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Quantifying heterogeneity in the relationship between R&D intensity and growth at innovative Japanese firms: A quantile regression approach

This paper focuses on innovative manufacturing firms in Japan in 2009–2020 and evaluates differences in the relationship between R&D intensity and firm growth. We use a longitudinal version of the conditional quantile regression model to estimate the augmented Gibrat's law equation for each of four innovative industries: chemicals and allied products; electronic and other electrical equipment; industrial and commercial machinery and computer equipment; and transportation equipment. The analysis reveals statistical differences in estimated coefficients for R&D intensity across low, median and high-growth firms within each industry and across pairs of industries. The results imply the presence of different patterns of R&D effectiveness which are discussed in the light of R&D management drawing on the experience of Sony and other fast-growing Japanese electronics firms. We also discover heterogeneity in the impact on growth of the age and size of firms.

Keywords: quantile regression; panel data; firm growth; innovation; R&D intensity.
JEL classification: C21; C22; D22; D24; O32; O47.

1. Introduction

Japan is a classic example of an innovative economy, where national policy is oriented to attaining economic growth by incentivizing R&D activity of firms (Lazonick, 2005). Overall, R&D expenditure is regarded as a prerequisite for innovation both by theoretical analysis (Osawa, Murakami, 2002; Klette, Kortum, 2004; Miyagawa et al., 2017) and by practitioners in US and Japanese companies (Gupta, Wilemon, 1996; Coad, 2007; Demirag, Doi, 2007). However, there is residual uncertainty about the outcome of R&D work: improper management of R&D expenditure may fail to produce innovation (Klette, Kortum, 2004) or the innovation may not prove a commercial success. Efficient linkage between R&D expenditure and company growth requires a combination of company-level managerial characteristics and favorable conditions on financial markets (Demirag, Doi, 2007; Suzuki, Takemura, 2016; Haneda, Ikeda, 2019; Iino et al., 2021).

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