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Is the incentive of Mixed Industrial Policy to enterprise innovation “real”?

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ABSTRACT. *This paper uses the 2005-2015 Chinese industrial enterprise data to analyze the impact of China's mixed industrial policy on corporate innovation behavior, attempting to solve2 questions: Does the mixed industrial policy have a real positive effect on innovation? what kind of enterprises can create real innovation ? Through theoretical analysis and preliminary regression, we find that companies that are motivated by industrial policies have significantly increased patent applications, but only non-inventive patents, pursuing “quantity” and neglecting “quality”. Further analysis of the grouping of enterprises found that the above phenomenon is more prominent in enterprises with government contacts. This shows that the selective industrial policy only encourages strategic innovation of enterprises, and enterprises increase the “quantity” of innovation for “seeking support”, and the innovation “quality” has not been significantly improved.*

KEYWORDS: *mixed industry, substantial innovation, strategic innovation*

1. Introduction

Industrial policy is a flexible means for a government to intervene in the formation and development of industry. It is considered by the theoretical circles to be a strong driver of economic development in the Asia-Pacific regions, especially in Japan and South Korea in the 1990s. China also began to implement industrial policies in the late 1980s. At the beginning, it showed a strong direct intervention and planned economy (Jiang Feitao, 2010), which is a typical “Selective Industrial Policy”. In the 21st century, the improvement of industrial policies has enabled China's GDP to maintain a growth rate of 9.2% in the harsh global economic crisis (Li Wenjing, 2016). However, since the 18th National Congress, as China's economy has entered the development stage of “new normal”, the contradictions accumulated by the extensive growth have become increasingly prominent. At this time, China's industrial policy began to emphasize the use of market mechanisms, and add some market-friendly "Functional Industrial Policies". Therefore, Jiang Feitao summarized China's current industrial policy as a "Mixed Industrial Policy" with "Selective Industrial Policy" as the main and "Functional Industrial Policy" as the supplement.

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However, there is no unified conclusion in the academic world about what kind of industrial policies in China have produced for China. Industrial policies can obviously bring short-term cost reduction and capacity increase, but whether it can sustain economic growth. The new economic growth theory believes that technological progress is the engine of economic growth (Romer, 1990), which stems from innovation. Innovation now is placed in the most important position in "Made in China 2025" and it is increasingly becoming the decisive factor that drives the sustained and healthy development of China's economy (Jiang Feitao, 2018).

At present, scholars discussed a lot on the allocation of industrial policy resources, but lacking the discussion on how industrial policies lead the industry to optimize and upgrade. As a technology catching-up country, China's technological innovation has always been in internal and external troubles. Taking the chip industry as an example, due to insufficient internal funds, Huawei HiSili, the largest chip manufacturing company in China, has only 1/12 of the R&D investment of international chip companies. At the same time, the impact of the Sino-US trade war is enough for us to see international competition. Under the suppression, it is difficult for China to rely solely on direct government input to drive the development of enterprises. In this way, it is particularly important to determine the boundaries of industrial policies and to study the empirical impact of China's current industrial policies on innovation.

However, when there is information asymmetry between enterprises and policy makers, policy makers often cannot distinguish the true face of business. Some of them may purse the original innovation (Substantial Innovation), others may only satisfy with secondary innovation (Strategic Innovation). Therefore, companies may release signals that are inconsistent with their true types, in order to confuse policy makers and obtain policy benefits (financial subsidies, tax rates, etc.). Therefore, we must not only discuss the role of industrial policy in enterprise innovation, but also distinguish which role it is, and find a solution to it.

This paper attempt to solve 2 problems:

- Can mixed industry policies encourage companies to make real innovations?
- What kind of companies that can create real innovations?

2. Literature Review

The current literature does not clearly define the types of industrial policies. According to the tools and measures of industrial policies, industrial policies are generally divided into functional industrial policies and selective industrial policies (Lall, 2001). Jiang Feitao (2018) combed the development process of China's reform and opening up 40 years ago, and attributed China's current industrial policy to a Mixed Industrial Policy based on selective industrial policies and supplemented by functional industrial policies.

