Government Subsidized R&D, Project Screening, and Firms' Innovation: Evidence from China*

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Abstract

The effects of government subsidies to corporate R&D on firms' innovation outputs still remain inconclusive in existing studies. Moreover, little is known how the screening system of the public R&D programs influences the effect of such programs. This study examines the effects of Innofund (one of the largest Chinese government programs supporting corporate R&D activities) on firms' innovation outputs in China. In particular, the project screening mechanism was changed due to policy amendments in 2005. This exogenous policy shock allows us to estimate how the project screening system affects the influence of public R&D subsidies. Based on a panel dataset of Chinese manufacturing firms, we find Innofund-backed firms outperform their non-Innofund-backed counterparts in innovation, measured by the number of patents, new product sales, and the volume of exports after they gained funding. The magnification effects of Innofund are larger after 2005, when the project-screening scheme became more decentralized indicating that decentralized screening functions better in public R&D investment. Finally, the effects of Innofund and the effects of the decentralized screening system that occurred in 2005 vary substantially across markets. The more economically and institutionally developed the market is, the stronger the Innofund effects and the project selection decentralization effects appear. The identification problems are handled by using the propensity score matching approach and the instrumental variable approach.

Key words: Government R&D Program, Innovation, Project screening system, Institutions

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1. Introduction

Government funding for R&D activities is a major phenomenon in most countries. Theoretical arguments on the pros and cons of public financing in corporate R&D are abundant. Empirical estimations on the effects of government-subsidized R&D based on firm-level data remains modest and inconclusive. Griliches and Regev (1998) and Branstetter and Sakakibara (1998) find that government-subsidized firms achieve higher productivity and profitability in Israel and Japan, respectively. Lerner (2000) reports that US firms subsidized by SBIR (Small Business Innovation Research program) grow faster in terms of employment and sales compared with firms that are not backed by SBIR. A collection of studies suggest that government-subsidized firms invest more in R&D activities compared with firms that are not backed by the governments in the US (Audretsch et al., 2002), Israel (Lach, 2002), Ireland (Görg and Strobl, 2007), and Germany (Aerts and Schmidt, 2008; Czarnitzki and Lopes-Bento, 2011). Griliches and Regev (1998) and Irwin and Klenow (1996) also suggested that government-subsidized firms generate higher social returns than their counterparts.

However, some studies find negative or no relationship between government subsidies, corporate R&D activities, and firm performance. For instance, Klette and Møen (1999) find that government subsidies have no positive effects on firm performance in Norway. Using similar data, Clausen (2009) finds that "research" subsidies stimulate R&D spending within firms whereas "development" subsidies substitute such spending in Norway, which suggests that private R&D expenditure is best stimulated in areas where the gap between the social and the private rate of return to R&D is high. Furthermore, examining the public R&D financing in Finland, Lööf, and Hesmati (2005) find that public R&D financing has positive effects only on the private research expenditures of small firms. Wallsten (2000) used a unique dataset that covers SBIR-funded firms and SBIR-rejected firms and firms that never applied for SBIR backing, and find that SBIR subsidies crowd out private R&D inputs. By contrast, David et al. (2000) suggest that this crowding effect varies across industries. Acemoglu et al. (2013) finds that government R&D subsidies to incumbent firms reduce social welfare and growth because of the crowding out effects.

The mixed results of the examinations on government backed private R&D activities alert us to some major questions. First, the different results from cross-country studies suggest that the effectiveness of public support to private R&D activities may vary under different institutional contexts. Second, the above-mentioned studies emphasize government involvement as a response to market failure, but they are based on an assumption that the government is well organized, uncorrupted, and relatively benevolent. However, distortions of government interference in the market have been extensively discussed (Stigler, 1971; Laffont and Tirole, 1993). In particular, China poses serious challenges to the literature that although its legal and financial institutions are underdeveloped or flawed, it is one of the fastest growing economies in the world in the past one third of a century (Allen et al., 2005; Xu, 2011, Allen et al., 2012). Moreover, driven by the government policy and government finance, China's R&D expenditure became the second largest in the world since 2010 (WSJ, 2010) and may become the largest in the world around 2022

(KPMG, 2013), its R&D over GDP ratio is now higher than the EU (Noorden, 2014), and its total patent applications has surpassed the U.S. since 2011 (KPMG, 2013).[1] A natural question is whether government interference can also solve market failures in an economy, such as that of China, where "government failures" are more severe, and market system is in the transition period and yet functional well.

Furthermore, most of existing literature focuses on the consequences of government R&D programs without examining the project screening system of the programs. The quality of the investment may depend on how the projects are selected. Sah and Stiglitz (1991) discuss the tradeoffs of the project selection under centralized and decentralized decision-making contexts. They suggest that centralized organizations might delay decision-making and reduce the total number of projects because of cost constraints and lack of local information compared with decentralized screening system. Associated with this line of research, which is mainly derived from the information approach, Aghion and Tirole (1997) and Hart and Moore (2005) further emphasize that a decentralized decision-making system may strengthen the incentive of local agents for acquiring information and may reduce the overload problem experienced by the principal. At the same time, decentralized decision-making for matters that are more relevant to local agents may facilitate the participation of the agent in contractual relationships. However, decentralized

[1] Noorden, Richard Van, 2014, "China tops Europe in R&D Intensity," Nature, 08 Jan. 2014, (http://www.nature.com/news/china-tops-europe-in-rd-intensity-1.14476); WSJ,2010,"China Surpasses Japan in R&D as Powers Shift," Wall Street Journal, 13/12/2010; KPMG, 2013, "Innovated in China: New Frontier for Global R&D," (http://www.kpmg.com/CN/en/IssuesAndInsights/ArticlesPublications/Newsletters/China-360/Documents/China-360-Issue11-201308-new-frontier-for-global-R-and-D.pdf);

decision-making may be at the cost of losing control. Another line of research mainly based on the soft-budget constraints approach argues that investment in projects of high uncertainty by a centralized system may be inefficient due to the lack of commitment to withdraw the investment. This bureaucratic screening system may mistakenly filter out or delay promising but risky projects that can potentially generate high social returns (Dewartripont and Maskin, 1995; Qian and Xu, 1998). The above-mentioned studies suggest that the efficiency and quality of investment decisions depend on how project selection is organized. However, to our knowledge, no research on public R&D subsidy programs addresses the effects of project screening system on the consequences of the programs.

The present study fills these gaps. We examine the effects of Innovation Fund for Small and Medium Technology-based Firms (Innofund), the largest government program that supports the R&D activities of privately owned small- and medium-sized firms in China. China is of our special interest for four major reasons. First, China is the world's largest economy where the government has long been deeply involved in businesses, particularly in resource allocation (Allen, et al., 2005; Li et al., 2008; Guo et al., 2013a; Guo et al., 2013b). At the same time, the Chinese government has been emphasizing the role of innovation in fostering a sustainable economy, and allocates public funds at accelerating rates to support R&D activities. These public financing initiatives set up a context for us to examine whether government R&D programs under the "visible hand model" is effective. Second, the Innofund program, which was initiated by the central government in 1999, experienced a substantial change in its project screening system in 2005, when the central government decided to shift from a centralized project screening system into a relatively more decentralized screening system. This exogenous policy change allows us to examine the effects of different ex-ante project selection systems on the effects of Innofund program, with a quasi-experiment approach. Third, China is large and the regions vary in terms of institutional and economic development (Xu, 2011). Examining the heterogeneity of the effect of the Innofund across regions within the same country (i.e., China) allows us to identify the effects of institutional and economic development resulting from government R&D programs by controlling identification concerns for which many cross-country studies are criticized (Allen et al., 2012). Finally, innovation and progress in science and technology are top government agendas in China. Public support in China for industrial innovation is also a major topic in international political economy because it determines the sustainability of China's growth and affects the competitive landscape of the global economy. However, solid empirical analysis on the consequences of public support is yet to be conducted. This assessment of Innofund will have important policy implications.

Three major questions are addressed in this paper. First, we ask whether Innofund-backed firms generate more innovation outputs compared with firms that are not backed by Innofund, and whether the outperformance is increased after the funds are infused. Second, we ask whether the change in project screening systems in 2005 affects the effect of Innofund on the innovation outputs of the firms. Third, we explore cross-market variations in the effects of Innofund on innovation outputs of the firms. Doing so allows us to identify how institutions and economic development interact with screening system changes after 2005.

We compare the innovation outputs of the Innofund-backed firms and their counterparts from 1998 to 2007, based on a panel dataset of Chinese manufacturing firms. Our sample includes almost all Innofund-backed manufacturing firms with annual sales over RMB 5 million across the nation within the period of time. The sample consists of over 18,000 firm-year observations for Innofund-backed firms and over 64,000 firm-year observations of non-Innofund-backed firms. We find that Innofund-backed firms generally outperform their non-Innofund-backed counterparts in terms of innovation, which is measured by new product sales, exports, and number of patents. At the same time, the increases in innovation outputs are significantly magnified after the firms gained Innofund. More importantly, the magnified effects of Innofund on corporate innovation were further increased after 2005 when the central government changed the project screening from a centralized system into a more decentralized one. The results confirm that decentralized screening is more effective than centralized screening in public R&D investment. Finally, we find that the effects of Innofund differ across markets. The effects of Innofund on the innovation outputs of firms are further increased in regions that are more economically developed and regions with a more developed private sector and legal institutions. Moreover, these magnification effects are further enlarged after 2005 when the Innofund screening system became more decentralized.

We use two approaches to deal with identification issues. First, we use the propensity score matching (PSM) methodology to match Innofund-backed firms with non-Innofund-backed firms by different dimensions in the year before the Innofund was awarded to reduce potential selection issues. To further address the potential concerns with omitted variables, we use an instrumental variable to identify whether the Innofund magnification effects are driven by unobservable variables. The instrumental variable we used is the total number of the firms in high-tech zones of the city, where the Innofund firm is located in each given year. The total number of the high-tech firms in local high-tech zones signals the overall development of corporate R&D capability and the supply of strong high-tech firms. This measure is a good instrumental variable for our estimations because of the higher probability of the local firms to be selected by Innofund when more high-tech firms are in a locality. The results of the two-staged regressions confirm that the magnification effects presented in Innofund-backed firms are driven by Innofund support.

The rest of this paper is organized as follows. Section 2 introduces the institutional background of Innofund program and the policy changes in 2005. Section 3 describes the sample and data. Section 4 presents the findings on whether Innofund affects innovation outputs of the firms and examines the robustness of the results. Section 5 reports the findings on the effects of the screening system change of Innofund. Section 6 provides empirical findings on the across-region heterogeneity of the Innofund effects. Section 7 concludes this study.

2. Institutional background of Innofund program

2.1 Introduction of Innofund Program

Innofund is a special government R&D program, which was established upon the approval of the State Council in May 1999. Innofund was included in the Law of the People's Republic of China on Scientific and Technological Progress in 2007. As a first policy guide fund, Innofund aims to "facilitate and encourage the innovation activities of small and medium technology-based enterprises (SMTEs) and the transformation of research achievements by ways of financing, trying to bring along and attract outside financing for R&D investment of SMTEs. At the same time, as a nonprofit-making government policy, 'it is oriented towards social welfare induced by positive effect of innovation."[2]

The principal criteria for Innofund applications are: First, the projects should comply with national industrial technology policies, bear relatively high potential for economic and social benefits, and should possess strong market competition capacity. Second, the applicant should be a business corporation with generally not more than 500 employees among which no less than 30% should have higher education Third, the annual R&D investment of the firm should be at least more than 3% of the total sales, and the number of direct R&D employees should be more than 10% of the total number of employees. Forth, firms with leading products in the market with economy of scale production must show good economic performance. The following projects will be prioritized: projects with innovative technology or independent intellectual property and high value-added; projects that are founded by research personnel or

[2] Source: http://www.innofund.gov.cn/

overseas returnees to transfer their scientific achievements; innovation projects jointly initiated by firms, universities, and research institutions; and projects that use new and high technology to revive the stock assets of traditional industries and drive job creation.

Innofund mainly provides three forms of financing, namely, appropriation, bank loan interest subsidies, and equity investment according to the introduction of the program. Appropriation is mainly the start-up capital provided to small firms founded by research personnel with their own scientific achievements. Partial subsidies are also provided to SMTFs for new product development and pilot production. The appropriation amount to each project will not exceed 1 million RMB, with a maximum of two million for key projects. Firms are required to provide dollar-to-dollar matching investments. Loan interest subsidies are mainly provided to SMTFs that require loans from commercial banks to expand the production scale of innovation projects. The total amount of subsidy of an individual project is generally within 1 million RMB and 2 million RMB for key projects. Equity investment is generally reserved for projects with high levels of technology, high innovation capacity, and market potential in emerging industries. On average, Innofund investments will not exceed 20% of the registered capital of the investee company.

Innofund has provided over 19.17 billion RMB to 30,537 projects from 1999 to 2011. Among these projects, 27,498 were backed through appropriation, 2880 were supported through loan interest subsidies, and 1,159 were sponsored by other forms, including bank loan insurance, equity investment, and other subsidies. In general, over 86% of Innofund-backed projects are backed with appropriation. The size of direct investments by Innofund seems modest compared with the total government R&D expenditure. Innofund induced 1:11 external finance from local governments, banks, and venture capitalists. Moreover, Innofund has incubated some world-class famous hi-tech firms, such as Zhongxingwei and Huawei. According to official reports, Innofund helped firms create about 450,000 jobs, 209.2 billion RMB in sales, 22.5 billion RMB in tax income, and 3.4 billion RMB in exports. By the end of 2008, 82 out of 273 publicly listed companies on China's Small and Medium Enterprises Stock Exchange were once supported by innofund[3].

