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Research on the Impact of Institutional Quality on Enterprise Innovation Quality from the Perspective of Heterogeneity of Innovation Motivation

Pan Zhang

School of Economics, Hubei Business College, Wuhan 430079, China

Abstract. From the perspective of heterogeneity of firms' innovation motivation, we analyze the internal mechanism between marketization institution environment and firms' innovation motivations, using the data of China's manufacturing industry listed firms from 2005 to 2019. We find that, the marketization institutional reform can strengthen the vertical innovation motivation and weaken the horizontal innovation motivation, which means that there are "institutional dividend effects" in the firms' innovation behaviors. After dividing the firms into different groups by ownership, region and high-tech intensity, we find that the "institutional dividend effects" mainly focus in the non-state-owned group, middle area and west area group, and both in the high-tech and non-high-tech group. Our findings can provide some evidences for the policy design and firms' strategy formulation.

Keywords: Marketization Institution; Innovation Motivation; Innovation Quality; Institutional Dividend Effects

1. Introduction

Since the 17th National Congress of the Communist Party of China in 2007 put forward the development strategy of "improving the ability of independent innovation and building an innovative country", the state has successively launched a series of enterprise innovation incentive policies, but we have to face the reality that the incentive policy has promoted a substantial increase in the number of national patents, but behind the surge in the number of patents, it has not brought substantial technological progress[1,2], and total factor productivity has not been effectively improved.

The institutional environment in which enterprises are located, especially the property rights protection system, has been widely recognized by the academic community for the importance of enterprise innovation investment. Most of the existing literature revolves around "Can the property protection system promote the innovation capacity of developing countries?" Representative studies include the "Northern Innovation-Southern Imitation" camp with a negative view, the "technology diffusion" camp with a negative view, and the "optimal property protection hypothesis" camp with a neutral view. However, using these theories and views, it still seems that it is still impossible to effectively explain the phenomenon that the number of patents in China has surged at this stage, but the quality of patents has not improved. According to Schumpeter's growth theory, innovation in the economic system can be divided into two sectors: horizontal innovation and vertical innovation, of which horizontal innovation emphasizes the dimension of "quantity" and vertical innovation emphasizes the dimension of "quality", so it can be seen that different innovation choices of enterprises will have an impact on the overall quality of innovation in society. Therefore, unlike previous studies, this paper no longer stays in the relationship between the test system and the ability to innovate, nor does it focus on revealing the phenomenon of "quantity and quality of Chinese innovation patents", but starts with the micro-innovation motivation of enterprises, by uncovering the "black box" between the institutional environment and the innovative behavior of enterprises, to excavate the deep-seated root causes behind this phenomenon, and to seek possible solutions to this dilemma at this stage.

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2. Literature Review

We find that the research logic chain of the existing literature can be simply summarized as "institutional environment → innovation decision-making" and "institutional environment → innovation results", and often ignore the analysis of the "innovation decision-making → innovation results" chain, tacitly acknowledging that when enterprises choose to invest in innovation resources, the innovation results obtained are conducive to the improvement of innovation quality. However, behind the innovation decisions of enterprises may be hidden different motivations and behaviors, and different innovation motivations may lead to completely different innovation results and innovation quality.

In fact, in recent years, some scholars have begun to pay attention to the phenomenon of inconsistent quantity and quality of patent innovation in China, but the relevant research is mostly explained from the policy design level of innovation incentives, and the research from the perspective of institutional environment changes and heterogeneity of enterprise innovation motivation is relatively thin. For example, Long Xiaoning et al. [1] believe that the performance appraisal background of the current digital indicators affects the design motivation of patent incentive policies, which makes this material incentive policy cannot improve the overall quality of patents. Li Wenjing et al. [2] found that macro industrial policies can only significantly increase the number of non-invention patents, which does not help to improve the overall quality of patents, although they also mentioned that different types of industrial policies may lead to heterogeneity of enterprise innovation motivation, but the authors do not systematically examine the micro mechanism of heterogeneity of enterprise innovation motivation and the possible institutional reasons behind it, after all, in the process of improving the quality of patent innovation, compared with the design of the policy incentive end, the improvement of the institutional environment may be more effective.

The above literature has laid a deep foundation for the research of this paper, but there is still a certain research space. Compared with the existing literature, the main contributions of this paper are mainly: First, it provides a perspective for the study of the innovation capacity of developing countries on the institutional environment, that is, the micro-innovation motivation of enterprises, and takes this as the starting point to theoretically reveal the micro-mechanism of enterprise innovation in the institutional environment. Secondly, using the data of China's manufacturing listed companies from 2005 to 2019, the impact of institutional environment changes on different innovation motivations is empirically tested, and combined with the group discussions of different property rights, different regions and different industries, the "institutional dividend" effect of improving the quality of Chinese enterprises' patents is verified, which will help explain the current phenomenon of "quantitative increase in quality and quality" of patent innovation, and provide feasible solutions. Finally, in further research, the mediating role of political associations in the above-mentioned "institutional dividend" effect is discussed.

