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Key Determinants of Japanese Commercial Banks Performance

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ABSTRACT

This paper reports how six bank-specific characteristics and several market and macroeconomic factors influence Japan's commercial bank performance in the recent years that cover global crises. The results suggest that net interest margin is an important performance variable. It is negatively correlated with credit risk, capital adequacy, while liquidity risk, asset quality, management efficiency have positive influences. The effects of income diversification and size are positive though not significant; so, is bank concentration positive for performance. GDP growth and money supply have negative and significant relationships on performance although their effects are marginal compared with bank-specific variables. The global crisis did have significant effect. To take into account profit persistence, GMM technique was applied and it produced moderate support for earnings persistence and there is good deal of competition. These are findings on Japanese banking.

Keywords: Net interest margin, Credit risk, Liquidity, capital, managerial efficiency, and Generalized Moments Method.

INTRODUCTION

Factors that affect performance of the bank have been debated broadly in the banking literature. Growing interest in this field of research also corresponds with an emphasis on quality and safety for banks in recent years, particularly after the global financial crisis have led to adjustment rules. Therefore, factors affecting the performance of banks need to be examined more closely for this special period using a more comprehensive model with six bank-specific factors, several macroeconomic factors and crisis period dummies as time trend controls. The aim of this study was

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to identify bank-specific factors associated with banking sector performance using the little used net-interest margin, NIM, as performance ratio. Some new dimensions were incorporated in this research: Japan as a key economy is studied over a lengthy period incorporating control variables for financial crises and macroeconomic factors. Meanwhile, advanced econometric methods were used so the results are robust. To produce robust results, the Generalized Method of Moments (GMM) panel regressions estimation was chosen for its power to reduce common estimation errors.

Japan is a developed country and the impact of global events in developed countries have been buffeting that country while Japan itself was slowly putting in place reforms needed to improve the economy that had entered a long period of stagnant growth since 1994. Japan is also a country that has a dominant role in international financial relations and economic. There is no serious study using a comprehensive model to test Japan's banking performance. In this sense, even if it is less affected by crisis, it is important to test to see if it is so. Identifying the performance relevant factors for this major banking sector would assist in the fast-tracking of reforms now underway in 2014 in this country. This is a major motivation for undertaking this study with a large sample of banks.

Once control factors were entered within the advanced test model which mainly concerned with the six bank-specific variables, significantly correlations of major factors with performance measures could clearly be observed. The results would have us argue in favour of six bank-specific factors being the main drivers of banking performance in Japan. Both market and macroeconomic factors, as well as time trends, are less important than the six significant factors, which are characteristics of banks.

These results are relevant to understand industry competitiveness as well. A competitive banking sector promotes economic efficiency by reducing funding costs of producers for working capital and investments. High bank margins create impediments to financial intermediation by lowering deposit rates, which discourages savings to flow to the banks and results in high lending rates that reduce investment opportunities for both banks and borrowers (Fungáčová & Poghosyan, 2011). Hence, NIM is also thought to be a broadly useful performance factor on effectiveness of intermediation, as well as a proxy for industry competition. Unlike variables such as return of asset ROA (around 0.9 per cent of assets in our time period, which included the global financial crisis) and return of equity ROE (about 10 per cent) are results of managed variables from accounting choices of top management. Therefore, NIM was taken into consideration in this study of banking performance.

Despite the fact that the recent financial crisis is the most severe in the world, especially in developed countries, it is generally accepted that Asian and the

Pacific countries have passed though this economic problem quite successfully. Bank industry of Japan has experienced financial crisis of 1991 to 1997 in its country, the Asian financial crisis of 1997, and recently global crisis of 2008. It has been argued that one of the main factors contributing to the resilience of Asian banks is regulatory environment changes that occurred after Asian financial crisis and practicing sound risk management.

The remaining part of the paper is organised as follows: Section 2 gives a brief review of the relevant literature on determinants of net interest margins. Section 3 provides a description of the data, specification of the empirical model and methodology. Section 4 presents and interprets the results of this study. The last section concludes the report.

