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Shareholder value creation in Japanese banking

Nemanja Radić *

The Business School, Middlesex University, The Burroughs, London NW4 4BT, UK

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ABSTRACT

This paper advances the study of Fiordelisi and Molyneux (2010) by examining the shareholder value efficiency and its determinants for a large sample of Japanese banks between 1999 and 2011. A new, specifically tailored measure of the Economic Value Added approach, based on the shadow price of equity, is developed in order to account for specific characteristics of the Japanese banking system. This new "shareholder value measure" is then used in a dynamic panel data model as a linear function of various bank-risk, bank-specific, and macroeconomic variables. This study finds that cost efficiency gains, credit risk and bank size are the most important factors in explaining the shareholder value creation in Japanese banking. Cost efficiency changes are also found to significantly influence cost of equity capital.

1. Introduction

The Japanese banking sector is one of the most important banking sectors worldwide. As a consequence, there is a well-established and growing literature that focuses on various factors that influence the performance of banks in Japan (see for example, Altunbas et al., 2000; Drake et al., 2009; Barros et al., 2012). The recent focus on the performance analysis of Japanese banks has predominantly been motivated by the complex economic environment in which these banks operate. Macroeconomic stagnation in the last two decades, combined with uncontrolled credit expansion, lack of capital and the extremely large volumes of non-performing loans, caused severe financial crises in the Japanese economy (Caballero et al., 2008). It is, therefore, not surprising that the performance analysis of Japanese banks continues to receive academic interest.

A large number of papers (Berger and Mester, 2003; Athanasoglou et al., 2008; Brissimis et al., 2008; Lepetit et al., 2008; Liu and Wilson, 2010) focus on bank profits by analyzing the impact of a wide range of factors (bank-specific, industry-specific and macroeconomic). However, the notion of "profitability" (usually measured by the Return on Assets – ROA and Return on Equity – ROE) is insufficient to assess bank stability since it does not consider the level of risk-taken. Specifically, the interpretation of high profitability ratios is ambiguous: it can both be interpreted as a signal of bank soundness or as a consequence of a high risk taking.

While there is a well-established and growing literature that focuses on the various factors that influence the performance of banks, only a handful of studies use value creation metrics as a performance indicator. Only a few studies have sought to link measures of bank productive efficiency to shareholder value and generally found a positive relationship. Fiordelisi (2007) developed a new measure of shareholder performance, where a bank producing the maximum possible Economic Value Added is defined as "shareholder value efficient". Beccalli et al. (2006) examined the relationship between stock returns and various efficiency measures, generally finding a positive link between return and improvements in efficiency.

This paper is motivated by all the above considerations. The aim is to extend the literature through examining Japanese banks shareholder value efficiency and its determinants by offering three important contributions. First, in this study we use a Stochastic Frontier model that accounts for risk (and NPLs) and asset quality factors in measuring and analysing the shareholder value efficiency of Japanese banks. This is an important contribution, since most studies that examine bank efficiency in Japan mainly apply non-parametric methods represented by DEA (see for example,

* Tel.: +44 020 8411 3239.
E-mail address: n.radic@mdx.ac.uk

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Fukuyama, 1993; Drake and Hall, 2003). Altunbas et al. (2000) paper is one of the few studies that applied a parametric method for measuring Japanese bank efficiency. The literature clearly discusses that NPLs are an undesirable by-product and that ignoring them might lead to biased conclusions (Fukuyama and Weber, 2008; Barros et al., 2012).

Secondly, we provide a shadow price of equity as a measure of cost of capital. We posit that the use of simple stock returns as a measure of shareholder value may be overstated and misleading. This novel measure of shadow price of equity enables us to include both listed and non-listed banks in our analysis.

Thirdly, we analyse a broad range of factors impacting on the shareholder value creation in Japanese banking by empirically testing the causality of these factors in the value creation process. We also take into account the trade-offs between various efficiency measures (i.e. cost, revenue, profit and shareholder efficiency). Contrary to the existing literature, which focuses on the relationship between shareholder value and just one type of bank-specific determinant (i.e. bank efficiency), we examine multiple factors that may influence shareholder returns (such as bank's risk-taking, cost of capital, macroeconomic conditions, etc.).[1]

Lastly, we also contribute to the banking literature on Japan by using recent data and focusing on an interesting period characterized by restructuring and consolidation. We use a unique dataset from 1999 to 2011, which enables us not only to examine the differences in bank shareholder efficiency between various bank types, but also to check for shareholder value trade-off between listed and non-listed banks.

2. Japanese banking system – an overview

Recapitalization, the continuous consolidation process of the financial market and the never-ending financial crisis has been widely discussed in academic literature (see for example, Fukao, 2007; Hoshi and Kashyap, 2010). Overall, in the last two decades we can distinguish three crisis phases in Japan. The first phase of the crisis occurred during 1991–1997 and was characterized by the bubble burst and the beginning of gradual and reluctant interventions by the Japanese government. During the second phase, 1997–1999, which saw the almost total collapse of the Japanese financial market, the government finally accepted the true extent of the crisis and implemented more systematic measures to address extreme credit squeeze and a sharp growth contraction. Finally, the period 1999–2003 was characterized by intensive consolidation of the banking sector, but the problems of credit misallocation and economic stagnation continued. Evidence on the performance of the Japanese banking system after the long economic downturn and various recessions during the last two decades is somewhat mixed. Few studies found gradual improvements in profitability of Japanese banks as a result of these phases (see for example, Loukoianova, 2008; Liu and Wilson, 2010), while other studies explain the persistently poor performance with a continuous deflationary macroeconomic environment, low margins charged on loans and high labor costs (Oyama and Shiratori, 2001; Kashyap, 2002; Hattori et al., 2007). As a result new measures were introduced in recent years on further normalization of the non-performing loan problem (for example, 2004 Financial Reform Program; ban on pay-offs lifted in 2005), and additional measures to stabilize the financial system (for example, Financial Functions Strengthening Act; and Deposit Insurance Act amendments in 2013).[2]

According to BIS Quarterly Review (2013) Japanese banks are back to being the largest international lenders, when at the end-March 2013 Japanese banks' share in the consolidated international claims of all BIS reporting banks rose to 13%, followed by the US banks with a 12% and German banks at 11%.[3] Similarly, in the Japanese domestic market, banks still play a dominant role in the Japanese financial markets, where in 2009 banks' share was 64.9% of the total fund-raising and 64.2% of the total loan.

The Japanese financial systems consist of both public institutions (namely, government financial institutions, joint corporations by local governments, development banks, etc.) and private institutions (deposit taking institutions and other financial institutions). The Japanese banking sector essentially consists of a dozen major and internationally oriented banks and more than a hundred much smaller regional banks. More specifically, city banks are typical large universal banks with international exposure and they provide a wide range of banking services, including retail, corporate and investment banking services to the large companies in Japan. Regional banks are divided into two associations, the Regional Bank Association of Japan and the Second Association of Regional Banks. The Regional Bank Association and the Second Association of Regional Banks are smaller in terms of the asset size and market share, and tend to focus on retail banking to small and medium sized companies at the regional level. The main distinction between regional banks is by size, where Second Association of Regional Banks serves even smaller companies and individuals within their immediate geographical regions.[4] Long Term Credit banks provide medium and long-term finance at low rates to the corporate sector.[5] Trust banks are a particular type of banks that provide conventional banking services but their main focus is on asset management for retail and other customers.[6]

Table 1 shows banks' profitability and non-performing loans proportions for Japanese banks operating from 2001 to 2012. Table 1 (Panel A) summarizes sector profitability, presented via operating profits across different types of banks, from which we can observe that banks' profitability declined across all banks since 2001. Figures are somewhat better for Regional banks (both associations) and might indicate that these banks have better absorbed or handled large write-off of NPLs, compared to City banks.