3. Theoretical Analysis and Research Assumptions

Drawing on the research ideas of Schumpeter's growth theory, this paper starts from the perspective of enterprise innovation quality, and divides the innovation motivation of enterprises into vertical innovation motivation and horizontal innovation motivation, of which vertical innovation motivation refers to the original intention of enterprise innovation is to improve product quality, maximize production profits and improve production efficiency, the entire innovation process will often have uncertainty, long-term and other characteristics, according to Schumpeter growth theory, at this time, enterprises will be innovative success probability assessment results into the vertical innovation decision-making framework; Horizontal innovation motivation refers to the fact that the original intention of enterprise innovation is to increase the "quantity" of product categories, and such innovative projects are often less difficult and have shorter cycles [3]. It can be seen that the innovation project under the vertical innovation motivation has a high technical

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content and requires more R&D investment; Innovation under the motivation of horizontal innovation is often low in technology, but can quickly obtain corresponding results.

There is nothing wrong with horizontal innovation, which is also beneficial to the development of enterprises, but a large number of empirical studies have shown that because horizontal innovation has the characteristics of short cycle and less difficulty, it is easy to derive a certain "strategic motivation" [2], that is, to show the reverse innovation behavior of "seeking subsidies". Specifically, judging from the Chinese government's previous innovation incentive policies, it will often use the number of innovation patents of enterprises as the standard and carry out corresponding "post-support"[2], which will lead to enterprises may obtain corresponding policy subsidies by increasing simple innovation patents with low technical content. This also partly explains why, for a long time in China, patent incentive policies have promoted a surge in the number of patents, but have not improved the quality of corporate patents [1].

With the improvement of the institutional environment, the relationship between the government and the market, the development of the non-state-owned economy, the degree of development of the product market, the degree of development of the factor market, and the legal environment for the development of market intermediary organizations and the maintenance of the market will be significantly improved, which will have an impact on the horizontal innovation motivation of enterprise innovation, specifically, on the one hand, with the improvement of the institutional environment, the relationship between the government and the market will be further clarified, the government's disposable resources will be reduced, and the factor market and the property rights system guarantee system will be further improved. Thus it may ameliorate the plight of the past when it was necessary to obtain certain scarce resources through rent-seeking, thereby dampening this strategic motivation to pander to the government; On the other hand, the improvement of the institutional environment will also gradually improve the completeness and effectiveness of innovation incentive policies, greatly reducing the possible rent-seeking space, and the reverse innovation choice behavior of "seeking subsidies" in the past will be greatly curbed.

In summary, the core research assumptions that can be proposed in this paper are as follows.

Hypothesis 1: As the institutional environment improves, vertical innovation motivations for firms may be strengthened.

Hypothesis 2: As the institutional environment improves, the company's motivation for horizontal innovation may be weakened.

4. Empirical Analysis

4.1 Model design

In order to test the research hypothesis proposed by the above theoretical analysis, the basic model is constructed as follows：

$$patent_{it} = \alpha_0 + \alpha_1 sys_{it} + \alpha_2 controls_{it} + \varepsilon_{it} \quad (1)$$

where i and t represent the enterprise ID and the corresponding year, respectively; patent represents vertical innovation motivation (patent_i) and horizontal innovation motivation (patent_n), and in order to eliminate the influence of extreme values, this paper treats them with 1% and 99% percentiles; The key explanatory variable sys indicates the institutional environment assessment value of the region where the enterprise is located, which is consistent with the practice of most literature and is measured by the "market-oriented index" proposed by Fan Gang et al. [17], including the relationship between the government and the market, the development of non-state-owned economic development, the degree of development of the product market, the degree of development of the factor market, and the development of market intermediary organizations and the legal environment.

Consistent with the existing literature practice, the model also controls other variables that may affect the innovative behavior of enterprises, including: (1) the size of the enterprise, measured in

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the logarithm of total assets, recorded as size; (2) the age of the enterprise, calculated based on the year of establishment of the enterprise, and used a logarithmic treatment, recorded as age; (3) the net operating cash flow of the enterprise, recorded as cf; (4) the enterprise asset-liability ratio, recorded as lev; (5) the current ratio of the enterprise, (6) Retained earnings of enterprises, which are treated logarithmically, are recorded as retained; (7) the return on assets of the enterprise is recorded as roa; (8) the income tax rate of the enterprise is recorded as tax.