The academic community has different views on the economic benefits of industrial policies. Proponents believe that policy interventions can enhance industry

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spillovers and contribute to socioeconomic growth (Mur-phy et al., 1989; Rodrik, 1995); during the economic start-up, selective industrial policies can alleviate corporate financing constraints (Chen Donghua, 2010), improve resource replacement efficiency and local productivity (Song Lingyun, 2013), ease market segmentation (Budan, 2017), and promote industrial structure upgrading and optimization (Han Yonghui, 2017). On the other hand, economists such as Krugman believe that there is no need for industrial policy. The reason is that there is no efficient standard for the selection of policy support objects and evaluation of implementation effects, which increases the possibility of misallocation of economic resources by the government (Krugman, 1983); domestic scholar Lin Yifu (2010) often proposed that the government supports are likely to cause “flushing effects” when the whole society has a consensus on promising industries. Li Wenjing (2014), Cheng Junjie (2015), Wang Kemin (2017) and other scholars also believe that the Selective Industrial Policy decreases the industrial production efficiency.

The above-mentioned literature focuses on the impact of industrial policies on the industrial structure through the allocation of resources, but lacks research on the micro-impact of the current industrial upgrading. In contrast, there is not much literature focusing on corporate innovation, nor a consistent conclusion. On the one hand, in theory, industrial policy may have two opposite effects on promoting technological innovation (Jiang Feitao, 2010; Lin Yifu, 2016; Zhang Weiying, 2016). On the other hand, in empirical research, measuring industrial policies is difficult. Existing literatures attempt to comprehensively examine the impact of industrial policies by interpreting the industrial policies and regulations. For example, Li Wenjing (2016) found that the number of patents granted by industrial policies has increased, but only non-invention patents have increased significantly, this finding means enterprises have pursued the number but not quality; Yu Minggui (2015), Tan Zhouling (2017) studied the relevance of China's industrial policy and enterprise innovation through government's “five-year plan”. Both of them believe that industrial policy can significantly promote enterprise innovation and promote the private enterprise; Meng Qingyu et al (2016) studied from the perspective of "resource effect" and "competitive effect" and found that industrial policy can increase the innovation investment of enterprises, but reduces their nnovation efficiency.

By reviewing literatures, we find that the correlation between industrial policy and innovation is more based on theoretical analysis at the macro level and empirical evidence at the micro level is lacking. What’s more, the predecessors' definitions of selective industrial policies and functional industrial policies are vague, and the relevant measures of the government are not distinguished in the empirical process. Last but not least, the current literature does not identify which industrial policy measures and what enterprises can bring real innovation.

3. Hypothesis

From the perspective of signal theory, the support measures of industrial policy are transmitted to private investors as a signal to improve investment, helping

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companies to label the government-approved, and help companies to obtain the required innovation resources to enhance innovation (Lerner, 1999; Feldman & Kelley, 2006; Kleer, 2010) Therefore, in theory, selective industrial policies can effectively improve the innovation ability of enterprises.

However, when there is information asymmetry between enterprises and policy makers, policy makers often do not understand the true type of the company. In order to confuse policy makers and obtain policy benefits (financial subsidies, tax rates, etc.), companies may also release signals that are inconsistent with their true types. In addition, when the government provides after-the-fact support to subsidize or protect a particular company, the industry threshold is lowered, and other companies will compete to enter the industry support industry, and the role of the market will be suppressed. When the economy is full of rent-seeking activities (Dosi et al., 2006; Lin Yifu, 2002), companies will adopt simple innovation (Tongliang et al., 2009) or one-sided pursuit of innovation (Hall & Harhoff, 2012) to get more government grants. This means that the "innovation" of a company is only a management strategy. Its purpose is not to substantially improve the technological competitiveness of the enterprise, but to obtain certain benefits or cater the government.