2.2 Innofund administration before and after 2005

Two major government agency levels are involved in the administration of Innofund. At the central level, the Innofund Administration Center (IAC) under the Ministry of Science and Technology (S&T) is in charge of Innofund operations including issuing application guide, proposing preferred fields and industries for each year, screening and evaluating projects, and, conducting midterm supervision on individual projects and closing contract with firms. The Ministry of Finance plays a regulatory role and is involved in approving the yearly budget of Innofund and the application guidelines proposed by the Ministry of S&T for transferring funds to the IAC twice a year, and monitoring and the evaluation of Innofund. The Ministry of S&T and the Ministry of Finance should report to the State Council on the operation and performance of Innofund each year. A consulting committee composed of

[3] http://www.innofund.gov.cn/.

technology and management specialists, economists, and entrepreneurs help identify preferred supporting areas and provide advice on Innofund guidelines. The IAC is required to adhere to the principles of honest application, fair processing, strict selection, and transparent administration. According to the reports published by IAC, the fraud cases that occurred each year were less than 0.5% of total projects in the past ten years.

At the local level, each province has an Innofund office under the Provincial Science and Technology Committee, which reports to the IAC. The role of the local Innofund office was changed significantly in 2005, when the Innofund administration was reformed. The main policy changes focused on reducing application processes and the decentralization of screening and evaluation. In particular, local Innofund offices were delegated with more power in selecting projects. Before 2005, project screening was more hierarchical and centralized. Local Innofund offices mainly act as bridges between the IAC and local firms without much say on project selection. The local Innofund offices had three major responsibilities before 2005. First, they were responsible for delivering and promoting guidelines or policies from the IAC to local firms or agencies that helped firms prepare application documents required by the IAC. Second, they collected the application materials and transferred them to the IAC. Third, they were in charge of certifying the qualification of Innofund candidates. A panel of experts at the IAC then evaluated the recommended projects and the IAC made the final funding decisions. That is, local Innofund offices could only decide on the projects they recommend, but they had no say on the final decisions. Meanwhile, local governments did not have to commit any resources to the recommended projects until the final decisions were made by the IAC. After the final funding decisions were made, the provincial Bureau of Finances was normally required to match 50% of the total support from the central governments to the projects selected by the IAC.

In 2005, the Innofund program introduced a new application and screening system. This system largely increased the transparency of project screening and decentralized decision-making during project selection. The roles of the local Innofund offices shifted afterwards. First, the local governments (provincial level) were required to set up their own Innofund programs and took responsibility for initial project selection starting from 2005. The project assessments conducted by the local Innofund offices comprised 30% of the final decision made by the IAC. Unlike in previous practice, where local governments only needed to provide matching funds to projects granted by the IAC, the 2005 reform required local Innofund offices to commit at least 50% of the proposed support (25% for provinces in western China) to the locally selected projects before they recommend such projects to IAC. Moreover, local Innofund offices were required to publicize the list of the projects they plan to recommend to IAC on their websites for two weeks before they finally submit their recommendations. The local Innofund offices must react if any public criticisms are made on the proposed projects.

The policy change in 2005 fundamentally changed the ex-ante project screening of the Innofund program. First, it decentralized decision-making in ex-ante project evaluation by giving local-knowledge holders more say in final decisions.

Second, it introduced a co-investment mechanism that aligns the interests of the local and central governments. Third, it created a monitoring system that allows the public to observe the decisions made by local governments through a system that makes mandates transparent. This systematic change reduces potential agency problems and incents local governments to exert more effort in project selection. Similarly, it reduces inefficiencies because of the hierarchical decision-making process. Hence, we expect this policy change to significantly change the effects of the Innofund program.

3. Data and Sample

Our data come from three major sources. First, basic information on Innofund-backed firms is from the website of Innofund program (http://www.innofund.gov.cn). The names of Innofund-awarded firms are publicly announced on the website each year since 1999. The website provides the name and address of the firm, the project by nature, the date the firm won Innofund, the type of support from Innofund, and the performance evaluation results of the project (i.e., terminated during the process or finished on time with the proposed goal achieved). Second, firm-level data on financial information and other firm-specific characteristics are from the Chinese Manufacturing Firm Survey Database (CMFSD). CMFSD is virtually composed of all manufacturing firms in China, with annual sales of at least 5 million RMB (US$ 750,000) between 1998 and 2007. This database provides sophisticated financial information and other firm-specific information, including location, industry, age, ownership structure, and others. Last, patent data are from National Patent Database, which covers complete information for all patents filed in China.

We first identify the Innofund-backed firms in CMFSD to gain financial and other information for the firms. We observe a total of over 6,167 projects backed by Innofund between 1999 and 2007 (some firms were backed by Innofund more than once) from the Innofund website. We use accurate matching to match Innofund-backed firms to the CMFSD by names, addresses, and SICs. Subsequently, we use fuzzy matching to avoid missing those firms whose names or addresses are not consistent with the census database (e.g., when abbreviations are used either in the Innofund website or the census database). Moreover, an Innofund-backed firm will be excluded if it lacks information in the year when it received funding. Given that the database only covers manufacturing firms with annual sales of at least 5 million RMB, we lose non-manufacturing Innofund-backed firms and Innofund-backed firms with sales less than 5 million RMB for the estimations. This data screening and matching strategy enables us to cover almost a full sample of Innofund-backed manufacturing firms that are included in the Chinese Manufacturing Enterprise Survey. After preliminary matching, 2,638 firms that won at least one Innofund between 1999 and 2007 are obtained for estimations. The sample consists of a total of 18,224 firm-year observations for Innofund-backed firms in total.

We then construct a control group to compare Innofund-backed and non-Innofund-backed firms in terms of innovation outputs. We build the control group in several steps to ensure that our results are not driven by a specific matching method. We first identify the non-Innofund-backed firms (i.e., firms that were eligible to applying for Innofund but did not apply or did not win it each year) from the Chinese Manufacturing Firm Survey Database. The Innofund selection criteria are announced officially each year. A firm is eligible for Innofund application if it has a SIC code[4] that is similar to the SICs of the awarded group, if it has less than 500 employees, if it has more than 30% employees working on R&D and if it has a leverage ratio lower than 70%. After identifying the non-Innofund-backed firms, we randomly draw one-

[4] The National Bureau of Statistics in China updates the SIC system in 2003, so we amend the two-digit SIC before 2003 so as to be consistent with the latest code system.

to-five matched pairs to build the control group of non-Innofund-backed firms (i.e. non-Innofund) while controlling for location (provincial level). This approach enables us to make detailed comparisons in different dimensions. Finally, 64,474 year-firm observations are obtained for 12,025 eligible firms. However, these firms are not supported by the Innofund program.

We are interested in the change in the innovation of firms after they receive support from Innofund. Innovation outputs are measured in three ways, namely, new product sales, total exports, and the newly granted patents of the firm in a given year. Data on new product sales and exports are available in the Chinese Manufacturing Firm Survey Database. We calculate the absolute number and the relative ratio of new products sales and exports to the total outputs of the firm in a given year.

Data on patents are obtained from the National Patent Database, which covers information on all patents granted in China, including the type of patent, the name of the inventor, the owner of the patent, the filing and granting time, the category of the patent by industry, and others. We match the patent information for all observations in our sample by year. Three types of patents exist in China, namely, invention patents, utility model patents, and design patents. Invention patents are subjected to searches and examinations similar to those conducted in other major patent offices in the world. Invention patents are given 20 years of protection and may be granted to methods and products. Utility patents are given 10 years of protection and are generally granted to technical solutions that relate to shapes or structures. Design patents are also given 10 years of protection and are normally granted to shapes and patterns with aesthetic appeal that may be patentable. All the three types of patents are protected by the Patent Law of China. Firms have to exert efforts to generate patents while invention patents are obviously the most technologically innovative and require more R&D effort than the other two types. This study measures patent outputs by two values: the number of invention patents and the total number of patents of all types granted to a firm in a given year. Given that working out and applying patents take time, we use the filing time of the newly granted patents for the panel estimations. In addition, we also try use one-year lag of the filing time for all estimations to check robustness of the results.

To capture the effects of cross-market heterogeneity, we focus on two aspects of regional characteristics, namely, economic development and institutional advancement. For economic development, we divide provinces into developed regions and non-developed regions according to the economic classification given by the National Bureau of Statistics of China. The developed regions include Beijing, Shanghai, Shandong, Jiangsu, Zhejiang and Guangdong, and the rest belong to non-developed regions.

For institutional advancement, we borrow an index system defined by Fan et al. (2009) that measures the degree of marketization in every province based on surveys and statistical data every year since 1997. We focus on two major aspects that may affect Innofund effects: the total share of the private sector and institutions for business activities, including law firms, accounting firms, and other business agents per 1,000 persons in a province in a given year. The details are discussed in Section V.

We also control some firm-specific variables that include the age, size, leverage ratio, and ownership structure of the firms. Firm characteristic information is from the Chinese Manufacturing Firm Survey Database (1998 to 2007). ***Firm_Age*** is the age of the firm in a given year. At the firm-specific level, to minimize statistical error, we adjust ***Firm_Age*** in a panel data fashion. The average firm age of Innofund-backed firms is around 10, which is similar to that of non-Innofund-backed firms in our randomly drawn sample. ***Firm_Size*** is measured by the natural logarithm of the annual sales of the firm. ***Leverage*** is the ratio of total liability over the total assets of the firm in a given year. Finally, we control the ownership structure of the firm. State_Shr is the ratio of state ownership over the total equity of a firm in a given year. The variables used are winsorized at the 1st and 99th percentiles to eliminate outliers.

Table 1 presents the distribution of the sampled Innofund-backed firms. Panel A shows the industry distribution of the Innofund-backed firms. Innofund support is mainly concentrated on the eight industries that basically belong to high-tech industries as defined by the National Bureau of Statistics. In total, 81% of the sampled Innofund-backed firms are in high-tech industries. The allocation of Innofund is consistent with the goal of government R&D programs of supporting corporate R&D activities. Panel B presents the year distribution of the Innofund-backed firms by the time when they received their first round of Innofund. We show the distribution of the awarding year for the sampled Innofund-backed firms in this study and the full sample of Innofund-backed projects. The panel shows that, during the year of 1999 to 2007, the sampled Innofund-backed firms have a similar year distribution compared with those in the full sample suggesting the representativeness of our sample in this aspect.

Table 2 reports the summary statistics of Innofund-backed firms and firms in the control group, including the number of observations, mean value, minimum and maximum, and standard deviation. Panel A shows the comparison of total firm-year observations. Panel B shows the same information for Innofund-backed firms when the firms gained their funds and their matched counterparts. The panel shows that, on average, Innofund-backed firms have better innovation outputs in terms of the number of patents, new product sales, and exports. Similarly, these firms are larger in size measured by total sales and total assets. Moreover, these firms have lower liability compared with non-Innofund-backed firms. The ages of the firms do not exhibit considerable difference.

4. Does Innofund stimulate Innovation?

In our subsequent analysis, we examine whether the Innofund program can stimulate innovation outputs. First, we compare the innovation outputs of Innofund-backed firms with non-Innofund-backed firms. Second, we look at whether the amount of Innofund is associated with innovation outputs. Finally, we address selection bias issues and identification issues using the PSM approach and 2SLS regression models.

4.1 Innovation outputs of Innofund-backed and non-Innofund-backed firms

To test whether the Innofund program helps firms generate more innovation outputs, we implement the fixed effect panel data regression approach through the following basic regression models:

$$y_{it} = \alpha_0 + \beta x_{it} + \delta InnoAft_{it} + e_i + e_t + e_{it} \quad (1.1)$$

$$E(y_{it}|x_{it}, e_i, e_t) = \alpha_0 + \beta x_{it} + \delta InnoAft_{it} + e_i + e_t + e_{it} \quad (1.2)$$

where i indexes firms, t indexes time, and y_{it} are dependent variables used to measure the innovation outputs of firm i including new product sales, exports, and patents at time t. ***InnoAft$_{it}$*** is a dummy variable that is equal to 1 if the firm has gained Innofund support at time t, and equals zero otherwise. A vector of control variables is indicated by x_{it}, e_i is used to control time-invariant firm-specific unobserved variables, and e_t is used to control yearly fixed effects. The effect of Innofund on innovation activities is represented by δ. The above equations are estimated on the Innofund firm sample and the randomly matched non-Innofund firm sample. We use fixed effect panel data model to estimate (1.1) when the dependent variables are export and new product sales. We use fixed effect negative binomial model to estimate (1.2) when the dependent variables are the number of patents. We adjust the standard errors for correlation within the cluster in all models (Petersen, 2009).

Table 3 presents the results on how Innofund affects the innovation outputs firms. Models (1) and (2) show that $InnoAft_{it}$ is significantly and positively associated with the new product sales of firms, regardless of whether it is measured by absolute number or relative ratio. This finding suggests that Innofund-backed firms generate significantly higher new product sales after they gained government support compared with non-Innofund-backed firms and the same firms before funds were infused. For example, Model (2) shows that, Innofund-backed firms generated a new product sales ratio that is 3.1% higher than that of non-Innofund-backed firms after winning Innofund and the same firms before the funds were infused. It is 18.56% of the average new product sales ratio of Innofund-backed firms when funds were awarded. To check the robustness, we use an alternative measure for new product sales. We found qualitatively similar results when we used the log-link formulation of new product sales. Models (1) and (2) show that Innofund not only motivates firms to generate more new product sales, but it also changes the composition of the total sales of the firms. Models (3) and (4) report the estimations on the exports of the firm. Similarly, we find that Innofund could also help firms generate more exports in terms of total amount and relative ratio. For example, Model (4) shows that after winning Innofund, Innofund-backed firms have 1.1% higher export ratio than non-Innofund-backed firms and the same firms before funds were infused. It is equivalent to 12.79% of the average export ratio of Innofund-backed firms when funds were awarded.

