



Firm-level analysis of information network use and productivity in Japan

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Received 5 December 2003; revised 25 May 2005

Available online 17 November 2005

Motohashi, Kazuyuki—Firm-level analysis of information network use and productivity in Japan

This paper presents firm-level micro analysis of information network use and the impact of such use on a firm's productivity. The positive impact of information network use on productivity growth is confirmed using METI's firm-level data for Japanese manufacturers and distributors from 1991 to 2000. In addition, the relationship between information networks and business networks is investigated, and it is found that these two types of networks are complementary in promoting productivity growth of a firm. *J. Japanese Int. Economies* **21** (1) (2007) 121–137. Research Center for Advanced Science and Technology (RCAST), University of Tokyo; Research Institute of Economy Trade and Industry (RIETI).

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JEL classification: D24; O33

Keywords: Firm-level micro data; Panel data analysis; Information network; Total factor productivity; Business network

1. Introduction

Is the information economy a driving force in the recent upward shift in productivity observed in the United States and other countries? It is undeniable that dramatic technological progress has taken place in IT, and progress has driven down quality-adjusted computer prices at the rate of more than 10% annually. In addition, today we cannot imagine daily life without the Internet, which began to come into common use in the mid 1990s. This timing coincided with

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a kinked point in US labor productivity trends. Specifically, after the productivity slowdown in 1980s referred to as Solow's productivity paradox, US labor productivity regained momentum in the late 1990s. [Oliner and Sichel \(2000\)](#) show that approximately two-thirds of the 1.5% productivity gains after 1995 can be attributed to the growth in IT investment. On the other hand, [Gordon \(2000\)](#) argues that recent US labor productivity growth is not a part of structural shift but merely reflects procyclical movement; Gordon then asserts that productivity growth is observed only within the IT sectors, and that IT user sectors cannot take advantage of the benefits of IT investment. After the burst of the "IT bubble" in 2001, the US economic growth rate slowed, and which caused a number of skeptical views of the "New Economy." However, BLS analysis of US labor productivity shows strong performance even after the IT bubble burst; it is thus fair to say that the IT investment surge can explain a significant portion, although not all, of the revival of US productivity after the mid-1990s ([Baily, 2002](#)).

In contrast, the Japanese economy of the 1990s was mired in unfavorable conditions following the collapse of the bubble economy early in the decade. Japan's GDP growth rate averaged 1.4% in the 1990s, in contrast to the 4.1% growth seen in the 1980s. This sluggish economic situation in Japan in the era of new economy is puzzling, as Japanese firms also heavily invested in information technology. [Jorgenson and Motohashi \(2005\)](#) performed a growth accounting exercise to compare the role of IT in economic growth between the two countries, and found that the contribution of IT capital services to economic growth and the rate of TFP growth in Japan in the late 1990s were almost equivalent to comparable figures in the US, and that the slow pace of Japanese economic growth can in fact be explained by the negative impact of labor factors on GDP growth.

A growth accounting exercise is useful to establish a global view of the relationship between IT investment and economic growth. However, such an exercise shows only a snapshot of what has actually occurred. In order to understand the relationship between IT and productivity, it is important to narrow the focus to firm-level business activities. This paper analyzes the effect of IT investment and network use on firm-level performance, with a particular focus on productivity. First, this paper provides firm-level evidence of the positive relationship between IT use and productivity growth. In order to understand this relationship properly, it is important to control for non-IT related factors for productivity growth.

A rich firm level data set relating to IT and performance compiled by METI allows us to conduct an in-depth investigation of general-purpose IT technology and the economic consequences of such technology. It was found that IT is not a sector-specific technology, but instead diffuses widely across industry ([Motohashi, 1997](#)). The other side of the coin in terms of this generality in use is seen in the variety of IT applications. For example, flexible manufacturing systems and Internet banking represent two entirely different types of IT applications. Even within a firm, we see a range of various IT applications, from financial accounting systems to inventory control. The METI firm-level data set includes information on the use of information network by type of application, which allows us to investigate the relationship between IT and firm-level performance by type of IT application.

A related issue to be addressed if we are to obtain a better understand of business use of IT is user-side innovation within the firm, which often runs parallel to changes in a firm's organization. In the case of introduction of a flexible manufacturing system in a factory, it is not difficult to imagine that significant changes in work style are required. In addition, new training may be required for new equipment, and new incentive systems may need to be introduced. At the firm level, IT investment is not simply a process of buying computers and software. Successful introduction of an IT system requires co-invention by suppliers and users, including organizational

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