Incorporating risk input into the analysis of bank productivity: Application to the Taiwanese banking industry

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ABSTRACT

This study reappraises banks' productivity by using 42 Taiwanese banks during 1999–2007 as observations. It introduces an input-oriented generalized metafrontier Malmquist productivity index (I-gMMPI), while considering the latent effect of risk-taking behavior in the analytic framework. We learn that public and private banks should face separate short-term technological frontiers, while the econometric model considering risk input can portray banks' operating frontiers better. Moreover, neglecting the influence of risk input would bring about distortions of efficiency, technology and TFP dynamic estimations for banks; meanwhile, the degree of scale economies would also be overestimated. The paper concludes that neglecting the risk-taking essence in bank performance evaluation is equal to allowing banks to barter risk-bearing as the term for further output growth. Consequently, the potential cost is that banks may excessively aggrandize their scales of business, implying the possibility of another financial crisis.

1. Introduction

Banking intrinsically refers to an industry that creates benefit by bearing risk. In the past two decades, financial liberalization, the knowledge economy wave and the ICT revolution have pushed forward the advancement of financial instruments and technologies while concurrently exacerbating the competition in the banking industry worldwide. Nowadays, these facts are transforming the banking sector into one that incorporates quite a weight of direct finance and capital market businesses, moving away from the purely indirect finance and money market businesses of the past. This implies that contemporary banks are shifting their role to one of active market participants and financial demand creators from that of conventional passive banking service providers. Accompanying the ongoing significantly diversified and complicated development trend, the entity of risk-bearing for bank operation has been expanded greatly and is naturally non-negligible.

The business of contemporary banking at present has developed into an arena in which loan, investment and financial services coexist, respectively corresponding to credit, market and operation risks. Theoretically, a distinct degree of risk originally implied

different extents of possibilities for gains and losses. While appraising banks' performance, the direct use of a general research model setting commonly adopted for manufacturing or other sectors seems inappropriate. Rather, a relatively reasonable specification should incorporate a well-defined risk-bearing measure as one kind of intangible input that simultaneously takes effect with other factors in creating output in the appraisal model. Omitting the risk input factor would not only result in a distorted conclusion (Mester, 1996; Hughes, 1999; Altunbas et al., 2000; Hughes et al., 2001); it might also result in a successive huge financial disaster in the future. We can elaborate and supplement this argument with an example. Suppose that two banks operate with similar businesses and launch the same volume of physical inputs. However, the qualities of the inputs for the two banks are asymmetric; that is, one bank chooses a strategy of higher risk bearing to promote the probability of acquiring more outputs. If the latent risk is neglected, we may reach the conclusion that the bank that bears higher risk has superior performance, implying praise of risky behavior. Once the prosperity reverses, the entire innocent economic system would become involved and would have to suffer jointly the subsequent financial turbulence. This instance is in fact a portrayal of the 'global financial tsunami' brought about by the 'sub-prime mortgage crisis' that exploded in 2008. Briefly, in a highly competitive environment, financial institutions can easily overstress the volume of businesses, such as the positions of real estate mortgages, consumer banking or derivative commodities,

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but the appraisal and control mechanisms, capabilities and recognitions of the quality of businesses are relatively slack, or even purposely disregarded. Incorporating the risk input into the analysis of bank performance is undoubtedly a critical and necessary issue, particularly in the current 'post-financial tsunami era'.

We can distinguish the existing literature concerning the issue of bank performance from the perspective of risk into three strands. The first does not consider the risk-related potential effect and tackles the issue directly by using the information embedded in the physical input and output variables (e.g. Färe et al., 2004; Carvallo and Kasman, 2005; Drake et al., 2006; Yildirim and Philippatos, 2007; Huang and Chen, 2009). The second considers the risk as one kind of exogenous factor or undesirable output to explore the impact of risk-bearing behavior on bank performance (e.g. Elyasiani et al., 1994; Berger and DeYoung, 1997; Berger and Mester, 1997; Chang, 1999; Chang and Chiu, 2006). The third considers the risk as an endogenous variable and directly incorporates it into the production or cost function, while using it to evaluate the bank performance (e.g. Mester, 1996; Hughes, 1999; Altunbas et al., 2000; Hughes et al., 2001; Chiu and Chen, 2009).