Table 1 (Panel B) shows the proportion of NPLs, indicating that the NPL ratio peaked in the end of 2001 at 9% for the Second Association of Regional Banks and 8.7% for City banks. Furthermore, we can also see that the Regional Bank Association and Second Association of Regional Banks showed the highest proportion of non-performing loans in the period 2001–2012. It is important to note that even though the ratio of total loans to NPLs remains twice higher for smaller Regional banks, overall levels of NPLs are several times lower compared to the starting point.

3. Empirical approach

The shareholder value concept is based on the work of Marshall (1890), but later modified for the banking industry in Europe by Fiordelisi (2007), and Fiordelisi and Molyneux (2010). However, such a concept can only be adopted for publicly traded companies and this creates limitations for evaluating the value creation in

[1] Failure to accommodate for various distortions in Japanese economy might lead to biased results (Hoshi and Kashyap, 2010).

[2] For more info, please see Deposit Insurance Corporation of Japan.

[3] This marks a return of Japanese banks to the position that they held in late 1980s, when Japanese banks' share of the cross-border claims of all BIS reporting banks peaked at no less than 36% in 1989. For more info please see BIS Quarterly Review, September 2013.

[4] For more information on the market structure, please see Bank of Japan.

[5] For more information, please see Casu et al. (2006).

[6] Due to specific focus of Trust banks and Long Term Credit banks as special institutions within Japanese financial system, their very small number (compared to the other bank types in our sample) and market share, we do not include them in our analysis.

Table 1
Profitability and non-performing loans in the Japanese banking sector. Source: Financial Service Agency.

	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012
Panel A: operating profits across different types of banks (trillion yen)												
City banks	3.3	3.4	3.2	3.1	3.1	2.7	2.6	2.3	2.5	2.7	2.7	2.8
Regional banks	1.4	1.4	1.4	1.5	1.5	1.5	1.4	1.0	1.4	1.4	1.3	1.3
Regional banks II	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.0	0.3	0.3	0.3	0.3
All banks	6.0	6.0	5.9	5.9	5.8	5.5	5.1	3.8	4.7	5.0	4.9	5.0
Panel B: non-performing loans across different types of banks (NPL ratio, %)												
City banks	8.7	7.3	5.3	3.0	1.8	1.5	1.4	1.7	1.8	1.8	1.9	1.8
Regional banks	7.7	7.6	6.8	5.5	4.4	3.9	3.7	3.3	3.0	3.1	3.0	2.9
Regional banks II	9.0	8.9	7.5	6.3	5.3	4.5	4.4	4.3	4.0	3.7	3.9	3.8
All banks	8.4	7.4	5.8	4.0	2.9	2.5	2.4	2.4	2.5	2.4	2.4	2.3

Japanese banking, as only a relatively small number of quoted banks exist. Therefore, we follow the aforementioned studies to some extent but differentiate in the way that we calculate cost of capital for both listed and non-listed banks to achieve a comprehensive assessment of the value creation process in the Japan. As defined by Fiordelisi and Molyneux (2010), a common measure of shareholder value creation is Economic Value Added (EVA), defined in our case as the Yen surplus value created by a bank on its existing investments. EVA (as defined in the Eq. (1)) is calculated as the difference between an "economic measure" of the bank net operating profits after taxes (NOPAT) and a capital charge over the same period, i.e. the product of invested capital at time $t-1$ (CI) and the estimated cost of capital (k)[7].

$$\mathrm{EVA}_{t-1,t} = NOPAT_{t-1,t} - (k_{t-1,t} * CI_{t-1}) \tag{1}$$

We estimate the economic profits by following the procedure proposed by Fiordelisi (2007) that accounts for banking specific features. Bank economic profits are obtained by adjusting accounting net operating profits to deal with various distortions (i.e. adjustments covering loan-loss provisions, loan-loss reserves; general risk reserves; R&D expenses and operating lease expenses). Regarding the second component, we estimate the cost of equity as the shadow price of equity. As noted by Hughes and Mester (2013), the shadow price of equity will equal the market price when the amount of equity minimizes cost or maximizes profit, but even when that is not the case, the shadow price nevertheless provides a measure of its opportunity cost. We estimate this measure estimating the bank cost (TC) function including the level of Equity (E) as a fixed input: this enables us to measure of the shadow cost of equity capital as:

$$w_k^* = -\frac{\partial C_{i,t}}{\partial E_{i,t}} = -[\partial \ln c(\mathbf{y}, \mathbf{w}, E, t)/\partial \ln E] \tag{2}$$

where, the subscripts i and t refer to the bank and the time period, respectively. Following Battese and Coelli (1995) we estimate the cost function using the translog functional function (for more info on the estimation please see Appendix A). As such, the shadow cost of equity is a measure of how much banks are willing to pay for equity since it indicates the amount that they would save in other costs as a result of an increase in the level of equity.

Regarding the third component, we estimate the invested capital as the total equity calculated following the Basel II definition: specifically, we calculate the invested capital as the sum of the primary bank capital (i.e. total equity plus disclosed reserves) and the secondary bank capital (i.e. the sum of undisclosed reserves, general loss reserves, subordinated term debt).[8]

In order to investigate the determinants of shareholder value in Japan we specify a linear model of bank performance, as is found in the established empirical literature on the determinants of bank performance (e.g. Athanasoglou et al., 2008; Brissimis et al., 2008; Fiordelisi and Molyneux, 2010). We estimate the following model where the bank's shareholder value is a function of various bank-risk exposure, bank-specific and macroeconomic-variables:

$$\begin{aligned}\ln(y_{i,t}) = {} & \alpha + \sum_{j=1}^{2}\beta_j \ln(y_{i,t-j}) + \sum_{j=1}^{2}\chi_j \Delta x - \mathrm{eff}_{i,t-j} + \sum_{j=1}^{2}\delta_j \Delta\tau - \mathrm{eff}_{i,t-j} \\ & + \sum_{j=1}^{2}\phi_j \mathrm{CR}_{i,t-j} + \gamma \mathrm{LIQ}_{i,t-1} + \eta \mathrm{MR}_{i,t-1} \\ & + \kappa \mathrm{ID}_{i,t-1} + \lambda \ln(\mathrm{BAS})_{i,t-1} + \nu \ln(\mathrm{NOE})_{i,t-1} \\ & + \theta \ln(\mathrm{GDP})_{i,t} + \rho INF_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{3}$$

where, i subscript denotes the cross-section dimension, t denotes the time dimension. The bank-specific variables include: bank's shareholder value variable (y) which is calculated as a ratio between the EVA and capital invested in the bank, net operating profits and the cost of capital (part of the EVA); cost and revenue efficiency changes over two consecutive periods (x-eff and τ-eff respectively); risk-specific factors include: (CR) is an aggregate measure of bad loans, (LIQ) is an aggregate measure of liquid assets; (MR) is a market risk indicator. Other bank-specific indicators include: (ID) is an income diversification measure[9]; (BAS) is bank asset size; and ln(NOE) is the natural logarithm of the number of employees. Finally, ln(GDP) is the natural logarithm of GDP growth; INF is the natural logarithm of the rate of inflation, and $e_{i,t}$ is the random error term. A detailed summary of the all variables used for the empirical investigation is provided in Table 2.

