Will Patent Information Disclosure Really Increase Corporate Value? - The Text Analysis Based on the Annual Report of Listed Companies in China

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Abstract: Patent information disclosure, as an important source of information for the innovation strength and sustainable development of enterprises, is an important factor affecting the value of the enterprise. Study based on signalling theory and principal-agent theory, use the 2015-2021 A-share listed company as a sample, use text analysis method and machine learning method to build patented information disclosure indicators, and empirical analysis of the value benefits of patented information disclosure. Studies have found that the current patent information disclosed by listed companies will curb the improvement of corporate value, but with the assistance of other favorable information, This kind of damage will be reduced. The study revealed the motivation for the disclosure of patent information to the enterprise, deepened the inherent impact mechanism of patent information disclosure on the value of the enterprise, and provided practical suggestions for maximizing the advantages of patent information disclosure.

Keywords: Patent Information Disclosure; Information Transparency; Investor Confidence; Corporate Value

1. Introduction

For enterprises, patent can increasing corporate value. How to pass the innovative strength to investors is one of the most concerned issues in the capital market.Information disclosure, as a direct information transfer method between listed companies and investors, is also the responsibility of listed companies. At present, most of the patent information disclosed by listed companies in the annual report is limited to the patent application volume, authorization volume, patent certificate, invention awards, etc., etc. Is this information enough to reflect the company's innovation ability? At present, the contents of the patent information of listed companies in my country can be said to be a kind of behavior that cater to policies, but the content of the disclosure does not truly reflect the market value of the patent. Can this caters of behavior bring value creation to enterprises? Therefore, it is necessary to study the disclosure of the patent information of the enterprise.

2. Literature Review and Theoretical Hypothesis

2.1 Literature Review

2.1.1 Research on patent information disclosure

By sorting out literature, we can know that the disclosure of patent information has brought a favorable role in enterprises. The disclosure of the pre -awarded patent information will significantly improve the accuracy of analysts' predictions (Mehdi & Pooyan, 2022). At the same time, Kim believes that the disclosure of patent information can not only stimulate innovation, but also promote the effective transactions and re -distribution of patents(Kim & Valentine, 2021). But not all information can bring good results. Yu Shixuan and Zhang lingang found that patent information disclosure and stock yields are correlated, but it depends on the quality and credibility of patent information. If the quality is low, the yield of stocks will decrease (Shixuan & Lingang, 2023). Li Duo(Duo & Mengmeng, 2024)and others found that the acquirers conducted patent disclosure in the prospectus to significantly strengthen the recognition of the market's value of mergers and acquisitions.

2.1.2 Related research on corporate value

Modigliani and Miller define corporate value

as the market price of the enterprise, and it is the sum of the market value of corporate stocks and the market value of corporate debt(Modigliani & Miller, 1959). Scholars have a little different views on the composition of corporate value. American economist Tobin proposed in 1969 that the use of Q values to measure corporate value has gradually been recognized by researchers at home and abroad. It is difficult to obtain for resetting costs, so many researchers choose Price-to-Book Ratio(Wuxiang & Yong, 2001), EVA (Jackson, 1996), REVA(Jeffrey & John, 1997) as a measure of corporate value.

Enterprise value is affected by many factors. Scholars are mainly analyzed the impact on corporate value from several aspects such as capital structure, business strategy, and internal governance. However, domestic scholars rarely analyze the research of patent information disclosure based on domestic conditions. Therefore, this article has been deepened from this perspective to enrich this part of research.

2.2 Theoretical Hypothesis

From the content of listed companies' disclosure of patent information, this information is limited to patent applications, authorizations, patent certificates and invention awards, etc., and cannot reasonably confirm the market value of patents. So why do companies disclose these patents information? Matthews (Matthews, 1997) gave possible explanations: a feeling of "social contract" to enhance the legitimacy of the enterprise and increase their financial valuation. Obtaining such legitimacy reduces the regulatory burden of the company's strategic execution. These one-sided patent information is more like a strategic measure. Enterprises consciously pass the patented quantitative information to investors to establish a good corporate image. Schaltegger and Burritt(Schaltegger & Burritt, 2010) believe that enterprises are purely for superficial reasons to improve corporate performance, not to improve potential sustainability. Or worse, it deliberately promoted good performance in some aspects of corporate social responsibility, and covered poor performance in other aspects(Owen & Swift, 2001). Management may use information asymmetry to make a behavior that meets its own interests but harms the interests of the client(Jensen & Meckling, 1976). It is also ironic that Brammer and Pavelin believe that the main purpose of the company's disclosure is to affect the Stakeholder's views on the company's future financial prospects, rather than truly trying to reduce social damage(Brammer & Pavelin, 2006). In order to highlight their management performance, managers disclose the amount of patent award obtained by the enterprise as the management results. Evidence shows that when information disclosure is voluntary, the company will only provide part of the information that is wise to choose. This information presents them in a positive way of congratulations(Hodder-Webb & Cohen, 2009). When the enterprise's patented foundation is weak or there is contradiction between the presence, it is impossible to explain and support related technical and product problems, it is easy to cause the information disclosure of scientific and technological innovation capabilities is not objective and insufficient. When investors are aware of the behavior of an enterprise, they will have uneasy and doubtful emotions, and will judge the target enterprise as no investment effect, which will then lead to a reduction in the value of the enterprise. Based on the above analysis, the following assumptions are proposed:

