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Does an R&D tax credit affect R&D expenditure? The Japanese R&D tax credit reform in 2003 [☆]



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ABSTRACT

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To what extent does a tax credit affect firms' R&D activity? What are the mechanisms? This paper examines the effect of R&D tax credits on firms' R&D expenditure by exploiting the variation across firms in the changes in the eligible tax credit rate between 2000 and 2003. Estimating the first-difference equation of the linear R&D model by panel GMM, we find the estimated coefficient of an interaction term between the eligible tax credit rate and the debt-to-asset ratio is positive and significant, indicating that the effect of tax credit is significantly larger for firms with relatively large outstanding debts. Conducting counterfactual experiments, we found that the aggregate R&D expenditure in 2003 would have been lower by 3.0–3.4 percent if there had been no tax credit reform in 2003, where 0.3–0.6 percent is attributable to the effect of financial constraint, and that the aggregate R&D expenditure would have been larger by 3.1–3.9 percent if there had been no cap on the amount of tax credits, where 0.3–0.8 percent is attributable to relaxing the financial constraint of firms with outstanding debts. *J. Japanese Int. Economies* **31** (2014) 72–97. University of British Columbia, BC V6T 1Z1, Canada; University of Tokyo, Tokyo 113-0033, Japan.

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1. Introduction

To what extent does a tax credit affect firms' R&D activity? What are the mechanisms? Because R&D has some characteristics of a public good, government subsidies of R&D investment could be justifiable to bridge the gap between the private and social rates of return. Furthermore, R&D investment plays an important role in long-run economic growth (Romer, 1986; Aghion and Howitt, 1998). Therefore, understanding the mechanisms through which tax policies affect R&D investment is a prerequisite for designing effective growth-promoting tax policies.

Proprietary information, highly uncertain returns, and a lack of collateral value for R&D capital may hinder the ability to finance R&D investment with external funds (see Arrow, 1962).¹ When firms do not hold sufficient internal funds, R&D investment may be restricted by financial constraint. From this perspective, a tax credit may promote R&D investment not only by increasing the private return from R&D investment but also by relaxing the financial constraint on R&D expenditure. While a small number of empirical studies provide micro-level evidence for the financial constraint of R&D investment (see Hall, 2002; Himmelberg and Petersen, 1994; Brown et al., 2009), few empirical studies directly examine the effect of tax credit policy changes on firms' R&D investment and quantify the importance of financial constraints to explain the policy effect on R&D investment. The present paper fills this gap by empirically examining the effect of the 2003 Japanese tax credit reform on firms' R&D expenditure using the panel data of Japanese manufacturing firms.

Estimating the effect of R&D tax credit policy is often difficult because, typically, the same R&D tax credit rate uniformly applies to all firms, and hence, there is no variation across firms to identify the effect of R&D tax credit policy on R&D expenditure. The 2003 Japanese tax credit reform provides an interesting case in which the changes in the eligible tax credit rate are not uniform across firms. In the 2003 tax reform, the Japanese government introduced a total tax credit system under which the aggregate tax credit was substantially larger than it had been under the incremental tax credit system that was in effect until 2002. In the incremental system, firms can apply for the tax credit only if R&D expenditure in the current fiscal year is greater than the average of the three largest yearly R&D expenditures from the previous five years. In the total tax credit system, the tax credit is applied on total R&D expenditure, independent of previous R&D expenditures. Because the tax credit depends on past R&D expenditure under the incremental system, but is independent of a firm's R&D history under the total tax credit system, changes in the eligible tax credit rate due to the 2003 reform vary across firms. The firms with high R&D expenditure prior to 2002 experienced a large increase in the eligible tax credit rate between 2002 and 2003, while the eligible tax credit rate remained roughly the same between 2002 and 2003 for firms without any R&D expenditure prior to 2002. We exploit this variation in the changes in the eligible tax credit rate across firms to identify the extent to which a tax credit affects firms' R&D expenditure.

Focusing on the details of the R&D tax credit policy in Japan, we use the variation across firms in the changes in the eligible tax credit rate between 2000 and 2003 to estimate the elasticity of R&D expenditure with respect to the eligible tax credit rate, and we examine the empirical validity of the financial constraint mechanism. Motivated by Hall and Van Reenen (2000), Bloom et al. (2002), and Brown et al. (2009), we consider a linear R&D investment model that includes terms representing possible interactions between the eligible tax credit rate and the measure of financial constraints. The model is estimated by the Generalized Method of Moments (GMM) using firm-level panel data from the *Basic Survey of Japanese Business Structure and Activities* [BS], hereafter] with a proxy we construct for the eligible tax credit rate under the Japanese tax credit system.

To understand how the 2003 tax credit reform affects firms' R&D investment, we develop a simple two-period model of R&D investment and examine the optimal R&D investment policy. First, even though the shift from the incremental to the total tax credit system increases credit substantially, it does not necessarily affect R&D investment. If the current R&D expenditure is greater than the base level expenditure defined in the incremental system, this R&D investment remains unaffected because invest-

¹ See also Brown et al. (2009) and Ogawa (2007).

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