14.51006	3.945849	0	22.10203
Ena	8.6726	6.6355	0	29
Ens	21.7384	1.4937	10.8422	31.0359
Tur	6.506895	16.13478	0.18506	128.2436
Dar	0.4454377	0.2028438	0.055685	0.901108
Roa	0.0340498	.0616987	-0.267834	0.186137
Inr	0.4298705	1.943263	-1.284144	16.26311
Shc	0.4430	0.5699	0	1
Fsr	36.6264	16.0917	0.29	100

4. Baseline Regression

The order of empirical tests in this section are as follows: the first is benchmark regression verifying the impact of enterprise innovation and executive ownership on stock price informativeness; the second is to check the mediating effect of executive ownership; and the last is to divide the enterprises into different groups according to their attributes and conduct heterogeneity analysis. Table 2 shows the descriptive statistical features of the main variables.

4.1 Results

The *p*-value of Hausman test is less than 0.01, so we accept the assumption of existing two-way fixed effects. Therefore, this paper selects a two-way fixed effect model. We test for heterovariance and cross-sectional correlations using the B-P test and Pesaran (2015)'s method, showing the equation has heterovariance and cross-sectional correlation problems at the 1% significance level. If the data is not further processed, the significance test of the results would be invalid.

Table 3 shows the benchmark regression results. Column (1) is the result of OLS regression; column (2) is the result of two-way fixed effect model. Column (3) reports Driscoll-Kraay standard error without heterovariance and cross-section correlation problems to estimate the significance levels of key variables (Driscoll and Kraay, 1998). This method alters the statistics of the original significance test to reduce the impact of the heterovariance and cross-sectional correlation problems on the regression results. Column (4) deletes the samples whose values of independent and dependent variables rank in the initial and final 5% rank. Column (5) is the result of IV regression. We hold that the number of design patent authorizations does not have a direct impact on the actual performance and stock price informativeness of enterprises. However, it has a strong positive relationship with the number of invention patent authorizations. Therefore, we select the number of corporate design patent authorizations and its one-phase-lag term as instrumental variables. The two IVs passed the IV tests of Cragg-Donald Wald F statistics, Sargan statistics, and Anderson canon.corr. LM statistics, which verifies the rationality of the selection of IVs. Column (6) is the regression results using system GMM method, where we chose the two-phase-lag and three-phase-lag terms of independent variables as IVs to conduct GMM-2SLS regression.

The result shows that the number of corporate patent licenses and executive ownership both have significant positive relationship with stock price informativeness. In some sense, this could result from the improvement of the overall innovation environment. As the Nobel Economics Prize winner Edmund S. Phelps, who focuses on China's "mass entrepreneurship and innovation initiative," mentioned the new engine of Chinese economy could bring great intangible benefits. More specifically, he states that the results would be excellent if most Chinese people achieved a sense of achievement through challenging work and innovative undertakings rather than being

satisfied through consumption. The improvement of the innovation environment will enable enterprises to devote more to innovation activities than speculation in the stock market. In another respect, it may also be that groups with insider information will increase their ownership of the enterprise when it conducts innovation activities, thus causing the increase in the stock price informativeness.

Table 3 Results of Benchmark Regression

	(1) OLS	(2) FE	(3) D-K	(4) Winsorize	(5) 2SLS	(6) GMM
Eni	0.002***	0.003***	0.003***	0.003***	0.005***	0.007***
	(3.46)	(4.28)	(3.62)	(3.31)	(2.54)	(3.03)
Ena	—	0.059***	0.059***	0.060***	0.009	0.003
		(5.08)	(5.25)	(4.85)	(1.49)	(0.50)
Ens	—	0.157**	0.157**	0.144	0.009	0.025
		(1.98)	(2.02)	(1.59)	(0.24)	(0.65)
Tur	—	0.008***	0.008***	0.007***	-0.002***	-0.001
		(3.72)	(6.65)	(6.68)	(2.65)	(-0.36)
Dar	—	-0.421	-0.421	-0.414	0.037	-0.144
		(-1.61)	(-1.18)	(-1.09)	(0.17)	(-0.68)
Roa	—	-1.248*	-1.248*	-1.138***	-2.751***	-3.004***
		(-1.73)	(-1.71)	(-2.62)	(-4.47)	(-5.22)
Inr	—	-0.002***	-0.002***	-0.002***	-0.010***	-0.010***
		(-2.57)	(-2.69)	(-2.77)	(-2.64)	(-1.81)
Shc	—	0.032	0.032	0.033	0.003	0.022
		(0.64)	(0.87)	(1.01)	(1.44)	(1.12)
Fsr	—	0.001	0.001	0.001	0.008	-0.009
		(0.93)	(0.40)	(0.15)	(1.17)	(-1.60)
Control time effect	Yes	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	-0.759***	-4.513***	-4.513***	-4.201**	-4.621	-4.550***
	(-8.15)	(-3.68)	(-2.83)	(-2.31)	(-0.76)	(-2.55)
Adj-R^2	0.3025	0.3383	0.3383	0.3445	0.3194	0.3763

Note: ***, **, and * mean significant at the levels of 1%, 5%, and 10%, respectively.

4.2 Robustness Test

Table 4 shows the results of the robustness test. We use the following methods for robustness tests. First, we control for the effects of innovation policy. The Chinese government has gradually built innovative pilot cities since 2008, and this policy can significantly improve the urban innovation level (Fan et al., 2021). The chosen cities under this policy are often with more developed financial markets, so the enterprises in these cities may have a higher stock price informativeness. Therefore, we divided sample into innovative and non-innovative urban enterprises according to their registered places, and then performed grouping regression. Column (1) is the result of innovative cities and column (2) is non-innovative cities. As shown in columns (1) - (2), whether the registered place is an innovative city does not change the positive effect of enterprise innovation on the stock price informativeness. For enterprises registered in innovative cities, their enterprise innovation promotes stock price informativeness less than those registered in non-innovative cities. It may be that innovative cities are mostly high-level cities with enterprise agglomeration, where information disclosure is relatively more complete, so that stock price informativeness cannot be enhanced by insider transactions.