BANKING PERFORMANCE LITERATURE

The banking performance literature is based on two major approaches (call them theories, if you like) and prior studies have been piecemeal in the sense that different authors used one or few factors to test if performance is related to these factors. There has not been a major comprehensive approach that includes all major performance relevant variables. Many models have been put forward to explain possible factors for performance of banks. Usual factors have been grouped as internal and external factors in the literature. Internal factors relate to actions at the bank level known as bank-specific determinants. The external factors refer to economic and legal environment at the country level or at industry and macroeconomic levels. Some explanatory variables have been picked up without them being comprehensive; each researcher proposed a combination from these two categories. Among them are competition, credit risk, market risk, average operating costs, etc.

In general, the vast empirical evidence has yet led to consensus confirming banking performance is explained, by which a number of potential factors suggested by theories and a *priori* reasoning. There is scant support for market structure theory (the first of the two) or the role of bank management as dealers in the market to determine performance. Ho and Saunders (1981) offered a theoretical framework on determinants. In their so-called dealership model, a bank is assumed to be a risk-averse dealer in the credit market, acting as an intermediary between the demanders and suppliers of funds to set interest rates on loans and on deposits to balance the asymmetric arrival of loan demands and deposits. An alternative to the dealership approach is the firm-theoretical model, originally developed by Klein (1971) and Monti (1972). This idea views banking firm in a static setting where the supply and demand of deposits and loans simultaneously clear both markets (Zarruck & Madura, 1992; Wong, 1997). Some of the variables in this study are from this approach, or in other words, we approach this research from this framework.

The structural approach is choice-theoretic. As such, it relies on a theoretical model of a banking firm using the business goal of optimisation such as in Panzar and Rosse (1987). This paper takes a different approach. The research topic was approached using a non-structural approach for performance by considering performance as linked to investment strategies and other factors such as firm-characteristics within the macro environment as buffeted by crisis events relevant for the industry. In short, the literature was used to gather potential bank-specific and macroeconomic variables. In addition, some proxies were also used to represent profit persistence (Goddard *et al*., 2011). This is explained in the section for results.

While theories are motivated by some of these factors as relevant, no general theory of performance provides a unifying framework. This paper brings together elements of literature into an estimable model that hypothesises correlation of a large number of factors with banking performance. For this purpose, data over an 11-year period and selected ten theory-suggested factors for performance were used. In order to achieve the accuracy of findings, advanced econometric models linking performance to key factors (in this paper, on Japan) were employed. The following were considered as the direct factors in this study:

Liquidity risk: Poor levels of liquidity are major causes of bank failures. During periods of increased uncertainty, financial institutions may decide to diversify their portfolios (improve asset quality) and/ or raise their liquid to reduce risks of banking run. In this respect, risks can be divided into credit and liquidity risk. According to the definition of the Basel Committee on Banking Supervision (1997), liquidity risk arises from the inability of a bank to accommodate decreases in liabilities or to fund increases in assets. Literature on two very important functions of banks - Liquidity creation and Risk transformation - show that these two functions do not move in the same direction.

Deep and Schaefer (2004) constructed a measure of liquidity transformation the "liquidity transformation gap" as the difference of liquid liabilities and liquid assets held by a bank, scaled by total assets on the two hundred largest U.S. banks during 1997-01. They concluded that banks do not appear to create much liquidity. Berger and Bouwman (2009) used data on the U.S. banks over 11 years and found that a relationship between capital and liquidity creation is significantly positive for large banks, but insignificant for medium-sized banks and negative for small banks.

Distinguin, Roulet, & Tarazi (2013) found that European and U.S. publicly traded commercial banks decreased their regulatory capital when they created more liquidity, i.e., they funded larger portions of illiquid assets with liquid liabilities. Small banks do actually strengthen their solvency standards when they face higher illiquidity. Horváth *et al*. (2012) used Granger-

causality tests to on capital and liquidity in Czech banks over 2000-10 (11 years), and found that capital Granger caused liquidity creation negatively in the case of small banks, while liquidity creation was shown to positively affect large banks.

