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Total factor productivity and shareholder returns in banking

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ABSTRACT

This paper examines shareholder value drivers in European banking focusing on the efficiency and productivity features of individual banks. In particular, we analyse the value relevance of bank cost efficiency and total factor productivity (TFP) (in all its components, including technological change, pure technical efficiency change and scale efficiency change) to see how these influence shareholder value creation in European banking. The paper focuses on the French, German, Italian and U.K. banking systems over the period 1995–2002 and includes both listed and non-listed banks. We find that TFP changes best explain variations in shareholder value (measured by market-adjusted returns, MAR, for listed banks and by the ratio of EVA_{bkg} to invested capital at time $t-1$ for non-listed banks). In both samples, we also find that technological change seems to be the most important component of TFP influencing shareholder value creation in European banking.

1. Introduction

The changing structural landscape of banking systems and the evolving competitive environment is expected to impact on the efficiency and productivity of banking business and this one would be expected to be reflected in bank stock performance. As such, this paper presents an insight into how bank efficiency and the main components of productivity are linked to value creation in the European banking system. There is a substantial literature examining factors that influence the performance of banks (see [75,64,66,1,65]). However, few of these studies use shareholder value creation indicators as measures of bank performance and this is surprising given that creating value for owners (generating returns in excess of the cost of capital) has been the main strategic objective of banks over the last decade or so.[1] As Greenspan [2] affirms "you may well wonder why a regulator is the first speaker at a conference in which a major theme is maximising shareholder value… regulators share with you the same objective of a strong and profitable bank system".[2] While there are extensive literatures dealing with bank efficiency and productivity[3] as well as shareholder value,[4] only a handful of studies (e.g. [3–7]) have empirically analysed the relationship between efficiency and shareholder value. Fernandez et al. [4] analyse the relationship between the components of productivity change (estimated using DEA) and bank stock performance using a panel of 142 banks operating in 18 different countries between 1989 and 1998. Fernández et al. [4] find that market returns have a strong positive relationship with pure efficiency change and technical change, while there is a weak relationship with scale efficiency. Beccalli et al. [3] estimate cost efficiency of a panel of European listed banks (using DEA and Stochastic Frontier Analysis—SFA) and find that changes in the prices of bank shares reflect percentage changes in cost efficiency, particularly those

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[1] Note that the literature dealing with shareholder value is substantial, but these studies do not usually analyse banks. These studies usually focus on: (1) developing and comparing new performance measures (e.g. [21–23]), (2) assessing the value-relevance of different company items such performance measures, accounting information, etc. (e.g. [24–26]), (3) modelling the link between market value and accounting values (e.g. [27–35]), (4) investigating the relationship between shareholder value and various corporate factors, such the diversification strategies (e.g. [71]), corporate governance mechanism (e.g. [62,70,76]), the number of shareholders (e.g. [61]), the ownership structure ([63,73]).

[2] Remarks of Alan Greenspan at the annual convention of American Bankers Association, Honolulu, Hawaii, October 5th, 1996.

[3] Studies dealing with bank efficiency focus on methodological issues (e.g. [36,37]), others compare estimates from different methodologies (e.g. [9,38]), others estimate efficiency focussing on countries and/or financial sectors poorly analysed by previous studies (e.g. [39–43]), others assess the source of inefficiency and the role of environmental factors (e.g. [44–49]).

[4] Studies analysing shareholder value usually focuses on developing and comparing new performance measures (e.g. [21,22,50]), assessing the value-relevance of different company items such performance measures, accounting information, etc. (e.g. [25,26]), modelling the link between market value with accounting values (e.g. [27–35]).

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derived from DEA. Eisenbeis et al. [5] analyse the ability of cost efficiency (estimated using DEA and SFA) in explaining risk-taking behaviour, managerial competence and bank stock returns. The authors estimate a negative relationship between cost inefficiency and stock returns and find that the stochastic frontier produces relatively more informative performance measures than does DEA. Chu and Lim [6] analyse a panel of six Singapore-listed banks (over the period 1992–1996) and find that percentage change in the price of bank shares reflect percentage change in profit rather than cost efficiency estimated using DEA. Fiordelisi [7] examines the performance of a large sample of listed and unlisted European banks between 1997 and 2002 and finds (using Economic Value Added as the main output) that, on average, banks are 36% shareholder value inefficient. He argues that shareholder value efficiency better explains value creation in European banking compared to cost or profit efficiency.

Various studies have empirically analysed the relationship between efficiency and profits (e.g. [8–10]) and, not surprisingly, usually find that there is a positive relationship (efficient banks are more profitable). Closely related to the efficiency studies is another strand of literature that examines productivity in banking. Stiroh [11], for instance, finds evidence of cost productivity improvements in the US banking sector between 1991 and 1997, although these only amounted to annual cost savings of under 1%. In contrast, Berger and Mester [1] find that cost productivity declined by 12.5% per annum over the same period, while profit productivity increased at some 16.5% annually over the same period. While these studies do not specifically examine shareholder value issues one would expect productivity improvements to be linked to shareholder value creation.