Secondly, to avoid systematic error caused by estimation with weekly data, we re-estimated stock price informativeness with monthly data, whose result is shown in column (3). It can be found that the promotion effect of enterprise innovation on stock price informativeness is still significant while the coefficients became smaller. The reason may be that the variance of monthly data is small, thus reducing the coefficient.

Thirdly, considering that utility model patents may also be conducive to the improvement of enterprise performance, we remeasured enterprise innovation with the numbers of invention patent authorization and utility model patent authorization. The result is shown in column (4). The promotion effect of enterprise innovation on stock price informativeness is still significant while the coefficients became smaller. The reason may be that the impact of utility model patent on enterprise performance is inferior to invention patent.

Fourthly, given that the administrative level of a municipality is higher, it is more likely to cooperate with the government, which may have an impact on the stock price informativeness of the enterprise. Therefore, here we removed the samples registered in Beijing, Shanghai, Tianjin, and Chongqing, and the result is shown in column (5).

Fifthly, due to the impact of macro-regulation, China experienced violent fluctuations in the stock market in 2008 and 2015, and the stock price informativeness in the two years may decrease. Therefore, here we removed samples in 2008 and 2015, and the regression result is shown in column (6). It can be found that the promotion effect of enterprise innovation on stock price informativeness

has been improved. To summarize, the conclusions drawn from our benchmark regression passes the robustness test.

Table 4 Results of Robustness Test

	(1)	(2)	(3)	(4)	(5)	(6)
Eni	0.002**	0.003***	0.001***	0.001***	0.002***	0.006***
	(2.07)	(3.77)	(2.86)	(3.69)	(3.43)	(4.21)
Ena	0.053***	0.061***	0.011***	0.056***	0.011***	0.013**
	(3.82)	(4.65)	(2.61)	(4.88)	(2.25)	(2.08)
Ens	0.101**	0.257**	0.101***	0.147**	0.120***	0.112
	(3.93)	(5.08)	(3.91)	(2.13)	(3.35)	(0.96)
Tur	0.013***	0.004***	0.001	0.011***	0.002	0.003
	(0.77)	(2.74)	(0.87)	(3.77)	(1.06)	(1.47)
Dar	-0.666	-0. 241***	-0.681***	-0.488	-0.633***	-0.663***
	(-1.32)	(-4.81)	(-4.87)	(-1.26)	(-3.79)	(-3.41)
Roa	-1.377***	-0.387*	-1.283**	-1.428*	-1.214***	-0.894*
	(-3.55)	(-1.76)	(-3.27)	(-1.84)	(-2.58)	(-1.67)
Inr	-0.004**	-0.003***	-0.001*	-0.003***	-0.009	-0.009
	(-2.21)	(-3.91)	(1.74)	(-2.56)	(-0.97)	(-0.77)
Shc	0.049	0.026	-0.066	0.052	-0.041	-0.079
	(0.94)	(0.29)	(0.37)	(0.34)	(-0.95)	(-0.30)
Fsr	0.001	0.001	0.001	0.001	-0.001	-0.001
	(1.41)	(0.71)	(0.44)	(0.73)	(-0.29)	(-1.58)
Control time effect	Yes	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	-2.089***	-4.983***	-3.092***	-2.249***	-3.591***	-2.352***
	(-3.71)	(-2.83)	(-3.58)	(-3.68)	(-3.23)	(-2.72)
Adj-R^2	0.2766	0.3313	0.2863	0.3562	0.2291	0.4025

5. Mediating Effect

5.1 Results

Table 4 shows the regression results of the mediating effect model to further study the impact mechanisms of enterprise innovation on stock price informativeness. When control variables are added, this does not change the result that the (a) shareholding amount of chairman of the board, chairman of the board of supervisors and general manager; (b) the sum of the total stocks held by the board of supervisors and all senior managers both have partial mediating effect. Panel A in Table 5 has no control variables, while Panel B adds control variables. And the mediating effect in Panel B is more significant than that in Panel A.

The results suggest that, in the process of enterprise innovation exerting an influence on stock price informativeness, executive ownership plays an important intermediary role. Specifically, when an enterprise performs innovative activities, the management with insider information will increase their number of holdings. The holding groups have more information on enterprise fundamentals, thus increasing the stock price informativeness of the enterprise.

Strictly defined, this should be referred to as insider trading behavior. Insider trading means that the expected return of traders who do not have private information is negative in a zero-sum game of securities trading behavior. This is harmful to the rights and interests of small and medium-sized investors and harmful to the healthy development of financial markets. Judging from the experience of capital market supervision in developed countries, cracking down on insider trading will remain the focus of the inspection and law enforcement of China's securities regulatory authorities for a long time in the future. Especially in recent years, securities and regulatory authorities have adhered to a "zero tolerance" attitude for insider trading. With the innovative development of China's capital market, the specific modes of insider trading are constantly evolving, and insider trading behaviors have become more complex and hidden. This is bound to require that regulatory methods be adjusted dynamically to adapt to insider trading requirements under an ever-changing situation.

Table 5 Results of Mediating Effect Analysis

Panel A						
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	*Exo*	*Spi*	*Spi*	*Exo'*	*Spi*	*Spi*
Eni	0.099*	—	0.002**	0.351*	—	0.002***
	(2.14)		(2.53)	(1.83)		(2.89)
Exo	—	0.013***	0.003*	—	—	—
		(5.07)	(1.97)			
Exo'	—	—	—	—	0.004***	0.004**
					(3.82)	(2.51)
Control time effect	Yes	Yes	Yes	Yes	Yes	Yes

Control Individual effect	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	7.431***	0.059***	-0.472***	10.412***	-0.149***	-0.460***
	(3.58)	(4.20)	(-13.16)	(2.91)	(-5.80)	(-6.09)
Adj-R^2	0.1043	0.2560	0.3091	0.1278	0.2651	0.3295
Sobel	Z = 1.449 > 0.97			Z = 1.477 > 0.97		