H: The current patented information disclosure will have a negative impact, thereby reducing corporate value.

3. Research Design

3.1 Sample Selection and Data Source

Since 2015 is the beginning of the in-depth implementation of the national intellectual property strategic action plan, this article selects the annual report of A-share listed companies in 2015-2021 as a research sample for analysis. In order to ensure the rationality of the results of the real evidence, this article follows the following principles: (1) to eliminate ST and ST*companies. (2) Companies that eliminate insurance, finance, and banks. The annual financial report document of the listed company comes from the huge information network. Other data come from databases such as Wanfe and CSMAR.

3.2 Variable Measurement

(1)Explained variables: Tobin Q. Reference Tan(Tan & Xiao, 2021)and other studies, this article uses Tobin Q to measure the value of corporate value. The specific calculation formula is: Tobin Q value = (market value of circulation shares + number of non -circulating shares × net assets per share + debt book value) /total corporate assets.

(2)Explanatory variables: level of patent information disclosure. This article uses Word2Vec to train the Chinese annual financial report corpus, and obtains semantic similarity between words by calculating the similarity between vectors. Refer to the methods of scholars such as Hu Nan(Nan & Fujing, 2021), divide the total word count of all keywords by the total word count in the annual report, and then multiply by 100 to obtain the level of patent information disclosure as the explanatory variable, Use W to represent the frequency of keywords, M represents the total number of annual reports. Calculated as follows:

FPID=(w/m)*100

3.3 Model Design

In order to examine the impact of patent information disclosure and the value of listed companies, the regression model is constructed in this article:

$$\text{Tobin's } Q_{i,t} = \beta 0 + \beta 1\ FPID_{i,t} + \beta 2\ Size_{i,t} + \beta 3\ Lev_{i,t} + \beta 4\ FirmAge_{i,t} + \beta 5\ Growth_{i,t} + \beta 6\ Cashflow_{i,t} + \beta 7 BM_{i,t} + \beta 8\ Top1_{i,t} + \beta 9\ Board_{i,t} + \beta 10\ Indep_{i,t} + \delta i + \eta t + \varepsilon i,t \quad (1)$$

Among them, i represent the industry, t represents the year, Tobin Q measures the company's corporate value, FPID measures the characteristic variables of the level of patent information disclosure of listed companies. δi is the fixed effect of the industry; ηt is the time fixed effect; εit is a random error item. Refer to the practice of articles such as Liu Xing(Xing & Kangtao, 2018) and Tang Yongjun(Yongjun & Wenchao, 2021)and Xu Jiangbo(Jiangbo & Qichen, 2022), this article controls the following feature variables: Company size (Size), Leverage ratio (Lev), market-to-book ratio (Bm), the largest shareholder shareholding ratio (Top1), Age of establishment of the company (FirmAge), cashflow ratio(Cashflow),Growth (Growth), ratio of independent directors(Indep), Number of directors(Board). In addition, the model has also controlled the industry and annual years, using stable standards to make mistakes and make cluster adjustments at the company level. See Table I for each variable definition.

4. Empirical Results and Analysis

4.1 Descriptive Statistics

The descriptive statistics of each variable in this article are shown in Table1. The level of disclosure of the company's patent information is not high, and it shows large individual differences, indicating that most enterprises do not choose to disclose patent information. At the same time, the company's operating income growth rate has a large standard difference. The growth rate of operating income is one of the main indicators to measure the growth of enterprises. Whether different industries are affected by policy assistance will affect the growth of the enterprise. Generally speaking, the growth of high -tech enterprises supporting policies will be much better, which also provides a basis for the study of whether the patent -intensive industry group has been studied later.