Regarding the first potential driver of shareholder value creation, we recognize that efficiency is likely to have an impact on bank performance (e.g. Berger and Mester, 2003; Beccalli et al., 2006; Fiordelisi and Molyneux, 2010). Cost, revenue, alternative profit and shareholder value efficiency levels are estimated using the Stochastic Frontier approach. These measures are used as

[7] In Japan, we find that some banks have a negative cost of capital (due to the severe crisis of some banks) that is counterintuitive. In the EVA calculation, this would imply to add a positive capital charge to NOPAT (formula (1)) that has no economic meaning, as such we opt to remove these banks (zombie banks) from our sample in order to fully capture how various components might be driving the EVA. We are thankful to one of the two referees for this valuable comment.

[8] More specifically, bank net operating profits are calculated as a sum of [ordinary profit (1 – tax rate), R&D, training expenses and operating lease expenses, provision of allowance for loan losses (minus the written-off of loans), income taxes-current and general reserve for possible loan losses]; invested capital is calculated as a sum of [shareholders' equity, capitalized R&D expenses and capitalized training expenses (minus the proxy for amortized R&D expenses and minus the proxy for amortized training expenses), proxy for the present value of expected lease commitments over time (minus the proxy for amortized operating lease commitments), net loan loss reserve, deferred tax (minus the deferred tax debits), and + general reserve for possible loan losses].

[9] Regarding bank diversification we follow approach similar to Berger et al. (2010) in order to estimate bank income diversification.

Table 2
Variables used to investigate shareholder value and its determinants in Japanese banking.

Variables	Symbol	Description
Economic Value Added	ψ	ψ is the EVA and represents the difference between net operating profits and a capital charge over the same period
Net operating profit	π	π is the measure of bank net operating profits
Cost of capital	k	k is the bank's cost of equity capital
Shareholder value efficiency	ψ-eff	ψ-eff are obtained using Stochastic Frontier analysis*
Cost efficiency	x-eff	x-eff are obtained using Stochastic Frontier analysis*
Revenue efficiency	τ-eff	τ-eff are obtained using Stochastic Frontier analysis*
Profit efficiency	π-eff	π-eff are obtained using Stochastic Frontier analysis*
Credit risk overall	CR	NPL are calculated as: (risk-monitored loans + loans to borrowers in legal bankruptcy + past due loans in arrears by 6 months or more + restructured loans + bankrupt and quasi-bankrupt assets + doubtful assets + substandard loans)/total assets
Liquidity risk overall	LIQ	LR is calculated as: (cash and due from banks + call loans + receivables under resale agreements + receivables under securities borrowing transactions + bills bought + monetary claims bought + trading assets + money held in trust)/(total demand deposits)
Market risk overall	MR	MR is calculated as: (government bonds + local government bonds + short-term corporate bonds + corporate bonds + stocks)/(total assets − tangible fixed assets − intangible fixed assets)
Income diversification	ID	ID is a measure of bank diversification focusing on its income, calculated as: ID = (interest on loans and discounts/income)^2 + (interest and dividends on securities/income)^2 + (other interest income/income)^2 + (fees and commissions/income)^2 + (trading income/income)^2 + (other operating income/income)^2 + (other income/income)^2
Bank assets size	BAS	BAS is the natural logarithm of the total assets
Number of employees	NOE	NOE is the natural logarithm of the number of employees
GDP growth	GDP	The growth in GDP (annual %)
Inflation	INF	Rate of inflation (annual %)

* More detail for the estimation procedures are provided in the Appendix A.

Table 3
Overview of the selected sample.

Bank type/year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total number of observations	Total assets of the average bank*
Full sample	136	136	134	133	129	127	124	123	122	122	119	119	119	1643	6,092,976
City banks	9	9	7	7	7	7	6	6	6	6	6	6	6	88	60,947,667
Regional banks	64	64	64	64	63	63	63	63	63	64	63	63	63	824	3,369,457
Regional-1	32	32	32	32	31	31	31	31	31	32	31	32	32	410	3,535,855
Regional-2	32	32	32	32	32	32	32	32	32	32	32	31	31	414	3,204,667
Regional banks II	54	54	55	53	50	48	47	46	45	44	42	42	42	622	1,253,450
Regional II-1	26	26	27	27	25	24	24	23	23	22	21	21	21	310	1,433,845
Regional II-2	28	28	28	26	25	24	23	23	22	22	21	21	21	312	1,075,360

* All values are in million yen.

Table 4
Annual shadow price of equity.

Year	Shadow price of equity (full sample)		Shadow price of equity (City banks)		Shadow price of equity (Regional banks)		Shadow price of equity (Regional II banks)	
	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.	Mean	Std. Err.
1999	0.0286	0.0044	−0.0262	0.0070	0.0077	0.0041	0.0624	0.0064
2000	0.0303	0.0041	−0.0393	0.0095	0.0122	0.0043	0.0634	0.0046
2001	0.0419	0.0043	−0.0188	0.0104	0.0226	0.0050	0.0721	0.0056
2002	0.0470	0.0045	−0.0246	0.0149	0.0305	0.0051	0.0765	0.0058
2003	0.0497	0.0044	−0.0362	0.0118	0.0372	0.0053	0.0775	0.0051
2004	0.0545	0.0044	−0.0220	0.0150	0.0409	0.0051	0.0834	0.0052
2005	0.0564	0.0042	−0.0107	0.0167	0.0418	0.0050	0.0846	0.0050
2006	0.0462	0.0040	−0.0110	0.0098	0.0329	0.0050	0.0719	0.0051
2007	0.0488	0.0040	−0.0076	0.0078	0.0381	0.0050	0.0712	0.0051
2008	0.0508	0.0039	−0.0142	0.0083	0.0414	0.0047	0.0733	0.0050
2009	0.0522	0.0039	−0.0201	0.0119	0.0440	0.0044	0.0756	0.0048
2010	0.0580	0.0037	−0.0151	0.0105	0.0501	0.0043	0.0808	0.0046
2011	0.0613	0.0040	−0.0108	0.0103	0.0534	0.0045	0.0840	0.0055
Mean	0.0477	0.0012	−0.0209	0.0031	0.0348	0.0014	0.0748	0.0015

Note: Regional banks – Regional Bank Association of Japan; Regional II banks – Second Association of Regional Banks.

covariates in the regression for shareholder value. Along with the established literature (e.g. Salas and Saurina, 2003; Athanasoglou et al., 2008) we assume that bank's risk-taking has a significant influence on the ability to generate returns. We focus on various types of risk, but more specifically, we control for the quality of the loan portfolio through the measurement of credit risk, liquidity and market risk exposure via aggregated liquid assets and various securities respectively. We believe that credit risk represents

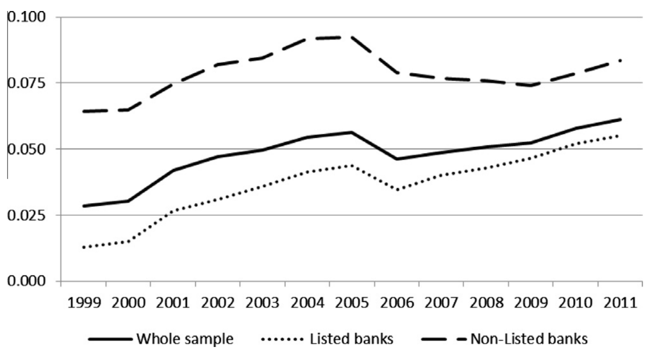

Fig. 1. Shadow price of equity: listed vs. non-listed banks.