1

Panel B

	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable	*Exo*	*Spi*	*Spi*	*Exo'*	*Spi*	*Spi*
Eni	0.062***		0.002***	0.041*		0.002*
	(2.63)		(3.76)	(1.77)		(1.93)
Exo	—	0.001**	0.002**	—		—
		(2.03)	(2.21)			
Exo'	—	—	—	—	0.004***	0.010**
					(3.11)	(2.31)
Ena	-1.21***	-0.027***	0.053***	-0.331***	-0.031***	-0.077***
	(-3.92)	(-16.90)	(4.00)	(-2.85)	(-12.19)	(-6.14)
Ens	11.131***	0.134***	0.204**	3.812***	0.099***	0.064
	(5.09)	(5.65)	(2.42)	(5.22)	(4.63)	(0.73)
Tur	0.065***	-1.00e-05	0.007***	0.054**	-1.6e-05	0.008***
	(3.64)	(-0.85)	(6.98)	(2.06)	(-0.61)	(4.51)
Dar	-1.082	-0.369***	-0.481	-2.031	-0.286***	-0.513
	(-0.24)	(-4.68)	(-1.38)	(-1.08)	(-2.96)	(-1.29)
Roa	-4.343**	-0.621***	-0.255	0.941	-0.484***	0.015
	(2.03)	(-5.12)	(-1.15)	(1.02)	(-3.79)	(0.03)
Inr	-0.022*	-7.51e-09	-0.002***	-0.078***	-7.94e-09*	0.012***
	(-1.69)	(-1.30)	(-4.00)	(4.40)	(-1.70)	(5.86)
Shc	1.013***	0.033**	-0.012	0.612**	0.042***	-0.057
	(2.97)	(2.46)	(-0.35)	(2.41)	(3.69)	(-1.57)
Fsr	-0.122***	-0.001*	0.001	0.059**	-0.002*	-0.006*
	(-1.65)	(-1.75)	(0.21)	(2.08)	(-1.79)	(-1.88)
Control time effect	Yes	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	-2.144***	-2.584***	-5.29***	-7.742***	-2.166***	-0.814
	(-4.83)	(-5.77)	(-2.91)	(-4.83)	(-5.09)	(0.667)

Adj-R^2	0.1026	0.2824	0.3349	0.1460	0.2996	0.3503
Sobel		Z = 1.691> 0.97			Z = 1.405 > 0.97	

5.2 Endogeneity

To ensure the robustness of regression results, we use instrumental variables to alleviate the possible impact of endogeneity on results. We chose the average of executive compensation and the average per capita income in birthplace as instrument variables. The higher the average of executive compensation, the more likely it that corporate incentives for executives lie in compensation rather than equity. On the other side, the higher the per capita income of the executive's birthplace, the more likely that their environment during growth and personal development were better, and the kinder they might be to society. Perhaps a kinder trader would be more reluctant to insider transactions. Additionally, these variables are not directly related to the stock price informativeness of the enterprise. As shown in Table 6, the partial mediating effect of executive ownership does not change.

Table 6 IV Regression

Panel A: 2SLS						
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables	*Spi*	*Exo*	*Spi*	*Spi*	*Exo'*	*Spi*
Eni	—	0.057**	0.002***	—	0.124**	0.002*
		(2.22)	(3.60)		(2.14)	(1.88)
Exo	0.003***	—	0.002**	—	—	—
	(3.31)		(2.50)			
Exo'	—	—	—	0.002***	—	0.018**
				(2.77)		(2.08)
Ena	0.060***	-1.61***	0.052***	0.060***	-0.548***	-0.08***
	(4.85)	(-5.42)	(3.84)	(4.85)	(-3.75)	(-6.10)
Ens	0.144	1.371***	0.197**	0.144	4.437***	0.085
	(1.59)	(5.34)	(2.04)	(1.59)	(5.48)	(0.88)
Tur	0.007***	0.006***	0.007***	0.007***	0.005**	0.008***
	(6.68)	(3.53)	(7.32)	(6.68)	(2.17)	(4.52)
Dar	-0.414	-2.822	-0.476	-0.414	-5.2e+06	-0.589*
	(-1.09)	(-0.57)	(-1.26)	(-1.09)	(-0.38)	(-1.67)
Roa	-0.138	-7.171***	-0.152	-0.138	0.026	-0.024
	(-0.62)	(-5.35)	(-0.63)	(-0.62)	(0.02)	(-0.05)

Inr	-0.002***	-1.412*	-0.003***	-0.002***	-0.005***	0.012***
	(-2.77)	(1.75)	(-4.21)	(-2.77)	(-2.85)	(5.98)
Shc	0.033	1.501**	-0.005	0.033	1.131*	-0.046
	(1.01)	(2.38)	(-0.15)	(1.01)	(1.65)	(-1.29)
Fsr	0.001	-0.183**	-0.001	0.001	0.038	-0.007**
	(0.15)	(-2.15)	(-0.19)	(0.15)	(1.26)	(-2.12)
Control time effect	Yes	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	-4.201**	-8.663***	-5.100**	-4.201**	-9.021***	-1.169
	(-2.31)	(-5.08)	(-2.51)	(-2.31)	(-4.98)	(-0.58)
Adj-R^2	0.3445	0.1206	0.3435	0.3445	0.1555	0.3645
Sobel	Z = 1.660 > 0.97			Z = 1.492 > 0.97**		

5.3 Robustness Test

5.3.1 Reestimate Dependent Variable

We use monthly data to remeasure stock price informativeness to check whether the systematic errors, that weekly data is more fluctuating, change the result or not. As shown in Table 7, the result remains unchanged. Executive ownership still has a vital partial mediating effect in the influence of creative destruction on stock price informativeness, and its significance even becomes stronger. The reason may be that the fluctuations in Chinese stock prices are more prone to noise interference in shorter periods, while in longer periods in months, this interference will decline. Although China is now the world's second-largest stock market after the U.S., extreme volatility remains typical of the Chinese stock market. Retail investors account for 80 to 90 percent of China's stock market volume, many of whom are inexperienced new investors. Moreover, even professional fund companies tend to conduct ultra-short-term trading. "Policy market," margin trading, and initial public offerings (IPOs) are also driving stock market volatility.