Shen *et al*. (2010) investigated the causes of liquidity risk and the relationship between bank liquidity risk and performance for 12 advanced economies over the period 1994-2006. They found that liquidity risk may lower bank profitability (ROA and ROE) because of higher cost of fund, but increase bank's net interest margins because banks with high levels of illiquid assets in loans may receive higher interest income. Note that this study limited the determinant to one factor, while in our paper, multiple factors were identified.

Credit risk: Since most of the bank earning accrues from loans, credit risk plays an important role in the NIM. As per insolvency theory, a bank fails when bank's assets become less than liability. In most cases, falling asset values is due to credit risk arising from non-performance of loan. Ahmad and Ariff (2007) found that an increase in loan loss provision is also considered to be a significant determinant of potential credit risk. So, credit risk is the main risk to banks. It is an internal factor that is familiar to bank management. Athanasoglou *et al*. (2008) suggests that the risk banks have far-reaching consequences for the profitability of banks and its security. Demirgüç-Kunt and Huizinga (1999) found credit risks have positive effects on NIM on 80 developed and developing countries. Kasman *et al*. (2010) found that credit risk is significantly and positively related to banks' NIM. Poghosyan and Cihak (2011) highlighted the importance of other sources of bank risk in addition to leverage; these include asset quality, earning profile which should be taken into account when designing benchmark criteria for bank soundness.

Capital adequacy: Most recent theories predict that capital improves bank performance. Some theories suggest that higher capital ratio of banks introduces a strong attraction to monitor borrowers and invest in safer assets, and thus reduces the probability of default. Demirguc-Kunt and Huizinga (1999) found a positive relationship between bank performance and capitalization, while Naceur and Goaied (2008) reported high NIM and profitability to be associated with banks with a relatively high amount of capital. Garcia-Herrero *et al*. (2009) showed better capitalised banks tended to be more profitable, while Beltratti and Stulz (2009) found that large banks with more Tier-1 capital and more deposit financing revealed significantly higher returns during crisis. Athanasoglou *et al*. (2008) demonstrated that capital is important in explaining bank profitability. Naceur and Omran (2011) found that bank-specific characteristics, particularly bank capitalisation and credit risk, have positive and significant impacts on banks' net interest margin, cost efficiency, and profitability. Berger and Bouwman (2013) found that capital helped small banks to increase their probability of survival and

market share at all times (during banking crises, market crises, and normal times) while capital enhanced the performance of medium and large banks mainly during banking crises. Once again, it is important to note that these are the two factors connecting profitability, while this study aimed to provide a multifactor model.

Asset quality: Asset quality and both credit and liquidity risks are closely related to each other. Asset quality reflects the quantity of existing and potential credit risks associated with loan and investment portfolios and other assets, as well as off-balance sheet transactions. Poor quality of the loan assets slowed down banks to expand more credit to the domestic economy, thereby adversely affecting economic performance. In addition, strong competition among banks erodes margins. In order to compensate for declining profitability, bank managers might increase loan growth with quality of their loan portfolios. Hawtrey (2009) argued that the Australian banks resilience is because of higher loan quality resulting from responsible lending practices. Sangmi and Nazir (2010) applied CAMEL parameters to evaluate the financial performance of the two major banks operating in northern India. Asset quality is concerned that both the banks have shown significant performance. They concluded that low nonperforming loans to total loans shows that the good health of the portfolio a bank and lower the ratio indicates better bank performance.