Table 5
Shareholder value, cost, revenue and profit efficiency in Japanese banking between 1999 and 2011.

	Shareholder value	Cost	Revenue	Profit
Panel A: City banks vs. Regional banks				
Full sample				
Mean	0.5955	0.9615	0.9309	0.8058
SD	0.0210	0.0265	0.0471	0.0881
Min	0.0000	0.6458	0.5862	0.0000
Max	0.7316	0.9980	0.9878	0.9842
City banks				
Mean	0.5867	0.9780	0.9043	0.6833
SD	0.0793	0.0196	0.0828	0.2584
Min	0.0000	0.9020	0.5960	0.0000
Max	0.7316	0.9980	0.9763	0.9842
Regional banks				
Mean	0.5962	0.9671	0.9265	0.8110
SD	0.0112	0.0228	0.0456	0.0536
Min	0.5487	0.6458	0.5862	0.4866
Max	0.7021	0.9945	0.9878	0.9791
Regional banks II				
Mean	0.5959	0.9517	0.9403	0.8163
SD	0.0058	0.0285	0.0393	0.0612
Min	0.5492	0.8010	0.6744	0.3887
Max	0.6374	0.9934	0.9863	0.9814
Panel A: listed banks vs. non-listed banks				
Listed banks				
Mean	0.5954	0.9653	0.9327	0.7999
SD	0.0241	0.0216	0.0441	0.0938
Min	0.0000	0.8010	0.5862	0.0000
Max	0.7316	0.9980	0.9787	0.9842
Non-listed banks				
Mean	0.5959	0.9512	0.9256	0.8219
SD	0.0078	0.0346	0.0543	0.0680
Min	0.5492	0.6458	0.6744	0.4646
Max	0.6607	0.9945	0.9878	0.9814

long-term bank exposure at bad loans, which take time to reflect and/or reduce on the balance sheet, while liquidity and market risk are seen as short term and can change in relative short period.

Furthermore, we follow Berger et al. (2010) and measure bank income diversification, to assess the link between performance and diversification. Additionally, the variables called bank assets size and number of employees are indicators of the size and space dimension for each bank. We opt out to use traditional measure of size (i.e. assets) and non-conventional measure of space dimension (i.e. number of employees) in order to better account for large differences in size and labor force across Japanese banking industry. Finally, as proposed by various studies (e.g. Salas and Saurina, 2003; Brissimis et al., 2008), we include some macro-economic variables as covariates in our analysis as control variables. These include annual real GDP growth to take account of business cycle effects and the inflation rate in order to control for the stance of monetary policy.

Table 6
The relationship between shareholder value and its determinants.

Dependent variable	(1) $y = y_i$	(2) $y = y_i$	(3) $y = y_i$
y_{t-1}	0.3828***	0.0145	0.3394**
	(0.0985)	(0.1014)	(0.1422)
y_{t-2}	0.0375	−0.2274***	0.0270
	(0.0531)	(0.0372)	(0.0699)
$\Delta x\text{-eff}_{t-1}$	0.4618**	0.3542**	
	(0.2310)	(0.1532)	
$\Delta x\text{-eff}_{t-2}$	0.2544*	0.3696***	
	(0.1391)	(0.1324)	
$\Delta \tau\text{-eff}_{t-1}$	−0.1754		−0.3882**
	(0.5790)		(0.1585)
$\Delta \tau\text{-eff}_{t-2}$	−0.0447		−0.0271
	(0.3996)		(0.1710)
CR_{t-1}	0.1999	−0.0969	0.2835
	(0.2641)	(0.3096)	(0.4386)
CR_{t-2}	0.2486**	0.2182**	0.5469**
	(0.0980)	(0.1037)	(0.2690)
LIQ_{t-1}	−0.0908	−0.0148	0.1384*
	(0.0831)	(0.0485)	(0.0726)
MR_{t-1}	0.1549	−0.0351	0.5371***
	(0.3465)	(0.3043)	(0.1990)
ID_{t-1}	0.3868	−1.2846**	−0.2683
	(0.4611)	(0.5295)	(0.2454)
$\ln(\text{BAS})_{t-1}$	−0.1708***	−0.0143	−0.0594
	(0.0619)	(0.0650)	(0.0514)
$\ln(\text{NOE})_{t-1}$	0.1268	0.0620	0.1245*
	(0.1068)	(0.0998)	(0.0738)
ln(GDP)	1.1147	3.0013***	2.6335***
	(0.9051)	(0.6577)	(0.6005)
INF	−0.4083	1.2418**	0.8583
	(0.4846)	(0.4938)	(0.5378)
CONS	1.0293	−0.6412	0.2423
	(1.0248)	(0.6954)	(0.3601)
Observations	1017	1017	1017
Hansen test, 2nd step, χ^2 (*p*-value)	0.378	0.502	0.275
A-B test AR(1)	0.002	0.014	0.030
A-B test AR(2)	0.993	0.120	0.706

Table 6 reports the results derived from the estimation of Eq. (3) to disentangle the inter-temporal relationships between bank EVA and its determinants. We estimate autoregressive models with two lags for the EVA, efficiency and risk variables. We use the two-step GMM estimators developed by Blundell and Bond (1998) with Windmeijer (2005) corrected standard error (reported in brackets). We use three different measures of EVA: ratio between the EVA and capital invested in the bank (y), net operating profits (π) and the cost of equity capital (k). Explanatory variables are defined in Table 2. The Hansen test of over-identifying restrictions for the GMM estimators: the null hypothesis is that the instruments used are not correlated with the residuals so the over-identifying restrictions are valid. Arellano-Bond (AB) test for serial correlation in the first-differenced residuals. The null hypothesis is that errors in the first difference regression do not exhibit second order serial correlation. The symbols *, **, and *** represent significance levels of 10%, 5% and 1% respectively.

We assume that for any bank risk or bank specific factor to have influence on the value creation process introduction of time through small number of lags is necessary.[10] However, the introduction of a lagged dependent variable among the predictors might create complications in the estimation as the lagged dependent variable is correlated with the disturbance (even under the assumption that $\varepsilon_{i,t}$ is not itself correlated). In order to tackle this problem we use the Generalized Method of Moments (GMM) estimators developed for dynamic panel models (Arellano and Bover, 1995; Blundell and Bond, 1998). Specifically we use the two-step system GMM

[10] Similar to previous studies (e.g. Berger and De Young, 1997; Williams, 2004) we assume that three and four lags model do not significantly differ from each other, so we opt for a small number of lags to accommodate for our somewhat small sample size.

Table 7
The relationship between net operating profits (and cost of equity capital) and its determinants.