Table 7: Robustness Test Part 1

Reestimate stock price informativeness with monthly data						
	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variables	*Spi*	*Exo*	*Spi*	*Spi*	*Exo'*	*Spi*
Eni	—	0.062***	2.5e-04	—	0.071*	0.019***
		(2.63)	(1.65)		(1.66)	(8.49)
Exo	0.008*	—	0.002*	—	—	—
	(1.87)		(1.87)			

Exo'	—	—	—	0.013*	—	0.002**
				(1.95)		(2.41)
Ena	0.056***	-1.21***	0.044	0.054***	-0.713***	-0.022
	(3.00)	(-3.92)	(0.33)	(2.81)	(-2.85)	(-0.58)
Ens	-0.009	3.11***	0.006	-0.011	3.812***	-0.567***
	(-0.11)	(5.09)	(0.939)	(-1.08)	(5.22)	(-2.84)
Tur	0.003	0.065***	0.001	0.004	0.051**	0.015***
	(0.72)	(3.64)	(0.61)	(0.54)	(2.06)	(8.03)
Dar	-0.280	-1.083	0.217	-0.105	-2.011	0.483
	(-0.90)	(-0.24)	(1.27)	(-0.88)	(-1.08)	(0.78)
Roa	-2.210***	-4.347**	-3.12***	-1.062***	0.942	-1.76***
	(-6.38)	(2.03)	(-4.63)	(-3.27)	(1.02)	(-2.85)
Inr	0.002***	-0.022*	-1.57e-06**	0.002*	-0.078***	-0.006
	(2.90)	(-1.69)	(-7.56)	(1.91)	(4.40)	(-0.76)
Shc	-0.003	1.015***	-0.039	-0.002	0.561**	-0.078
	(-0.03)	(2.97)	(-0.80)	(-0.15)	(2.41)	(-0.65)
Fsr	0.032***	-0.761***	0.003	0.074***	0.659**	0.024***
	(5.61)	(-1.65)	(0.64)	(2.58)	(2.08)	(2.98)
Control time effect	Yes	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	-0.660**	-8.143***	omitted	-0.582***	-7.744***	11.82***
	(-2.41)	(-4.83)		(-3.50)	(-4.83)	(2.93)
Adj-R^2	0.1865	0.1026	0.1649	0.1776	0.1460	0.2229
Sobel	Z = 1.524> 0.97			Z = 1.367> 0.97		

5.3.2 Reestimate Independent Variable

We expand the metric index of enterprise innovation from invention patents to the sum of invention patents and utility model patents for utility model patents may have some effects to creative destruction in an enterprise. As shown in Table 8, although the significance of the partial mediating effect of executive ownership decreased, the reason may be utility model patents do not have a big impact on enterprise performance while executives have no incentive to hold more stocks after some utility model patents, the result remains relatively stable. In fact, a utility model patent is only related to the shape and structure of the product, which is narrower in protection scope than an invention patent. The approval procedure for the utility model patent application stipulated in the Patent Law of the People's Republic of China is more simplified than that of an invention patent.

The utility model is only initially reviewed, while the invention patent additionally needs a substantive review. Chen & Zhang (2019) found that, in China, different policies have different incentives for various types of patents, and the higher the technical content, the more difficult it is to be encouraged.

Table 8: Robustness Test Part 2

Redefine enterprise innovation as the sum of invention patents and utility model patents						
Dependent Variables	(13) *Spi*	(14) *Exo*	(15) *Spi*	(16) *Spi*	(17) *Exo'*	(18) *Spi*
Eni	—	0.065**	0.001***	—	0.037*	0.001**
		(2.24)	(2.58)		(1.79)	(2.23)
Exo	0.002***	—	0.003**	—	—	—
	(3.16)		(2.07)			
Exo'	—	—	—	0.002***	—	0.010**
				(2.67)		(2.34)
Ena	-0.048***	-1.67***	-0.055***	-0.041***	-0.651***	-0.014
	(-2.67)	(-4.68)	(-2.99)	(-3.58)	(-3.53)	(-0.82)
Ens	0.010	5.45***	0.060	0.008	4.51***	-0.127
	(0.10)	(4.75)	(0.63)	(0.22)	(4.32)	(-1.50)
Tur	0.008***	0.008***	0.006***	0.011***	5.941**	0.008***
	(6.24)	(3.22)	(5.72)	(5.73)	(2.53)	(3.57)
Dar	-0.453	-1.021	-0.511	-0.406	-0.003	-0.552*
	(-0.93)	(-0.13)	(-1.09)	(-0.58)	(-0.00)	(-1.80)
Roa	-0.434	-2.38	-0.438	-0.336	-1.73	0.166
	(-1.50)	(-0.44)	(-1.43)	(-1.46)	(-0.70)	(0.25)
Inr	-0.002***	-0.021	-0.002***	-0.002***	-0.154***	0.016***
	(-3.92)	(-1.23)	(-8.82)	(-3.88)	(-4.32)	(9.40)
Shc	-0.015	0.064	-0.049	-0.021	0.110	-0.055
	(-0.33)	(0.08)	(-1.37)	(-0.30)	(0.44)	(-1.34)
Fsr	0.005	-0.784	0.002	0.006	0.074	-0.003
	(1.14)	(-1.62)	(0.69)	(0.95)	(1.36)	(-0.80)
Control time effect	Yes	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	-0.207	-7.671***	-0.978	-0.322	-9.232***	2.76*

	(-0.11)	(-4.51)	(-0.53)	(-0.12)	(-4.04)	(1.70)
Adj-R^2	0.3199	0.1569	0.3144	0.3058	0.2320	0.3478
Sobel		Z=1.520>0.97			Z=1.421>0.97	

5.3.3 Grouping Regression of Samples from Different Areas

To verify whether the difference in corporate residence can change the results or not, we divide the sample into enterprises in the eastern, central, and western regions according to their residential area (Table 9). Compared with western developed countries, one of the significant characteristics of China lies in its great regional heterogeneity and not achieving balanced development. The proportion of total GDP of the eastern, central, and western regions is approximately 3:1:1. The total GDP of 12 western provinces is roughly equivalent to that of the six central provinces, and the sum of these two accounts only for about two-thirds of the GDP in the eastern region. The number of Chinese cities presents east-center-west steps distribution, with the east taking the lead. 61 of the top 100 cities are in the east, 23 in the middle and 16 in the west, descending from east to west, central and western cities accounting for less than 40% of total GDP. After decades of rapid industrialization, the physical environment gap between Chinese cities has been significantly narrowed, but the social environment gap is still significant. Cities' planers pay more attention to the construction of physical environment, accumulating rich experience with a mature mode of development. Nevertheless most of these less developed cities are still constructing their social environment.

