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Picking ‘winners’ in China: Do subsidies matter for indigenous innovation and firm productivity? ☆



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ABSTRACT

This paper examines the effects of public subsidies across several dimensions of the innovation process and the implications for productivity. As an identification strategy, panel data is used to estimate a structural innovation model that controls for unobserved heterogeneity combined with matching techniques that help ensure comparability between subsidized and non-subsidized firms. The findings reveal that public subsidies reduce firms' economic performance in lower and higher technology industries despite promoting indigenous innovation in the higher technology industries. Policymakers may tolerate lower average efficiency if they expect that some of the state-backed firms will eventually become successful innovators that go on to generate significantly large social welfare payoffs. Although the findings do not support such an expectation, thus bringing into question whether the social payoff from China's so-called picking ‘winners’ strategy justifies the cost.

1. Introduction

It is well known that technological change is a key driver of productivity growth. Technological innovation and upgrading are therefore key aspects of catch-up for transitioning and developing countries. A main source of technological change in the early stages of economic transition originates from the local appropriation and imitation of foreign technologies. As transitioning countries continue to develop, however, there is a growing need to rely less on foreign technologies in favor of promoting the country's own indigenous innovation capabilities. This shift from foreign to indigenous sources of knowledge often coincides with the need to implement industrial policies to overcome coordination and externality problems.

In order to shape and promote indigenous technological capabilities, a key question that naturally arises in any transitioning economy is how deeply should the state remain involved in picking ‘winners’ and supporting its national industrial champions. Early critics over the state's attempts to pick winners and losers often point to the failed import substitution policies of the 1970s, arguing that ‘picking winners’ strategies often fail and in reality become ‘saving losers’ strategies that prevent inefficient firms from existing the market. However, the rapid growth of Asia's tigers (Hong Kong SAR, Singapore, South Korea and Taiwan), and more recently China, has given rise to optimism that state-led innovation and industrial policies if correctly executed can be a major contribution to economic growth (Stiglitz, Lin, & Monga, 2013).

China offers an important case study that many other low- and middle-income countries attempt to emulate. Since the turn of the century, the Chinese government at both the central and local levels has relied increasingly on industrial policy to encourage indigenous innovation and technological upgrading, and spur regional development and catch-up (Barbieri, Tommaso, & Bonnini, 2012; Demurger, Sachs, Woo, Bao, & Chang, 2002). Industrial policies, e.g. tax incentives, public subsidies, free or low cost loans,

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subsidized energy, subsidized raw materials, and land, are being used to help re-structure the economy and transform China into an innovation-oriented society (Haley & Haley, 2013).

Public subsidies are an integral part of China's industrial policy and are allocated across various industries in China. State financial support may help to reduce risk and help firms to overcome other innovation barriers, although the ability of the state to pick winners and promote indigenous innovation is not well understood. Recently, Hu and Jefferson (2008) express serious skepticism that China's rapid increase in R & D spending is driven primarily by government funding. Giving credence to this skepticism, recent firm-level evidence reveals that public subsidies indeed have a negative (i.e. crowding-out) effect on publicly-listed firms' innovation efforts in China (Boeing, 2016).

A key drawback with the existing firm-level studies on China, and elsewhere, is that they do not take into account simultaneously the linkages among subsidies, innovation and productivity. These linkages are important to consider, however, especially in transitioning economy contexts, since subsidies may spur innovation activities of some firms' that do not have sufficient technical know-how, which may reduce their overall economic performance. Conversely, subsidies may result in lower innovation performance, yet still give rise to economies of scope at the firm level, which could in turn, lead to higher overall economic performance.

Based on the above discussion, the current paper attempts to carry out the following two objectives. First, examine the effects of state subsidies along several dimensions of innovation and assess what are the implications for firms' productivity. Second, compare the returns to firms' innovation outputs for comparatively more successful innovators that initially received state-support versus their counterparts that did not. Making this comparison tests, at least partially, the effectiveness of China's so-called 'picking winners' strategy.

To meet these two objectives, a structural innovation approach à la Crépon, Duguet, and Mairesse (1998) (CDM, hereafter) is employed. The CDM model extends the knowledge production framework developed in Pakes and Griliches (1980), embedding it into a recursive system of equations that links the knowledge production function to firm performance. Crépon et al. (1998) find that the firm's decision to invest in innovation increases innovation output, which in turn, increases productivity. A number of subsequent studies confirm this virtuous relationship in both advanced market economies (Benavente, 2006; Griffith, Huergo, Mairesse, & Peters, 2006) and transitioning and newly industrialized economies (Aw, Roberts, & Xu, 2011; Crespi & Zuniga, 2012; Jefferson, Bai, Guan, & Yu, 2006).

Unlike many of the initial structural innovation studies that rely on cross-sectional data, the current paper relies on panel data to estimate the CDM model. In this way, both unobserved firm heterogeneity and the time lag can be accounted for throughout the entire innovation process, i.e. from the firm's decisions whether or not to engage in R & D activities to its impact on productivity through innovation output. Moreover, in this paper, public subsidies are linked for the first time to each stage of the structural model.

Public subsidies here refer to production-related subsidies that get allocated to firms in order to encourage technological upgrading, among various other reasons. There is no precondition for firms that receive a production subsidy to invest in innovation, thus there are less concerns about the screening process and selection issues. Nevertheless, it is acknowledged upfront that the allocation of production subsidies is also likely to not be assigned at random, making it difficult to identify the causal effect of subsidies.

To deal with this issue, PSM techniques are combined with the structural innovation framework as an identification strategy to ensure the comparability between firms that receive subsidies and those that do not. Combining PSM with the CDM framework is advantageous since the former ensures comparability between the treatment and control groups, while the random effects included the structural framework accounts for time-invariant unobservable firm heterogeneity which is neglected by PSM. The empirical analysis is estimated on a large sample of more than 100,000 entrepreneurial firms where the private, non-state entity is the majority shareholder.

This paper makes several contributions to the literature. First, the CDM framework is used to study the entire process of innovation and estimate the effects of that innovation on firm TFP in a large, transitioning economy context. Second, matching techniques are combined with the structural innovation framework in order to better identify the causal effect of state subsidies across the entire process of firm innovation and productivity. Third, the returns to innovation, in terms of productivity gains, are compared for successful innovators that initially received state support versus those that did not, making it possible to comment on whether the social gains derived from China's picking winners strategy outweigh the costs.

The subsequent section introduces the relevant literature. Section 3 introduces the data and development of the main variables. Section 4 introduces the structural innovation model and identification strategy. The empirical results are presented in Section 5 and Section 6 concludes.

2. Literature review

Public support programs for innovation are immensely popular in both advanced and less advanced economies. The obvious rationale behind state support is rooted and supported in the seminal work by Arrow (1962) who shows that under free market conditions private firms will invest in suboptimal levels of R & D. Despite the popularity of policy incentives, the evidence on the effects of public programs on firms' innovation behavior and performance remains mixed and controversial (Czarnitzki & Hottenrott, 2011).

According to Zuniga-Vicente, Alonso-Borrego, Forcadell, and Galan-Zazo (2014), 63% of recent firm-level studies find evidence that public (R & D) subsidies boost firms' own R & D expenditures, while the remaining one-third of the studies find either a crowding out effect or no effect at all. Specifically, some studies reveal that state-subsidized firms invest more in R & D activities in various

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