Table 1. Descriptive Statistical Characteristics of Variables

variable	N	mean	sd	min	median	max
TobinQ	18454	2.240	2.631	0.641	1.658	122.189
FPID	18454	0.037	0.099	0	0.016	3.084
Size	18454	22.453	1.340	17.641	22.269	28.636
Lev	18454	0.435	0.202	0.008	0.428	1.758
FirmAge	18454	2.999	0.280	1.792	3.045	4.159
Growth	18454	0.422	14.697	-2.733	0.106	1878.372
Cashflow	18454	0.0490	0.0730	-0.704	0.0480	0.876
BM	18454	0.614	0.268	0.008	0.603	1.559
Top1	18454	33.181	14.702	0.286	30.783	89.093
Board	18454	2.116	0.199	1.099	2.197	2.890
Indep	18454	37.787	5.655	14.290	36.360	80.000

4.2 The Impact of Patent Information Disclosure on Corporate Value

This article uses the model (1) to test the assumption. According to Table 2, the explanation variable coefficient is -0.461, and it is significant at the level of 1%, indicating that the company's patent information disclosure is significantly negatively related to corporate value.

Table 2. Regression Results of Patent Information Disclosure and Enterprise Value

variable	(1)
FPID	-0.461***
	(16.067)
Size	-0.151*
	(0.089)
Lev	0.909**
	(0.411)
FirmAge	0.438***
	(0.104)
Growth	0.000
	(0.000)
Cashflow	-0.626
	(0.442)
BM	-5.469***
	(0.162)
Top1	-0.003**
	(0.001)
Board	-0.036
	(0.122)
Indep	0.012***
	(0.005)
Constant	6.927***
	(1.528)
Observations	18,454
R-squared	0.319
Industry FE	YES
Year FE	YES

Note: The values in brackets are t statistics; ***, **, and * indicate significant differences at 1%, 5%, and 10% levels, respectively.

5. Mechanism Inspection

This article refers to the research papers of scholars such as Wang Min(Min & Minli, 2024), and measures technical human capital with the proportion of technical personnel to general employees. R&D technicians as carriers of scientific knowledge and applications, in their own development strategies, more deployment of technical talents has accelerated the diffusion of science and technology, enhance high-quality development capabilities, and enhance corporate value. In summary, the proportion of technical personnel as a regulatory effect can alleviate the impact of the disclosure of patented information on the reduction of corporate value. The return result is shown in Table 3.

Table 3. Technical Human Capital

variable	(1)
FPID	-0.562***
Technical human capital	(0.187) -0.177
	(0.171)
FPID* Technical human capital	2.282**
	(0.920)
Size	-0.150*
	(0.089)
Lev	0.937**
	(0.417)
FirmAge	0.443***
	(0.105)
Growth	0.000
	(0.000)
Cashflow	-0.628
	(0.453)
BM	-5.491***
	(0.166)
Top1	-0.003**
	(0.001)
Board	-0.049
	(0.122)
Indep	0.012**
	(0.005)
Constant	7.011***
	(1.555)
Observations	18,318
R-squared	0.319
Industry FE	YES
Year FE	YES

Note: The values in brackets are t statistics; ***, **, and * indicate significant differences at 1%, 5%, and 10% levels, respectively.

6. Conclusion

This paper deeply studies the relationship between patent information disclosure and corporate value of Chinese listed companies, and draws the following conclusions after exploring its internal mechanism:

(1) The current level of patent information disclosure by listed companies is generally low, and the disclosure of patent information in the

annual report only involves the number of patent applications, the number of patents granted, the patent certificates obtained, etc. The quality of these contents is low, they fail to bring added value to the company in the direction expected by the management.For the users of the annual report, the information conveyed cannot show the competitive advantage of the company in the fierce competition environment. Whether the company's behavior has "ulterior motives" has reduced investor confidence and inhibited the growth of corporate value. After the robustness test, the above conclusion still holds true.

(2) Mechanism analysis shows that, when supplemented by other information that can help investors understand and recognize the company's innovation capabilities,such as the company's technical human capital can show that the company has made efforts to innovate, which can alleviate the effect of patent information disclosure on the reduction of corporate value.

At this stage, the quality of patent information disclosed by listed companies in the annual report is not high. Enterprises need to improve and enrich the content of patent information disclosure. In the annual report, they should disclose patented information with Substantive content, which will maximize the role of patent information disclosure. At the same time, the patented information disclosed is generally decentralized, and the relevant documents do not clearly specify the location and form of the disclosure. Therefore, it is recommended that listed companies concentrate in specific chapters or fixed areas in the annual report to standardize relevant texts in a standardized manner, and can also increase the related chapters of intellectual property.

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