Although the number of invention patents and stock price informativeness of enterprises showed a significant positive relationship in the East and the Midwest, and the mediating effect of executive ownership is significant. The mediating effect in the Midwest is much greater than that in the east. This may be due to the differences in business environment. In recent years, in the process of combining its own advantages and exploring the path of expanding and opening-up, the western region has investigated developing port functional areas such as waterless ports, port operation areas, follow-up supervision areas, and bonded warehouses, making achievements in institutional reforms and institutional innovations.

However, due to the constraints of some factors such as geographical location, opening up concepts and institutions, there is still a gap between the business environment in the Midwest and the eastern coastal areas. Low-degree openness, low administrative efficiency, redundant examination and approval items, and weak service level have, to some extent, limited the construction of an open economic system in the Midwest of China. The second reason may lie in the differences in the industry of the enterprises. The enterprises in the east are majorly high-tech, so their innovation behaviors are easier to develop. However, the excess income of innovation brought

to enterprises was limited in scope. Thus, the behavior of senior executives holding shares due to enterprise innovation is less clear.

By contrast, most of the enterprises in the Midwest regions are old industrial enterprises, where county industrialization, agricultural industrialization, and urbanization are relatively slow, and which cannot effectively absorb and digest the rural surplus labor force. This leads to a low degree of industrial agglomeration and insufficient competitiveness. Overall, the leading and industries with comparative advantage in the Midwest are concentrated in raw material, fuel power, and agricultural products processing. Some Midwest cities have an single industrial structure, which only relies on local natural resource extraction, or is only supported by one or a few pillar industries. Another reason may be that many enterprises in Midwest China have a relationship of industrial cooperation with each other, so any change of a single enterprise would impact other enterprises. This makes the interaction of enterprises' innovation less straightforward.

Table 9 Robustness Test Part 3

Panel A								
	Enterprises in Eastern China				Enterprises in Midwest China			
Dependent variable	*Spi*	*Exo*	*Spi*	*Spi*	*Spi*	*Exo*	*Spi*	*Spi*
Eni	0.002*** (2.76)	0.062* (1.92)	—	0.002*** (2.72)	0.005*** (2.71)	0.211** (2.59)	—	0.002* (1.91)
Exo	—	—	0.003*** (6.38)	0.002*** (2.67)	—	—	0.008*** (3.41)	0.016** (2.51)
Ena	0.084*** (5.84)	-2.041*** (-4.88)	0.607*** (3.14)	0.077*** (4.86)	-0.707*** (-3.08)	0.154* (1.90)	-0.277*** (-8.61)	-0.714***' (-3.80)
Ens	-0.003 (-0.05)	7.546*** (5.38)	0.038*** (4.43)	0.052 (0.72)	0.324** (2.37)	-7.051* (-1.66)	0.229 (1.12)	0.330*** (2.97)
Tur	0.007*** (6.54)	0.017*** (3.42)	-0.821 (-1.08)	0.006*** (6.36)	0.009* (1.88)	1.9e+06** (2.53)	-0.009** (-2.50)	0.011 (1.40)
Dar	-0.354 (-1.30)	2.042 (0.42)	0.302 (0.62)	-0.414 (-1.60)	-0.624 (-0.40)	-1.462 (-0.52)	-1.364 (-1.19)	-0.309 (-0.22)
Roa	-0.508 (-1.60)	-1.744 (-0.81)	-0.003 (-0.29)	-0.494 (-1.49)	3.112** (2.06)	8.786*** (4.43)	2.574 (0.80)	2.853 (1.62)
Inr	-0.002**	-0.052	-0.001	-0.002**	-0.267**	0.615	-0.033	-0.267***

	(-2.36)	(-1.55)	(-0.01)	*	*	(0.71)	(0.50)	(-9.69)
				(-3.48)	(-9.24)			
Shc	0.008	1.973***	0.021**	-0.044	0.181	-2.991*	0.184	0.164**
	(0.18)	(4.17)	(2.22)	(-1.03)	(2.05)	(-1.78)	(2.35)	(2.31)
Fsr	0.002	0.035***	-0.077	4.4e-04	0.007	0.533**	-0.004**	-0.003
	(0.46)	(3.02)	(-0.65)	(0.11)	(1.15)	(2.29)	*	(-0.65)
							(-4.77)	
Control time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	-1.180	-8.862**	-12.52**	-2.069	0	0	0	0
	(-0.84)	*	*	(-1.32)				
		(-5.25)	(-3.21)					
Adj-R^2	0.3287	0.1357	0.4538	0.3296	0.5385	0.2046	0.4745	0.5540
Sobel		Z = 1.559> 0.97				Z = 1.802> 0.97		

Panel B

Dependent variable	Enterprises in Eastern China				Enterprises in Midwest China			
	Spi	*Exo'*	*Spi*	*Spi*	*Spi*	*Exo'*	*Spi*	*Spi*
Eni	0.002**	0.042**	—	0.002	0.005***	0.041***	—	0.005***
	*	(2.34)		(1.27)	(2.71)	(4.15)		(2.77)
	(2.76)							
Exo'	—	—	0.004*	0.006**	—	—	0.021***	0.012***
			(1.79)	(1.99)			(3.32)	(5.21)
Ena	0.084**	-0.506**	-0.174**	-0.057**	-0.707**	2.027*	-0.621*	-0.692***
	*	*	*	*	*	(2.00)	(-1.78)	(3.74)
	(5.84)	(-3.29)	(-6.38)	(-3.23)	(-3.08)			
Ens	-0.003	4.513***	0.607***	-0.019	0.324**	-0.612*	0.313**	0.348***
	(-0.05)	(5.14)	(3.14)	(-0.17)	(2.37)	(-1.71)	(2.06)	(4.93)
Tur	0.007**	0.061**	0.038***	0.079***	0.009*	0.006***	0.011*	0.002
	*	(2.32)	(4.43)	(3.67)	(1.88)	(7.22)	(1.76)	(0.22)
	(6.54)							
Dar	-0.354	0.212	-0.821	-0.296	-0.624	-2.862	-0.579	-2.634**
	(-1.30)	(0.17)	(-1.08)	(-0.72)	(-0.40)	(-0.77)	(-0.34)	(-2.37)
Roa	-0.508	1.555	0.302	0.020	3.112**	7.974	3.832**	1.575

