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Governance and effects of public R&D subsidies: Evidence from China[☆]

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ABSTRACT

This study examines the effects of public research and development (R&D) subsidies and the governance of such subsidies on firm productivity based on the analysis of a firm-level panel dataset between 1998 and 2007 in China. It is found that public R&D subsidies tend to support more productive firms and the productivity of these government-backed firms is improved further after they get the government support. Less attention is paid to the observable or measurable performance measurements in ex-ante project selection, and the ex-post effects are stronger when the governance of the public R&D subsidies becomes more decentralized due to an exogenous policy change. In other words, better decentralization of governance is associated with more pronounced effects of R&D subsidies. Identification concerns are addressed with various approaches to confirm the treatment effect of public R&D subsidies and the governance of such subsidies.

1. Introduction

This study examines the effects of public research and development (R&D) subsidies and how the governance of such grants influences those effects. Corporate R&D activities may be underinvested in a free market because the social returns of R&D activities are larger than their private returns (Nelson, 1959; Arrow, 1962). Therefore, government engagement is called for as a mechanism to respond to such market failures (Romer, 1986; Aghion and Howitt, 1992).

Empirical evidence on the effects of public R&D support is numerous while the results remain inconclusive. Some studies discover positive effects of public R&D support on firm performance and R&D intensity (Griliches and Regev, 1998; Branstetter and Sakakibara, 1998; Aerts and Schmidt, 2008; Hsu et al., 2009; Ratinho and Henriques, 2010; Czarnitzki and Lopes-Bento, 2011; Doh and Kim, 2014; Radas et al., 2015; Guo et al., 2017). Meanwhile, such effects depend on the evaluation criteria of such programs (Hsu et al., 2009), the size or technology of the firm (Löf and Hesmati, 2005; Clausen, 2009; Lee, 2011), or, the market conditions under which such programs operate (Sternberg, 2014; Guo et al., 2017). However, other studies find that

public R&D support has done nothing to stimulate firm performance (Klette and Møen, 1999; Guan and Yam, 2015). Moreover, several studies find that public R&D support crowds out private R&D inputs, thereby reducing social welfare and growth (Wallsten, 2000; Hussinger, 2008; Acemoglu et al., 2013; Hong et al., 2016).

Existing studies have significantly improved the understanding of public R&D programs. However, several knowledge gaps are left to be filled. First, although the role governments play in public R&D programs is well recognized, scholars have little understanding of how such programs are governed and how the governance influences the effects of such programs. To what extent the government may solve market failures relies on the capability and incentives of government agencies, which in turn are determined by the governance of such agencies. Therefore, the exploration of the governance of public R&D programs is essential for scholars to gain insights into the circumstances under which government engagement in corporate R&D activities may solve market failures. Second, existing studies mainly focus on public R&D programs in market-centered economies, where governments seldom intervene in markets and are assumed to be relatively efficient. Evidence on the effectiveness of public support for enterprise R&D is

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scarce where governments themselves are deeply engaged in business activities. Third, the endogeneity issue attributed to selection biases in public R&D programs has been a significant challenge and may contribute to the mixed findings in existing studies (David et al., 2000).

This study attempts to address the omission in the literature by examining the effects of public R&D subsidies in China and the governance of such grants. The Chinese government has recognized the importance of promoting corporate innovation and has invested substantial efforts in this endeavor (Sun et al., 2013). However, systematic analysis on public R&D subsidies in China is limited. Among the few studies on public support to corporate R&D in China, most are based on listed firms (e.g., Fan, 2006; Boeing, 2016; Boeing et al., 2016). Guo et al. (2016, 2017), Guan and Yam (2015), and Wang et al. (2017) are among the few studies that examine public R&D support to small-and-medium-sized enterprises (SMEs) in China. However, these studies do not provide sufficient insights into the governance of such public programs or the consequent effects of the governance change.

This study utilizes the data of the Innovation Fund for Small and Medium Technology-based Firms (Innofund) and the Above-Scale Industrial Firms Panel 1998–2007 (ASIFP) for the systematic examinations. It first determines whether public R&D subsidies select more productive firms, and, whether the productivity of firms is further enhanced after they get the public support than that of other firms and the same firms before winning the grants. Subsequently, this study investigates how the change of the governance of public R&D programs from a centralized to a relatively decentralized system owing to the exogenous policy change affects the efficacy of the two mechanisms mentioned before.