Models (5) to (8) present the estimation of how Innofund affects newly granted patents, which show that Innofund significantly and positively motivates firms to generate more patents. Given the count-based nature of the dependent variables, Models (5) and (6) are negative binomial models, where the dependent variables are the number of the total newly granted patents in that year and the number of newly granted invention patents in that year. We prefer the negative binomial model to the Poisson model because the former relaxes the assumption that the mean is equal to the variance for the error term. Our results hold when we switched to the Poisson model. To check the robustness, Models (7) and (8) are estimated using fixed effect panel data models, where the dependent variables are log-link formulations of the number of the total newly granted patents and the number of newly granted invention patents in that year.

The coefficients of $InnoAft_{it}$ from Model (5) to Model (8) are significantly positive, which indicate that Innofund-backed firms generate more new patents after winning Innofund support compared with non-Innofund-backed firms and the same firms before funds were infused. In addition, our results remain when we use the one-year lag for the patent filing time in Model (5). This result shows that Innofund-backed firms were granted 1.08 more patents of all types per year (which is 136.18% of the average total number of newly awarded patents of Innofund-backed firms at the time of being supported by Innofund) after winning Innofund compared with non-Innofund-backed firms and the same firms before the government funds were infused. More importantly, improvements in terms of the number of newly granted invention patents after firms gained Innofund are more significant. Model (6) shows that Innofund-backed firms were granted 1.66 more invention patents per year (which is 531.41% of the average number of newly granted invention patents of the Innofund-backed firms at the time of gaining Innofund) than non-Innofund-backed ones and the same firms before they received R&D funding from the government. In summary,

Table 3 shows that Innofund effectively affects the innovation outputs of the awarded firms as measured by new product sales, exports, and patents.

We also examine the monetary effect of the funding. With the estimation focusing on the total amount of Innofund support given to the firms, we may obtain more insightful ideas about the extent to which government R&D funding solves the financial constraints of firms in China, where resource allocation is biased. We moderate our model to estimate the effect of new funding:

$$y_{it} = \alpha_0 + \beta x_{it} + \delta InnoAmt_{it} + e_i + e_t + e_{it} \quad (2.1)$$

$$E(y_{it} | x_{it}, e_i, e_t) = \alpha_0 + \beta x_{it} + \delta InnoAmt_{it} + e_i + e_t + e_{it} \quad (2.2)$$

The key difference between (1.1)/(1.2) and (2.1)/(2.2)is the dummy variable $InnoAft_{it}$, is replaced with the variable $InnoAmt_{it}$. $InnoAmt_{it}$ is equal to the dollar amount of Innofund awarded if the firm has gained Innofund support at time t, and equals zero if the firm did not gain Innofund or has not gained Innofund yet at time t.

The results are presented in Table 4. Models (1) and (2) show that $\boldsymbol{InnoAmt_{it}}$ is significantly and positively correlated to the new product sales of firms. For example, Model (2) shows that 1 million Yuan of Innofund funding increases the new product sales ratio of firms by 4.5%, whereas the average new product sales ratio of Innofund-backed firms when funds were awarded is 16.7%. Models (3) and (4) show that the amount of Innofund supports significantly and positively motivates firms to generate more exports. For example, Model (4) shows that a funding of 1 million Yuan increases the export ratio of firms by 1.6%, whereas the average export ratio of

Innofund-backed firms when funds were awarded is 8.6%. The coefficients of ***InnoAft**$_{it}$* across Model (5) to Model (8) are significantly positive, suggesting new external financial resource can help obtain new patents. For example, Model (5) shows that a funding of 1 million Yuan increases the new patents of a firm regardless of type by 1.4 yearly. The average of newly awarded patents of Innofund-backed firms when funds were awarded is 0.796. Moreover, Innofund has a larger effect on the invention patents of firms compared with its effects on patents of all types. Model (6) shows that a funding of 1 million Yuan increases the new invention patents of firms by 2.2 every year, which is 7.05 times the average of newly awarded invention patents of Innofund-backed firms when they received funds.

It is well noted that the absolute figure of the funds may has different impacts on firms' innovation outputs as firms may face different level of financial constraints. We hence use the relative weights of the funds over total profits and the ratio of ***InnoAmt*** over total free cash of the firm to replace ***InnoAmt*** and repeat the regressions we conducted in Table 4. But the results show that neither the above-mentioned relative measures has significant effects on the innovation outputs of the firm (we do not present the results to save space).

4.2 Identification

Although we have shown the significant and positive relationship between Innofund and the innovation outputs of firms, we cannot claim the causality as the positive correlation may be caused by other reasons. First of all, the selection of

Innofund is not random as mentioned in previous sections. Firms which are more likely to generate innovation outputs in the future may be more likely selected by Innofund. Thus, the positive association between the innovation outputs of firms and Innofund may be caused by ex-ante selection bias. If this is the case, we can hardly distinguish whether it is the Innofund which drives the improvement in the innovation outputs of the firms. That is, Innofund-backed firms might have generated the increased innovation outputs even without Innofund support.

In order to control the ex-ante selection effect, we employ a propensity score matching (PSM) algorithm proposed by Rosenbaum and Rubin (1983) to construct the control sample. We match Innofund-backed firms with non-Innofund-backed firms on multiple dimensions in the year prior to the awarding of the Innofund. In the context of our study, the propensity score is the predicted probability of a firm winning an Innofund. When constructing the non-Innofund-backed firms on this propensity score, we ensure that the matched non-Innofund-backed firms are selected based on their two-digit SIC industry code, location, and size measured by total sales, exports, new product sales, and the number of patents as suggested by Demurger et al. (2002). We control the location to capture the disparities in regional growth rates and levels of development, which may affect the results. We also match the size, and innovation outputs of Innofund-backed firms and their counterparts. These criteria ensure that, Innofund-backed firms and non-Innofund-backed firms are similar in many aspects that may affect the innovation outputs of the firms in the future. More specifically, we use one-to-five, nearest-neighbor propensity score matching to identify non-Innofund-backed firms.

After the PSM, we compare the means and medians for export, new product sales, and the number of newly granted patents between Innofund-backed firms and the firms in the control group in the year prior Innofund. Both the-tests on means and two-tailed Wilcoxon rank-sum tests on medians show that there is no statistically significant difference between the two groups in export, new product sales. The t-tests are presented in Table A.1.

We then re-estimate (1.1) and (1.2) based on this newly matched sample. Table 5 shows the results of the propensity score matching-based analysis. The results of the estimations for the PSM sample, wherein the ex-ante selection effect has been controlled, are similar to those of the random sample. The economic magnitudes of Innofund on innovation outputs decrease, but they remain statistically significant. Model (2) shows that firms experience a 2.8% increase in new product sales ratio after winning Innofund, which is 16.77% of the average new product sales ratio of Innofund-backed firms when the fund was awarded. Model (4) shows that firms experience a 0.8% increase in export outputs ratio after winning Innofund, which is 9.3% of the average export ratio of Innofund-backed firms when the fund was awarded. Model (5) shows that firms are granted 0.56 more patents of all types per year after winning Innofund. The average of newly granted patents of Innofund-backed firms at the time of being awarded the fund is 0.796. Model (6) shows that firms gain 1.01 more invention patents than non-Innofund-backed firms per year after winning Innofund while the average newly granted invention patents of Innofund-backed firms when they received the fund is 0.312. In summary, the above estimates suggest that Innofund-backed firms outperform non-Innofund-backed firms in terms of new product sales, exports, and newly awarded patents after potential ex-ante selection effects are controlled by using PSM approach.

One significant limitation of the PSM methodology is its incapability of capturing the effects of unobservable variables. Missing variables instead of Innofund, may contribute to improved innovation outputs. For instance, we are not able to measure the R&D ability of the firms or to observe the management capability of the executives based on the existing data while both factors may contribute to the innovation outputs of the firms. To address the identification concerns of unobservable variables, we use an instrumental variable to identify the firms that won Innofund. A proper instrumental variable must be correlated to the endogenous variable while unrelated with the unobserved variables that may affect dependent variables, which are the innovation outputs of the firms in this case.

Our main concern is identifying the variable that represents firms that won Innofund. We use the number of firms in high-tech zones in the city where a firm is located at a given year to identify the probability of the firm winning Innofund. High-tech zones are a special type of special economic zone (SEZ) in China, wherein central and local governments seek to stimulate corporate R&D activities. The total number of the high-tech firms in local high-tech zones signals the overall development of corporate R&D capability and the supply of strong high-tech firms.

This measure is a good instrumental variable for our estimations because of the higher probability of the local firms to be selected by Innofund when more high-tech firms are in a locality. However, this variable should not be related to firm-specific innovation outputs, which are our dependent variables, because this is a city-level variable.

The results of the 2SLS based on the random sample are reported in Table 6. Panel A of Table 6 presents the results from the 1st stage estimation, which shows that the number of firms in local high-tech zones is significantly and positively correlated to whether a firm wins Innofund at a given year. This result suggests a greater probability of receiving Innofund when a city has better-developed corporate R&D capability and larger supply of high-tech firms. This first stage estimation confirms the relevance of the instrumental variable. The results of the 2nd stage estimation are presented in Panel B of Table 6. Models (1) and (2) show that firms generate more new product sales after they gained Innofund compared with non-Innofund firms and the same firms before receiving Innofund support. Similar results were observed in exports and the number of patents. In general, the results of 2SLS are consistent with the regression results in Tables 3 and 4. To further check the robustness of the results, we repeated the 2SLS for the samples matched by PSM. The results are shown in the appendix (Table A.2). The main conclusions remain after we control for the potential ex-ante selection effect.

These results empirically show that winning an Innofund has positive effects on innovation outputs even after accounting for the endogenous nature of Innofund.

5. Project screening systems and Innofund effects

As mentioned in Section 2, the project screening system experienced a significant change in 2005. The major feature of this change is that the central government substantially delegated the decision-making power during project screening to local Innofund offices. As R&D projects are associated with high level of uncertainty, any investment in such projects including government R&D funding has to heavily depend on screening mechanisms. Hence, we ask whether the change in ex-ante screening systems might affect the effects of the Innofund on the innovation outputs of the firms.

Sah and Stiglitz (1991) argue that the quality of project selection may depend on the structure of organizations because the rationality of human beings is bounded and information gathering, transmission, and processing are costly. The authors suggest, at the same level of evaluating costs, the hierarchical organizations might delay project selection, reject good projects, and reduce the total number of project portfolios. By contrast, decentralized organizations may speed up the selection process and increase the number of selections by reducing communication costs and information issues. However, decentralized decision-making might accept bad projects. Consequently, the authors suggest that the relative performance of decentralized project evaluation is better than that of centralized project evaluation if the portfolio quality is better. Following this information approach, Aghion and Tirole (1997) emphasize the trade-off between loss of control and the ex-ante incentives of the agents to acquire information under decentralization. The authors argue that the level of decentralization of decision-making should depend on the size of the organization, the load and feature of the information passage, the multiplicity of the supervisors, and the urgency and complexity of the decisions to be made. Hart and Moore (2005) show how the trade-off between loss of control and information could explain why generalists command specialists in many hierarchies. Dessein (2002) develops a model, wherein decentralization to a specialized agent entails a loss of control for the principal, but at the same time reduces the incentive of the agent to miscommunicate information to the principal. Stein (2002) further suggests that decentralized organizations are more attractive when the information needed is "softer," whereas centralized organizations are more favorable when the information needed can be "hardened" without cost. The more recent discussion by Ahgion et al. (2013) discusses the interwoven effects of market competition, firm dynamics, and innovation.

Another strand of research on the decentralization of decision-making is mainly derived from soft budget constraints (SBC) theory. Dewatripont and Maskin (1995) suggest that a centralized credit market might affect efficiency, whereas the decentralization of credit might promote efficient project selection when creditors are not fully informed ex-ante about project quality. The authors attribute the inefficiency of the centralized system to a problem of adverse selection and refinancing as a moral hazard. Qian and Xu (1998) further extend this discussion in the context of innovation investment when information issues are profound and distinguishing the quality of the project by ex-ante screening is difficult. The authors suggest that bureaucracy results in more mistakes by rejecting promising projects and delays innovation. Efficiency loss caused by soft financial constraints increases as prior knowledge becomes worse and as research stage investment requirements become lower. By contrast, decentralized decision-making may not only reduce ex-ante screening costs, but may also commit to terminate bad projects ex-post so that both types of errors mentioned earlier may be reduced. Thus, decentralized organizations may increase the number of selected projects and reduce errors in accepting or continuing re-financing bad projects when investing in innovation. This effect should be more obvious in investment when the uncertainty is higher and the quality of the projects is harder to predict ex-ante. However, centralized decision-making systems may be more efficient when the technology of the innovation is more certain.

Empirically, some recent studies examine organizational forms and innovation from different aspects. Rajan and Wulf (2006) show a strong movement towards flatter corporations in the US between 1986 and 1999. Caroli and Van Reenen (2001) report a positive association between decentralization and the development of information technology. Baker and Hubbard (2004) document the effect of new technologies on ownership patterns in the US trucking industry. Acemoglu et al. (2007) examine the relationship between the diffusion of new technologies and the decentralization of firms. Using firm-level data in France and UK, the authors find that firms closer to the technological frontier, firms in more heterogeneous environments, and younger firms are more likely to choose decentralization. Based on data from the US, Arora et al. (2011) distinguish the effects of organization of R&D

activities by focusing on the trade-offs between responsiveness to immediate and local business needs and the type of research that can benefit firms as a whole. The authors find that centralized R&D tends be more scientific and broader in scope, has more technical impact. However, firms with a more decentralized structure, on average, invest less in R&D, generate fewer patents per R&D investment, and exhibit greater sales growth and higher market value.

