



Organizational capital, technology adoption and the productivity slowdown[☆]

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Abstract

There is evidence linking the productivity slowdown of the 1970s and 1980s to changing patterns of technological adoption related to the spread of information technology (IT). Notably, IT appears to require plant-level reorganization for its full implementation.

I develop a general equilibrium model in which organizational capital plays a central role in establishment dynamics, and study its transition path after a shock in the form of an incompatibility between new technologies and previously accumulated plant-level expertise. The behavior of the model is consistent with the structure of the slowdown, as well as the subsequent resurgence. Further applications are discussed.

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1. Introduction

The dynamics of total factor productivity (TFP) are a key unexplained element of macroeconomics. Research on the topic often draws a link between productivity change and patterns of technology adoption. For example, the productivity slowdown of the 1970s and 1980s and the ensuing expansion of the late 1990s have been linked to the widespread diffusion of information technology (IT). There is evidence that the adoption of IT required *new forms of organization* at the plant level to have its full impact on productivity. This raises a question: Could the degree of compatibility between new technologies and old plant-level expertise be a factor behind aggregate TFP dynamics?

To address this question, I develop a general equilibrium model of the process of technology adoption, and introduce this incompatibility.

In the model, plant dynamics are driven by organizational capital—plant-specific productivity that depends upon accumulated knowledge and the level of technology in use. The model captures two empirically important features of the plant lifecycle: learning and lumpy investment. Jovanovic and Nyarko (1996) model learning as the accumulation of knowledge regarding the best way to implement a new technology. Khan and Thomas (2003), among others, model lumpy investment using direct adjustment costs. However, Prescott and Visschler (1980) show that organizational capital can *itself* lead to adjustment costs, if accumulated knowledge becomes obsolete once factors are rearranged.

In the current model, investment is lumpy because it often coincides with the adoption of new technologies at the plant level, where adoption is shown to follow an (S, s) rule. This corresponds to the empirical observation that large adjustments tend to coincide with periods of plant-wide technical change, as suggested by the results of Milgrom and Roberts (1990), Cooper et al. (1993) and Sakellaris (2004).

To model the IT revolution, the calibrated model is subjected to a shock whereby new technologies become incompatible with knowledge accumulated under old techniques. I call this an “organizational shock.” The transition dynamics of the model resemble the main features of the productivity slowdown: stockmarket capitalization falls by up to 40%, while TFP and output drop below trend for 25 years. Output *growth* remains low for over a decade—after which it rises *above* trend for a similar period as the economy returns to its growth path. The model thus provides a unified account of the productivity slowdown and the subsequent resurgence, offering a theory of productivity dynamics that may be applicable to other episodes of structural change.

Section 2 outlines the structure of the slowdown. Section 3 develops the model of plant dynamics, and Section 4 studies its behavior after an “organizational shock.” To conclude, Section 5 discusses related accounts of the slowdown and proposes further applications of the model.

2. Motivation

The mid-1970s saw pronounced declines in TFP growth and in the value of the stockmarket relative to GDP, lasting over 20 years. Greenwood and Yorukoglu (1997) find that the slowdown coincided with an increase in the rate of capital-embodied technical change—which is highest in IT industries—and Gordon (1999) attributes the eventual recovery to the widespread diffusion of IT. This raises the hypothesis that the slowdown itself might have been caused by the initial costs of adopting IT capital.

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