4.2 Sample selection

In this paper, the manufacturing listed enterprises in the A-share market from 2005 to 2019 are selected as the research sample, and the processing of the sample data includes: excluding the ST or ST* enterprise sample; Eliminate samples of companies with missing patent data; Due to the serious lack of data in Tibet, a sample of listed companies in the region was also excluded. The patent data and related financial data of listed enterprises are derived from the CSMAR database, and the regional institutional environment data are derived from the China Marketization Index by Fan Gang and others.

4.3 Empirical analysis results

In order to examine the impact of institutional environment changes on vertical innovation motivation and horizontal innovation motivation, we use the system GMM method to estimate Model (1). At the same time, in order to ensure the robustness of the results, we also use the panel quantile regression estimation method to conduct a regression test for the situation under different quantiles.

Table 1 Results of the influence of the institutional environment on the vertical innovation

variable being explained: patent_i	(1)	(2)	(3)	(4)	(5)	(6)
	system GMM	panel quantile regression				
		10%	25%	50%	75%	90%
sys	0.005***	0.036***	0.034***	0.023***	0.028***	0.032***
size	0.018**	0.074***	0.027***	0.038***	0.030***	0.032***
age	-0.285***	-0.271*	0.017	-0.035**	-0.010	-0.022***
cf	0.034	0.077***	0.079***	0.072***	0.078***	0.026***
lev	-0.157***	0.105***	0.053	0.131***	0.025	0.064***
liquidity	0.001	0.001	0.001	0.008***	0.005***	0.008***
retain	-0.008	0.068***	0.057***	0.070***	0.063***	0.037***
roa	-0.016	-0.155	-0.207**	-0.138	-0.220**	-0.056***
tax	-0.001***	0.012	-0.004***	-0.004***	-0.004***	-0.005***

Note: *, **, *** indicate that they passed the significance test at the level of 10%, 5% and 1% respectively; The numbers in parentheses are the corresponding standard errors; The table below is the same.

Table 1 and Table 2 report regression results under vertical innovation motivation and horizontal innovation motivation, respectively. The results show that: (1) the Wald test, Sargan test and autocorrelation test after the GMM regression of the system show that there is no autocorrelation or excessive identification problem in the model, and the resulting regression results have certain credibility; (2) through the results of column (1) in Table 1 and Table 2, it can be found that with the improvement of the institutional environment, it will significantly promote the vertical innovation motivation of enterprises and reduce the horizontal innovation motivation of enterprises, which is basically consistent with the research hypothesis proposed in the above theoretical analysis; In order to investigate the regression results under different quantile levels of enterprise innovation motivation, we adopted the panel quantile regression method, and it can be seen from Table 1 and Table 2 that under the percentiles of 10%, 25%, 50%, 75% and 90%, the positive and negative and significant conditions of the sys regression coefficient of the institutional environment are basically

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consistent with the results under the regression of the aforementioned system GMM, which indicates that the test results of this paper have certain robustness.

Table 2 Results of the influence of the institutional environment on the horizontal innovation

variable being explained: patent_n	(1) system GMM	(2) panel quantile regression 10%	(3) 25%	(4) 50%	(5) 75%	(6) 90%
sys	-0.014***	-0.047***	-0.017**	-0.030***	-0.027***	-0.026***
lnsize	-0.043***	-0.050**	-0.042***	-0.055***	-0.030***	-0.028***
lnage	0.293***	0.087	0.080	0.126**	0.008***	0.009***
cf	-0.039	-0.073***	-0.076***	-0.077***	-0.086***	-0.103***
lev	0.083	-0.022	-0.064	-0.037	-0.029***	-0.048***
liquidity	-0.001	-0.001	-0.001	-0.001	-0.006***	-0.005***
lnretain	-0.001	-0.054***	-0.062***	-0.062***	-0.030***	-0.044***
roa	-0.071	0.165*	0.159	0.104	0.170***	0.203***
income_tax	0.002***	0.002	0.004***	0.004***	0.005***	0.005***

5. Conclusions

From the perspective of micro-motivation of enterprise innovation, this paper unveils the “black box” between the institutional environment and enterprise innovation, studies the mechanism of the impact of institutional environment changes on the motivation of enterprise innovation, and uses the data of China’s manufacturing listed companies from 2005 to 2019 to conduct empirical tests. The main findings include: The improvement of the institutional environment can significantly promote the vertical innovation motivation of enterprises, and there is an “institutional dividend” effect, which can also reduce its horizontal innovation motivation.

The research conclusions of this paper are conducive to a more thorough understanding of the root causes of the “quantity and quality of innovation patents” in the past period of time, and can also provide strong policy enlightenment for how to improve the quality of enterprise innovation.

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