All the above-mentioned studies focus on the efficiency of the decision-making and the organizational forms of for-profit organizations. None of these papers investigate the relationship between decentralization (or organizational change) and investment decision-making for public subsidy programs.

The above-mentioned theories and empirical studies suggest three potential consequences of the change in the Innofund project screening system in 2005 in China. Given that the Innofund program targets young firms with advanced technology potentials in some frontier industries, we expect these projects to be associated with high level of uncertainty and severe information issues. Based on the existing literature (Sah and Stiglitz, 1991; Qian and Xu, 1998; Ahgion and Tirole, 1997; Hart and Moore, 2005), first, we expect that the decentralized screening system after 2005 will help in selecting better quality projects compared with the centralized screening process before 2005. The effects of Innofund on entrepreneurial firms should be consequently stronger after 2005. Second, the better the portfolio of the firms is, the higher the probability is to enhance the effects of the decentralized screening system (Sah and Stiglitz, 1991). Third, the more competitive the market is and the better the institutions are, the stronger the impact of the decentralization on the Innofund effects we should expect (Ahgion et al., 2013).

To test whether a significant change occurred in terms of the Innofund effects on the innovation of a firm after the change in the project screening systems, we conduct a series regressions for innovation outputs by distinguishing firms backed by Innofund before and after 2005 and their non-Innofund-backed counterparts. The regressions equations are as follows:

$$y_{it} = \alpha_0 + \beta x_{it} + \delta_1 Inno\_2005Bef_{it} + \delta_2 Inno\_2005Aft_{it} + e_i + e_t + e_{it} \quad (3.1)$$

$$E(y_{it}|x_{it}, e_i, e_t) = \alpha_0 + \beta x_{it} + \delta_1 Inno\_2005Bef_{it} + \delta_2 Inno\_2005Aft_{it} + e_i + e_t + e_{it} \quad (3.2)$$

While all the variables stay as same as Equations (1.1) and (2.2), we replace the Innofund dummy variable with two dummy variables to specify the Innofund-backed firms before and after 2005. ***Inno_2005Bef*** is a dummy variable that is equals to 1 if the firm has gained Innofund support at time t and the Innofund was granted before 2005 and equals zero otherwise. ***Inno_2005Aft*** is a dummy variable that is equal to 1 if the firm has gained Innofund support at time t and the first Innofund was granted after 2005 and equals zero otherwise.

Table 7 reports the regression results for the effects of the change in the screening system. Models (1) and (2) show that ***Inno_2005Bef*** and ***Inno_2005Aft*** are significantly and positively correlated with new product sales measured by absolute number and relative ratio, which is consistent with the findings shown in Table 3. More importantly, we find that the coefficient of ***Inno_2005Bef*** is smaller than that of

Inno_2005Aft in both regression models. The difference between the two is statistically significant. For example, Model (2) shows that firms selected before 2005 experience a higher new product sales ratio by 2.4% after wining Innofund, whereas firms selected after 2005 have 4.5% higher new product sales compared with their non-Innofund counterparts and the same firms before they gained Innofund. Similar results are shown with the absolute number of total new product sales. The results indicate that the effects of Innofund supports on the new product sales of firms significantly improved after the policy change in 2005 when the screening system became more decentralized.

Models (3) and (4) present the effects of Innofund before and after 2005 on the exports of the firms. ***Inno_2005Bef*** and ***Inno_2005Aft*** are significantly and positively correlated to export measured by absolute number and relative ratio. The coefficient of ***Inno_2005Aft*** is 1.62%, which is almost twice that of ***Inno_2005Bef*** (0.82%) in Model (4). The results suggest that the effects of Innofund on exports significantly increased compared with the effects before 2005 after project screening became more decentralized in 2005.

We find consistent findings regarding the effects of Innofund on the patent generation of firms before and after 2005. Models (5) and (6) present negative binomial regressions, where the dependent variables are the total number of patents (all types) and the number of invention patents newly granted in that year. Models (7) and (8) show the fixed effect panel data models. This result shows that ***Inno_2005Bef*** and ***Inno_2005Aft*** are significantly and positively associated with newly granted patents of all types, whereas the coefficients of ***Inno_2005Aft*** are consistently significantly larger than those of ***Inno_2005Bef*** in any regression model. This finding confirms that the significant improvement of Innofund effects on innovation after project screening was systematically changed from a centralized system into a relatively decentralized one in 2005.

We further divide the sample into two subsamples to address the effects of the policy change in project screening: (1) the subsample that only includes the firms backed by Innofund before 2005 and their non-Innofund-backed counterparts; and (2) the subsample that only includes the firms backed by Innofund after 2005 and their non-Innofund-backed counterparts. The results the two subsamples are shown in the Appendix (Table A.3). The results reconfirm that the degree of the effects of Innofund is different, even if both firms backed before 2005 and after 2005 generate more innovation outputs than non-Innofund-backed ones. Innofund infused after 2005 when the screening system became more decentralized has significantly more positive effects on the innovation outputs of firms than Innofund infused before 2005. The results are consistent with the arguments of Sah and Stiglitz (1991), Ahgion and Tirole (1997), and Qian and Xu (1998), which favor a more decentralized screening system for investing in R&D oriented projects when the degree of uncertainty is higher and the information issues is more severe.

6. The Cross-Market Heterogeneity of Innofund Effects

In the previous section, we looked at the effects of the Innofund policy change on project screening and show that more decentralized screening increased the effects of Innofund on the innovation outputs of firms. Few other questions follow that are associated with this question. First is whether the effects of Innofund differ across regions given that China is large and heterogeneous in both institutional aspects and the economic endowments (Xu, 2011). Second, if we find cross-region heterogeneity of the Innofund effects, are the cross-region effects more significant after 2005 when the project screening power is more delegated to local governments?

First, we examine the cross-market heterogeneity of Innofund effects by conducting a set of regressions as follows:

$$y_{it} = \alpha_0 + \gamma x_{it} + \delta InnoAft_{it} + \gamma Mrt_{it} + \theta InnoAft_{it} * Mrt_{it} + +e_i + e_t + e_{it} \quad (4.1)$$

$$E(y_{it}|x_{it}, e_i, e_t) = \alpha_0 + \gamma x_{it} + \delta InnoAft_{it} + \gamma Mrt_{it} + \theta InnoAft_{it} * Mrt_{it} + e_i + e_t + e_{it} \quad (4.2)$$

We then look at whether the change in the project screening system in 2005 influences the effects of regional heterogeneity on the innovation outputs of the Innofund program. According to Sah and Stiglitz (1991), decentralized organizations may be more effective in selecting a larger number of quality projects when the portfolio is better. If this is the case, we should expect that the effects of the 2005 change found in the last section increase in a more advanced market where a larger number of better firms is supplied. Additionally, Aghion and Tirole (1997) and Hart and Moore (2005) suggest that more valuable local information results in more superior knowledge of local managers and more efficient delegation of decision-making to local decision-makers. We expect regions with higher levels of competition and better institutions to use the local government to seek for information and assess the quality of projects better because R&D projects have a higher level of uncertainty and profound information issues. Consequently, the Innofund effects after 2005 might be increased in economically and institutionally more advanced regions. We conduct the following set of regressions to address these questions:

$$y_{it} = \alpha_0 + \gamma x_{it} + \delta_1 Inno\_2005Bef_{it} + \delta_2 Inno\_2005Aft_{it} + \gamma Mrt_{it} + \theta_1 Inno\_2005Bef_{it} * Mrt_{it} + \theta_2 Inno_{2005Aft_{it}} * Mrt_{it} + e_i + e_t + e_{it} \quad (4.3)$$

$$E(y_{it}|x_{it}, e_i, e_t) = \alpha_0 + \gamma x_{it} + \delta_1 Inno\_2005Bef_{it} + \delta_2 Inno\_2005Aft_{it} + \gamma Mrt_{it} + \theta_1 Inno\_2005Bef_{it} * Mrt_{it} + \theta_2 Inno\_2005Aft_{it} * Mrt_{it} + e_i + e_t + e_{it} \quad (4.4)$$

Other variables remain similar to regression Equations (3.1) and (3.2), we add a series of variables that measure the characteristics of a region represented by ***Mrt*** in Equations (4.1) and (4.2). We also include the interaction terms between InnoAft and ***Mrt*** to capture the cross-region effects of the Innofund Program. We then include the interaction terms of ***Mrt*** and ***Inno_2005Aft*** and the interaction terms of ***Mrt*** and ***Inno_2005Bef*** in Equations (4.3) and (4.4) to capture the across-region effects of Innofund before and after the 2005 policy change.

We focus on two major aspects of the regions. First, we look at the economic aspects of the region. We divide the regions into two groups using ***DVP***, a dummy variable that is equal to 1 if the province is defined as a developed region in a given year by the State Statistical Bureau, and equals 0 otherwise. Second, we look at the marketization of the region indicated by ***Mrt*** in the equations. We use two market indexes defined in Fan et al. (2009): ***Pri*** indicates the share of the total non-SOEs in a given province in a given year; ***Instn*** represents the quality of institutions in a given province in a given year which is measured by the development of local institutions, including patent protection departments, law firms, and accounting firms.

We focus on the above-mentioned regional measurements for several reasons. First, developed regions may have a larger number of firms that invest in innovation compared with less developed regions. The chance of selecting more innovative firms in regions with more advanced economic development should be higher because of the high supply of potential candidates for the Innofund program. Moreover, the 2005 policy change requires local governments to match the funds with at least 50% of the total support before they make recommendations. Hence, richer provinces may have more incentives to submit more projects and consequently gain more chances to be selected by the Innofund compared with poorer regions after 2005. Moreover, richer regions may have a larger portfolio of quality firms than poorer regions, which is expected to strengthen the effects of decentralized screening system (Sah and Stiglitz, 1991; Qian and Xu, 1998). Thus, we expect that a more economically developed region is more likely to enjoy more benefits from the delegation of the project screening after the 2005 policy change.

Second, innovations are normally generated by SMEs and Innofund aims to support SMEs. Most of SMEs in China are private firms. Regions with a larger private sector are normally more market-oriented with a higher level of competition. This phenomenon is more obviously seen after the late 1990s, when the state privatized most smaller sized SOEs with the “Capturing the large firms while letting the small firms go” policy. We expect markets in regions with a larger private sector to be more competitive and to have a larger supply of more innovative firms compared with regions with a smaller private sector. Hence, Innofund effects should be more significant in regions with a larger private sector. We also expect local Innofund office in a region with a larger private sector to produce fewer errors in terms of accepting bad projects compared with others regions when the screening became more decentralized after 2005. Similarly, we also expect the more developed the local institutions are, the more likely the local governments have better channel to gain information of the projects and hence increase the project selection quality and enlarge the Innofund effects. Furthermore, the effects of institutions should be more significant after the screening becomes decentralized after 2005 when the local decisions are given more weight.

Table 8 reports the empirical results of the across-region effects. Panel A of Table 8 shows the effects of the economic development of the region. In general, it suggests that Innofund effects are seen more significant in more economically developed regions. Models (1) and (2) show that the interaction term between ***InnoAft*** and ***DVP*** is positively and significantly correlated with new product sales measured by both absolute number and relative ratio. Similar results are observed in

Models (6), (7), and (8), where we estimate the effects of Innofund on newly granted patents across regions with different level of economic development. However, the interaction terms do not have statistically significant relationship with on the exports of the firms.

Panel B of Table 8 presents how private sector development may influence the effect of Innofund on innovation. These results show that the interaction term between ***InnoAft*** and ***Pri*** is significantly and positively correlated with new product sales, exports, and newly granted patents from Model (1) to (8). This finding implies that the effects of Innofund are apparently more significant in provinces with more developed private sector. Panel C of Table 8 shows the relationship between the development of legal institutions and the effects of Innofund. Similar to the results in Panel B, the interaction term between ***InnoAft*** and ***Instn*** is significantly and positively associated with all measures of innovation, which suggests that Innofund has a stronger effect on innovation outputs in provinces with better institutions for business activities.

Table 9 shows the effects of the 2005 policy change on the cross-region effects of the Innofund program. Panel A shows the results with the focus on the economic development of the region. Models (1) and (2) show that the interaction term of ***Inno_2005Bef*** and ***DVP*** and the interaction term of ***Inno_2005Aft*** and ***DVP*** are positively and significantly correlated with new product sales measured by absolute number and relative ratio. However, the coefficients of the interaction term of ***Inno_2005Aft*** and ***DVP*** are significantly larger than those of the interaction term of ***Inno_2005Bef*** and ***DVP***. Similar results are observed in Models (5) and (6), where we estimate the effects of the Innofund on newly granted patents. However, the interaction terms had no significant effects on exports. The results suggest that, in general, the effects of the Innofund on the new product sales and the newly granted patents of firms increased in more economically developed regions after the 2005 policy change compared with other regions.

Panel B of Table 9 presents the empirical results regarding the effects of the 2005 policy change, with a focus on the development of the private sector. The results are consistent with our predictions. On the one hand, the share of the private sector in a region is significantly and positively associated with new product sales, exports, and newly granted patents. On the other hand, new products sales and newly granted patents significantly increased with the increase in the interaction terms of ***Inno_2005Bef*** and ***Pri*** and the interaction terms of ***Inno_2005Aft*** and ***Pri***. However, the coefficients of the interaction terms of Inno_2005Bef and Pri is significantly larger than those of the interaction terms of Inno_2005Aft and Pri suggesting the 2005 policy change have different effects on the Innofund impacts across region. A province with a more developed private sector is more likely to experience more Innofund effects on innovation. Moreover, this impact is magnified after 2005.