The results of this study show that public R&D programs choose to support firms with high productivity and the productivity of these chosen firms is further improved after they acquire government support. Public R&D programs pay less attention to observable or measurable performance measurements in ex-ante project selection, and the ex-post effects are stronger when the governance of such programs is more decentralized. Finally, the better the decentralization is implemented by local governments, the stronger the effects of public R&D subsidies are observed. This study employs propensity score matching strategy and two-stage estimations with an instrumental variable to identify the ex-post effects of public R&D subsidies. Several other approaches, including quasi-difference-in-difference estimations, moving time-window cutoffs, and ruling out co-existing external shocks, are utilized to check the robustness of the effects of governance change of the public R&D program.

The rest of the paper is organized as follows. Section 2 discusses why public R&D subsidies are expected to have an impact on firm productivity in China and how the governance of public R&D support potentially influences the effects of such programs. Section 3 introduces the institutional background and the policy change of the Innofund program. Section 4 introduces the samples, data, and variables. Section 5 presents the empirical findings on the effects of public R&D subsidies and addresses the identification concerns. Section 6 reports the empirical findings on the effects of the governance of public R&D subsidies and the robustness checks. Section 7 discusses the implications of the empirical findings to theory, policy-making and business practice.

2. Public R&D subsidies, the governance of such programs and firm productivity

2.1. Public R&D subsidies and firm productivity

The effects of public R&D programs on firm productivity depend on several factors. First, the liquidity constraints of firms may affect the effects of public R&D programs. Investing in R&D activities can be a complicated decision-making process that involves various costs (Lucas, 1967). Firms need to calculate the costs and benefits of initiating adjustment and decide whether to take actions upon government support.

If an awarded firm chooses to finance itself regardless of whether it gains public R&D support or not, government support may substitute the private R&D investment that exerts limited effects on R&D investments and firm productivity. However, if the awarded firm is financially constrained and chooses not to finance itself if there were no government support, the firm is expected to take actions with government support, and the effects of the public R&D program should be observed.

Second, the effects of public R&D support may also be related to the incentives of firms to secure certification effects of the public funding. Empirical studies confirm that firms with public R&D support have increased access to other external finance in the market (Lerner, 2000; Meuleman and De Maeseneire, 2008). Direct financial support may not be the only reason a firm applies for public R&D support; instead, companies may maximize the certification effect of such program, which may help them gain other sources of external financial support. Administrative agencies periodically assess projects sponsored by public R&D subsidies. Failed evaluations send negative signals to potential external financiers. Therefore, firms have to prove their performance to secure the certification effect of public R&D support, specifically when financial constraints are strong, the financial market is not well-developed, and the credit system does not function well.

Public R&D subsidies are expected to have significant effects on SMEs in China. Chinese SMEs have suffered from severe financial constraints due to profound information issues and the monopoly of state-owned banks in the banking industry (Gordon and Li, 2003; Allen et al., 2005). Firms, especially high-tech SMEs, are expected to value government grants and the certification effect of such grants. By the aforementioned theoretical reasoning and the context of China, following hypothesis is posited:

Hypothesis 1. Firms backed by public R&D subsidies experience significantly stronger improvements in productivity after winning the grant compared to their non-government-backed counterparts and to themselves before the infusion of government grants in China.

2.2. Governance of public R&D program and its effects

The primary rationale for the government intervention in corporate R&D activities is that firms may under-invest in R&D under a free market (Romer, 1986; Aghion and Howitt, 1992). Such reasoning suggests that incentives and capabilities of government agencies, which are mainly determined by the governance of such agencies, are crucial factors to determine the effects of public R&D program. Above all, the quality of project selection depends on the governance structure of organizations. Based on incentive theory, Sah and Stiglitz (1991) argue that decentralized decision-making system provides more incentives to local knowledge holders to exert more efforts in project selection. With the same evaluation costs, hierarchical organizations delay project selection, reject good projects and reduce the total number of project portfolios. By contrast, decentralized organizations accelerate the selection process and increase the number of selections by reducing communication costs and information issues though decentralized decision making may accept bad projects. Similarly, some scholars (Aghion and Tirole, 1997; Dessein, 2002; Stein, 2002) argue that decentralized organizations induce a loss of control for the principal while reducing the agent's incentive to miscommunicate information at the same time. Stein (2002) further proposes that decentralized organizations are more attractive when the information required is “softer,” whereas centralized organizations are more favorable when the information required can be “hardened” with less verification cost. Furthermore, Qian and Xu (1998) further argue that decentralized decision making may not only reduce ex-ante screening costs but also terminate bad projects ex-post on time because of the hardened budget constraints, such that both types of errors mentioned previously may be reduced. Such effects of decentralization should be evident in

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