Dependent variable	(1) $y = \pi$	(2) $y = \pi$	(3) $y = \pi$	Dependent variable	(4) $y = k$	(5) $y = k$	(6) $y = k$
π_{t-1}	0.0720***	0.0364***	0.0721***	k_{t-1}	0.6226***	0.5789***	0.4042***
	(0.0079)	(0.0067)	(0.00907)		(0.0711)	(0.0661)	(0.0805)
π_{t-2}	0.0170*	−0.0052	0.0168**	k_{t-2}	0.0409	0.0187	0.1329**
	(0.0095)	(0.0064)	(0.00848)		(0.0599)	(0.0490)	(0.0521)
$\Delta x\text{-eff}_{t-1}$	−0.2276	−1.4040		$\Delta x\text{-eff}_{t-1}$	−0.0656***	−0.0478*	
	(0.6126)	(1.0181)			(0.0243)	(0.0287)	
$\Delta x\text{-eff}_{t-2}$	0.5534	1.1766**		$\Delta x\text{-eff}_{t-2}$	−0.0691***	−0.0490**	
	(0.3609)	(0.5679)			(0.0204)	(0.0234)	
$\Delta \tau\text{-eff}_{t-1}$	−0.5570*		−0.535*	$\Delta \tau\text{-eff}_{t-1}$	0.0334		−0.1681**
	(0.3145)		(0.301)		(0.0605)		(0.0756)
$\Delta \tau\text{-eff}_{t-2}$	−0.4588*		−0.460*	$\Delta \tau\text{-eff}_{t-2}$	0.0918*		−0.0264
	(0.2747)		(0.254)		(0.0542)		(0.0632)
CR_{t-1}	−0.2556	0.3084	0.00144	CR_{t-1}	0.0230	0.0231	0.0057
	(1.8120)	(0.8100)	(1.679)		(0.0390)	(0.0414)	(0.0367)
CR_{t-2}	1.3715	0.5258	1.146	CR_{t-2}	−0.0470**	−0.0004	0.0479**
	(1.5953)	(0.6660)	(1.583)		(0.0211)	(0.0158)	(0.0203)
LIQ_{t-1}	0.1112	0.6736***	0.131	LIQ_{t-1}	−0.0065	−0.0388***	−0.0541***
	(0.3864)	(0.2391)	(0.348)		(0.0159)	(0.0141)	(0.0188)
MR_{t-1}	−0.3638	1.1766***	−0.308	MR_{t-1}	−0.1321**	−0.1153**	0.0699
	(0.8263)	(0.4010)	(0.793)		(0.0590)	(0.0531)	(0.0491)
ID_{t-1}	−0.9328	1.8090	−0.827	ID_{t-1}	−0.0195	0.0009	−0.0785
	(0.9586)	(1.2779)	(0.802)		(0.0809)	(0.0698)	(0.1150)
$\ln(BAS)_{t-1}$	−0.1063	0.0775	−0.0740	$\ln(BAS)_{t-1}$	0.0204*	0.0052	−0.0154
	(0.1084)	(0.1861)	(0.0985)		(0.0120)	(0.0087)	(0.0167)
$\ln(NOE)_{t-1}$	0.4492**	−0.2682	0.414**	$\ln(NOE)_{t-1}$	−0.0251	−0.0149	−0.0195
	(0.1765)	(0.2634)	(0.162)		(0.0163)	(0.0159)	(0.0294)
ln(GDP)	1.9946	0.7655	2.368*	ln(GDP)	−0.5544***	−0.5603***	−0.4909**
	(1.4487)	(1.1637)	(1.365)		(0.1504)	(0.1346)	(0.2014)
INF	4.3780	−1.9190	4.455	INF	−0.2719***	−0.2293***	−0.1165
	(3.3116)	(1.4367)	(2.935)		(0.0863)	(0.0785)	(0.1215)
CONS	9.5491***	11.5380***	9.598***	CONS	−0.0588	0.1683**	0.5838***
	(0.8709)	(1.8440)	(0.631)		(0.1266)	(0.0696)	(0.1518)
Observations	1017	1017	1017		1017	1017	1017
Hansen test, 2nd step, χ^2 (p-value)	0.286	0.885	0.259		0.280	0.190	0.373
A-B test AR(1)	0.040	0.062	0.002		0.000	0.000	0.000
A-B test AR(2)	0.836	0.152	0.780		0.669	0.812	0.532

Table 7 reports the results derived from the estimation of Eq. (3) to disentangle the inter-temporal relationships between bank EVA and its determinants. We estimate autoregressive models with two lags for the EVA, efficiency and risk variables. We use the two-step GMM estimators developed by Blundell and Bond (1998) with Windmeijer (2005) corrected standard error (reported in brackets). We use three different measures of EVA: ratio between the EVA and capital invested in the bank (y), net operating profits (π) and the cost of equity capital (k). Explanatory variables are defined in Table 2. The Hansen test of over-identifying restrictions for the GMM estimators: the null hypothesis is that the instruments used are not correlated with the residuals so the over-identifying restrictions are valid. Arellano-Bond (AB) test for serial correlation in the first-differenced residuals. The null hypothesis is that errors in the first difference regression do not exhibit second order serial correlation. The symbols *, **, and *** represent significance levels of 10%, 5% and 1% respectively.

estimator with Windmeijer (2005) corrected standard error. For robust statistical inference, we also report the statistics for the Hansen test of over-identifying restrictions, and the second-order autocorrelation test of no second-order autocorrelation in the error term (Hansen, 1982).[11]

Finally, for a robustness checks we disentangle our dependent variable, EVA, into its two main components [i.e. bank net operating profits (NOPAT) and the estimated cost of capital (k)] which we then use as dependent variables in the model 3 in order to investigate whether profits or the cost of equity are influenced by similar factors.

4. Data and empirical results

The data used in the empirical analysis was drawn from the Bank of Japan and the Japanese Bankers Association with particular focus on commercial banks between 1999 and 2011. Table 3 reports the breakdown by bank type of the number of observations and asset size of the banks included in the sample.[12] Overall, our sample comprises 1643 bank observations. The City banks are the biggest on average by asset size, whereas the Regional banks group has the largest number of institutions in total.

Table 4, reports the estimated cost of equity across the designated time period in comparison to various benchmark measures, such as City banks vs. Regional banks. At the sample mean, the shadow price on equity (i.e. the negative log derivative of the cost function) is between 2.8% and 6.1%. For the City banks, the cost of equity over time is significantly negative. These results are in line with Uchida and Tsutsui (2005), but might also be due to the fact that the profits of many banks were low or negative in these periods. Furthermore, the banks' use of equity capital does not interact significantly with the marginal cost of loans in the sample, but it does correlate negatively with the price of borrowed funds, and it has reacted strongly with the passing of time. All of the variables involving the level of equity impact significantly on costs. Lastly, if we divide the sample as listed vs. non-listed banks, the differences between two subgroups are even greater. Specifically, cost of equity for non-listed banks is double the cost of the listed banks (see Fig. 1). This could be the direct result of bad lending practices and government subsidies for larger banks.

Table 5 reports our mean shareholder value, cost, revenue and profit efficiency estimates by bank type and by listed banks. Over the period analyzed the range of efficiency levels appears to be

[11] We also check for stationarity by applying Fisher's type unit root test for unbalanced panel data, as developed by Maddala and Wu (1999).