Finally, Panel C of Table 9 reports the estimation results of the cross-region effects of Innofund with a focus on the development of local institutions. We show that the Innofund effects on innovation depend on local institutions and the screening system. We observe more significant and positive effects of Innofund on innovation in provinces with more developed institutions for business activities compared with those of provinces with less developed institutions. Moreover, the positive effects of Innofund and institutions appear to be magnified after 2005 policy change when the project screening system is more decentralized.

7. Conclusion

This paper estimates the effects of Innofund on the innovation outputs of firms. Innofund is the largest Chinese government program targeting R&D of SMEs in China. We study its general effects on innovation outputs of firms. We also examine how institutions affect the influences of Innofund by exploring the policy change and institutional variations over time and across regions.

Based on the results of firm-level panel data analysis, we find that Innofund-backed firms generate significantly more innovation outputs by new product sales, exports, and newly granted patents, compared with non-Innofund-backed firms and the same firms before Innofund funding was infused. We use PSM methodology to control the selection issues. Moreover, we use two-staged Heckman estimations to address the identification problems. The results remain robust. These findings are consistent with most existing literature, which indicates that government funding stimulates corporate R&D activities (Irwin and Klenow 1996; Griliches and Regev, 1998; Audretsch et al., 2002; Lach, 2002; Görg and Strobl, 2006).

However, we find that Innofund effects are different before and after 2005 when decision-making in the project selection process was transformed from a centralized process into a relatively decentralized one. That is, the effect of Innofund on the innovation outputs of firms further improved when project screening became more decentralized. Finally, we find Innfound effects and the 2005 policy effects are heterogeneous across-markets. The more economically and institutionally developed the market is, the stronger the Innofund effects and the project selection decentralization effects appear. These results are consistent with Sah and Stiglitz (1991), Ahgion and Tirole (1997), Hart and Moore (2005), Qian and Xu (1998) and Allen et al. (2012).

This study contributes to literature in three aspects. First, this study is the first systematic examination on government supported corporate R&D program in China, where the institutions are substantially different from those in developed market economies. Second, our estimations of the across-region effects within a country further shows that institutions affect how government R&D programs work. It suggests local government incentives play an important role in R&D financing. Thirdly, we extend the existing studies by looking further at the project screening systems and their influence on the effects of government R&D programs that have been largely neglected by extant literature. Our study provides a new perspective for evaluating government R&D policy and policy implications. Thus, this study contributes not only to understanding government R&D financing, but also to literature on R&D financing mechanisms in general.

This study raises several questions for further research. First, if government R&D programs indeed contribute to the innovation outputs of the firms, are innovation outputs transferred to improvements in productivity or profitability of the firms at the same time? Second, apart from project screening schemes, can other mechanisms affect the effects of government R&D funding, such as financial budget constraints (Qian and Xu, 1998; Huang and Xu, 1999); the competition in product and input markets, or, trust and relationships (Allen, et al., 2012)? If so, how do different mechanisms work together or interact to each other? Third, do different forms of government R&D programs have different effects? If so, what are the explanations/mechanisms for the differences observed? Finally, do government R&D programs have spillover effects?

Table 1: Industry and Year Distribution of the Sampled Innofund-backed Firms

This table reports the industry and year distribution of the Innofund-backed firms and projects. Panel A is the industry distribution of the Innofund-backed firms by two-digit SIC codes. Panel B is the year distribution of Innofund-backed firms and projects from 1999 to 2011.

Panel A: Industry Distribution

Industry Description	two-digit SIC code	No. of Innofund-backed firms	Percent
Raw Chemical Materials and Chemical Products	26	306	11.60
Medicines	27	401	15.20
General Purpose Machinery	35	268	10.16
Special Purpose Machinery	36	336	12.74
Transport Equipment	37	125	4.74
Electrical Machinery and Equipment	39	206	7.81
Communication Equipment, Computers and Other Electronic Equipment	40	353	13.38
Measuring Instruments and Machinery for Cultural Activity and Office Work	41	173	6.56
others		470	17.81
Total		2,638	100

Panel B: Year Distribution of Innofund-backed firms and Projects

Innoyear	No. of Innofund-backed firms	Percent	No. of projects	Percent
1999	293	11.11	1,089	3.57
2000	217	8.23	869	2.85
2001	204	7.73	1,008	3.30
2002	192	7.28	780	2.55
2003	230	8.72	1,197	3.92
2004	345	13.08	1,464	4.79
2005	465	17.63	1,552	5.08
2006	327	12.40	1,905	6.24
2007	365	13.84	2,113	6.92
2008	2,638	100	2,470	8.09
2009			5,847	19.15
2010			3,709	12.15
2011			6,534	21.40
Total			30,537	100

Table 2: Summary Statistics of Innofund- and non-Innofund-backed Firms

Panel A: Observation Comparison between Innofund- and non-Innofund-backed Firms

Variable	Innofund-backed Obs	Mean	Std. Dev.	Min	Max	non-Innofund-backed Obs	Mean	Std. Dev.	Min	Max
New product sales (1000 RMB)	15,602	12,808.30	28,013.29	0	142,572	55,624	2,508.29	12,213.83	0	142,572
New product sales ratio	15,546	0.16	0.28	0	1	55,092	0.05	0.17	0	1
Export (1000 RMB)	15,602	10,305.47	33,984.29	0	295,684	55,624	6,238.61	25,123.21	0	295,684
Export ratio	15,546	0.09	0.21	0	3.46	55,092	0.11	0.28	0	8.98
Patent (number)	18,224	0.70	2.84	0	117	64,474	0.10	0.80	0	46
Invention (number)	18,224	0.25	1.34	0	75	64,474	0.02	0.34	0	37
Firm_age	18,222	10.07	7.41	0	29	64,456	10.16	7.59	0	29
State-owned capital (1000 RMB)	18,224	2,475.01	9,831.65	0	206,920	64,474	1,404.80	7,055.41	0	322,324
Paid-in capital (1000 RMB)	18,224	22,962.44	35,742.87	0	295,452	64,473	12,184.77	27,750.72	0	489,554
State_shr ratio	18,079	0.11	0.28	0	1	63,530	0.13	0.32	0	1
Total liability (1000 RMB)	18,224	56,849.24	93,971.49	0	776,643	64,474	24,605.14	53,598.09	0	776,643
Total asset (1000 RMB)	18,224	102,038.00	163,731.40	0	1,596,637	64,472	42,141.18	87,660.30	0	1,427,323
Leverage ratio	18,176	0.56	0.25	0	13	64,145	0.61	0.34	0	16
Sales (1000 RMB)	18,224	83,690.62	148,757.60	0	1,302,231	64,474	41,148.86	87,107.16	0	1,302,231

Panel B: Innofund- and non-Innofund-backed Firms in the Year of the Fund Infused

Variable	Innofund-backed Obs	Mean	Std. Dev.	Min	Max	non-Innofund-backed Obs	Mean	Std. Dev.	Min	Max
New product sales (1000 RMB)	2,293	10,090.26	22,220.73	0	142,572	10,461	1,822.48	9,656.56	0	142,572
New product sales ratio	2,285	0.17	0.30	0	1	10,316	0.05	0.17	0	1
Export (1000 RMB)	2,293	7,199.95	25,937.70	0	295,684	10,461	4,612.95	19,271.66	0	295,684
Export ratio	2,285	0.09	0.22	0	3.46	10,316	0.10	0.27	0	2.14
Patent (number)	2,638	0.80	3.40	0	89	12,025	0.09	0.83	0	46
Invention (number)	2,638	0.31	1.84	0	68	12,025	0.02	0.33	0	23
Firm_age	2,637	8.42	6.92	0	29	12,016	8.80	7.42	0	29
State-owned capital (1000 RMB)	2,638	2,051.26	9,017.00	0	111,020	12,025	1,034.99	5,959.05	0	111,020
Paid-in capital (1000 RMB)	2,638	18,371.17	28,204.86	0	295,452	12,024	10,064.05	24,063.67	0	295,452
State_shr ratio	2,620	0.09	0.25	0	1	11,761	0.11	0.30	0	1
Total liability (1000 RMB)	2,638	41,821.89	67,233.01	0	776,643	12,025	19,501.68	44,116.28	0	776,643
Total asset (1000 RMB)	2,638	74,526.55	111,610.90	0	1,287,128	12,025	33,053.51	69,236.54	0	1,287,128
Leverage ratio	2,632	0.55	0.22	0	1.99	11,909	0.60	0.39	0	15.70
Sales (1000 RMB)	2,638	63,185.95	98,716.90	0	1,241,706	12,025	33,387.11	69,676.80	0	1,302,231

Table 3: Innovation Outputs of Innofund Supports (Random-Draw Sample)

This table reports the fixed effects panel data regressions of Innofund on innovation outputs of the firms based on 18224 observations from 2638 Innofund-based firms and 64474 observations from 12025 randomly selected non-Innofund-backed firms across 1999 and 2007. ***InnoAft*** is a dummy variable that is equal to 1 if the firm has gained Innofund support at time t, and equals zero otherwise. Innovation outputs are measured by the natural logarithm of new product sales of the firm (***Lnnewpro***), ratio of total new product sales over total sales of the firm (***newproratio***), natural logarithm of export volume of the firm (***Lnexport***), ratio of total export volume over total sales of the firm (***exportratio***), total number of newly granted patents of the firm (patent) and total number of newly granted invention patents of the firm (***invention***) in a given year. Firm size (***Firm_size***) is measured by the natural logarithm of the annual sales of the firm in a given year. ***Leverage*** is the ratio of total liability over the total assets of the firm in a given year. ***State_Shr*** is the ratio of state ownership over the total equity of a firm in a given year. We also control firm age, and year and firm fixed effects. Model (1), (2), (3), (4), (7) and (8) are fixed effect panel data models while Model (5) and (6) are negative binomial models. Standard errors are reported in parentheses. Correlations significant at the 90% confidence level are presented with one asterisk (*), those significant at the 95% level are presented in bold with two asterisks (**), and those significant at the 99% level are presented with three asterisks (***).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	lnnewpro	newproratio	lnexport	exportratio	patent	invention	lnpatent	lninvention
InnoAft	0.773***	0.031***	0.564***	0.011***	1.084***	1.658***	0.151***	0.100***
	-0.089	-0.006	(0.068)	(0.004)	(0.039)	(0.053)	(0.011)	(0.007)
Firm_age	-0.018	-0.001	0.019*	0.001	-0.002	-0.004	-0.001	0.000
	-0.015	-0.001	(0.010)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)
State_Shr	0.103	0.003	0.048	-0.003	0.102	0.117	-0.006	-0.005
	-0.09	-0.005	(0.062)	(0.003)	(0.068)	(0.104)	(0.008)	(0.005)
Leverage	-0.086	-0.011**	0.084	0.003	-0.317***	-0.625***	-0.006	-0.008***
	-0.062	(0.005)	(0.061)	(0.004)	(0.067)	(0.098)	(0.005)	(0.003)
Firm_size	0.313***	0.003**	0.420***	0.010***	0.344***	0.386***	0.020***	0.008***
	-0.021	(0.002)	(0.021)	(0.001)	(0.015)	(0.021)	(0.002)	(0.001)
_cons	-1.449***	0.048***	-2.261***	0.011	-5.624***	-7.697***	-0.168***	-0.083***
	(0.225)	(0.016)	(0.222)	(0.014)	(0.266)	(0.749)	(0.024)	(0.014)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y
N	70,247	69,937	70,247	69,937	81,584	81,584	81,584	81,584
adj. R-sq	0.023	0.005	0.041	0.004			0.032	0.034
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 4 Innovation Outputs and The Amount of Innofund Supports (Random-Draw Sample)

This table reports the fixed effects panel regressions of the amount of Innofund supports on innovation outputs of the firms based on 18224 observations from 2638 Innofund-based firms and 64474 observations from 12025 randomly selected non-Innofund-backed firms across 1999 and 2007. ***InnoAmt*** is equal to the dollar amount of Innofund awarded if the firm has gained Innofund support at time t, and equals zero if the firm did not gain Innofund or has not gained Innofund yet at time t. Innovation outputs are measured by the nature logarithm of new product sales of the firm (***Lnnewpro***), ratio of total new product sales over total sales of the firm (***newproratio***), nature logarithm of export volume of the firm (***Lnexport***), ratio of total export volume over total sales of the firm (***exportratio***), total number of newly granted patents of the firm (patent) and total number of newly granted invention patents of the firm (***invention***) in a given year. Firm size (***Firm_size***) is measured by the natural logarithm of the annual sales of the firm in a given year. ***Leverage*** is the ratio of total liability over the total assets of the firm in a given year. ***State_Shr*** is the ratio of state ownership over the total equity of a firm in a given year. We also control firm age, and year and firm fixed effects. Model (1), (2), (3), (4), (7) and (8) are fixed effect panel data models while Model (5) and (6) are negative binomial models. Standard errors are reported in parentheses. Correlations significant at the 90% confidence level are presented with one asterisk (*), those significant at the 95% level are presented in bold with two asterisks (**), and those significant at the 99% level are presented with three asterisks (***).