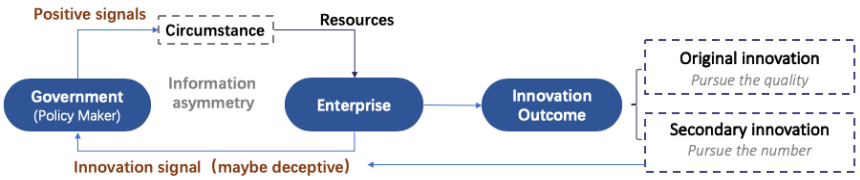

Figure. 1 The mechanism of Hypothesis 1

H1: Mixed Industrial Policy will promote the overall innovation output of enterprises, but innovation is more strategic innovation than substantive innovation.

Generally speaking, there is information asymmetry in the government's decision to provide subsidies to which companies. For private enterprises, the presence of former government officials in enterprises is more likely to be regarded as having good development prospects and social contributions (Cull and Xu, 2005; Li et al., 2008). Therefore, private enterprises with political connections can obtain more financial subsidies than private enterprises without it.

Establishing political ties is a positive reaction of private enterprises to the market, government and law. Political connections can be used as an informal alternative mechanism to overcome backward systems such as law, property rights and financial development, helping private enterprises overcome backwardness. The formal system is a hindrance to its own development. Therefore, the establishment of political links between private enterprises is not only conducive to the

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development of enterprises themselves, but also to the effective allocation and economic development of scarce resources in the whole society (Chen et al., 2005; Li et al., 2008; Yu Minggui, Pan Hongbo, 2008; Luo Party Theory, Tang Qingquan, 2009).

However, under the Selective Industrial Policy, local governments have strong economic autonomy and control over fiscal expenditure. In addition to individual expenditure items, there is no clear legal and institutional norms restrict. Therefore, local government officials have strong discretion when deciding to provide financial subsidies to enterprises. Government officials may even deliberately make the criteria for granting subsidies ambiguous or highly arbitrary, thus providing local government officials with “free rent” and corporate rent-seeking.

H2: Enterprises without political connections have higher levels of substantive innovation than private enterprises with political connections.

4. Methods

4.1 Sample and data source

This paper selects the 2005-2015 Chinese industrial enterprise data as a research sample, deleted For financial and ST-type enterprises, companies with a total number of patent applications less than one are deleted, and companies with less than zero shareholder equity are deleted.

The industrial policy data is derived from the open policies and regulations of the China Development and Reform Commission. The patent data is from the patent database of China A-share listed companies established by Tong et al. (2014). The financial data and government subsidy data of the company are sourced from Guotai'an database, enterprise. The property data comes from the Wind database.

4.2 Variable design

(1) Industrial policy (IP_D). the same empirical evidence as the impact of existing research macro-industry policies on micro-enterprise behavior (Chen Donghua et al., 2010; Song Lingyun and Wang Xianbin, 2013; Li Wenjing and Li Yaotao, 2014; Han Gan and Hong Yongzhen, 2014), Based on the interpretation of the industrial policy documents: the industries with “development”, “encourage” and “adjustment” in the industrial policies issued by the China Development and Reform Commission. When the industry in which the company is located is in the scope of industrial policy incentives, the IP value is 1. On this basis, the industry with key support is proposed, with a value of 2. Otherwise 0.

(2) Enterprise innovation capability. Referring to Dosi et al. (2006), Tan et al. (2014), Tong et al. (2014), and Zhou Wei et al. (2012), this paper measures the innovation ability of enterprises by the number of patent applications.

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(3) Control variables. Controlling the size of the company, the age of the company (Age), cash flow (CF), debt ratio (Lev), liquidity (Liquidity), retained earnings (RE), asset structure (Tangibility) and return on assets (ROA).