Managerial efficiency: During the last two decades, a large number of bank failures occurred. The empirical literature identified that a large proportion of non-performing loans and a low level of cost efficiency were the two main reasons of these failures. The fundamental dispute is that bad management increases the probability of bank failures. The bad management hypothesis forecasts that cost efficiency exerts an impact on non-performing loans, as bad managers do not monitor loan portfolios efficiently. According to the bad management hypothesis, low efficiency is a signal of poor managerial performance, which also affects loan lending behaviour. Efficient cost management is a precondition for the improved efficiency of the banking system and that banks have much to gain if they improve their managerial practices.

Williams (2004) studied a large sample of European savings banks using 1990-8 data. He found that decreases in cost and profit efficiency tend to be followed by deteriorations in loan quality, which support the bad management hypothesis. In contrast, Rossi *et al*. (2005) showed similar findings to those of Williams but for a longer time period. Goddard *et al*. (2013) found managerial efficiency measured as cost-income ratio appears to be a more important determinant of performance than either concentration or market share. Athanasoglou *et al*. (2008) found that operating expenses are negatively and strongly linked to profitability.

Size: Obviously, size and performance are closely related to each other inversely since size is a proxy for lower risk. Larger banks are expected to have higher level and variety of loan products than smaller banks, all of which reduce risks of bank. Besides, there are economies of scale from larger size, i.e., reduced risk and economies of scale lead to improved performance. Furthermore, recent financial crisis data revealed that bank size is associated with large risks to public financial activity.

Demirgüç-Kunt and Huizinga (2011) distinguished between absolute size as measured by the logarithm of total assets and systemic size as measured by liabilities-to-GDP ratio. They found that banks with large absolute size tended to be more profitable as indicated by the return on assets, whereas banks with large systemic size tended to be less profitable. Pasiouras and Kosmidou (2007) found a negative relationship between size and profitability as did Ben Naceur and Goaied (2008). Goddard *et al*. (2004) found only weak evidence for any consistent or systematic size–profitability relationship. Micco *et al*. (2007) found there no statistically significant correlation between relative bank size and bank return. Shih, Zhang, and Liu (2007) also found that in China, size is not correlated to bank performance. Cornett *et al*. (2010) found that banks of all size groups suffered bank performance decreases and the largest banks faced the largest losses.

Market structure: View regarding the relationship between bank concentration and net interest margin is contrasting. The structure–conduct–performance (market-power) hypothesis states that increased market power yields monopoly power. Based on this view, more concentrated markets charge higher interest on loan and pay lower rate for deposit. On the other hand, the efficient-structure (ES) theory claims that market concentration is not the case of a bank's superior profitability and attributes the higher profit to superior efficiency, which enables efficient banks to gain market share and earn higher profits.

In supporting the first theory, Molyneux and Thornton (1992) found a statistically significant positive relationship between bank return on capital and concentration ratio across eighteen European countries between 1986 and 1989. Goddard *et al*. (2011) examined the persistence of bank profit in 65 national banking industries as an indicator of intensity of competition. They found that persistence is positively related to the size of entry barriers. Mirzaei *et al*. (2013) investigated the effects of market structure on profitability and stability for 1929 banks in 40 emerging and advanced economies over 1999–2008. They viewed that a greater market share led to higher bank profitability in advanced economies. Nevertheless, this hypothesis is not supported in emerging economies.

In contrast, the study by Staikouras and Wood (2004) indicated a negative but statistically insignificant relationship between bank concentration and bank profits. Similarly, Mamatzakis and Remoundos (2003) did not justify the

traditional hypothesis of Structure-Conduct-Performance in the Greek banking sector. Athanasoglou *et al*. (2008) and Ben Naceur and Goaied (2008) did not find any evidence to support the SCP hypothesis. A recent study by Chortareas *et al*. (2012) considered the determinants of interest rate margins in Latin American banking sector covering the period 1999–2006; the results demonstrated that the concentration index and the market share had little or no influence on interest rate margins. Some of the macro factors are discussed below.