[12] We account for the vast majority of operating banks in the observed period (Table 3), from the overall sample of commercial banks available from Japanese Bankers Association.

wider than existing studies on commercial banks. More specifically, mean cost inefficiency estimates range between 3% (City banks) and 5% (Regional banks II) and these results are generally higher than existing studies on Japanese banking (i.e. Drake and Hall, 2003; Altunbas et al., 2000). Further, mean revenue efficiency estimates range between 90% (City banks) and 94% (Regional banks II). The profit efficiency scores over the sample period appear typically in line with those found in other studies on commercial banks (i.e. Drake et al., 2009), with a mean value of 80% for the full sample and a minimum value of 68% for city banks, which appear to be the least profit efficient bank type in our sample. The results also show that non-listed banks are more efficient then listed banks, which is to be expected due to their somewhat limited access to capital.

Furthermore, shareholder efficiency scores range between 58% (City banks) and 60% (Regional banks). Interestingly, on average it can be seen that Japanese banks squander more than one third of their potential shareholder value between 1999 and 2011. This is also true across different bank types. Similarly, listed institutions show no improvement to non-listed ones, indicating that banks in Japan could create at least 40% greater shareholder value for their owners if they operated at best-practice. These results just emphasize the enormous influence of bad loans on the efficiency and shareholder value in Japanese banking.

Lastly, Tables 6 and 7 report the results obtained from estimating the EVA and its components as dependent variables. Focusing on the Table 6, we notice that various factors have been found important in driving the shareholder value up. Namely, the shareholder value measure has been positively related to the cost efficiency and credit risk in the main model, and macroeconomic indicators in the reduced models (at the 10% level or less), while negatively related to the bank size, income diversification and revenue efficiency (at the 10% level or less). Some of these results are in line with the existing literature on European banking, namely Fiordelisi and Molyneux (2010), where results confirm that cost efficiency gains are driving the shareholder value. Other results are quite novel and unexpected. Bank assets size (in the main model 1) and revenue efficiency improvements (in the reduced model 3) are negatively linked to the EVA models and this might require special attention from the future studies. A possible explanation why larger banks have lower value creation might be that the size improvements are subsidized via shareholder value, implying that some banks might be involved in the empire building while other banks possibly belong to larger business groups (keiretsu) and therefore follow their own agenda.[13]

Our estimates for net operating profits, in Table 7, are positively related to the number of employees (in both the main and in the reduced model 3) and cost efficiency, liquidity and market risk exposure (in reduced model 2), while negatively related to revenue efficiency improvements (in both the main and in the reduced model 3). Some of these results are in line with Fiordelisi and Molyneux (2010), and they also further highlight the importance of risk management in banking in achieving higher profit rates. Regarding the net operating profits' positive link with the liquidity and market exposure, we can conclude that Japanese banks benefit greatly from the higher level of liquid assets and greater involvement in the financial markets. Additionally, the negative link between revenue efficiency gains and profits, cannot be properly assessed without considering how quickly actions pays-off and other externalities that might be affecting the relationship (such as higher cost of capital, bad lending practices and government interventions).

Table 8
The relationship between shareholder value and its determinants focusing on profit efficiency.

Dependent variable	(1) $y = y_i$	(2) $y = \pi$	(3) $y = k$
y_{t-1}	0.3934***	0.0661***	0.5418***
	(0.0875)	(0.0140)	(0.0632)
y_{t-2}	0.0420	0.0050	0.0259
	(0.0577)	(0.0103)	(0.0559)
$\Delta\pi\text{-eff}_{t-1}$	−0.1770*	0.2270	−0.0411**
	(0.1051)	(0.1888)	(0.0195)
$\Delta\pi\text{-eff}_{t-2}$	−0.1099***	−0.3572***	−0.0085
	(0.0351)	(0.1243)	(0.0106)
CR_{t-1}	−0.2419	−0.1726	0.0159
	(0.2494)	(1.5662)	(0.0400)
CR_{t-2}	0.1615	1.7903	0.0257*
	(0.1070)	(2.1395)	(0.0149)
LIQ_{t-1}	−0.1025	0.1102	−0.0496***
	(0.0848)	(0.2535)	(0.0136)
MR_{t-1}	0.0107	−0.1250	−0.1283***
	(0.4109)	(0.4508)	(0.0442)
ID_{t-1}	0.6397**	−0.1765	−0.0232
	(0.3258)	(0.4401)	(0.0788)
$\ln(BAS)_{t-1}$	−0.2162***	0.3605*	−0.0051
	(0.0561)	(0.1839)	(0.0106)
$\ln(NOE)_{t-1}$	0.1932**	−0.2659	−0.0092
	(0.0900)	(0.2267)	(0.0171)
ln(GDP)	1.1211*	1.5127	−0.6537***
	(0.6701)	(1.1654)	(0.1453)
INF	−0.2565	1.3688	−0.1811*
	(0.4180)	(2.0984)	(0.0969)
CONS	1.9111***	7.4737***	0.2294***
	(0.6733)	(0.9947)	(0.0809)
Observations	1017	1017	1017
Hansen test, 2nd step, χ^2 (p-value)	0.403	0.506	0.326
A-B test AR(1)	0.003	0.077	0.000
A-B test AR(2)	0.852	0.817	0.668

Table 8 reports the results derived from the estimation of Eq. (3) to disentangle the inter-temporal relationships between bank EVA and its determinants. We estimate autoregressive models with two lags for the EVA, efficiency and risk variables. We use the two-step GMM estimators developed by Blundell and Bond (1998) with Windmeijer (2005) corrected standard error (reported in brackets). We use three different measures of EVA: ratio between the EVA and capital invested in the bank (y), net operating profits (π) and the cost of equity capital (k). Explanatory variables are defined in Table 2. The Hansen test of over-identifying restrictions for the GMM estimators: the null hypothesis is that the instruments used are not correlated with the residuals so the over-identifying restrictions are valid. Arellano-Bond (AB) test for serial correlation in the first-differenced residuals. The null hypothesis is that errors in the first difference regression do not exhibit second order serial correlation. The symbols *, **, and *** represent significance levels of 10%, 5% and 1% respectively.

Various factors are found to be statistically significant drivers for the cost of equity capital. Namely, bank assets size and a 2-year lagged credit losses are found to have a positive impact on the implied cost of capital (Table 7, models 4 and 6), potentially indicating continuously poor loan portfolio quality as a result of rather complex governance structure (consistent with Chen et al. (2009)). In contrast, liquidity and market risk exposure are found to have a negative effect on the cost of capital, and only further confirm the trade-off between profits and equity cost via liquidity and market exposure. Another interesting result is that lower cost efficiency gains could be driving the cost of equity capital up.

Regarding the bank specific factors, there is a negative relationship between bank asset size and EVA, indicating that the smaller banks appear to have a higher value creation. It is also found that the EVA is not influenced by higher number of employees, potentially indicating that shareholders in Japan do not benefit from practices that concentrate on lowering the number of employees (significance at the 10% level or less). Furthermore, we also find that operating profits can be improved if further labor force is employed.

[13] For more info on the Japanese business group affiliations and their strengths, please see Aggarwal and Dow (2012).