Table 1 Variables Defination

Variables	Definition
IP_D	Fiscal variables of industrial policy. When the industry in which the company is located is in the scope of industrial policy incentives, the IP assignment is 1. The industry that proposes the key support, the assignment is 2, otherwise 0.
Patent	Total number of company patents (inventions, utility models and designs) for year
Patenti	The total number of company invention patents for the year
Patenud	The total number of non-invention patents (utility models and designs) in the year
Political	According to Fan et al. (2009), if the company's general manager, chairman or director is now or has served as a local government official or Communist Party official, then Political is defined as 1 , otherwise 0.
Size	Natural logarithm of total assets
Age	Since the establishment of the company, take the natural logarithm
CF	Natural logarithm of net cash flow from operating activities
Lev	Asset-liability ratio = total liabilities / total assets
Liquidity	Current ratio = current assets / current liabilities
RE	Natural logarithm of retained earnings
Tangibility	Fixed assets ratio = net fixed assets / total assets
ROA	Return on assets = net profit / total assets balance
Industry	Industry dummy variable. Based on the 2001 Industry Classification Guidelines and the 2012 Industry Classification Guidelines issued by the China Securities Regulatory Commission, the manufacturing industry code (category C) is divided into three levels, which are divided into 62 industry dummy variables.

4.3 Models

(1) Hypothesis 1:

$$LnPatent_{i,t}\left(LnPatenti_{i,t}, LnPatentud_{i,t}\right) = a_0 + a_1\, IP\_D_{i,t} + \sum controls + \varepsilon \quad (1)$$

(2) Hypothesis 2:

$$LnPatent_{i,t}\left(LnPatenti_{i,t}, LnPatentud_{i,t}\right) = a_0 + a_1\, IP\_Di,t + a_2\, IP\_D^{*}\, Political\ i,t + \sum controls + \varepsilon \quad (2)$$

5. Results

In order to verify the conclusion, this article firstly performs regression on the main hypothesis (hypothesis 1), and the test results are shown in the following figure:

(1) Descriptive statistical characteristics

Table 1 contains descriptive statistics for all variables involved in Hypothesis 1. After the industry-level three-digit code screening, the industrial policy incentive (IP_D) was 0.536, which was less than 0.8 in the data of Li Wenjing (2016). The

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annual average value of patent applications (PAT) is 30.59, and the standard deviation is 82.25. The data distribution of Li is basically the same. It can be seen that the patent applications between enterprises in China are uneven. The average value of patents (Patenti) is 13.21, which is only 50% of non-invention patents.

Table 2 Descriptive statistical characteristics

Variable	Obs	Mean	Std.Dev.	Min	Max
IP D	3,744	0.536	0.499	0	1
Patent	3,744	30.59	82.25	1	1052
Patenti	2,774	13.21	40.50	1	949
Patentud	3,087	25.23	62.78	1	774
Liquidity	3,727	1.538	1.021	0.306	6.506
ROA	3,727	0.0345	0.0561	-0.199	0.183
Size	3,727	21.63	1.076	19.38	26.10
Age	3,744	2.657	0.236	1.792	3.258
CF	3,110	18.74	1.514	14.72	23.90
Tangibility	3,727	0.302	0.150	0.00847	0.744

(2) Result of hypothesis 1

The empirical analysis results are consistent with the assumptions. The IP valuations in (1) (2) (3) are all significant at the level of 5%, while the coefficients in column (2) are 0.323, and those in column (3) are 0.597.

