The dynamics of efficiency improving input allocation

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Abstract A dynamic theory of efficiency improving input reallocations is presented which relaxes the assumption that decision-making units have the ability to reorganize their activities instantaneously to achieve efficient input allocations. Explicit account is taken of the decision-making unit’s gradual transition to an efficient input allocation. A balanced panel data set covering 906 U.S. agricultural banks is constructed for the period 1996–2000 and we find that these banks are allocatively efficient but technically inefficient. The explicit solution for the optimal input use finds evidence of gradual transitions for two of the three inputs, with the labor input transition being the slowest. The efficiency improving path finds the firm transitions toward an efficient allocation by simultaneously improving on technical efficiency instantaneously and on allocative efficiency intertemporally, which suggests a non-linear path toward the most efficient allocation.

JEL Classifications D21, D24, D92, G21

Keywords Dynamic production theory · Transition costs · Banking

Introduction

The theory of production addresses rational producers seeking to minimize production costs given their target outputs. With a convex production technology, achieving allocative efficiency is guaranteed once the first-order conditions of cost minimization or profit maximization are satisfied. Achieving efficiency requires input reallocation and the neoclassical theory assumes there are no transition costs associated with this reallocation. The explicit solution for the optimal input use finds evidence of gradual transitions for two of the three inputs, with the labor input transition being the slowest. The efficiency improving path finds the firm transitions toward an efficient allocation by simultaneously improving on technical efficiency instantaneously and on allocative efficiency intertemporally, which suggests a non-linear path toward the most efficient allocation.

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Introduction

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Each point on an isoquant is a technique of a production process (or technology) and the smooth isoquant results in the presence of an infinite number of techniques to achieve a given output level (Mundlak 1984). Changing the input bundle as the firm reorients the techniques of production to enhance efficiencies...
can cause the firm to incur monitoring costs associated with reorganizing the production process. This can be revealed by the presence of transition costs associated with reallocation inputs.

A common approach to examining input allocation decision making is to identify the degree of inefficiency by using production frontier estimation methods and then examining the relative magnitude of the technical and allocative inefficiency levels. This involves following a ray from the origin to identify technical efficiency first (Farrell 1957). Upon identifying technical efficiency, allocative efficiency can be evaluated as the measured deviation of the technically efficient input bundle from the cost minimizing input bundle. This approach inevitably involves identifying the target location on the production frontier from which one can evaluate the firm’s technical inefficiency level. The traditional order of the efficiency decomposition is to evaluate the degree of technical inefficiency first and then define the allocative efficiency as the residual. Bogetoft and Färe (1998) oppose this traditional order of efficiency decomposition by proposing a reverse Farrell approach. Allocative efficiency is measured first without presuming technical efficiency as a means of reallocating resources under the assumption that doing so within a hierarchy or a market is easier than changing production procedures. Technical efficiency then follows. Bogetoft and Hougaard (2003) revisit the motivation for the presence of inefficiency and present a framework that rationalizing inefficiencies by focusing on an organization behavior perspective allowing for defensive behavior and the degree of willingness to use knowledge to improve performance.

Plans to reduce a firm’s inefficiencies requires reorganizing production processes which can involve transition costs associated with reorganizing activities which are based on two properties: (1) costs associated with implementing efficiency improving input re-allocations at a rapid rate per unit of time; and, (2) these transition costs increase rapidly with the absolute rate of transition and are so rapid that the inefficient firm never attempts to achieve a full shift in its efficient position at any given moment. With the transition of input use toward the fully efficient input bundle being gradual, the control variable is defined as the change in input levels, while the stock variable is defined as the input level upon entering the decision period. In this context, static approaches to production efficiency analysis are expected to be incomplete in addressing how firms become efficient.¹

The notion of optimality in neoclassical economics is based on a frictionless world absent of transaction costs. Zero transaction costs arise when all relevant information is available costlessly, and the decision maker exhibits perfect rationality with instantaneous access to all available information. However, positive transaction costs are inevitable in actual production processes, and a human decision maker has bounded rationality and an imperfect ability to promptly adjust (Williamson 1975). With the decision maker’s ability to recognize all available options and compare each option to others at a given point in time is limited, a decision maker may want to explore and imitate “best practice” firms in the industry to improve inefficiencies of his firm. Each exploratory and imitating activity can require costs associated with search, learning and reorganization.²

The sources of inefficiencies are related to managerial ability, factor fixities, regulations, characteristics of capital, and quality or environmental attributes that can prevent a firm from attaining full efficiency in a given time period. There may be residual sources of inefficiencies as well. The economic consequences of inefficiencies vary with the environment in which firms are operating. If the market is competitive and if there is no government intervention to support inefficient firms, competition will eventually expel an inefficient firm from the market. Productivity growth can be decomposed into (i) a scale effect, (ii) an allocative efficiency gain/loss effect measured as the impact of the difference between the observed input cost share and the efficiency input cost share, (iii) a technical efficiency gain/loss effect measured by the shifting in the cost function, and (iv) a classical exogenously driven

¹ The literature often resorts to two-step procedures to address firm efficiency by first evaluate firm efficiencies using a frontier estimation approach, then the cost efficiency estimates are then regressed on firm-specific characteristics (e.g., Berger and Mester 1997). This procedure acknowledges the presence of inefficiency and that some identifiable forces exist that drive this behavior. In this paper, we acknowledge the presence of inefficiency and specifically identify the mechanism driving changes in inefficiency (namely, the transition function).

² Some authors attempt to link bounded rationality to emotional and cognitive factors. Conlisk (1996) depicts bounded rationality as mainly concerned with cognitive problems while Kaufman (1999) suggests that economic rationality is bounded not only by cognitive limitations but also by emotional considerations.