

The impact of strategic emerging industries policy mix on firms' innovation performance

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Abstract. Based on the data of strategic emerging firms listed in Chinese A-shares from 2007-2019, this paper uses the PSM-DID model to investigate the impact of the combination of credit financing and tax incentives policies on firms' innovation performance. It is found that the policy combination constructed in this paper has a positive impact on the innovation performance of strategic emerging firms at a high significant level. In addition, by testing credit financing and tax incentives separately, it is found that both credit financing and tax incentives have a positive effect on the innovation performance of enterprises.

Keywords: Policy Portfolio; Innovation Performance; PSM-DID.

1. Introduction

As an important industry leading the long-term socio-economic development, strategic emerging industries are of great significance to promote China's socio-economic transformation and innovation-driven development, and the effects of their policy formulation and implementation are particularly important. Since the release of strategic emerging industries policy, scholars have been analyzing its implementation effect. At the macro level, Xing hui et al. believe that strategic emerging industries policy promotes enterprise in-novation, but the substantive innovation of enterprises is affected by rent-seeking behavior [1]; Shao Yunfei et al. conclude that the overall innovation capacity of strategic emerging industries in China is weak and the regional development is unbalanced [2]; Sun Yang-yang et al. use double-difference model analysis concluded that strategic emerging industry policies can alleviate the financing constraints of enterprises and improve their total factor productivity in this way [3]; Chen Wenjun et al. paper used the panel data of bio-pharmaceutical enterprises from 2007-2014 as a sample and concluded that the innovation performance of listed biopharmaceutical companies was significantly reduced due to the enactment of strategic emerging industry policies [4]. At the level of single policy instrument analysis, Ran Yu et al. concluded that credit policy enhances the scale of interest-bearing debt financing of strategic emerging enterprises, and when combined with regional industrial policies, herding effects and rent-seeking activities emerge, making enterprises over-finance and reducing the efficiency of credit policy in optimizing resource allocation [5]; Yan Xiaochang et al. concluded through empirical studies that government subsidies improve the economic performance of strategic emerging industries, but have no significant effect on Yan et al. concluded through empirical studies that government subsidies improve the economic performance of strategic emerging industries but have no significant effect on innovation performance, and in general, there is overcapacity in strategic emerging industries in China [6]; other researchers concluded that the subsidy policy implemented in China promotes innovation in strategic emerging industries [7]; Chen Yanglin et al. used the PSM model to empirically show that the innovation investment of enterprises in emerging industries is significantly increased by tax incentives [8]. In the comparison of the effects of tax incentives and fiscal subsidies on the innovation performance of enterprises, Chu Deyin et al. concluded that fiscal subsidies and tax incentives have a positive incentive effect on innovation investment in strategic emerging industries [9]; Hu Jia concluded through an empirical study that the positive effect of tax incentives on R&D intensity of strategic emerging enterprises is more obvious compared to fiscal subsidy policies, and both tax incentives and fiscal subsidies have a

innovation capacity of emerging industries did not achieve the expected effect of incentive effect [10].

After the release of strategic emerging industries policy, many scholars have analyzed the effect of its implementation, but most of them analyze the impact of strategic emerging industries policy on enterprises at the macro level or use a single policy tool to conduct empirical research on enterprises' innovation performance and innovation efficiency, while enterprises are often affected by multiple policies in the process of development. Therefore, this paper investigates the impact of a combination of credit financing and tax incentives on the innovation performance of enterprises from the perspective of a policy combination tool, and uses it to make relevant suggestions.

2. Research Design

2.1 Sample selection and data sources

This paper selects the data of strategic emerging companies in Chinese A-share listed companies from 2007-2019 for empirical investigation, taking 2011 as the policy starting point. The specific data sources are as follows: (1) the industry-level data of strategic emerging industries used in this paper are obtained from the latest list of emerging compo-site index sample stocks released by China Securities and Exchange Corporation, on which the NSS sample is excluded and only A-share listed companies are retained; (2) the patent data of listed companies are obtained from the patent segment of CNRDS database; (3) interest payable, tax rebates received and control variables Data were obtained from the company research series segment of CSMAR database. The data obtained for strategic emerging enterprises were processed as follows: (1) companies with ST and *ST during 2007-2019 were excluded; (2) companies with incomplete data were excluded; (3) to re-duce the influence of outliers, this paper used the Stata software Winsor command to tai-lor the data by 1% up and down.