Despite there being no lack of literature, the issue still needs further exploration. For the first category, as previously mentioned, because the risk-bearing essence of contemporary banks is ill-considered and the research merely adopts the physical input and output variables to appraise performance, the conviction of the derived conclusion will be fairly limited. For the second category, though it subsumes the risk variable while considering it as an exogenous or environmental factor, there is still a degree of theoretical and econometric inappropriateness. Theoretically, a bank's operation faces exogenous (or environmental) and endogenous risks simultaneously. It is insufficient merely to consider one of them (Chang and Chiu, 2006; Chiu and Chen, 2009). Econometrically, risk input has its own endogeneity for banks' operation. Regarding the endogenous variable as exogenous would also to a certain extent induce a specification error. Moreover, some view risk as an undesirable output. Nonetheless, we should clarify that risk refers to an *ex ante* concept and undesirable output refers to an *ex post* concept. Not only would regarding risk as an undesirable output cause a certain amount of causal fallacy to arise, but also the frequently used *ex post* risk measures (e.g. non-performing loans, bad loans) are incomplete in nature. Specifically, those measures only capture the risk that has already happened and are incapable of reflecting the assumed but not yet happening (possibly) uncertainty risk. As for the third category, some studies omit the potential effect of exogenous risk while incorporating endogenous risk. Moreover, some adopt a two-stage or multi-stage approach as the evaluation framework, thus originating unknown estimation bias or a logical inconsistency problem in the model specification. There are also studies that adopt non-parametric programming; nonetheless, they also suffer from deficiencies in terms of high sensitivity to outliers and incapability of conducting a statistical hypothesis test to judge the model and variable selection.

Furthermore, past studies commonly use several sorts of indicator as the measure or proxy for the bank risk, such as non-performing loans (NPLs), allowances for loan losses, risky assets or value at risk. Notionally, some measures can actually profile the risk that banks face (e.g. NPLs), but the coverage often only involves certain parts of the business (e.g. loans). Some indicators have sufficient coverage, but the measure might be excessively complicated or limited due to the data availability, which would diminish the operational applicability and popularized worth. Indeed, a concrete risk indicator that provides data availability and sufficient coverage of the banking businesses is still lacking. Additionally, differently from other industries, the operation of the banking system has high externality and directly concerns the financial stability of the economic system to which it belongs. Then, official or

pan-public owned banks (hereafter, public banks) usually exist. The operational focus and goal for such kinds of banks often differ from those of normal private banks and have to consider or harmonize with policy objectives to a certain extent, in addition to pursuing profit. It is inappropriate to regard the two types of banks as belonging to the same production possibility sets.[1] Although the past literature also recognizes the heterogeneity lying between the public and the private banks, empirical estimations generally pool the two kinds of banks together. This naturally gives rise to doubt about the existence of specification error.

On the basis of the preceding discussion, this study aims to introduce an input-oriented generalized metafrontier Malmquist productivity index (I-gMMPI) analysis framework to consider the potential effect of omitting the risk-bearing behavior. It empirically reinterprets the issue of bank performance analysis with unbalanced panel data comprising 42 Taiwanese banks for the period 1999–2007. Differing from past research, the novelties of this paper are threefold. Firstly, this study attempts to accomplish and incorporate a new and succinct risk measure, the RCAR indicator, which is equipped with the requirements of data availability and sufficient coverage of businesses, developed by referring to the interpretation of the bank risks from the Basel Accord and the literature. This should promote the worth of operational applicability for bank performance research. Secondly, the analysis simultaneously incorporates the endogenous internal risk and the exogenous external environment risk for banks into the analysis, while considering the heterogeneity of public and private banks with a one-stage parametric programming approach to inspect the static productivity and its dynamics. Thirdly, this paper adopts a tailor-made approach for this theme, I-gMMPI, which can take into account the heterogeneity between public and private banks and simultaneously inspect the total factor productivity of the banks from a more long-run perspective. It is also capable of decomposing the productivity dynamics into efficiency, technology and scale aspects for deriving and obtaining further contributive policy implications.

The structure of this study is organized as follows. After this introduction, Section 2 reviews and comments on the related literature and documents, including the past academic studies on bank performance and the Basel Committee's elaboration of bank risks. Section 3 then introduces the analytic methodology, model specifications and variable constructions of this paper. The empirical results and analyses all appear in Section 4. Finally, Section 5 concludes the study.

2. Literature review

2.1. Review of the bank-performance-related literature

In the literature, studies interested in evaluating banks' performance are abundant. Purely from the aspect of risk, at least three strands can be distinguished from the paper pool. The first does not consider the risk-related potential effect and directly tackles the issue of banks' performance evaluation by mining the information embedded in the physical input and output variables. The features of such a line of study usually aim at refining or extending the estimation approach, or at discussing specific financial policies. Huang and Chen (2009) focus on introducing the concept of forward-looking rational expectations of macroeconomics for

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[1] O'Donnell et al. (2008) definitely indicate that while the physical capital, labour, financial capital, economic infrastructure, endowment conditions and other system, social or business environmental characteristics of production units are different, the alternative technologically feasible input–output combinations should naturally be regarded as belonging to distinct technology sets.