Impact of Bank Operational Efficiency Using a Three-Stage DEA Model

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ABSTRACT

In this study the authors use a three-stage sequential technique to develop a Data Envelopment Analysis (DEA) model for examining a bank’s technical efficiency index. Internal risk and environmental risk are incorporated into this model to accommodate the well-known BASEL III Accord (required capital adequacy ratio in the financial industry) and to ensure the amount of derivatives turnover ratio is at the level defined by industry best-practices. Information is obtained from 34 Taiwanese commercial banks for the period from 2008 to 2011 following the global financial crisis. The Malmquist total factor productivity index (TFP) is also employed to measure the impact of changes in productivity on the panel data. Empirical results derived from the DEA approach show a gain in technical efficiency and scale efficiency in the industry after adjusting the slack variables when using the corrected ordinary least squares (COLS) regression model. The results indicate that commercial banks need to diversify to increase their market share when dealing with derivatives which are associated with higher risk. The Balk’s Malmquist TFP index shows a decrease in bank productivity and improvement in pure technical efficiency. In this study the authors found that after risk-adjustment there was a distinct inefficient unit decrease and but a marginal unit increase in efficiency.

Keywords: Amounts Turnover Of Derivatives, BASEL III Accord, Efficiency Evaluation, Data Envelopment Analysis, Three-Stage DEA Approach

INTRODUCTION

The second financial reform in Taiwan that was initiated by the government in July 2004 has allowed Taiwan banks to pursue functional diversification over a wide variety of activities such as commercial banking, investment banking, insurance, billing services and other financial services. Commercial banks (CBs) have reacted to the new environment by adopting a proactive strategy, widening the range of products they offer to their customers. According to the statistical report of the Bureau of Monetary Affairs, there has been a decline in the interest spread from 4.5% in 1996 to 2.5% in 2011. Furthermore, there has been a drastic decline in the mean return on equity and return on assets in traditional banking operations from...
10.3% and 0.63% %, respectively, in 2002 to 2.22% and 0.14%, respectively, in 2007. By the end of 2012, there were 39 domestic CBs with 3,413 branches, and 51 foreign CBs with branches in Taiwan. With the increasing number of CBs, competition in the banking industry has become more extreme than ever. The BASEL Committee on Banking Supervision issued the BASEL III Capital Accord that, once finalized will replace in January 2001 BASEL II Capital Accord in 2009. BASEL III strengthens capital requirements and introduces new rule requirements on liquidity risk and debt for financial institutions.

Unlike other industries, the banking industry operates based on financial innovation, which greatly diversifies risk and creates profit through arbitrage. Financial innovation is the driving force behind financial development and it is therefore necessary to pursue efficiency in emerging market countries. CBs have been forced to respond by changing their traditional manner of functioning and embrace new financial innovation strategies in order to develop derivatives as well as keep old customers and attract new clients. However, these complex banks are allowed to engage in a broader range of non-traditional activities (Boyd, Kwak & Smith, 1998; Barth, Caprio, Levine, 2004). One needs to consider the environmental risk in the financial market. Greater volatility means that the customer needs to hedge their speculative behavior. Different clients will adjust their attitude toward risk when trading with the banks. In January 2001 the BASEL committee divided bank risk into three types, credit, market and operating.

CBs are also required to comply with stringent capital adequacy ratios as part of the financial requirements to strengthen their capital structure. Capital adequacy ratio can influence competition and risk-taking in various ways, for example, leading to stringent higher initial capital requirements which can impose entry barriers for new entrants, and higher overall capital requirements associated with higher fixed costs for running the bank (Agoraki, Delis & Pasiouras, 2011) so that fewer banks are able to afford these costs. More stringent capital adequacy requirements lead banks to set stricter acceptance criteria for granting new loans (Bolt & Tieman, 2004).

In recent years, given the great uncertainty in the financial environment and appearance of derivatives, risk has to be considered when measuring bank efficiency. It is important when evaluating bank efficiency to incorporate both environmental risk and the diversification involved in financial innovation. The new types of complicated business undertaken through financial innovation and pursuance of non-interest income involve conjunction with market risk, which is a good index to evaluate the risks of CBs (Chiu & Chen, 2009).

**Problem Statement**

The existing literature on Taiwan CBs focuses on cost efficiency (Berge & DeYoung, 1997; Huang & Huang, 2002; Peng & Wang, 2004; Hauner, 2005; Chiu & Chen, 2009) and competitive effects (Hughes, Mester & Moon, 2001; Lieu, Yeh & Chiu, 2005; Banker, Chang & Lee, 2010; Chiu, Chen & Bai, 2011). The decline in interest margins induced by greater competition has encouraged banks to charge higher fees for both existing and new services. In fact, there has been a dramatic change in the structure of bank income with implications for risk. The importance of the safety and soundness are major challenge for both supervisory authorities and the banking system.

Fried’s three-stage sequential Data Envelopment Analysis (DEA) approach can be used to analyze managerial efficiency based upon Fried model (Fried, Lovell, Schmidt & Yaisawarng (2002). Ruggiero (1998) demonstrated that performance of a decision-making unit (DMU) given the operating environment and measurement error can also be estimated with DEA (Avkiran, Rowlands, 2008). Pastor (2002) attempted to measure the credit risk of CBs using a three-stage DEA model designed to purge the influence of environmental effects and statistical noise. Shang, Hung, Lo & Wang (2008) evaluated 57 hotels in Taiwan, as well as
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