GDP growth: There is no conclusive result on the effect of economic growth on NIM. On the one hand, higher growth signals greater demand for bank loans and the banks could then charge more for their loans. On the other hand, as far as economic growth shows, under increased competition and macroeconomic stability, one can expect a lower spread is associated with stronger growth. Claeys and Vennet (2008) studied the Central and Eastern European countries (CEEC) and found that in the Western European countries, higher economic growth is associated with higher margins, whereas no link is found in the Central Eastern European countries. Kosmidou (2008) and Flamini *et al*. (2009) found that output growth has a positive impact on bank profitability, while Demirguc-Kunt *et al*. (2003), Sufian (2009), Liu and Wilson (2010), and Tan (2012) found a negative effect.

Thus, it can be concluded that the increase in economic growth can lead to an increase in economic activity and improved business performance among borrowers, a situation that called for the banks to reduce their interest margins. In contrast, low economic growth weakens debt service to borrowers and contributes to increased credit risks and interest margin.

Inflation: Empirical studies have shown that the effects of inflation on bank performance depend on whether operating expenses and revenue increase at a higher rate than inflation. In other words, the impacts of inflation on bank profitability depend on whether inflation is fully anticipated. Thus, inflation is one of the main paths through which it is possible to affect the operations and margins of banks through interest rates. Perry (1992) suggested that the effect of inflation on bank performance is positive if the rate of inflation is fully anticipated. This gives them the opportunity to adjust the interest rates accordingly and consequently earn higher profits.

In a study of 80 developed and developing countries, Demirgüç-Kunt and Huizinga (1999) found a positive relationship between inflation and net interest margin. The same result was also found in other studies [see Staikouras and Wood (2004) for European banks, Athanasoglou *et al*. (2008) for Greek banks, and Albertazzi and Gambacorta (2009) for 10 industrialized countries].

On the other hand, negative impacts of inflation on bank profitability have been found in other studies. Afanasieff *et al*. (2002) studied the behaviour of bank

interest spread in Brazil and found that the inflation rate negatively affected interest margins. Kosmidou (2008) and Naceur and Kandil (2009) also found inflation rate negatively affected interest margins in the study conducted for Greek and Egypt, respectively.

Other factors: There are a lot of other performance determinants such as taxation, off-balance sheet items and non-traditional activity, as well as indicators of the quality of the offered services that can be taken as additional functions. Demirguc-Kunt and Huizingha (1999) considered a comprehensive set of determinants and found that macroeconomic factors implicit and explicit financial taxation also explained the variation in interest margins. Vivas and Pasiouras (2010) investigated the relevance of non-traditional activities in the estimation of bank efficiency levels using a sample of 752 publicly quoted commercial banks from 87 countries around the world. The results indicated that non-interest income resulted in higher and statistically significant different profit efficiency scores compared to the traditional model.

As this brief review suggests, there are quite a number of factors that have been suggested as correlated with bank performance. It is the aim of this study to gather these factors and also test if all of them are associated with bank performance by using a different procedure of GMM, which is advanced for this kind of research using panel regressions.

DATA AND METHODOLOGY

Econometric Specification

To examine the determinants of net interest margin (NIM) in our large sample of commercial banks, this study employed a dynamic panel data approach since the tests and fine-tuning methodology pointed to this as the most appropriate research method. The dynamic panel models use panel data that are large in cross-sectional dimension and short in time series one: this is the econometric justification, namely that $n > t$ in the matrix and that the GMM handles the dynamic nature of the relationship over time. Both the time and cross-sectional variations are located in the model and the method also allows inclusion of lag dependent variables (test profit runs) and unobserved individual-specific effects. Furthermore, the model is efficient in allowing for variations of relationships across subjects and time. It also permits individual-specific dynamics to be captured. Consequently, the results help to avoid any bias arising from either the time series dynamics influence or heterogeneity of banks. The GMM dynamic panel data approach was used as advocated by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998).