Table 3 Mixed industrial policy and innovation

	(1)	(2)	(3)
	LnPatent	LnPatenti	LnPatentud
IP_D	0.589**	0.323**	0.597**
	(0.094)	(0.091)	(0.107)
L.Liquidity	-0.021	0.033	-0.046
	(0.034)	(0.035)	(0.039)
L.ROA	1.203*	0.691	1.408*
	(0.677)	(0.662)	(0.741)
L.Size	0.514***	0.399***	0.502***
	(0.059)	(0.058)	(0.064)
L.CF	0.009	0.008	-0.006
	(0.026)	(0.026)	(0.029)
L.Tangibility	-0.607***	-0.155	-0.659***
	(0.208)	(0.207)	(0.230)
L.Age	0.015	-0.221**	0.003
	(0.103)	(0.100)	(0.112)
L.RE	0.062	0.073*	0.034
	(0.041)	(0.040)	(0.045)
L.Lev	-0.383	-0.115	-0.604**
cons	-9.938***	-8.098***	-8.904***
	(0.699)	(0.676)	(0.763)
N	2138	1727	1812
R^2	0.384	0.325	0.366

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The expected conclusions are consistent with the hypothesis. Current mixed industrial policies have spurred the improvement of the level of innovation of enterprises, but most of them are strategic, pursuing innovation in quantity rather than quality. The means of implementing industrial policies are more direct than the financial support (the fiscal and taxation policy). non-financial support can make a good market atmosphere, such as increasing market competition, increasing credit support, and improving the level of substantive innovation of enterprises. At the same time, private enterprises with government contacts is more likely to acquire more resources, but it is easier to participate in rent-seeking activities and reduce innovation behavior. Conversely, private enterprises with no government connections can create higher levels of real innovation.

(2) Result of hypothesis 1

Compared with non-politically linked companies, political unions are more likely to receive financial subsidies, so they blindly innovate to cater for policies and obtain more support

In model (2), we use the political connection variable Politicalt as the multiplication term, and the test results showed in table 4 that the coefficient of IP_D * Political in column (3) is significant at the level of 10%, but not Significantly in column (2) . This result is consistent with the expectations of Hypothesis 1. Enterprises with political ties are stimulated by industrial policies and the increase in patent applications is more likely to be motivated by the policy to capture the government and “find support”. Instead of really improving the "quality" of innovation. The implementation of China's industrial policy should pay attention to the market competition environment, and cannot replace market choices with government intervention.

Table 4 Government links, industrial policy and innovation

	(1)	(2)	(3)
	LnPatent	LnPatenti	LnPatentud
Political	0.4673**	-0.0564	0.5438**
	(4.00)	(-0.29)	(3.28)
IP_D* Political	0.0362*	0.101	0.100*
	(11892)	(11874)	(21142)
Control Variables	Yes	Yes	Yes
cons	-9.938***	-8.098***	-8.904***
	(0.699)	(0.676)	(0.763)
N	2138	1727	1812
R^2	0.384	0.325	0.366

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6. Conclusion

This article takes innovation as an entry point, using the data of Chinese industrial listed companies from 2005 to 2015, and uses Li Wenjing's (2016) classification of corporate motives in an attempt to help the government distinguish between "innovation-seeking" innovative companies and those that actually create substantial innovation. And on this basis, the types of enterprises, cross-research on which enterprises are more able to promote the creation of true innovation, rather than pursuing innovation that ignores quantity in quality. The relevant results are summarized as follows: the current mixed industrial policy has stimulated the improvement of enterprises 'innovation level, but most of them are strategic, that is, they mostly pursue quantitative rather than qualitative innovation; at the same time, although government-linked private enterprises are more It is possible to obtain more resources, but it is easier to participate in rent-seeking activities and reduce innovation. On the contrary, non-government-owned private enterprises can create a higher level of real innovation.

The analysis results of this article may have the following policy implications and micro-recommendations: First, when the government formulates industrial policies to stimulate enterprise creation, it should refine according to the difficulty, depth and potential value of innovative behaviors to promote substantial innovation. Second, when implementing industrial policies, the government 's judgment and choices should not be used instead of market choices. Instead, market mechanisms should be maintained, and the "survival of the fittest" in market competition should be used to screen out capable enterprises to give innovation subsidies. Third, strengthen The control of government-linked enterprises creates a good market environment, reduces restrictions on private enterprises, and protects their innovation activities.

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