	(-1.60)	(1.05)	(0.62)	(0.04)	(2.06)	(1.56)	(2.31)	(0.38)
Inr	-0.002** (-2.36)	-0.088** * (-3.99)	-0.003 (-0.29)	0.014*** (5.51)	-0.267** * (-9.24)	0.056 (0.07)	-0.134** * (-6.71)	-0.217*** (-14.86)
Shc	0.008 (0.18)	1.115*** (2.93)	-0.001 (-0.01)	-0.130** (-2.36)	0.181** (2.05)	-0.627*** (-3.66)	0.185** (225)	0.198* (1.79)
Fsr	0.002 (0.46)	0.019 (0.539)	0.021** (2.22)	-0.008* (-1.81)	0.007 (1.15)	0.008*** (3.73)	0.006 (0.89)	-0.016 (-0.71)
Control time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	-1.180 (-0.84)	-9.223** * (-4.78)	-12.52** * (-3.21)	0.983 (0.43)	0	0	0	0
Adj-R^2	0.3287	0.1782	0.4538	0.3257	0.5385	0.3445	0.5442	0.5848
Sobel		Z = 1.516> 0.97				Z = 3.246> 0.97		

5.3.4 Robustness Check from Other Emerging economies

In order to verify whether the mediating effect of executive shareholding in the impact path of creative destruction on stock price informativeness still exists in other emerging economies, we replace the sample with listed companies in Thailand and Indonesia[1], which is used as a robustness test. We chose these two countries because: (1) the stock exchanges in these two countries were established earlier and are relatively mature (2) the total number of listed companies in these two countries exceeds 400, which ensures the sufficiency of the sample size.

Table 10 shows the regression results. It can be found that even if the sample is changed to listed companies in Thailand and Indonesia, the basic conclusions of the article do not change. It is worth noting that the Sobel values of the sample regressions in Thailand and Indonesia are both larger than those in China. The reason may be that the financial market scale of Indonesia and Thailand is relatively small relative to China, and the financial center index of Bangkok and Jakarta is also lower than that of Shanghai in mainland China. This may bring about that the level of marketization may be relatively weak so the behavior of insider trading will be more widespread. Thus, the three propositions proposed in this paper have passed the robustness test.

[1] The data comes from listed companies' annual statements, which can be found on the official website of the Thai Stock Exchange and the Indonesian stock Exchange. The time period is 2000-2019.

Table 10 : Robustness Test Part 4

Panel A：Thailand listed Companies							
Dependent Variables	(1) *Spi*	(2) *Spi*	(3) *Exo*	(4) *Spi*	(5) *Spi*	(6) *Exo'*	(7) *Spi*
Eni	0.011***	—	0.089**	0.003**	—	0.093**	0.002**
	(3.23)		(2.24)	(2.26)		(2.32)	(2.36)
Exo	—	0.002***	—	0.012**	—	—	—
		(4.28)		(2.43)			
Exo'	—	—	—	—	0.001***	—	0.006***
					(2.58)		(3.10)
Ena	0.024***	-0.082***	-2.18***	-0.088***	-0.082***	-2.35***	-0.051***
	(2.71)	(-3.74)	(-3.43)	(-2.87)	(-3.74)	(-3.32)	(-2.27)
Ens	-0.201	-0.023	3.21**	0.031	0.035	3.32**	0.033
	(-0.01)	(-0.36)	(2.35)	(0.52)	(0.42)	(2.48)	(0.58)
Tur	0.025	0.019***	0.011***	0.014***	0.024***	0.013***	0.035*
	(1.37)	(2.94)	(3.28)	(3.13)	(3.02)	(3.91)	(3.33)
Dar	0.113	-0.802	-0.826	-0.765	-0.723	-0.729	-0.737
	(0.75)	(-0.28)	(-0.23)	(-0.92)	(-0.37)	(-0.27)	(-0.27)
Roa	2.015*	-0.538	-2.26	-0.421	-0.422	-2.34	-0.263
	(1.91)	(-1.25)	(-0.64)	(-1.57)	(-1.11)	(-0.24)	(-1.62)
Inr	-0.001**	-0.001***	-0.213	-0.002***	-0.001***	-0.209	-0.001***
	(-2.22)	(-3.18)	(-1.49)	(-6.48)	(-3.27)	(-1.38)	(-3.07)
Shc	0.035	-0.035	0.183	-0.033***	-0.062	0.126	-0.043*
	(1.03)	(-0.21)	(0.16)	(-2.84)	(-0.11)	(0.37)	(-2.46)
Fsr	0.071	0.021	-0.268*	0.021	0.031*	-0.237*	0.023
	(0.23)	(1.66)	(-1.72)	(0.57)	(1.70)	(-1.73)	(0.74)
Control time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	-0.667***	-0.254*	4.626***	-0.473	-0.246	4.633***	-0.425
	(-2.69)	(-1.73)	(3.87)	(-0.54)	(-1.64)	(3.36)	(-0.88
Adj-R^2	0.4138	0.3659	0.2749	0.4172	0.3571	0.2668	0.4206
Sobel	—		Z=1.646>0.97			Z=1.8570.97	