2.2 Variable Description

Explained variable: firm innovation performance. The innovation performance of enterprises is mostly measured by indicators such as R&D investment, new product output value, and the number of patent applications or licenses. In high technology industries, innovation results can better reflect the innovation capability of enterprises than R&D investment, and since new product output value is difficult to obtain, this paper draws on Chen's definition [4] and uses the total number of three types of patent applications to measure innovation quality, and the total number of invention patent applications to measure innovation quality.

Explanatory variables: combination of credit financing and tax incentives. In this paper, borrowing from Wang Guijun et al [11], we construct a dummy variable $combi_{i,t} = \{0, 1\}$ to measure the implementation of the combination of tax incentives and credit financing. bank loans are the main source of enterprise financing, but enterprise financing loan funds come from more than banks, so in measuring credit financing, we refer to Hai benlu et al [12] and use interest expense to measure credit financing ($cre_{i,t}$), and for the measurement of tax incentives, this paper refers to Liu Guangqiang et al. [13] and uses tax rebates to measure tax incentives ($tax_{i,t}$). the definitions and measures of the main variables are shown in Table 1.

Table 1. Variable definition and metric

Variable Type	Variable Name	Definition and Metric
Explained variables	Quantity of innovation (patent)	LN(1 + the total number of three types of patents filed by the enterprise in the year)
	Quality of innovation (innovation)	LN(1 + the total number of invention patents applied by the enterprise in the year)
Explanatory variables	Credit financing (cre)	Interest payable greater than 0 is 1, otherwise 0
	Tax incentives (tax)	Tax rebate received is 1 if greater than 0, 0 otherwise
	Policy mix (combi)	Combi=1: both credit financing and tax incentives take the value of 1; Combi=0: at most one of credit financing and tax incentives takes the value of 1
Control variables	Age of the company (age)	LN(1 + age of the firm)
	Firm size (size)	LN(total assets of the firm)
	Asset intensity (k)	Total assets/revenue
	Return on assets (roa)	Net profit/total assets
	Gearing ratio (lev)	Total liabilities/total assets
	Fixed assets ratio (fix)	Enterprise fixed assets / enterprise total assets
	Current ratio (liq)	Enterprise current assets/enterprise current liabilities

Notes: LN() means to take the natural logarithm of a number

2.3 Model Design

In this paper, the PSM-DID model is used to study the impact of assessing the policy mix of strategic emerging industries on firms' innovation performance. According to the PSM matching requirement, the sample was divided into two categories, one for the treatment group, i.e., firms that received both credit financing and tax incentive policy support, and the other for the control group, i.e., firms that received at most one of credit financing and tax incentive policy support. In this paper, one-to-one neighbor matching is adopted, and the multidimensional covariates are reduced to one-dimensional variables by logit regression, and one-to-one matching is performed after obtaining the propensity score values. After matching is completed, the unmatched samples are removed and regression is performed with the DID model. the PSM model is constructed as shown in (1) and the DID model is constructed as shown in (2).

$$combi = \alpha_0 + \alpha_1 age + \alpha_2 size + \alpha_3 k + \alpha_4 roa + \alpha_5 lev + \alpha_6 liq + \alpha_7 fix + \varepsilon \tag{1}$$

$$innovation_{i,t} = \beta_0 + \beta_1 combi_{i,t} \times year_t + \beta_2 X_{i,t} + \mu_i + \delta_t + \varepsilon_{i,t} \tag{2}$$

3. Empirical Results and Analysis

3.1 Descriptive Statistics

The mean value of the indicator of the combination of credit financing and tax incentives (combi) is 0.271, which indicates that 27.1% of the firms in the sample received both credit financing and tax incentives, indicating that fewer firms received support from both policies. The mean values of innovation quantity (patent) and innovation quality (innovation) indicators are 1.654 and 1.212, with standard deviations of 1.576 and 1.336, both with minimum values of 0.000 and maximum values of 6.031 and 5.308, which indicate that the overall innovation capability of enterprises is average and varies widely across enterprises. In addition, the selected control variables indicators of asset intensity (k), current ratio (liq), and fixed asset share (fix) also have a relatively wide range of fluctuations.