	(1) lnnewpro	(2) newproratio	(3) lnexport	(4) exportratio	(5) patent	(6) invention	(7) lnpatent	(8) lninvention
InnoAmt	0.011***	0.0005***	0.008***	0.0002***	0.014***	0.022***	0.002***	0.001***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Firm_age	-0.019	-0.001	0.019*	0.001	-0.003	-0.006*	-0.001	0.0004
	(0.015)	(0.001)	(0.010)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)
State_Shr	0.102	0.003	0.047	-0.003	0.103	0.114	-0.006	-0.005
	(0.091)	(0.005)	(0.062)	(0.003)	(0.068)	(0.105)	(0.008)	(0.005)
Leverage	-0.087	-0.011**	0.083	0.003	-0.316***	-0.628***	-0.006	-0.008***
	(0.062)	(0.005)	(0.061)	(0.004)	(0.067)	(0.098)	(0.005)	(0.003)
Firm_size	0.314***	0.003**	0.422***	0.010***	0.341***	0.381***	0.020***	0.008***
	(0.021)	(0.002)	(0.022)	(0.001)	(0.015)	(0.021)	(0.002)	(0.001)
_cons	-1.455***	0.048***	-2.267***	0.011	-5.572***	-7.577***	-0.170***	-0.084***
	(0.225)	(0.016)	(0.222)	(0.014)	(0.267)	(0.750)	(0.024)	(0.014)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y
N	70,247	69,937	70,247	69,937	81,584	81,584	81,584	81,584
adj. R-sq	0.023	0.005	0.041	0.004			0.031	0.033
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 5 Innovation Outputs and Innofund Supports (PSM Sample)

This table reports the fixed effects panel regressions of Innofund on innovation outputs of the firms based on 18224 observations from 2638 Innofund-based firms and 64991observations from 10739 non-Innofund-backed firms selected by propensity score matching approach across 1999 and 2007. ***InnoAft*** is a dummy variable that is equal to 1 if the firm has gained Innofund support at time t, and equals zero otherwise. Innovation outputs are measured by the natural logarithm of new product sales of the firm (***Lnnewpro***), ratio of total new product sales over total sales of the firm (***newproratio***), natural logarithm of export volume of the firm (***Lnexport***), ratio of total export volume over total sales of the firm (***exportratio***), total number of newly granted patents of the firm (patent) and total number of newly granted invention patents of the firm (***invention***) in a given year. Firm size (***Firm_size***) is measured by the natural logarithm of the annual sales of the firm in a given year. ***Leverage*** is the ratio of total liability over the total assets of the firm in a given year. ***State_Shr*** is the ratio of state ownership over the total equity of a firm in a given year. We also control firm age, and year and firm fixed effects. Model (1), (2), (3), (4), (7) and (8) are fixed effect panel data models while Model (5) and (6) are negative binomial models. Standard errors are reported in parentheses. Correlations significant at the 90% confidence level are presented with one asterisk (*), those significant at the 95% level are presented in bold with two asterisks (**), and those significant at the 99% level are presented with three asterisks (***).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	lnnewpro	newproratio	lnexport	exportratio	patent	invention	lnpatent	lninvention
InnoAft	0.582***	0.028***	0.416***	0.008**	0.563***	1.016***	0.132***	0.086***
	(0.091)	(0.006)	(0.068)	(0.004)	(0.032)	(0.047)	(0.011)	(0.007)
Firm_age	-0.016	-0.0005	0.014	0.0002	-0.015***	-0.019***	-0.002	0.001
	(0.019)	(0.001)	(0.011)	(0.001)	(0.002)	(0.003)	(0.002)	(0.001)
State_Shr	0.189*	0.003	0.157**	0.001	0.059	0.247***	-0.003	-0.003
	(0.099)	(0.006)	(0.068)	(0.003)	(0.048)	(0.083)	(0.010)	(0.005)
Leverage	-0.194***	-0.019***	0.074	0.005	-0.263***	-0.553***	-0.020***	-0.010**
	(0.073)	(0.006)	(0.056)	(0.003)	(0.048)	(0.082)	(0.008)	(0.004)
Firm_size	0.580***	0.009***	0.530***	0.009***	0.307***	0.382***	0.043***	0.015***
	(0.027)	(0.002)	(0.025)	(0.001)	(0.011)	(0.017)	(0.003)	(0.001)
_cons	-3.274***	0.025	-3.021***	0.018	-4.759***	-6.485***	-0.33***	-0.140***
	(0.303)	(0.019)	(0.264)	(0.014)	(0.164)	(0.355)	(0.034)	(0.017)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y
N	71,421	71,267	71,421	71,267	83,215	83,215	83,215	83,215
adj. R-sq	0.032	0.006	0.049	0.005			0.022	0.030
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 6: 2SLS Regressions for Innofund and Innovation Outputs

This table reports the 2SLS regressions for Innofund effects based on randomly selected sample. Panel A shows the first stage of the estimations and Panel B presents the second stage estimations. ***Ln(firmno)*** is the instrumental variable to predict whether a specific firm might be supported by Innofund in a given year. It is the total number of firms in high-tech zones in a given city in a given year. The dependent variable in Panel A is ***InnoAft*** which is a dummy variable that is equal to 1 if the firm has gained Innofund support at time t, and equals zero otherwise. The dependent variables in Panel B are measurements for innovation outputs which are measured by the natural logarithm of new product sales of the firm (***Lnnewpro***), ratio of total new product sales over total sales of the firm (***newproratio***), natural logarithm of export volume of the firm (***Lnexport***), ratio of total export volume over total sales of the firm (***exportratio***), total number of newly granted patents of the firm (patent) and total number of newly granted invention patents of the firm (***invention***) in a given year. Firm size (***Firm_size***) is measured by the natural logarithm of the annual sales of the firm in a given year. ***Leverage*** is the ratio of total liability over the total assets of the firm in a given year. ***State_Shr*** is the ratio of state ownership over the total equity of a firm in a given year. We also control firm age, and year and firm fixed effects. Standard errors are reported in parentheses. Correlations significant at the 90% confidence level are presented with one asterisk (*), those significant at the 95% level are presented in bold with two asterisks (**), and those significant at the 99% level are presented with three asterisks (***).

	(1)	(2)	(3)	(4)	(5)	(6)
	InnoAft	InnoAft	InnoAft	InnoAft	InnoAft	InnoAft
Panel A: first-stage coefficient						
ln(firmno)	0.007***	0.007***	0.007***	0.007***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Firm_age	0.006***	0.006***	0.006***	0.006***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
State_Shr	0.135***	0.135***	0.135***	0.135***	0.151***	0.151***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.026)	(0.026)
Leverage	-0.219***	-0.221***	-0.219***	-0.221***	-0.232***	-0.232***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.023)	(0.023)
Firm_size	0.283***	0.288***	0.283***	0.288***	0.288***	0.288***
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.005)
_cons	-3.750***	-3.800***	-3.750***	-3.800***	-8.979	-8.980
	(0.063)	(0.063)	(0.063)	(0.063)	(97.344)	(97.344)
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Panel B: second-stage regression						
	(1)	(2)	(3)	(4)	(5)	(6)
	lnnewpro	newproratio	lnexport	exportratio	lnpatent	lninvention
InnoAft	5.875***	0.736***	7.889***	0.380***	0.820***	0.342***
	(0.811)	-0.064	(0.916)	(0.063)	(0.077)	(0.057)
Firm_age	0.018***	0.0004	0.016***	-0.001***	0.001**	0.0002
	-0.003	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)
State_Shr	0.047	-0.008	-1.024***	-0.057***	-0.024***	-0.011*
	(0.105)	(0.008)	(0.096)	(0.006)	(0.008)	(0.006)
Leverage	-0.267	0.005	0.203	0.029*	0.022*	0.026
	(0.285)	(0.010)	(0.179)	(0.016)	(0.011)	(0.020)
Firm_size	0.227***	0.0003	0.223***	0.014***	-0.010***	-0.009***
	-0.021	(0.003)	(0.022)	(0.002)	(0.001)	(0.001)
_cons	-1.041***	0.018	-0.598***	-0.036**	0.140***	0.083***
	(0.203)	(0.023)	(0.203)	(0.018)	(0.020)	(0.013)
Year Fixed Effects	Y	Y	Y	Y	Y	Y
N	58,507	58,284	58,507	58,284	69,247	69,247
P-value	0.000	0.000	0.000	0.000	0.000	0.000

Table 7: Project Screening and Innofund Effects

This table reports the fixed effects panel regressions on the project screening system changes and the Innofund influences on innovation outputs of the firms based on random sample as described in Table 3. Project screening system was changed from centralized screening to decentralized screening in 2005 according to the Innofund policy. We hence use this policy change to capture the project screening change. ***Inno_2005Bef*** is a dummy variable that is equals to 1 if the firm has gained Innofund support at time t and the Innofund was granted before 2005 and equals zero otherwise. ***Inno_2005Aft*** is a dummy variable that is equal to 1 if the firm has gained Innofund support at time t and the first Innofund was granted after 2005 and equals zero otherwise. Innovation outputs are measured by the natural logarithm of new product sales of the firm (***Lnnewpro***), ratio of total new product sales over total sales of the firm (***newproratio***), natural logarithm of export volume of the firm (***Lnexport***), ratio of total export volume over total sales of the firm (***exportratio***), total number of newly granted patents of the firm (patent) and total number of newly granted invention patents of the firm (***invention***) in a given year. Firm size (***Firm_size***) is measured by the natural logarithm of the annual sales of the firm in a given year. ***Leverage*** is the ratio of total liability over the total assets of the firm in a given year. ***State_Shr*** is the ratio of state ownership over the total equity of a firm in a given year. We also control firm age, and year and firm fixed effects. Model (1), (2), (3), (4), (7) and (8) are fixed effect panel data models while Model (5) and (6) are negative binomial models. Standard errors are reported in parentheses. Correlations significant at the 90% confidence level are presented with one asterisk (*), those significant at the 95% level are presented in bold with two asterisks (**), and those significant at the 99% level are presented with three asterisks (***).

	(1) lnnewpro	(2) newproratio	(3) lnexport	(4) exportratio	(5) patent	(6) invention	(7) lnpatent	(8) lninvention
Inno_2005Bef	0.708***	0.024***	0.569***	0.008*	0.971***	1.561***	0.134***	0.089***
	(0.115)	(0.007)	(0.087)	(0.005)	(0.046)	(0.063)	(0.014)	(0.009)
Inno_2005Aft	0.886***	0.045***	0.555***	0.016***	1.277***	1.802***	0.177***	0.118***
	(0.144)	(0.009)	(0.110)	(0.005)	(0.055)	(0.073)	(0.019)	(0.013)
Firm_age	-0.019	-0.001	0.019*	0.001	-0.001	-0.003	-0.001	0.0004
	(0.015)	(0.001)	(0.010)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)
State_Shr	0.105	0.003	0.048	-0.003	0.104	0.125	-0.006	-0.005
	(0.090)	(0.005)	(0.062)	(0.003)	(0.067)	(0.104)	(0.008)	(0.005)
Leverage	-0.086	-0.011**	0.084	0.003	-0.319***	-0.630***	-0.006	-0.008***
	(0.062)	(0.005)	(0.061)	(0.004)	(0.067)	(0.098)	(0.005)	(0.003)
Firm_size	0.312***	0.003**	0.420***	0.010***	0.352***	0.395***	0.020***	0.008***
	(0.021)	(0.002)	(0.021)	(0.001)	(0.015)	(0.021)	(0.002)	(0.001)
_cons	-1.449***	0.048***	-2.261***	0.011	-5.742***	-7.827***	-0.170***	-0.084***
	(0.225)	(0.016)	(0.222)	(0.014)	(0.267)	(0.750)	(0.024)	(0.014)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y
N	70,247	69,937	70,247	69,937	81,584	81,584	81,584	81,584
adj. R-sq	0.023	0.005	0.041	0.003			0.032	0.034
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 8: Regional Heterogeneity of Innofund Effects

This table reports the fixed effects panel estimations on regional heterogeneity of Innofund effects on innovation outputs of the firms based on the random sample as described in Table 3. Panel A, Panel B and Panel C present the impacts of economic development, the development of the private sector and the quality of the institutions of the province on Innofund effects respectively. Economic development is measured by ***DVP,*** a dummy variable that is equal to 1 if the province is defined as a developed region in a given year by the State Statistical Bureau, and equals 0 otherwise. ***Pri*** indicates the share of the total non-SOEs in a given province in a given year. ***Instn*** represents the quality of institutions in a given province in a given year which is measured by the development of local institutions, including patent protection departments, law firms, and accounting firms. ***InnoAft*** is a dummy variable that is equal to 1 if the firm has gained Innofund support at time t, and equals zero otherwise. Innovation outputs are measured by the natural logarithm of new product sales of the firm (***Lnnewpro***), ratio of total new product sales over total sales of the firm (***newproratio***), natural logarithm of export volume of the firm (***Lnexport***), ratio of total export volume over total sales of the firm (***exportratio***), total number of newly granted patents of the firm (patent) and total number of newly granted invention patents of the firm (***invention***) in a given year. Firm size (***Firm_size***) is measured by the natural logarithm of the annual sales of the firm in a given year. ***Leverage*** is the ratio of total liability over the total assets of the firm in a given year. ***State_Shr*** is the ratio of state ownership over the total equity of a firm in a given year. We also control firm age, and year and firm fixed effects. Model (1), (2), (3), (4), (7) and (8) are fixed effect panel data models while Model (5) and (6) are negative binomial models. Standard errors are reported in parentheses. Correlations significant at the 90% confidence level are presented with one asterisk (*), those significant at the 95% level are presented in bold with two asterisks (**), and those significant at the 99% level are presented with three asterisks (***).