Empirical work on the determinants of bank performance potentially includes three sources of inconsistency: very persistent profits, endogeneity and omitted variables. The dynamic panel techniques help to correct these potential problems. In the banking literature, using the fixed and/

or random effects model within panel data causes difficulty when lagged dependent or independent variable has influences especially in some time periods or across several banks. According to Baltagi (1995), neither the Generalized Least Squares (GLS) estimator nor the Fixed Effect estimator will produce consistent estimates in the presence of dynamics and endogenous influences. This is the third reason for avoiding these methods.

The linear dynamic panel data model can be specified as follows:

$$NIM_{it} = c + \delta NIM_{it-1} + \sum_{j=1}^{J} \beta_j X_{it}^{j} + \sum_{k=1}^{K} \beta_k Y_{it}^{k} + \sum_{l=1}^{L} \beta_l Z_{it}^{l} + \varepsilon_{it}$$

$$\varepsilon_{it} = v_i + u_{it} \quad (1)$$

Where, NIM_{it-1} is the one-period lagged of dependent variable and δ is the speed of adjustment to equilibrium. NIM_{it} is the net interest margin of bank i at time t, with $i = 1,\ldots,N$, $t = 1,\ldots,T$, c is a constant term, X_{it}'s are bank-specific variables, Y_{it}'s industry-specific variables, Z_{it}'s the macroeconomic variables, and ε_{it} is the disturbance with v_i as the unobserved bank-specific effect and u_{it} the idiosyncratic error. This is a one-way error component regression model, where $v_i \sim (IIN(0, \delta_v^2)$ and independent of $u_i \sim (IIN(0, \delta_u^2)$.

Put the lagged dependent variable on the right-hand side of the equation, i.e. this variable is correlated with the error term, ε_{it}, which is a function of the bank specific effect, v_i. Due to this, dynamic panel data estimates of Equation (1) suffer from a bias. Estimator option in such environment is to use GMM proposed by Arellano and Bond (1991). This procedure differentiates the model to eliminate the effects of a bank-specific or time invariant bank-specific variables, as well as endogeneity issue in the model. In addition to these favourable characteristics of the model, stationary regressors are certain. GMM uses the orthogonal condition between different errors and lag dependent variable, which are valid under the assumptions that the error term is serially uncorrelated, and the lag of the explanatory variables are weakly exogenous.

For consistency of GMM estimators, the test relies on two test specifications. First is the Hansen test for over identification of restrictions. The GMM estimation of dynamic panel data increases the number of conditions, and therefore, the Hansen test is used to test over-identification restrictions. Second is the Arellano–Bond order 2 for second order serial correlation in the disturbance term. Failure to reject the null hypothesis in both tests will give supports to reliable estimations.

The GMM estimators are typically used in one-step and two-step. The one-step uses a weighted matrix independent of the parameters estimated, while the two-step GMM uses the optimal weighting matrix as weighted by consistent covariance matrix. In this study, the two-step estimator was used as it is more efficient. Windmeijer

(2005) showed that the two-step GMM estimation with various instruments could lead to biased standard errors and parameter estimates. Bias in the two-step standard measures can be corrected by using Windmeijer's (2005) correction procedure, which was used in this study to greatly reduce this problem. In this study, this correction procedure was implemented to get robust results.

Data and Variables

Unbalanced panel data of 115 commercial banks were used in this work and these resulted in 1265-year observations over 11 years ending in 2012. The bank balance sheet and income statements were obtained as bank-specific observations from the BankScope database provided by Fitch-IBCA. Therefore, the variables were taken from published financial information source widely used in published studies. Meanwhile, data on concentration, inflation, money supply and GDP growth were computed from the world development indicators. It is important to note that the sample of this study included only commercial banks. The number of banks in the sample accounted for 73% of the total assets of commercial banks during the period.