3.2 Propensity score matching test

The regressions were performed with Logit based on the PSM model. According to the matching requirements, the sample was divided into two categories, i.e., treatment and control groups, i.e.,

firms that received support from both credit financing and tax incentives and firms that received support from at most one of credit financing and tax incentives. The results show that the bias value of the matched sample is significantly reduced, and the absolute value of the bias of each control variable after matching is less than 5%, and none of the t-values are significant. It can be seen that the data collected in this paper are well matched, and the matching results of the control variables in the treatment and control groups satisfy the requirements of the equilibrium assumptions of the DID model, indicating that the use of the PSM-DID model in this paper is appropriate.

3.3 Baseline regression results

The data in this paper were logit regressed according to the PSM model, and after matching was completed, the samples that did not match were removed and regressed with the DID model, and the baseline regression results are shown in Table 2. The interaction term regression coefficient of *combi*year* in the first column (1) is 0.067, which is significant at the 5% level, indicating that the policy combination constructed in this paper has a significant positive promotion effect on the quantity of enterprise innovation; the interaction term regression coefficient of *combi*year* in the second column (2) is 0.065, which is significant at the 5% level, indicating that the combination of credit financing and tax incentives has a similar positive promotion effect. In this paper, the two policies of credit financing and tax incentives are tested separately, and the test results are shown in *credit(3)* and *tax(4)*.

The results are shown in *credit(3)* and *tax(4)*. It can be seen that credit financing and tax incentives have a significant positive effect on the policy mix constructed in this paper, which further concludes that the policy mix constructed in this paper has a significant positive effect on the innovation performance of enterprises at a high level.

Table 2. Table 4 Baseline regression results and path test.

Variables	patent(1)	invention(2)	credit(3)	tax(4)
<i>combi*year</i>	0.067** (2.20)	0.065** (2.44)	0.595*** (59.2)	0.375*** (37.69)
<i>age</i>	0.143 (1.14)	0.338 (0.31)	-0.130*** (-3.15)	0.111*** (2.72)
<i>size</i>	0.262*** (9.00)	0.237*** (9.35)	0.116*** (12.08)	-0.016* (-1.71)
<i>k</i>	-0.001*** (-5.99)	-0.001*** (-5.26)	0.000*** (5.60)	-0.000*** (-6.91)
<i>roa</i>	0.108 (0.44)	0.256 (1.19)	-0.232*** (-2.85)	-0.005 (-0.06)
<i>lev</i>	-0.094 (-0.88)	0.001 (0.01)	0.549*** (15.62)	-0.096*** (-2.76)
<i>liq</i>	-0.003* (-0.96)	-0.001 (-0.05)	-0.006*** (-6.74)	0.001* (-1.29)
<i>fix</i>	1.032*** (5.69)	0.660*** (4.17)	-0.016 (-0.27)	0.134** (2.27)
Year fixed effects	be	be	be	be
Corporate fixed effects	be	be	be	be
R2	0.086	0.080	0.437	0.164
<i>_cons</i>	-4.68*** (-7.26)	-4.416*** (-7.84)	-2.009*** (-9.43)	0.737*** (3.51)

Notes: *, **, *** denote significance levels at 10%, 5%, and 1%, respectively.

4. Concluding remarks

This paper empirically analyzes the impact of the policy mix of credit financing and tax incentives on the innovation performance of strategic emerging firms based on data from strategic emerging firms listed in Chinese A-shares from 2007-2019. It is found that (1) the policy combination constructed in this paper has a positive impact on the innovation performance of strategic emerging firms at a high significant level; (2) by testing credit financing and tax incentives in the policy combination separately, it is concluded that both credit financing and tax incentives have a positive driving effect on firms' innovation performance. (3) After the placebo test, the conclusion reached is consistent with the main regression findings that the combination of credit financing and tax incentives policies has some positive effect on firms' innovation performance.

This paper inevitably has some shortcomings and limitations: this paper only selects the effects of two policy tools, credit financing and tax incentives, on enterprise innovation performance in strategic emerging industries policy, in fact there may be interaction effects between multiple financial policy tools, and future research considers the combined effects of multiple financial policy tools such as equity financing, government subsidies and R&D subsidies.

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