



Market competition, differences in technology, and productivity improvement: An empirical analysis based on Japanese manufacturing firm data[☆]

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ABSTRACT

In this paper we examine empirically the effect of market competition on firm productivity improvements using data drawn from the Japanese manufacturing sector. We find that a non-linear relationship between competition and productivity growth induced by R&D activity as suggested by Aghion et al. (2005) holds for Japanese manufacturing firms. We also show that greater market competition widens technology differences across firms, and firms facing more intense competition are more productive than other firms. Our empirical results imply that productivity improvement through R&D activity depends on not only a competitive environment but also technological differences between firms.

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1. Introduction

Since the collapse of the bubble economy, the average annual rate of economic growth in Japan has fallen from 4% to 1%. As noted by Hayashi and Prescott (2002) and Hoshi and Kashyap (2011), one of the main causes of ‘the lost two decades’ is productivity slowdown. Productivity analysis has a long history. One of the oldest issues in this field surrounds the relationship between market competition and firm-level innovation which leads to productivity growth. Schumpeter (1934) argues that monopolistic firms can more readily invest in R&D activities because they face less market uncertainty and have greater funds from more secure sources. On the other hand, Arrow (1962) showed that innovative firms benefit more from innovation in more competitive markets. A consequence of these competing arguments has been a number of empirical studies which examine the impact of innovation, typically measured using R&D and patent data, on productivity improvements.

The increasing availability of firm- and establishment-level data sets since the early 1990s has provided detailed insights on this issue. Notably, many studies conducted using this data contrast with the Schumpeterian hypothesis and provide evidence

that competitive environments induce innovative activities and enhanced productivity. In line with these empirical results, the Japanese government has sought to promote more competition through deregulation in an attempt to revitalize the Japanese economy in the 1990s and the early 2000s. However, the effects of market competition on productivity improvement are ambiguous in Japan. Although Okada (2005) and Funakoshi and Motohashi (2008) present evidence that supports the argument that the market competition improved productivity, the findings of the 6th Policy Effect Report on Structural Reform in Japan published by the Cabinet Office, Government of Japan (Cabinet Office, 2006), and Hoshi and Kashyap (2011) on deregulation and productivity growth were neither positive nor significant.

A related finding in the empirical firm-level literature is that there are large, and often persistent productivity differences between firms, or establishments, even within narrowly defined industries (Syverson, 2011). Jovanovic (1982), Hopenhayn (1992), and Melitz (2003) develop an industry equilibrium model which includes entry and exit behavior of heterogeneous firms. In their model, the new innovative firms with high productivity grow and survive in the market. On the other hand, low productivity firms decline and exit from the market. Baily et al. (1992), Good et al. (1997), Aw et al. (2001), and Foster et al. (2006) show that entry and exit behavior contributed to productivity growth at the industry level using firm-level data. For Japan, Nishimura et al. (2005), and Fukao and Kwon (2006) also examined the effects of entry and exit behavior on productivity growth at both the firm and industry levels. However, the Japanese context appears to differ from other countries with the evidence showing within-firm productivity growth to be more important in generating aggregate productivity improvements compared to the entry–exit channel. Finally, Kawakami and Miyagawa (2010) demonstrate that a larger share of aggregate productivity growth in Japan is derived from product switching behavior amongst incumbent firms compared with the creative destruction channel.

The purpose of our paper is to reexamine the relationship between market competition and productivity based on Aghion et al. (2005). As noted above, the primary engine of productivity growth in Japan during recent history has been within firm (establishment) productivity growth. Our focus therefore is on the effects of market competition and how this affects the within firm channel. The model in Aghion et al. (2005) focuses on the relationship between competition among heterogeneous incumbent firms in technology and productivity growth, and generates an inverted-U relationship between the competition and the productivity growth. Our empirical results using firm-level data from the *Basic Survey of Business Activities of Enterprises* (BSBAE) conducted by the Ministry of Economy, Trade and Industry (METI), show such an inverted-U relationship between competition and productivity growth to hold for the Japanese manufacturing industry. We also find that market competition widens technology differences across firms, and that in industries where firms compete at the technology frontier, the impact of market competition is greater than in other industries where firms lag far behind from the technological frontier.

Our results provide a number of improvements on previous empirical studies of Japan on this topic. First, based on Aghion et al. (2005), we examine the inverted-U relationship between competition and productivity growth, an aspect that the previous Japanese empirical studies did not examine. Second, we investigate the relationship between the market competition and the technology gaps of firms since the model suggested by Aghion et al. (2005) implies that productivity improvement induced by market competition depends on the distribution of the technology levels of firms. Regarding the second topic, our study is the first study that takes into account the technology level of firms.

The remainder of this paper is organized as follows: In the next section, we provide a survey of the related empirical literature and clarify the features that differentiate our work from earlier papers. Section 3 introduces our empirical model and the data used in our study. Section 4 presents and discusses our estimation results on the effects of competition on productivity improvement at the firm level. Finally Section 5 summarizes our results and discusses possible areas for future study.

2. Related empirical literature

Empirical consideration of the relationship between market competition and firm performance has received significant attention since the early 1990s, primarily due to the increasing availability of detailed firm-level data sets. In early application using such information, Geroski (1990) examined how the market concentration ratio affects innovative activities using data on 4378 major innovations introduced in U.K. between 1945 and 1983, he showed that an increase in the concentration ratio led to a decrease in innovative activities. Since the mid-1990s, a number of studies examining the effects of the competitive environment on innovative activities using firm-level data have been published. Among these, Nickell (1996) studied the effect of market structure on TFP, using U.K. firm-level data from 1972 to 1986. By estimating a production function that included independent variables representing market structure, he showed that market competition was a positive factor in the productivity growth of firms. In addition to the impact of market competition Nickell et al. (1997), also examine the effects of corporate governance such as pressures from financial intermediaries and the effects of shareholders on managers' efforts on innovation. Their results showed that while market competition played an important role in this process, financial pressures also have a positive impact on the productivity growth of firms. Meanwhile, Blundell et al. (1999) use a headcount innovation measure of major new technological breakthroughs instead of TFP growth as the dependent variable. Their estimation results showed that market share has a positive impact on firms' innovative activities, while the concentration ratio has a negative impact. Their results also suggest that innovative activities are unrelated to cash flow. Tang (2006) conducted a study similar to Blundell et al. (1999) but focuses on the nature of competition and innovation. Using the 1999 Survey of Innovation conducted by Statistics Canada and constructing several competition measures, he shows that the relationship between competition and innovative activity depends on the types of competition and innovation.³

The above empirical studies are inconsistent with the Schumpeterian view that monopolistic firms have high incentives to conduct R&D investment that leads to productivity improvement. A study that reconciles the Schumpeterian view with the empirical results in the 1990s emerged in the 2000s. The empirical examination by Aghion et al. (2005) shows that an inverted U-curve relationship exists between competition and innovation. Their findings are based on firm-level information from the UK on the number of patents, weighted by citations as the dependent variable, and the Lerner Index and price-cost margin as indices of market competition. Further evidence in support of their work may be found in Tingvall and Poldahl (2006) who test show such an inverted U-relationship to hold for Sweden when they using data on the Herfindahl Index and R&D activities.

³ By using this survey, four types of competition measures (Easy substitution of products; Constant arrival of competing products; Quick obsolescence of products; Rapid change of production technologies) and four types of innovation measure (No innovation; Product innovation only; Process innovation only; Both product and process innovation) are constructed.

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