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Panel B：Indonesia listed Companies							
Dependent Variables	(1) *Spi*	(2) *Spi*	(3) *Exo*	(4) *Spi*	(5) *Spi*	(6) *Exo'*	(7) *Spi*
Eni	0.023**	—	0.125**	0.018***	—	0.334**	0.032**
	(2.31)		(2.32)	(2.54)		(3.27)	(2.01)
Exo	—	0.005***	—	0.014***	—	—	—
		(2.98)		(3.63)			
Exo'	—	—	—	—	0.023***	—	0.013***
					(3.84)		(3.22)
Ena	0.175***	-0.236***	-1.37***	-0.021***	-0.855***	-1.34***	-0.034***
	(2.32)	(-2.75)	(-5.34)	(-3.25)	(-2.74)	(-5.57)	(-3.37)
Ens	-0.037**	0.011	4.92***	0.370**	0.021	4.55***	0.330***
	(-2.17)	(1.10)	(3.84)	(2.36)	(1.12)	(3.24)	(2.96)
Tur	0.075**	0.032***	0.029***	0.026***	0.032***	0.023***	0.025***
	(2.36)	(6.06)	(2.79)	(4.91)	(6.74)	(2.78)	(4.51)
Dar	-0.274	-0.362	-1.251	-0.321	-0.527	-1.236	-0.532
	(-1.66)	(-0.37)	(-1.26)	(-1.08)	(-0.47)	(-1.28)	(-1.16)
Roa	1.61**	1.98*	-2.26	-0.235	1.01	-2.82	-0.53
	(2.36)	(1.90)	(-1.34)	(-1.23)	(1.37)	(-1.46)	(-1.83)
Inr	-0.012***	-0.021***	-0.261	-0.075***	-0.074	-0.237	-0.063***
	(-2.75)	(-3.24)	(-0.65)	(-4.34)	(-1.24)	(-0.92)	(-4.45)
Shc	0.011	-0.027	0.032	-0.026	-0.032	0.028*	-0.042
	(0.12)	(-0.21)	(1.11)	(-0.54)	(-0.73)	(1.71)	(-0.53)
Fsr	0.042	0.002	-0.254	0.002	0.006	-0.372	0.003
	(0.37)	(1.00)	(-0.72)	(0.73)	(1.10)	(-0.29)	(0.88)
Control time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intercept	-2.165***	-2.373***	-5.082***	-2.343***	-2.633***	-5.058***	-2.436***
	(-2.66)	(-3.38)	(-3.21)	(-3.35)	(-3.36)	(-3.27)	(-3.40)
Adj-R^2	0.2274	0.2488	0.1569	0.3202	0.2532	0.1569	0.3215
Sobel	—		Z=1.954>0.97			Z=2.294>0.97	

5.4 Heterogeneity Analysis

To verify whether the mediating effects of executive ownership in the influence mechanism of creative destruction to stock price informativeness still existed in foreign-funded enterprises listed in China, we first divided samples into Chinese-funded enterprises and foreign-funded enterprises to conduct group regression, whilst the ownerships of foreign-funded enterprises listed in China mainland are mainly from Japan, US and other developed areas. It can easily be observed in Table 11 that the mediating effect of executive ownership only exists significantly in Chinese-funded enterprises but not in foreign-funded enterprises because creative destruction can't raise executive ownership.

On the one hand, the reason for this could be that foreign-funded enterprises have less insider trading activity, which confirms Proposition 3. Executives would not hold more stocks even if they knew the enterprise might have excess returns. The arrival of more foreign capital will force China's financial institutions to reform. Chinese financial institutions can learn from the advanced experience of foreign financial institutions with high quality and strong capability when cooperating with them, to stimulate the vitality and innovation capacity of Chinese financial institutions. Besides, it will also promote the adjustment of the operational rules of the Chinese financial market in line with international standards to make it serve the real economy better. At present, foreign capital accounts for only 2% of China's A-stock market value, foreign financial capital accounts for only 2.9% of China's bond market, foreign bank assets account for 1.64% of all domestic commercial bank assets, and foreign insurance companies account for 6.36% of the domestic insurance market. On the other hand, it might be because foreign enterprises have greater scientific and technological innovation in China, but of low quality. The technology transfer and diffusion of multinational enterprises in research and development institutions within the host countries can help improve the overall research and development level of local enterprises, accelerate the pace of technological innovation and product upgrading, and promote regional economic growth and industrial structure adjustment. To encourage multinational enterprises to set up research and development institutions in China, the General Administration of Customs issued preferential policies in 1999. Driven by the dual round of Chinese market demand and policy, the number of foreign research and development institutions proliferated, and their scope expanded from developed provinces and cities such as Beijing, Shanghai, and Guangdong to the central and western regions. In the process of such rapid expansion, this may have emphasized increasing the amount of innovation investment while ignoring the efficiency of innovation, pursuing innovation subsidies. In contrast, the actual effect of innovation is not satisfactory.

Table 11 Heterogeneity Analysis: Chinese/Foreign-funded enterprises

Panel A					
	Chinese-funded enterprises				Foreign-funded enterprise
Dependent Variables	*Spi*	*Exo*	*Spi*	*Spi*	*Exo*
Eni	0.003***	0.061**	—	0.002***	0.028
	(3.45)	(2.53)		(3.73)	(0.63)
Exo	—	—	0.007**	0.002**	—
			(1.97)	(2.23)	
Ena	0.058***	-1.312***	-0.027***	0.052***	-0.151
	(5.04)	(-3.72)	(-16.65)	(3.70)	(-0.06)
Ens	0.170**	4.195***	0.120***	0.220**	-0.233
	(2.18)	(4.88)	(5.45)	(2.55)	(-0.35)
Tur	0.008***	1.208***	-9.53e-06	0.007***	0.003***
	(6.63)	(3.00)	(4.87)	(7.90)	(3.36)
Dar	-0.429	-1.517	-0.362***	-0.486	-8.56***
	(-1.25)	(-0.32)	(-4.69)	(-1.43)	(-5.36)
Roa	-0.129	-3.639*	-0.600***	-0.131	-11.21***
	(-0.75)	(-1.69)	(-5.09)	(-0.69)	(-4.46)
Inr	-0.002***	-0.026*	-7.53e-09	-0.002***	0.524
	(-2.67)	(-1.71)	(-1.28)	(-4.22)	(1.67)
Shc	0.029	1.163***	0.034**	-0.018	0.853*
	(0.86)	(2.99)	(2.45)	(-0.57)	(1.82)
Fsr	0.001	-0.0143*	-0.001*	0.001	0.171**
	(0.39)	(-1.77)	(-1.79)	(0.19)	(2.21)
Control time effect	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes
Intercept	-4.782***	-7.316***	-2.523***	-5.601***	—
	(-2.94)	(-4.66)	(-5.56)	(-3.01)	
Adj-R^2	0.3289	0.1094	0.2743	0.3258	0.2369
Sobel	Z = 1.672> 0.97				

