A Mergers and Acquisitions Index in Data Envelopment Analysis: An Application to Japanese Shinkin Banks in Kyushu

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ABSTRACT

In this paper, a dynamic network DEA model is developed to evaluate the potential gains in final output from a merger of two firms. The two firms are allowed to have different production technologies or share a common technology. In a beginning period each firm uses period specific inputs to produce a final output and an intermediate output that becomes an input in the production of final outputs in a subsequent period. Firms that merge can use the intermediate input of one firm to produce final output for the other firm, leading to gains in final output for the two merged firms over what the firms could have produced individually. The method is applied to study Japanese cooperative Shinkin banks during 2003 to 2007. Mergers between banks in Nagasaki, Kagoshima, and Miyazaki prefectures tend to have the highest potential gains, while mergers between banks within Fukuoka prefecture and other prefectures and within Saga prefecture tend to have the smallest potential gains.

Keywords: DEA (Data Envelopment Analysis), Dynamic DEA, Efficiency, Mergers and Acquisitions Index, Shinkin Banks

INTRODUCTION

In the two decades since the collapse of the Japanese real estate and stock market bubbles, financial markets and institutions have undergone deregulation along with an unprecedented wave of mergers and acquisitions. However, the financial service industry is still subject to many regulations, including risk-based capital regulations and service provider regulations. (Saunders & Cornett, 2008) In particular, regional banks and cooperative Japanese Shinkin banks (credit associations) are still restricted by law to provide financing to small and medium
sized businesses and members in a particular geographic region, usually the prefecture. From 1968 to 2006, the number of Shinkin banks decreased from 520 to 292 as a consequence of mergers, acquisitions, and bankruptcies that were part of the new competitive environment. Still, the small size of Shinkin banks relative to regional banks, national banks, and international banks suggests that further efficiency gains might be realized by mergers and acquisitions. In order to assess potential and/or actual efficiency gains from mergers and acquisitions, we need a suitable method.

The purpose of this paper is to develop a DEA (data envelopment analysis) mergers-acquisitions model which can gauge gains in outputs or efficiency from mergers and acquisitions. We construct such a model by extending Färe and Grosskopf’s (1996) dynamic DEA model. Earlier work in this area measured the benefits of diversified versus specialized firms and included research by Baumol, Panzar, and Willig (1982), Färe (1986), Färe and Primonial (1988), and Färe, Grosskopf, and Lovell (1994). The major feature of our model is that it allows resources to be reallocated among firms over time, so that larger joint quantities of final output or higher efficiency might be realized through two firms combining resources and jointly optimizing their outputs.

As an illustration of our method we use data on Japanese Shinkin banks. Shinkin banks are cooperative credit associations whose primary objective is to provide loans to small and medium sized firms in a specific region, usually the prefecture. As with most banks, the timing of the loans they make is discretionary. Some banks might find that regional economic conditions are such that they and their customers would be better served if loans are delayed for one or more periods. While deposit funds can be combined with labor and capital and transformed into loans, the amount of suitable loans will generally not equal raised funds. Although the neoclassical model would suggest that interest rates change so as to reach equilibrium, the cooperative nature of Shinkin banks suggests that non-price rationing might also take place. Moreover, numerous studies, beginning with Stiglitz and Weiss (1981) found that adverse selection among borrowers might cause banks to ration credit, rather than raise interest rates during periods when the lending environment becomes more risky. Because of the potential for non-price rationing, we allow Shinkin banks to save deposits by also investing in securities. Such securities can be sold in future periods with the proceeds used to finance loans above the amounts that would normally be feasible from deposits raised in a one period production model. Thus, we treat securities investments as an intermediate output in one period that can be used, along with deposits, labor, and capital to finance loans in a future period. In addition, our model allows resources from two firms in different regions to be combined so that jointly produced final outputs might potentially increase.

A GENERAL PRODUCTION TECHNOLOGY

We denote A and B as index sets of Regions A and B. Let \( a \in A \) be a firm in Region A and \( b \in B \) a firm in Region B. Let \( K_A \) and \( K_B \) represent the number of firms producing in region A and region B. These firms are assumed to maximize final outputs over two periods, \( t \) and \( t+1 \). Let \( x_a^t \) and \( y_a^t \) denote vectors of inputs and outputs for firm \( a \in A \) at times \( \tau = t, t + 1 \). We distinguish between final output \( y_a^{\tau} \left( \tau = t, t + 1; a \in A \right) \) and intermediate output \( y_a^{\tau} \left( \tau = t, t + 1; a \in A \right) \). Intermediate outputs are produced in one period, \( t \), and used as an input to produce final outputs in the next period, \( t+1 \). We would like to examine effects of mergers and acquisitions by a DEA model in which an acquirer (decision maker) can decide the amount of intermediate outputs (inputs) by maximizing the sum of final outputs over time. The production process is based on Shephard’s (1953, 1970) production theory and Färe and Grosskopf’s (1996) dynamic production model. The underlying technology
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