Panel A. Economic Development and Innofund Effects

	(1) lnnewpro	(2) newproratio	(3) lnexport	(4) exportratio	(5) patent	(6) invention	(7) lnpatent	(8) lninvention
InnoAft	0.407***	0.009	0.467***	0.007*	1.054***	1.544***	0.099***	0.075***
	(0.112)	(0.007)	(0.085)	(0.004)	(0.053)	(0.073)	(0.014)	(0.009)
DVP	8.278**	0.387**	-0.753	-0.137	0.211***	0.159**	0.174	0.091
	(3.442)	(0.165)	(0.776)	(0.138)	(0.045)	(0.067)	(0.320)	(0.294)
InnoAft*DVP	0.799***	0.049***	0.211	0.009	0.082	0.240**	0.112***	0.054***
	(0.181)	(0.012)	(0.136)	(0.007)	(0.069)	(0.099)	(0.023)	(0.015)
Firm_age	-0.020	-0.001	0.019*	0.001	-0.003	-0.005	-0.001	0.0003
	(0.015)	(0.001)	(0.010)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)
State_Shr	0.089	0.002	0.043	-0.003	0.146**	0.157	-0.008	-0.006
	(0.090)	(0.005)	(0.062)	(0.003)	(0.068)	(0.104)	(0.008)	(0.005)
Leverage	-0.087	-0.011**	0.084	0.004	-0.331***	-0.648***	-0.006	-0.008***
	(0.061)	(0.005)	(0.061)	(0.004)	(0.067)	(0.098)	(0.005)	(0.003)
Firm_size	0.313***	0.003**	0.420***	0.010***	0.335***	0.376***	0.020***	0.008***
	(0.021)	(0.002)	(0.021)	(0.001)	(0.015)	(0.021)	(0.002)	(0.001)
_cons	-5.259***	-0.130*	-1.908***	0.075	-5.663***	-7.681***	-0.245	-0.123

	(1.607)	(0.078)	(0.424)	(0.065)	(0.267)	(0.749)	(0.151)	(0.137)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y
N	70,247	69,937	70,247	69,937	81,584	81,584	81,584	81,584
adj. R-sq	0.025	0.006	0.041	0.003			0.033	0.035
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Panel B. Private Sector Development and Innfound Effects

	(1) lnnewpro	(2) newproratio	(3) lnexport	(4) exportratio	(5) patent	(6) invention	(7) lnpatent	(8) lninvention
InnoAft	-0.149	-0.003	0.011	-0.005	0.908***	1.370***	-0.033	-0.033
	(0.211)	(0.014)	(0.164)	(0.008)	(0.095)	(0.135)	(0.028)	(0.020)
Pri	0.147***	0.011***	0.059***	0.004***	0.057***	0.043***	0.001	0.001
	(0.023)	(0.001)	(0.021)	(0.001)	(0.010)	(0.015)	(0.003)	(0.002)
InnoAft*Pri	0.155***	0.006***	0.090***	0.003**	0.034**	0.048**	0.030***	0.022***
	(0.033)	(0.002)	(0.026)	(0.001)	(0.014)	(0.019)	(0.004)	(0.003)
Firm_age	-0.020	-0.001	0.018*	0.001	-0.002	-0.004	-0.001	0.0001
	(0.016)	(0.001)	(0.011)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)
State_Shr	0.086	-0.001	0.071	-0.001	0.120*	0.092	-0.008	-0.007
	(0.095)	(0.005)	(0.064)	(0.003)	(0.071)	(0.108)	(0.009)	(0.005)
Leverage	-0.085	-0.011**	0.081	0.003	-0.351***	-0.650***	-0.008	-0.009***
	(0.065)	(0.006)	(0.062)	(0.004)	(0.068)	(0.099)	(0.005)	(0.003)
Firm_size	0.299***	0.002	0.412***	0.009***	0.336***	0.378***	0.020***	0.008***
	(0.022)	(0.002)	(0.023)	(0.001)	(0.015)	(0.021)	(0.002)	(0.001)
_cons	-1.887***	0.017	-2.453***	-0.005	-5.821***	-7.194***	-0.147***	-0.074***
	(0.252)	(0.018)	(0.250)	(0.016)	(0.180)	(0.292)	(0.025)	(0.015)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y
N	65,471	65,192	65,471	65,192	75,677	75,677	75,677	75,677
adj. R-sq	0.026	0.008	0.040	0.004			0.031	0.035
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Panel C. Institutions and Innofund Effects

	(1) lnnewpro	(2) newproratio	(3) lnexport	(4) exportratio	(5) patent	(6) invention	(7) lnpatent	(8) lninvention
InnoAft	0.108	0.011	0.197	-0.0002	0.969***	1.454***	0.0004	-0.009
	(0.178)	(0.011)	(0.141)	(0.007)	(0.079)	(0.113)	(0.022)	(0.015)
Instn	0.111***	0.005***	0.040***	0.003***	0.043***	0.032***	0.002	-0.001
	(0.016)	(0.001)	(0.014)	(0.001)	(0.008)	(0.011)	(0.002)	(0.001)
InnoAft*Instn	0.097***	0.003**	0.051***	0.002*	0.022**	0.030**	0.021***	0.016***
	(0.023)	(0.002)	(0.018)	(0.001)	(0.009)	(0.014)	(0.003)	(0.002)
Firm_age	-0.020	-0.001	0.018*	0.001	-0.002	-0.004	-0.001	0.0001
	(0.016)	(0.001)	(0.011)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)
State_Shr	0.049	-0.002	0.060	-0.002	0.114	0.096	-0.009	-0.007
	(0.095)	(0.005)	(0.064)	(0.003)	(0.071)	(0.108)	(0.009)	(0.005)
Leverage	-0.076	-0.010*	0.085	0.003	-0.356***	-0.657***	-0.008	-0.009***
	(0.065)	(0.006)	(0.063)	(0.004)	(0.068)	(0.099)	(0.005)	(0.003)
Firm_size	0.298***	0.002	0.411***	0.009***	0.333***	0.377***	0.020***	0.008***
	(0.022)	(0.002)	(0.023)	(0.001)	(0.015)	(0.021)	(0.002)	(0.001)
_cons	-1.709***	0.041**	-2.369***	-0.001	-5.720***	-7.120***	-0.150***	-0.068***
	(0.242)	(0.017)	(0.240)	(0.015)	(0.178)	(0.290)	(0.023)	(0.013)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y
N	65,471	65,192	65,471	65,192	75,677	75,677	75,677	75,677
adj. R-sq	0.027	0.007	0.040	0.004			0.031	0.036
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 9: Regional Heterogeneity, Project Screening and Innofund Effects

This table reports the fixed effects panel estimations on the influences of regional heterogeneity and project screening on Innofund effects based on the random sample as described in Table 3. Panel A presents how economic development of a region and the project screening changes affect the innovation outputs of the Innofund-backed firms. Panel B reports how private sector development and the project screening influence the innovation outputs of the Innofund-backed firms. Panel C shows how institutions and the project screening impact on the Innofund effects. Project screening system was changed from centralized screening to decentralized screening in 2005 according to the Innofund policy. We hence use this policy change to capture the project screening change. ***Inno_2005Bef*** is a dummy variable that is equals to 1 if the firm has gained Innofund support at time t and the Innofund was granted before 2005 and equals zero otherwise. ***Inno_2005Aft*** is a dummy variable that is equal to 1 if the firm has gained Innofund support at time t and the first Innofund was granted after 2005 and equals zero otherwise. Economic development is measured by ***DVP,*** a dummy variable that is equal to 1 if the province is defined as a developed region in a given year by the State Statistical Bureau, and equals 0 otherwise. ***Pri*** indicates the share of the total non-SOEs in a given province in a given year. ***Instn*** represents the quality of institutions in a given province in a given year which is measured by the development of local institutions, including patent protection departments, law firms, and accounting firms. ***InnoAft*** is a dummy variable that is equal to 1 if the firm has gained Innofund support at time t, and equals zero otherwise. Innovation outputs are measured by the natural logarithm of new product sales of the firm (***Lnnewpro***), ratio of total new product sales over total sales of the firm (***newproratio***), natural logarithm of export volume of the firm (***Lnexport***), ratio of total export volume over total sales of the firm (***exportratio***), total number of newly granted patents of the firm (patent) and total number of newly granted invention patents of the firm (***invention***) in a given year. Firm size (***Firm_size***) is measured by the natural logarithm of the annual sales of the firm in a given year. ***Leverage*** is the ratio of total liability over the total assets of the firm in a given year. ***State_Shr*** is the ratio of state ownership over the total equity of a firm in a given year. We also control firm age, and year and firm fixed effects. Model (1), (2), (3), (4), (7) and (8) are fixed effect panel data models while Model (5) and (6) are negative binomial models. Standard errors are reported in parentheses. Correlations significant at the 90% confidence level are presented with one asterisk (*), those significant at the 95% level are presented in bold with two asterisks (**), and those significant at the 99% level are presented with three asterisks (***).

Panel A. Economic Development, Screening System Change and Innofund Effects

	(1) lnnewpro	(2) newproratio	(3) lnexport	(4) exportratio	(5) patent	(6) invention	(7) lnpatent	(8) lninvention
Inno_2005Bef	0.419***	0.0004	0.495***	0.009	0.907***	1.423***	0.080***	0.066***
	(0.149)	(0.009)	(0.114)	(0.006)	(0.063)	(0.087)	(0.017)	(0.011)
Inno_2005Aft	0.389**	0.021**	0.426***	0.005	1.286***	1.717***	0.125***	0.087***
	(0.168)	(0.010)	(0.127)	(0.005)	(0.074)	(0.097)	(0.023)	(0.016)
DVP	8.274**	0.386**	-0.753	-0.138	0.205***	0.155**	0.173	0.090
	(3.444)	(0.165)	(0.776)	(0.138)	(0.045)	(0.067)	(0.321)	(0.294)
Inno_2005B*DVP	0.592***	0.047***	0.152	-0.001	0.143*	0.282**	0.110***	0.045***
	(0.229)	(0.015)	(0.170)	(0.009)	(0.083)	(0.118)	(0.028)	(0.017)
Inno_2005A*DVP	1.243***	0.060***	0.321	0.029***	0.006	0.191	0.127***	0.076***
	(0.299)	(0.019)	(0.231)	(0.011)	(0.099)	(0.134)	(0.039)	(0.027)
Firm_age	-0.021	-0.001	0.019*	0.001	-0.001	-0.004	-0.001	0.0002
	(0.015)	(0.001)	(0.010)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)
State_Shr	0.091	0.002	0.043	-0.003	0.149**	0.167	-0.008	-0.006
	(0.090)	(0.005)	(0.061)	(0.003)	(0.068)	(0.104)	(0.008)	(0.005)

Leverage	-0.087	-0.011**	0.084	0.004	-0.334***	-0.653***	-0.006	-0.008***
	(0.061)	(0.005)	(0.061)	(0.004)	(0.067)	(0.098)	(0.005)	(0.003)
Firm_size	0.313***	0.003**	0.420***	0.010***	0.344***	0.385***	0.020***	0.008***
	(0.021)	(0.002)	(0.021)	(0.001)	(0.015)	(0.021)	(0.002)	(0.001)
_cons	-5.256***	-0.130*	-1.907***	0.075	-5.779***	-7.814***	-0.246	-0.124
	(1.608)	(0.078)	(0.424)	(0.065)	(0.268)	(0.750)	(0.151)	(0.137)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y
N	70,247	69,937	70,247	69,937	81,584	81,584	81,584	81,584
adj. R-sq	0.025	0.007	0.041	0.004			0.033	0.035
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Panel B. Private Sector Development , Screening System Change and Innofund Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	lnnewpro	newproratio	lnexport	exportratio	patent	invention	lnpatent	lninvention
Inno_2005B	-0.134	-0.001	-0.091	-0.00663	0.764***	1.275***	-0.061*	-0.053**
	(0.260)	(0.017)	(0.206)	(0.00985)	(0.107)	(0.153)	(0.033)	(0.024)
Inno_2005A	-0.196	-0.013	0.298	-0.00312	1.323***	1.594***	0.024	0.012
	(0.346)	(0.023)	(0.244)	(0.0106)	(0.156)	(0.205)	(0.053)	(0.037)
Pri	0.147***	0.011***	0.058***	0.00369***	0.060***	0.045***	0.001	0.001
	(0.023)	(0.001)	(0.021)	(0.00141)	(0.010)	(0.015)	(0.003)	(0.002)
Inno_2005B*Pri	0.150***	0.005*	0.114***	0.00245	0.041***	0.050**	0.032***	0.024***
	(0.042)	(0.003)	(0.033)	(0.00166)	(0.016)	(0.022)	(0.005)	(0.004)
Inno_2005A*Pri	0.165***	0.009**	0.040	0.00288*	-0.001	0.032	0.023***	0.016***
	(0.053)	(0.004)	(0.037)	(0.00174)	(0.021)	(0.027)	(0.008)	(0.006)
Firm_age	-0.020	-0.001	0.018*	0.000842	-0.001	-0.003	-0.001	0.0002
	(0.016)	(0.001)	(0.011)	(0.000697)	(0.003)	(0.004)	(0.001)	(0.001)
State_Shr	0.086	-0.001	0.071	-0.000767	0.126*	0.101	-0.008	-0.007
	(0.095)	(0.005)	(0.064)	(0.00313)	(0.071)	(0.107)	(0.009)	(0.005)
Leverage	-0.085	-0.011**	0.081	0.00283	-0.352***	-0.653***	-0.008	-0.009***
	(0.065)	(0.006)	(0.062)	(0.00383)	(0.068)	(0.099)	(0.005)	(0.003)
Firm_size	0.299***	0.002	0.412***	0.00916***	0.343***	0.386***	0.020***	0.008***
	(0.022)	(0.002)	(0.023)	(0.00141)	(0.015)	(0.021)	(0.002)	(0.001)
_cons	-1.888***	0.017	-2.448***	-0.00482	-5.911***	-7.283***	-0.147***	-0.073***
	(0.252)	(0.018)	(0.250)	(0.0159)	(0.181)	(0.295)	(0.025)	(0.015)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y

