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Nonlinear impacts of operating risk and demand management policy on banks' performance: The role of leading indicator

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ABSTRACT

This paper uses the slacks-based super-efficiency DEA model and panel smooth transition regression model to evaluate the nonlinear effects of one-period lagged efficiency score, core capital ratio (the proxy of operating risk), price cost margin (the proxy of market monopoly or competition pressure) and demand management policy (monetary and fiscal policies) on banks' current performance. In empirical, 37 New York commercial banks during 1996:3Q–2016:3Q as sample objects (i.e., 2997 observations). The empirical results show that the increases in monopoly power, leverage ratio, and real federal fund rate would reduce the banks' performance as the leading indicator is below its threshold. However, long-run interest rates have a reverse effect. The opposite conclusion holds as the leading indicator is over the threshold. The associated policies to raise the performance are to create competitive environments and construct a dynamic leverage ratio varying with the change of the leading indicator. In addition, resolving the problem of high financing costs, reducing short-run interest rates and increasing long-run interest rates during recessionary periods are also available.

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1. Introduction

In the past fifty years, the GDP share of the added value in the U.S. financial banks has risen from 10% to 20%, and the private sector share has reached to 25%. Evidently, the financial industry has played a key role in the U.S. economic development. However, the financial banks have experienced several severe challenges in recent years, including the destructive competition among banks, high risk in operating leverage, low level of interest rates, and accelerative threat from digital transactions. To further push the contribution of the financial industry to U.S. economic development, more accurately evaluating the performance of financial institutions and the influence of external environments on the performance is an important task.

In literature, several approaches are developed to assess commercial banks' performance, including the financial ratio approach, the regression analysis approach, data envelopment analysis (DEA) and the balanced scorecard approach. Each approach has its traits and shortcomings. In light of the characteristic of banks' multiple inputs and outputs, DEA approach

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is a more suitable tool for measuring banks' performance. Three main approaches have been developed for determining the inputs and outputs in the DEA models for evaluating the operating performance of banks, namely the intermediation approach (see e.g. [Unvan and Tatlidil, 2012](#); [Akinsoyinu, 2015](#)), production approach (see e.g. [Parsons et al., 1993](#); [Subramanyam and Reddy, 2008](#)), and profitability approach (see e.g. [Dekker and Post, 2001](#); [Sevcovic et al., 2001](#)).

Intermediation approach considers commercial banks as the ones to provide the service of the financial intermediary. Hence, this approach regards operating expenses and interest expenses as inputs and loans and investments as outputs ([Singh and Thaker, 2016](#)). However, [Almanza et al. \(2017, p.8\)](#) and [Avkiran and Thoraneenitiyan \(2010\)](#) use interest income and non-interest income as outputs and interest expenses and non-interest expenses as inputs. [Avkiran and Thoraneenitiyan \(2010\)](#) indicate that this input and output set is consistent with the intermediation approach to modeling bank behavior and is appropriate to cover the entire range of resources used and outputs created while providing acceptable discriminatory power. Production approach claims that banks employ capital, labor, and other expenditures to provide the services of deposits and loans. Thus, this approach uses operating expenses to measure inputs and the account numbers of deposits and loans or their use numbers to assess outputs ([Fujii et al., 2014](#)). Regarding profitability approach, it is used to measure the relationship between costs and profits in banks. Therefore, it uses personnel costs, operating costs, and financing costs as inputs and revenues or profits as outputs ([Drake et al., 2006](#)).

To estimate the effects of external factors and non-discretionary factors on the efficiency score of the decision-making units (DMUs), two-stage DEA models are used. In the first stage, one can employ various DEA models to assess the efficiency values of DMUs, and in the second stage, one can use regression models to estimate the influence of external factors on the efficiency values. For example, [Ramalho et al. \(2010\)](#) employ fractional regression models for second stage DEA efficiency analyses, and [Pasiouras \(2008\)](#), [Paradi et al. \(2011\)](#), and [Shyu \(2014\)](#) apply Tobit regression model to evaluate the impacts of external factors on banks' operating efficiency.

While many previous studies have used two-stage DEA models to measure the performance of banks, four problems are still unresolved. **First**, most previous studies used a short-run period to measure the performance (see e.g. [Ar and Kurtaran, 2013](#); [Sambracos, 2015](#)) and ignored the impacts of long-run uncertainty factors and external environment changes on the performance and the dynamic persistence effect of the performance. For instance, severe competition, high operating leverage, low interest rates, and rapid growth in digital transactions all make financial institutions adjust their operating strategies, which will change the dynamic process of banks' performance. **Second**, most previous studies have concentrated the analysis on the effects of banks' idiosyncratic characteristics on performance, such as the scale of the firm ([Wanke and Barros, 2014](#)) and profitability ([Shafiee, 2013](#)). However, government's policies to stimulate economic growth and to stabilize the price level would influence the performance of banks, which is almost neglected by these studies. For example, several countries have adopted expansionary monetary or fiscal policies to stimulate private investment and economic growth in recent years. These policies would change the structure of banks' assets and liabilities and the performance of banks' operation. **Third**, to evaluate the influence of public policies on banks' operating performance, the researchers need to construct a panel framework, i.e., using panel data to conduct the estimation. However, this treatment is almost ignored by the users of DEA models ([Berger and Mester, 2003](#)). **Most importantly**, banks' operating performance may be affected by external shocks to display a nonlinear dynamic process. For example, the European debt crisis in 2011 and the FinTech development in recent years might have changed the physical constitution and operating performance of commercial banks. That is the reason why the Basel Accord III set a more severe specification for the core capital (leverage) ratio to protect the rights of shareholders and avoid the occurrence of financial crises. Unfortunately, most previous studies have employed linear models to measure the impacts of public policies on the operating performance of banks (see e.g. [Flannery, 2011](#); [Otuori, 2013](#); [Maigua and Mouni, 2016](#)). In addition, the effects of the business cycle, market concentration, and governmental policies on the performance are especially neglected. However, ignoring this phenomenon will lead to a biased estimation result.

To simultaneously resolve the above problems in evaluating the efficiency of commercial banks, this paper adopts the following two-stage DEA approach. In the first stage, the slacks-based super efficiency model (hereafter super-SBM) proposed by [Tone \(2002\)](#) is used to obtain the efficiency scores of the banks.¹ This treatment can overcome the ignorance of the production characteristic with multiple inputs and outputs by the traditional linear regression models and can identify the difference between efficient units in the traditional DEA models (e.g. CCR and BCC models). In the second stage, the panel smooth transition regression (PSTR) model proposed by [González et al. \(2005\)](#) is used to replace the traditional linear regression models for estimating the nonlinear impacts of the one-period lagged efficiency score (a measure of efficiency persistence), core capital ratio (a measure of leverage ratio), price cost margin (a measure of market concentration or monopoly power), and demand management policy (i.e., monetary policy or fiscal policy) on current operating efficiency. The transition variable in the PSTR model is the U.S. leading indicator. We will interpret the PSTR model more detailed later.

Basically, PSTR model assumes the series displays a nonlinear smooth transition process with the change in a specific transition variable. This model has three main traits. First, it can grasp the heterogeneity of the data set due to its permission of differential smooth transitions in different regimes. Second, the threshold value of the transition variable is endogenously

¹ Three major reasons drive this study to adopt the intermediation approach to evaluate the performance of commercial banks, including: (1) the data of the account numbers of deposits and loans or their use numbers cannot be gotten easily; (2) interest expenses are regarded as expenditures in financial management, but not as input costs, and (3) in the face of a more competitive and low interest rate environment, most banks are inclined to increase interest rates to absorb funds.

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