Panel B					
	Chinese-funded enterprises				Foreign-funded enterprise
Dependent Variables	*Spi*	*Exo'*	*Spi*	*Spi*	*Exo'*
Eni	0.003***	0.045**	—	0.002*	0.012

	(3.45)	(2.41)		(1.84)	(0.43)
Exo'	—	—	0.003**	0.001**	—
			(2.38)	(2.25)	
Ena	0.058***	-0.363***	-0.031***	-0.079***	-1.123
	(5.04)	(-2.95)	(-16.68)	(-6.22)	(-0.11)
Ens	0.170**	3.95***	0.091***	0.069	-0.671
	(2.18)	(5.42)	(4.71)	(0.78)	(-0.30)
Tur	0.008***	0.335**	-1.4e-05	0.008	0.301***
	(6.63)	(2.08)	(-0.54)	(4.45)	(3.28)
Dar	-0.429	-0.696	-0.290***	-0.511	-5.91***
	(-1.25)	(-0.36)	(-3.09)	(-1.30)	(-5.44)
Roa	-0.129	0.891	-0.445***	-0.003	-9.19***
	(-0.75)	(0.92)	(-3.71)	(-0.01)	(-3.08)
Inr	-0.002***	-0.075***	-7.81e-09*	0.012***	0.577
	(-2.67)	(-4.18)	(-1.69)	(5.82)	(1.51)
Shc	0.029	0.616**	0.048***	-0.055	0.978*
	(0.86)	(2.40)	(3.97)	(-1.51)	(1.88)
Fsr	0.001	0.561**	-0.001**	-0.007**	0.232**
	(0.39)	(1.99)	(-1.98)	(-1.99)	(2.36)
Control time effect	Yes	Yes	Yes	Yes	Yes
Control Individual effect	Yes	Yes	Yes	Yes	Yes
Intercept	-4.78***	-8.081***	-1.969***	-0.901	—
	(-2.94)	(-5.02)	(-5.81)	(-0.47)	
Adj-R^2	0.3289	0.1504	0.3005	0.3475	0.2107
Sobel	Z=1.645>0.97				

6. Conclusion

Chun et al. (2008) believed that the relationship between stock price informativeness and creative destruction innovation is due to the behavior of enterprise with strong innovation tendency is unpredictable, so that its stock price's fluctuation is significantly different from other enterprises. However, our research shows that enterprise innovation may make executives with internal information have more motivation to hold more shares in emerging economies, thus stock price informativeness would be increased. We also found that such an impact mechanism might not exist in developed economies-funded enterprises listed in emerging economies.

Few of the existing literature incorporated stock price informativeness into equilibrium frameworks. Stock price informativeness can be a pivotal proxy to measure how much stock price in secondary market can reflect the fundamental information of the enterprise. In this paper, we took the Kolmogorov-Smirnov distance between the density function of stock price and density function of enterprise future cash flow discount as a measure for the difference between the fundamental information and stock price of an enterprise. The expansion of this difference represents the difference between the equilibrium price of the game between buyer and seller and the cash flow discount per share in the stock price market is greater, and it also means the decline of stock price informativeness.

The policy significance of the research results of this paper is clear. Firstly, it is not necessarily good that enterprise innovation can drive the increase of stock price informativeness, if executives make excess gains by relying on information asymmetry. Since the establishment of The Shanghai Stock Exchange in 1991, China's stock market has gradually improved its system, and though legislation tends to improve, the investor protection is not ideal enough. For a long time, various kinds of securities fraud has damaged the rights and interests of investors, and some cases even have become the norm in the industry. The underlying reason lies in the weak position of medium and small investors and legislative flaws in their protection. Some scholars pointed out that the protection of medium and small investors should start from whether it is conducive to the improvement of efficiency and overall social welfare. That is, by protecting medium and small investors from alleviating the information asymmetry between all parties to the contracts, reduce the agency cost of the enterprise, to further promote the efficiency of the enterprise and the capital market, and bring the improvement of the overall social welfare. From this point of view, the primary problems to be solved in the stock market are the illegal securities acts such as insider trading, false statements, and market manipulation caused by the information asymmetry between investors and the parties to the contracts.

Secondly, different locations of enterprises in a particular economy will not only affect their production and trading behavior, but also affect the attitudes of investors towards enterprises in stock market. Spatial economics has been working to incorporate the spatial factors ignored by mainstream economics into the analytic framework of general equilibrium, but the location of enterprises in the research of corporate finance has been neglected. Although the impact of location on corporate finance has been included in the impact of location on corporate production and operation, there is still a large regional heterogeneity that has not been explained, especially in enterprise-level research in highly heterogeneous regions such as China, India, Brazil and Russia. Different cultures, climates, and even linguistic habits are all important determinants of corporate finance.

The most fundamental assumption in the empirical part of this paper is that stock price synchronization is a measure of stock price informativeness. In fact, however, there are still some debates about how academia should understand R^2. In essence, smaller R^2 means that earning change with corporate characteristics is above the market average. Then does higher-earning change represent more abundant corporate characteristics or noise unrelated to the fundamental information of the enterprise? This is a question that has not been fully answered. However, many studies have fallen into the misconception that R^2 appears as a purely quantitative indicator of information efficiency, which turned the above problem into a simple dichotomous question that low R^2 either means more information or more noise. Future studies can be extended from two perspectives. One is nonlinearity, as R^2 may be a complex mixture of noise and information, without a monotonic linear relationship with information efficiency. Therefore, exploring whether there is a nonlinear relationship between R^2 and other information efficiency indicators and is the nature of the relationship, will further deepen the understanding of R^2. Another perspective is conditionate. The amount of information or noise containing in R^2 is conditional. For example, in a market where property protection is complete, arbitrager trading behavior drives the absorption of private information, when a lower R^2 represents a higher level of trait information. However, in an irrational market where investor trading is susceptible to emotion, limited cognition, and biased behavior, lower R^2 represents higher noise (Hou et al., 2013). Therefore, exploring what kind of conditions R^2 and other information efficiency indicators will change with also further deepen our understanding of R^2.

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