



The effect of risk-sharing government subsidy on corporate R&D investment: Empirical evidence from Korea

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ABSTRACT

Despite the wide belief that the high social rates of returns to R&D investment justify government subsidy policy in advanced countries, there are only limited studies about whether the R&D subsidy as a means of risk-sharing stimulates R&D investment of small and medium sized enterprises (SMEs) in developing countries. This paper empirically investigates the issue, using a unique data set on government subsidy for new technology development of Korean manufacturing firms, listed and non-listed, for the period from 2000 to 2007. The paper employs the DID estimation procedure and controls for simultaneity of the subsidy for new technology development using 2SLS and two step Tobit procedure. Our empirical results show that there is no solid evidence for crowding-out effects of the government subsidy. These results suggest that government subsidies could help SMEs to overcome the barriers to risky R&D projects through sharing R&D failure risk with government and by reducing capital costs to undertake new technology development projects, and thus the subsidy policy for new technology development seems to be partly successful in promoting the R&D investment of the Korean SMEs.

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1. Introduction

While the emphasis has been placed on export-oriented growth strategies in most developing countries, the importance of innovation and the improvement on technological efforts is recognized [1]. In particular, R&D investment in new technology development has been thought of as one of the most important factors for enhancing technological progress and thus economic growth for developed and developing countries [2].

In Korea, the nature of and incentives to firm R&D investment have been understood in the context of implementing its underlying export-led growth strategies in the market structure dominated mainly by large enterprises. In terms of their size and limited capital, the Korean SMEs (small and medium sized enterprises) have generally spent little on R&D or technology license.

In general, it would be relatively easy for large firms to undertake R&D activities or to import technology from foreign sources either through joint venture or consultancy. But it is difficult for the SMEs to undertake the risky R&D projects by being financed in the market. It is more difficult for the SMEs to get external equity finance in the absence of well-established capital markets. Without efficient capital markets, the external costs of capital might be higher especially to the SMEs than internal costs of capital [3,4]. It is due to asymmetric information between inventor and investor about the likelihood of success, moral hazard problem which may arise from separation of ownership from management, and tax considerations that drive a wedge between external and internal financing by retained earnings. For these reasons firms should be more dependent on internal financing, which makes the SMEs exposed to the higher default risk. High default risk and high capital costs would cause private SMEs to appropriate less return and to face greater risk than society does.

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The shortfalls of the private expected outcomes from the expected returns of the society reflect the appropriability problems. On the other hand, R&D subsidies to the SMEs could help overcome barriers to technology-enhancing but risky R&D projects either by lowering failure risk associated with the underlying R&D projects or by reducing capital costs to undertake the R&D projects. The direct R&D subsidies to the SMEs would facilitate risk management by sharing with government the risk nature of the R&D projects and by reducing failure risk against the development of new products and their commercialization. The default risk and thus market failure can be partially alleviated by government policies such as subsidy and tax incentive policies.

At the macroeconomic level, an increase in R&D investment encouraged by government policy can induce innovation and new technology development and thus promote economic growth. As the endogenous growth theory has argued, R&D investment could create new scientific and technological knowledge which is an important source of economic growth. Many empirical studies have reinforced the message. If new technological knowledge created by R&D investment is an important driver of economic growth, then technology-enhancing R&D policy would be good for inducing economic growth, which may be a critical issue in Korea and in most of developing countries as well. Despite the importance of government R&D policy, there are few empirical studies on the effectiveness of the government policy in newly industrialized countries (NICs) [3,5].

This paper empirically investigates the effect of government R&D subsidy as a means of risk-sharing with the SME, using a unique data set on government R&D subsidies for the Korean manufacturing firms in the period 2000–2007. To do so, we employ both the DID (difference-in-difference) methodology to mitigate a sample selection bias [6–8] and 2SLS (two stage least squares) and two step Tobit procedure to control for a simultaneity bias of the government subsidy for new technology development [9,10].¹ DID estimator can mitigate the selection bias caused by the counterfactual outcomes, using non-subsidized firms to evaluate what would have happened to subsidized firms if they had not been subsidized by the government [11]. The DID estimator, nonetheless, could have the potential simultaneity problem which may arise when the probability of being selected by government is correlated with error terms. To eliminate such a simultaneity bias, either 2SLS or GMM estimator will be used [12,13].

The issue about whether government R&D subsidies to SMEs crowd out corporate R&D investment can have very important policy implications for Korea and other NICs as well. If scientific knowledge and new technology created by R&D investment were an important source of economic growth, then government subsidy should be good for creating scientific knowledge and new technology development and inducing economic growth particularly in developing countries. However, if the subsidy for new technology development crowded out private R&D spending, government subsidy policy should not be appropriate.

2. Literature review

It is widely accepted that in absence of government policy intervention in R&D markets, the social rate of return to R&D expenditure exceeds the private rate, leading to a socially suboptimal rate of investment in R&D [3,14]. The issue whether public R&D spending or government subsidy is complementary and simply additional to private spending or it substitutes for and tends to crowd out private R&D has been discussed in many studies. However, theoretical development remains conflicting, and empirical evidences on the effectiveness of public R&D policies are still limited and mixed.

The central rationale for government subsidies for new technology development is to correct the market failure, which may arise from the incomplete private appropriability of returns on private investment in scientific and technological knowledge. Firms tend to under-provide R&D investment due to high failure risk and uncertain nature of R&D and its beneficiaries as well.

R&D subsidies to the SMEs could help overcome barriers to technology-enhancing but risky R&D projects either by lowering failure risk associated with the underlying R&D projects or by reducing capital costs to undertake the R&D projects. The R&D projects typically require large fixed costs, and these costs are generally sunk costs in many cases. That's why firms with large sales can invest sufficient amount of money into the R&D projects, but SMEs have difficulties in launching and operating R&D activities. In addition, small and medium sized firms cannot depend on external finance due to the imperfection of capital markets [3,4]. Thus, the government has introduced R&D policy in order to support the corporate R&D activity as well as to share the financial risk related to the R&D projects of SMEs.

In this context, the direct R&D subsidies given to the SMEs would facilitate risk management by sharing with government the risk nature of the R&D projects and thus reducing failure risk against the development of new products and their commercialization. Government subsidies to SMEs can positively affect judgment of external investors by lowering cognitive biases that stem from the reliance on judgmental heuristics of investors. The reliance on heuristics and the prevalence of biases are not restricted to investors and policymakers.² Experienced researchers are also prone to the same biases [15–17]. If the subjective judgments which are a major component in risk assessment of R&D projects are faulty, efforts at right decision making are likely to be misdirected. R&D subsidies to the SMEs can induce more external investment through reducing biases of investors from subjective judgment and from heuristics of R&D investments [17–19].

The market alone cannot create the necessary incentives in the private investment to the extent that social return exceeds private return on R&D investment. Since ideas and invention can be reused at a lower cost that incurred to discover them, the original inventor is unable fully to appropriate the returns to the invention. Government subsidy for new technology development

¹ Yoo [9] finds evidence for bidirectional causality between government R&D and private R&D spending during the period 1972–2002 using Korean national level data based on Granger causality testing results.

² The path-breaking work of Tversky and Kahneman [15] demonstrated how boundedly rational individuals employed heuristics such as availability, representativeness, and anchoring and adjustment to make judgments and how they used simplified strategies to make choices.

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