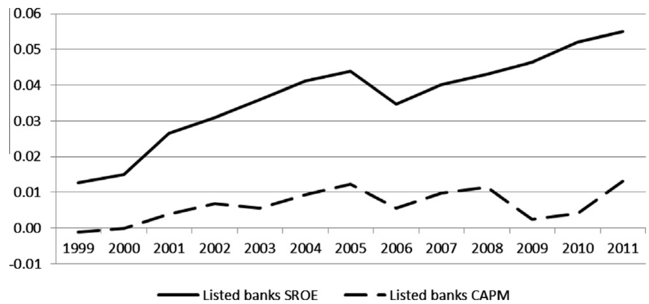

Fig. 2. Comparing cost of capital estimates for listed banks: *SROE* vs. *CAPM*.

5. Robustness checks

In order to further confirm the aforementioned findings, we conduct some additional robustness checks. Firstly, we assess various alternative models with a smaller number of parameters by using only one regressor of changes in efficiencies (rather than all of them). Tables 6 and 7 show that our estimated coefficients and their significance for the three main models (shareholder value, net operating profits and cost of equity capital) are consistent with those from reduced models, yielding almost the same signs and magnitudes.

Secondly, in order to further confirm our results we test for sensitivity to the type of efficiency measure adopted and replace cost and revenue efficiency variables with the profit efficiency measure. As shown in the Table 8, our findings are consistent across various efficiency measures. For example, only actions directed to increase cost efficiency display a positive impact on EVA, while revenue and profit efficiency gains will make no impact.

Thirdly, we compare our measure of cost of capital (i.e. shadow price of equity) with cost of capital for listed banks in Japan based on the CAPM model. In order to estimate this standard measure of cost of capital we use DataStream database for weekly prices for listed banks and NIKKEI 500 weekly price index to calculate returns; and Bank of Japan data for short term money market rate for risk free rate. Fig. 2 shows that our findings are fairly consistent with traditional cost of capital estimates. Both methods have the same time trend pattern and CAPM method yields somewhat lower estimates for cost of capital (i.e. 1–3% on average across observed period).

6. Conclusions

This paper presents new evidence on the shareholder value efficiency and determinants of shareholder value creation for the Japanese banking industry, using more robust and innovative methodologies. We base our analysis on the broad sample of both listed and non-listed Japanese banks between 1999 and 2011.

Firstly, we find that the sample mean of the shadow price of equity is between 2.8% and 6.1%, and that costs have increased significantly over the analysed period. We test for the differences in the listed versus non-listed banks, and find that cost of equity for non-listed banks is double the cost of listed banks. Our results for shadow price on equity are also very similar to the traditional cost of capital estimates (i.e. CAPM).

Secondly, our cost inefficiency estimates range between 3% and 5%, revenue efficiency estimates range between 90% (City banks) and 94% (Regional banks II), while profit efficiency scores over the sample period range between 80% for the full sample and 68% for city banks. We also find that Japanese banks squander more than one third of their potential shareholder value, and that this is true across different bank types.

Thirdly, cost efficiency, credit risk and bank size are found to be the most important factors in explaining the value creation in Japan, while income diversification, liquidity and market risk exposure seems to matter for shareholder value creation in the reduced models. Interestingly, our results indicate that the smaller banks appear to have a higher value creation. It is also found that the higher number of employees do not hinder value creation for Japanese banks. Further, our results for net operating profits show that they benefit greatly from the cost efficiency gains, higher level of liquid assets and greater involvement in the financial markets. Another interesting result is that the cost of equity capital could be reduced by improving the cost efficiency.

Different policy implications can emerge from the study. First, we show that the Japanese banks are on average around 40% shareholder value inefficient, and thus, government policies aimed at aiding the industry in order to foster higher improvements for these banks should be reassessed. Second, cost of equity for non-listed banks is double the cost of the listed banks, signaling that continuous government subsidies for larger banks should be reconsidered and their impact extensively monitored in the years to come. Finally, future policies and studies should try to investigate the negative impact of profit efficiency improvements on the EVA models.

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Appendix A

Efficiency is measured using the Stochastic Frontier (SF) analysis and, namely, Battese and Coelli (1995) Stochastic Frontier model. We use the following translog functional form:

$$\begin{aligned}\ln TP(TC) = {} & \alpha_0 + \sum_{i=1}^{3}\alpha_i \ln y_i + \sum_{i=1}^{3}\beta_i \ln w_i + \tau_1 \ln E + t_1 T \\ & + \frac{1}{2}\left[\sum_{i=1}^{3}\sum_{j=1}^{3}\delta_{ij} \ln y_i \ln y_j + \sum_{i=1}^{3}\sum_{j=1}^{3}\gamma_{ij} \ln w_i \ln w_j \right. \\ & \left. + \phi_1 \ln E \ln E + t_{11}T^2\right] + \sum_{i=1}^{3}\sum_{j=1}^{3}\rho_{ij} \ln y_i \ln w_j \\ & + \sum_{j=1}^{3}\psi_i \ln y_i \ln E + \sum_{j=1}^{3}\varphi_i T \ln y_i + \sum_{j=1}^{3}\theta_i \ln w_i \ln E \\ & + \sum_{j=1}^{3}\vartheta_i T \ln w_i + \sum_{i=1}^{M} \ln Z_i + \ln u_c + \ln \varepsilon_c \end{aligned} \quad (4)$$

where TP is the logarithm of the net profits, or cost of production, y_i ($i = 1, 2, 3$) are output quantities, w_j ($j = 1, 2, 3$) are input prices, k_i ($i = 1, 2, \ldots, 6$) are bank specific factor influencing the efficiency estimation, $\ln E$ is the natural logarithm of total equity capital, Z_i are firm-specific factors assuming different values for each firm, T is the time trend, u_c are the cost inefficiency components. Symmetry and linear homogeneity restrictions are imposed standardizing shareholder value (EVA), total profits (TP), total costs (TC) and input prices P_i by the last input price.

Bank inputs and outputs are defined according to the value-added approach, originally proposed by Berger and Humphrey (1992). We posit that labor, capital and funds are inputs[14], whereas we have three asset based outputs: loans (y_1), securities (y_2) and off-balance sheet activities (y_3); and we treat the level of equity capital as the critical quasi-fixed input. We also estimate the alternative profit and shareholder value efficiency measures introduced applied to banks by Berger and Mester (1997), Humphrey and Pulley (1997) and Fiordelisi (2007). The profit and shareholder value efficiencies are estimated by calculating the alternative profit functional model adopted for the cost efficiency[15], by using as dependent variable: 1) the ln(TP) in the profit function, and 2) the ln(EVA) in the shareholder value function.[16] In order to account for heterogeneity in the sample firm-specific factors are assumed to have a direct influence on the production structure. As such, we include some control variables in the deterministic portion of the Stochastic Frontier function in Eq. (4), namely we account for presence of non-performing loans on the balance sheet (in line with the existing studies on Japan, like for example, Fukuyama and Weber (2008) or Barros et al. (2012)). We posit that the presence of large volume of bad loans would inevitably lead to destruction of shareholder value and poor performance, and if omitted from the equation might lead to biased results.[17]

We estimate shadow cost of equity capital by using a simplified version of the previous bank cost function by including only the level of equity as a fixed input but not including the additional factors into the deterministic portion of the cost function. Thus, we exclude M-firm-specific factors from the formula (4). We aim to capture only the changes in equity levels, for example during recapitalization process, in order to allow for a possible negative shadow price on equity during the various recovery phases in Japanese banking industry.