In this paper, we analyse the relationship between shareholder value and efficiency in banking analysing the value-relevance (looking both to the relative and incremental information contents)[5] of a broad range of bank efficiency measures (namely, technical, allocative, scale, cost efficiency, Total Factor Productivity changes and its components) obtained using DEA. Focussing on the French, German, Italian and U.K. banking systems over the period 1995–2002, we analyse the value relevance of efficiency and productivity estimates for samples of both listed banks and non-listed banks.

2. Methodology

The methodological approach developed aims to assess whether efficiency and productivity factors explain variation in shareholder value for a sample of listed and non-listed European banks. To test the relationship between shareholder value with TFP changes and cost efficiency, we apply the following panel data regression model[6]:

$$\psi_{i,t} = \alpha_i + \varphi_t + \sum_{j=0}^{2} \beta_j X_{i,t-j} + e_{i,t} \quad (1)$$

where ψ_t is the variable representing shareholder value created over the period t, X is the variable that we are analysing to assess its value relevance, α_i are the individual effects capturing the time-invariant effect of the un-observed characteristics of each individual on the dependent variable (unobserved heterogeneity), φ_t are time effects capturing the effect of period t which is common across individuals, $e_{i,t}$ is the random error term and sub-indices i and t refer to the individual bank and the time period, respectively.[7]

We measure shareholder value created over the period t using market adjusted returns (MAR) for publicly listed banks and the ratio between economic value added (EVA) and the invested capital at time $t-1$ for non-publicly listed banks. The independent variables analysed (X_t) are cost efficiency and its components (namely, Technical, Allocative and Scale Efficiency) and total factor productivity (TFP) changes and its components (namely, technological change, technical efficiency change, pure technical efficiency change and scale efficiency changes).[8] These are derived from frontier estimations using DEA.[9] We decide to examine all the components of productivity derived from the DEA estimates as these all have a different economic meaning expressing various operational features of a company. By assessing the value relevance of these variables, we are able to analyse if the creation of shareholder value is generated mainly by a technical ability of the bank or the allocative ability or both.[10] Table 1 illustrates the variables used in the empirical investigation.

One criticism of this approach is that investors may look at efficiency changes over time rather than efficiency levels at a given moment. Some studies (e.g. [12]) recognise this issue and analyse the value relevance of change in efficiency estimates between two consecutive periods. Although shareholder value may be certainly affected by efficiency changes, it is imprecise to estimate efficiency changes by comparing efficiency estimates obtained using frontier methodologies in two different periods since efficiency estimates are obtained measuring the distance

[5] Value-relevance studies investigate the relationship between stock market values (or changes in value) and various company items (such as performance indicators, accounting and financial information, etc.). These studies can be classified in relative association studies, in incremental association studies and marginal information contents studies. Relative association studies compare the relationship between stock market returns and alternative company items (such performance measures, efficiency measures, and so on). The investigation methods are usually very similar: the "value-relevance" (labelled as "relative information content") is assessed looking at difference in the adjusted R^2 of regressions, where the dependent variable is expressed as share prices or market raw- or adjusted-returns and the independent variable is the variable under investigation. In such models, the company item with the higher R^2 is described as being the more value-relevant. Incremental association studies assess the contribution provided by a company item in explaining a company's market value or market-returns given other specified variables. In these studies, an accounting measure is usually considered value-relevant (labelled as "incremental information content") if the regression coefficient is different form zero and statistically significant. Marginal information content studies evaluate whether investors' available information set is increased by the release of particular accounting information. In other words, it is assessed if value changes are associated with the release of specific accounting data (conditional on other information released). For a review of these studies, see Holthausen and Watts [26].

[6] In this model, independent variables do not suffer from scale effects and, consequently, it is not necessary to deflate independent variables.

[7] We run the Hausman [72] test for assessing the assumption of no correlation between the effects and the explanatory variables. According to results obtained, we apply the fixed effects model. For further details, see Green [15].

[8] Technical efficiency change can been further decomposed by analysing the extent to which efficiency changes between t and $t+1$ is due to scale efficiency or to pure efficiency change (labelled as scale efficiency change and pure technical efficiency change, respectively). The value of the decomposition is that it attempts to provide information on the sources of the overall productivity change in the banking sectors.

[9] DEA is a linear programming methodology which uses data on the input and output quantities of a group of firms to construct a piece-wise linear surface over the data points. We apply the multi-stage DEA methodology proposed by Coelli [20].[9] This method involves a sequence of DEA models to identify the projected efficient points. We use DEA to estimate the distances of each data point relative to a common technology in Malmquist total factor productivity (TFP) index. For further details, see Appendix A.

[10] These variables are measured at time t, $t-1$ and $t-2$. The economic rationale for using two lagged terms is that shareholder value created over the current period (t) is assumed to be influenced by information (such as productivity changes, cost and profit efficiency) over the last two periods (t, $t-1$ and $t-2$), while older information is assumed to be fully captured in market prices.