N	65,471	65,192	65,471	65,192	75,677	75,677	75,677	75,677
adj. R-sq	0.026	0.008	0.040	0.004			0.031	0.036
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Panel C. Institutions, Screening System Change and Innofund Effects

	(1) lnnewpro	(2) newproratio	(3) lnexport	(4) exportratio	(5) patent	(6) invention	(7) lnpatent	(8) lninvention
Inno_2005B	0.166	0.015	0.170	-0.001	0.813***	1.318***	-0.024	-0.026
	(0.213)	(0.013)	(0.172)	(0.008)	(0.088)	(0.127)	(0.026)	(0.018)
Inno_2005A	-0.094	-0.007	0.319	-0.0003	1.433***	1.775***	0.062	0.036
	(0.307)	(0.020)	(0.218)	(0.010)	(0.135)	(0.176)	(0.043)	(0.029)
Instn	0.111***	0.005***	0.040***	0.003***	0.047***	0.034***	0.002	-0.001
	(0.016)	(0.001)	(0.014)	(0.001)	(0.008)	(0.011)	(0.002)	(0.001)
Inno_2005B*Instn	0.086***	0.002	0.060***	0.001	0.030***	0.038**	0.023***	0.017***
	(0.029)	(0.002)	(0.023)	(0.001)	(0.011)	(0.015)	(0.004)	(0.003)
Inno_2005A*Instn	0.125***	0.007***	0.031	0.002	-0.012	0.008	0.015***	0.011***
	(0.038)	(0.003)	(0.027)	(0.001)	(0.014)	(0.019)	(0.005)	(0.004)
Firm_age	-0.020	-0.001	0.018*	0.001	-0.001	-0.003	-0.001	0.0002
	(0.016)	(0.001)	(0.011)	(0.001)	(0.003)	(0.004)	(0.001)	(0.001)
State_Shr	0.048	-0.002	0.060	-0.002	0.119*	0.105	-0.008	-0.007
	(0.095)	(0.005)	(0.064)	(0.003)	(0.071)	(0.108)	(0.009)	(0.005)
Leverage	-0.076	-0.010*	0.085	0.003	-0.357***	-0.659***	-0.008	-0.009***
	(0.065)	(0.006)	(0.063)	(0.004)	(0.068)	(0.099)	(0.005)	(0.003)
Firm_size	0.298***	0.002	0.411***	0.009***	0.341***	0.385***	0.020***	0.008***
	(0.022)	(0.002)	(0.023)	(0.001)	(0.015)	(0.021)	(0.002)	(0.001)
_cons	-1.709***	0.041**	-2.368***	-0.001	-5.815***	-7.211***	-0.150***	-0.068***
	(0.242)	(0.017)	(0.240)	(0.015)	(0.179)	(0.292)	(0.023)	(0.013)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y
N	65,471	65,192	65,471	65,192	75,677	75,677	75,677	75,677
adj. R-sq	0.027	0.007	0.040	0.004			0.031	0.036
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Appendix

Table A.1 Summary Statistics of the PSM Sample

This table reports the summary statistics and T-tests of the Innofund-backed firms and their counterparts selected by propensity score matching.

Variable		(1) **Innofund-backed firms**	(2) **non-Innofund-backed firms in random draw sample**	(2) - (1) **Difference and t-statistics**	(3) **non-Innofund-backed firms in PSM sample**	(3) - (1) **Difference and t-statistics**
ln(new product sales)	Mean	3.338	0.915	-2.423***	3.381	0.043
	Observations	2,293	10,461	*(-24.102)*	9,436	*(0.399)*
ln(export)	Mean	2.499	1.802	-0.697***	2.520	0.021
	Observations	2,293	10,461	*(-7.472)*	9,436	*(0.217)*
Patent (number)	Mean	0.796	0.085	-0.711***	0.696	-0.100
	Observations	2,638	12,025	*(-10.657)*	10,739	*(-0.899)*
Invention (number)	Mean	0.312	0.021	-0.291***	0.216	-0.096
	Observations	2,638	12,025	*(-8.100)*	10,739	*(-1.053)*
ln(employee)	Mean	4.970	4.424	-0.546***	4.952	-0.018
	Observations	2,638	12,025	*(-25.187)*	10,739	*(-0.834)*

Table A.2 2SLS Regressions in PSM Sample

This table reports the 2SLS regressions for Innofund effects based on samples selected by propensity score matching. Panel A shows the first stage of the estimations and Panel B presents the second stage estimations. ***Ln(firmno)*** is the instrumental variable to predict whether a specific firm might be supported by Innofund in a given year. It is the total number of firms in high-tech zones in a given city in a given year. The dependent variable in Panel A is ***InnoAft*** which is a dummy variable that is equal to 1 if the firm has gained Innofund support at time t, and equals zero otherwise. The dependent variables in Panel B are measurements for innovation outputs which are measured by the natural logarithm of new product sales of the firm (***Lnnewpro***), ratio of total new product sales over total sales of the firm (***newproratio***), natural logarithm of export volume of the firm (***Lnexport***), ratio of total export volume over total sales of the firm (***exportratio***), total number of newly granted patents of the firm (patent) and total number of newly granted invention patents of the firm (***invention***) in a given year. Firm size (***Firm_size***) is measured by the natural logarithm of the annual sales of the firm in a given year. ***Leverage*** is the ratio of total liability over the total assets of the firm in a given year. ***State_Shr*** is the ratio of state ownership over the total equity of a firm in a given year. We also control firm age, and year and firm fixed effects. Standard errors are reported in parentheses. Correlations significant at the 90% confidence level are presented with one asterisk (*), those significant at the 95% level are presented in bold with two asterisks (**), and those significant at the 99% level are presented with three asterisks (***).

	(1)	(2)	(3)	(4)	(5)	(6)
	InnoAft	InnoAft	InnoAft	InnoAft	InnoAft	InnoAft
Panel A: first-stage coefficient						
ln(firmno)	0.010***	0.010***	0.010***	0.010***	0.011***	0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Firm_age	-0.001	-0.002	-0.001	-0.002	0.0001	0.0002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
State_Shr	0.074***	0.073***	0.074***	0.073***	0.086***	0.086***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.025)	(0.025)
Leverage	-0.237***	-0.238***	-0.237***	-0.238***	-0.250***	-0.250***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.023)	(0.023)
Firm_size	0.129***	0.132***	0.129***	0.132***	0.135***	0.135***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
_cons	-2.041***	-2.072***	-2.041***	-2.072***	-7.080	-7.081
	(0.061)	(0.061)	(0.061)	(0.061)	(67.178)	(67.178)
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Panel B: second-stage regression						
	(1)	(2)	(3)	(4)	(5)	(6)
	lnnewpro	newproratio	lnexport	exportratio	lnpatent	lninvention
InnoAft	4.139**	1.052***	4.237*	0.050	3.422***	1.552***
	(2.169)	(0.157)	(2.192)	(0.080)	(0.491)	(0.168)
Firm_age	0.048***	0.003***	0.005	-0.003***	0.010***	0.005***
	(0.007)	(0.001)	(0.007)	(0.0004)	(0.001)	(0.001)
State_Shr	0.622***	-0.009	-0.399*	-0.025***	-0.164***	-0.088***
	(0.229)	(0.016)	(0.221)	(0.008)	(0.048)	(0.018)
Leverage	-0.561	0.014	-0.325	-0.012	0.040	0.064*
	(0.771)	(0.039)	(0.744)	(0.017)	(0.167)	(0.035)
Firm_size	0.625***	0.010	0.488***	0.029***	-0.068***	-0.050***
	(0.050)	(0.005)	(0.060)	(0.003)	(0.011)	(0.005)
_cons	-4.082***	-0.081*	-2.258***	-0.130***	0.766***	0.482***
	(0.501)	(0.043)	(0.576)	(0.024)	(0.122)	(0.060)
Year Fixed Effects	Y	Y	Y	Y	Y	Y
N	58,979	58,863	58,979	58,863	69,787	69,787
P-value	0.000	0.000	0.000	0.000	0.000	0.000

Table A.3 Innofund and Innovation Outputs for the Subsamples Before and After 2005

This table presents the fixed effects panel regressions of Innofund on innovation outputs for the subsamples gaining Innofund before and after 2005 to further address the effects of the policy change in project screening on Innofund influence. Panel A only includes the firms backed by Innofund before 2005 and their non-Innofund-backed counterparts and Panel B shows the estimations for subsample that only includes the firms backed by Innofund after 2005 and their non-Innofund-backed counterparts. ***InnoAft*** is a dummy variable that is equal to 1 if the firm has gained Innofund support at time t, and equals zero otherwise. Innovation outputs are measured by the natural logarithm of new product sales of the firm (***Lnnewpro***), ratio of total new product sales over total sales of the firm (***newproratio***), natural logarithm of export volume of the firm (***Lnexport***), ratio of total export volume over total sales of the firm (***exportratio***), total number of newly granted patents of the firm (patent) and total number of newly granted invention patents of the firm (***invention***) in a given year. Firm size (***Firm_size***) is measured by the natural logarithm of the annual sales of the firm in a given year. ***Leverage*** is the ratio of total liability over the total assets of the firm in a given year. ***State_Shr*** is the ratio of state ownership over the total equity of a firm in a given year. We also control firm age, and year and firm fixed effects. Model (1), (2), (3), (4), (7) and (8) are fixed effect panel data models while Model (5) and (6) are negative binomial models. Standard errors are reported in parentheses. Correlations significant at the 90% confidence level are presented with one asterisk (*), those significant at the 95% level are presented in bold with two asterisks (**), and those significant at the 99% level are presented with three asterisks (***).

Panel A: Innofund and Innovation Outputs for Firms Backed Before 2005

	(1) lnnewpro	(2) newproratio	(3) lnexport	(4) exportratio	(5) patent	(6) invention	(7) lnpatent	(8) lninvention
InnoAft	0.690***	0.024***	0.560***	0.008*	1.114***	1.636***	0.137***	0.088***
	(0.115)	(0.007)	(0.088)	(0.005)	(0.051)	(0.071)	(0.014)	(0.008)
Firm_age	-0.033**	-0.002*	0.020	0.0004	-0.004	-0.010**	-0.001	0.0004
	(0.016)	(0.001)	(0.013)	(0.001)	(0.003)	(0.005)	(0.001)	(0.001)
State_Shr	0.133	0.001	0.044	-0.004	0.198**	0.256**	0.001	-0.006
	(0.107)	(0.006)	(0.072)	(0.004)	(0.078)	(0.119)	(0.010)	(0.006)
Leverage	-0.002	-0.003	0.036	0.001	-0.400***	-0.645***	-0.005	-0.006*
	(0.072)	(0.004)	(0.084)	(0.005)	(0.086)	(0.128)	(0.006)	(0.003)
Firm_size	0.308***	0.004**	0.429***	0.010***	0.377***	0.405***	0.020***	0.009***
	(0.025)	(0.002)	(0.027)	(0.002)	(0.019)	(0.027)	(0.002)	(0.001)
_cons	-1.186***	0.051***	-2.177***	0.015	-5.962***	-7.669***	-0.165***	-0.084***
	(0.273)	(0.020)	(0.283)	(0.018)	(0.312)	(0.776)	(0.029)	(0.016)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y
N	44,479	44,200	44,479	44,200	51,080	51,080	51,080	51,080
adj. R-sq	0.023	0.003	0.041	0.003			0.029	0.031

P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Panel B: Innofund and Innovation Outputs for Firms Backed After 2005

	(1) lnnewpro	(2) newproratio	(3) lnexport	(4) exportratio	(5) patent	(6) invention	(7) lnpatent	(8) lninvention
InnoAft	1.002***	0.048***	0.614***	0.016***	1.260***	1.888***	0.184***	0.127***
	(0.143)	(0.009)	(0.109)	(0.005)	(0.068)	(0.092)	(0.019)	(0.013)
Firm_age	0.023	0.001	0.018*	0.001*	0.008*	0.007	-0.002	0.001
	(0.033)	(0.002)	(0.011)	(0.001)	(0.004)	(0.006)	(0.002)	(0.001)
State_Shr	0.027	0.008	0.067	-0.001	-0.083	-0.183	-0.021	-0.003
	(0.169)	(0.010)	(0.119)	(0.005)	(0.132)	(0.218)	(0.015)	(0.007)
Leverage	-0.234**	-0.024**	0.179***	0.008*	-0.187*	-0.618***	-0.008	-0.011**
	(0.102)	(0.010)	(0.068)	(0.005)	(0.105)	(0.154)	(0.010)	(0.005)
Firm_size	0.330***	0.002	0.400***	0.009***	0.327***	0.386***	0.020***	0.008***
	(0.039)	(0.003)	(0.035)	(0.002)	(0.025)	(0.035)	(0.004)	(0.002)
_cons	-1.950***	0.044	-2.357***	0.005	-5.734***	-26.510	-0.196***	-0.092***
	(0.397)	(0.028)	(0.351)	(0.020)	(0.578)	(17798.0)	(0.047)	(0.026)
Year and Firm Fixed Effects	Y	Y	Y	Y	N	N	Y	Y
N	25,768	25,737	25,768	25,737	30,504	30,504	30,504	30,504
adj. R-sq	0.026	0.009	0.039	0.005			0.036	0.040
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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