References

Aggarwal, R., Dow, S.M., 2012. Dividends and strength of Japanese business group affiliation. J. Econ. Bus. 64, 214–230.

Altunbas, Y., Liu, M.H., Molyneux, P., Seth, R., 2000. Efficiency and risk in Japanese banking. J. Bank. Finance 24, 1605–1628.

Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. J. Econom. 68, 29–51.

Athanasoglou, P.P., Brissimis, N.S., Delis, M.D., 2008. Bank-specific, industry-specific and macroeconomic determinants of bank profitability. J. Int. Financ. Markets Inst. Money 18, 121–136.

Bank for International Settlements, BIS Quarterly Review, September 2013.

Barros, C.P., Managi, S., Matousek, R., 2012. The technical efficiency of the Japanese banks: non-radial directional performance measurement with undesirable output. Omega 40, 1–8.

Battese, G.E., Coelli, T.J., 1995. A model for technical inefficiency effects in a stochastic frontier production function for panel data. Empirical Economics 20, 325–332.

Beccalli, E., Casu, B., Girardone, C., 2006. Efficiency and stock performance in European banking. J. Bus. Finance Acc. 33, 218–235.

Berger, A.N., De Young, R., 1997. Problem loans and cost efficiency in commercial banks. J. Bank. Finance 21, 849–870.

Berger, A.N., Hasan, I., Zhou, M., 2010. The effects of focus versus diversification on bank performance. Evidence from Chinese banks. J. Bank. Finance 34, 1417–1435.

Berger, A.N., Humphrey, D.B., 1992. Measurement and efficiency issues in commercial banking. In: Griliches, Z. (Ed.), Output Measurement in the Service Sectors, National Bureau of Economic Research Studies in Income and Wealth. The University of Chicago Press, Chicago.

Berger, A.N., Mester, L.J., 1997. Inside the black box: what explains differences in the efficiency of financial institutions. J. Bank. Finance 21, 895–947.

Berger, A.N., Mester, L.J., 2003. Explaining the dramatic changes in the performance of US banks: technological change, deregulation, and dynamic changes in competition. J. Financ. Intermed. 12, 57–95.

Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. J. Econometrics 87, 115–143.

Brissimis, N.S., Delis, M.D., Papanikolaou, N.I., 2008. Exploring the nexus between banking sector reform and performance. Evidence from newly acceded EU countries. J. Bank. Finance 32, 2674–2683.

Caballero, R.J., Hoshi, T., Kashyap, A.K., 2008. Zombie lending and depressed restructuring in Japan. Am. Econ. Rev. 98 (5), 1943–1977.

Casu, B., Girardone, C., Molyneux, P., 2006. Introduction to Banking. FT Prentice-Hall.

Chen, K.C.W., Chen, Z., Wei, K.C.J., 2009. Legal protection of investors, corporate governance, and the cost of equity capital. J. Corporate Finance 15, 273–289.

Drake, L., Hall, M.J.B., 2003. Efficiency in Japanese banking: an empirical analysis. J. Bank. Finance 27, 891–917.

Drake, L., Hall, M.J.B., Simper, R., 2009. Bank modelling methodologies: a comparative non-parametric analysis of efficiency in the Japanese banking sector. J. Int. Financ. Markets Inst. Money 19, 1–15.

Fiordelisi, F., 2007. Shareholder value efficiency in European banking. J. Bank. Finance 31, 2151–2171.

Fiordelisi, F., Molyneux, P., 2010. The determinants of shareholder value in European banking. J. Bank. Finance 34, 1189–1200.

Fukao, M., 2007. Financial crisis and the lost decade. Asian Econ. Policy Rev. 2, 273–297.

Fukuyama, H., 1993. Technical and scale efficiency of Japanese commercial banks: a non-parametric approach. Appl. Econ. 25, 1101–1112.

Fukuyama, H., Weber, W.L., 2008. Japanese banking inefficiency and shadow pricing. Math. Comput. Model. 71, 1854–1867.

Hansen, L.P., 1982. Large sample properties of generalized method of moments estimators. Econometrica 50 (4), 1029–1054.

Hattori, M., Ide, J., Miyake, Y., 2007. Bank profits in Japan from the perspective of ROE analysis. Bank Japan Rev., 1–7.

Hoshi, T., Kashyap, A.K., 2010. Will the U.S. bank recapitalization succeed? Eight lessons from Japan. J. Financ. Econ. 97, 398–417.

Hughes, J.P., Mester, L.J., 2013. Who said large banks don't experience scale economies? Evidence from a risk-return-driven cost function. J. Financ. Intermed. 22 (4), 559–585.

Humphrey, D.B., Pulley, L.B., 1997. Banks' responses to deregulation: profits, technology, and efficiency. J. Money Credit Bank. 29, 73–93.

Kashyap, A., 2002. Sorting out Japan's financial crisis. National Bureau of Economic Research Working Paper, No. 9384. http://www.nber.org/papers/w9384.

Lepetit, L., Nys, E., Rous, P., Tarazi, A., 2008. Bank income structure and risk: an empirical analysis of European banks. J. Bank. Finance 32, 1452–1467.

Liu, H., Wilson, J.O.S., 2010. The profitability of banks in Japan. Appl. Financ. Econ. 20, 1851–1866.

Loukoianova, E., 2008. Analysis of the efficiency and profitability of the Japanese banking system. IMF Working Paper, No. 08/63.

Maddala, G.S., Wu, S., 1999. A comparative study of unit root tests with panel data and a new simple test. Oxford Bull. Econ. Stat. 61, 631–652.

Marshall, A., 1890. Principles of Economics. The Macmillan Press Ltd, London.

Oyama, T., Shiratori, T., 2001. Insights into the low profitability of Japanese banks: some lessons from the analysis of trends in banks' margins. Bank of Japan Discussion Paper, No. 01-E-1.

Radić, N., Fiordelisi, F., Girardone, C., 2012. Efficiency and risk-taking in pre-crisis investment banks. J. Financ. Serv. Res. 41, 81–101.

Salas, V., Saurina, J., 2003. Deregulation, market power and risk behaviour in Spanish banks. Eur. Econ. Rev. 47, 1061–1075.

Uchida, H., Tsutsui, Y., 2005. Has competition in the Japanese banking sector improved? J. Bank. Finance 29, 419–439.

Williams, J., 2004. Determining management behaviour in European banking. J. Bank. Finance 28, 2427–2460.

Windmeijer, F., 2005. A finite sample correction for the variance of linear two-step GMM estimators. J. Econometrics 126, 25–51.

[14] Input prices are obtained as general and administrative expenses over number of employees (w_1), non-interest expenses over tangible fixed assets (w_2) and interest expenses over total funds (w_3).

[15] Following Berger and Mester (1997) findings and considering our research aims, the translog functional form is preferred to the Fourier-flexible since it is substantially equivalent on an economic viewpoint and both rank of individual efficiency banks in almost the same order.

[16] Using a translog specification we have to solve the problem of sample banks with negative values of profit (for both profits and EVA), for which we cannot take the logarithm. Therefore, the constant term $\theta = |\pi^{\min}| + 1$ is added to every firm's dependent variable in the alternative profit function so that natural log is taken for a positive number (Berger and Mester, 1997). Thus, for the firm with the lowest value for that year, the dependent variable will be $\ln(1) = 0$.

[17] For similar application of the translog functional form in banking industry please see Radić et al. (2012).