TABLE 1
Descriptive statistics of the Variables in the Model

Variable	Mean	Standard Deviation	Minimum	Maximum
NIM	1.612	0.394	0.000	3.172
LR	-0.215	0.103	-0.845	0.246
CR	0.005	0.008	-0.001	0.175
CA	0.807	25.555	-0.191	909.000
AQ	0.047	0.027	0.000	0.198
ME	0.012	0.003	0.000	0.079
ID	0.003	0.003	-0.027	0.022
LTA	16.967	1.174	13.812	21.419
CONCEN	55.313	3.514	50.156	58.834
GDPG	0.816	2.486	-5.527	4.652
M2	215.700	13.912	202.807	241.234
INF	-0.165	0.768	-1.983	1.055

Notes: NIM is the net interest rate margin defined as the interest rate income minus interest rate expenses over average total earning assets; LR is a measure of liquidity risk calculated as ratio of financing gap (difference between bank's loan and customer deposit) to total assets; CR is a measure of credit risk calculated as loan loss provisions over total loans; CA is a measure of capital adequacy calculated as equity capital to total loans; AQ is a measure of asset quality calculated as nonperforming loan over total loans; ME is a measure of managerial efficiency calculated as operating expenses to total asset; ID is a measure of income diversification calculated as non-interest income over total assets; LTA is a measure of size calculated as natural logarithm of total assets; CONCEN is 5-Bank asset concentration for Japan that is assets of five largest banks as a share of total commercial banking asset; GDPG is GDP growth (annual %); M2 is money and quasi money as % of GDP; and INF is inflation, end of period consumer prices (percent change).

Table 1 presents the descriptive statistics of the sample. The NIM, the proxy variable for interest rate spreads, has a mean value of 1.612 per cent. The average inflation rate in the region in the period under study was -0.165 per cent, and the average GDP growth was 0.816 per cent. Meanwhile, non-interest income over total asset is so small, indicating banks are cautious in engaging to non-interest income generating activities. Entering to the field of non-interest income generating activities will more likely be faced with the risks of mistake, and this will consequently result in losses.

FINDINGS OF THE STUDY ON JAPAN BANKS

This study began with an OLS analysis on the NIM as the dependent variable and the LR, CR, CA, AQ, ME, ID, LTA, CONCEN, GDPG, M2 and INF as the independent variables. Table 2 shows the preliminary OLS regression results. The results indicated that all bank-specific, industry- specific and macroeconomic variables affected NIM in the Japanese banking sector. Meanwhile, liquidity risks (LR) and asset quality (AQ) managerial efficiency (ME) were found to be positively related to NIM as well, whereas credit risk (CR), capital adequacy (CA), income diversification (ID) and size (LTA) had negative influence on bank's performance. All the country specific variables, except for GDP growth, negatively influenced NIM.

TABLE 2
OLS regression (NIM as the dependent variable)

Variables	OLS		VIF	1/VIF
constant	2.34	***		
	(8.92)			
LR	0.149	***	1.21	0.827
	(1.97)			
CR	-3.360	***	1.33	0.750
	(-3.43)			
CA	-0.006	***	2.26	0.443
	(-14.44)			
AQ	3.552	***	1.79	0.559
	(9.97)			
ME	55.395	***	4.07	0.246
	(12.49)			
ID	-45.288	***	1.53	0.653
	(-15.90)			
LTA	-0.026	***	2.78	0.360
	(-2.6)			
CONCEN	-0.008	***	2.46	0.406
	(-2.50)			
GDPG	0.007)	**	1.72	0.582
	(1.8)			

M2	-0.002	***	2.67	0.375
	(-2.98)			
INF	-0.030	***	2.14	0.468
	(-2.26)			
R^2	0.5749			
Adjusted R^2	0.5711			
F-statistic	153.41	***		

Note: VIF is the Variance Inflation Factor. The mean VIF is 2.18

This OLS regression results are reliable with the Adjusted R-squared values of 0.5711 (57.11%), a strong explanatory power for the variation in NIM. The significant variables in the model explain 57 percent of the variations in the NIM, a result that is seldom observed in the literature. Note that the macroeconomic variables are entered though not quite influential are shown. The time trend variables, though included in the test runs, are not shown in the table above. The F-statistics of 153.41 suggests a good model fit, which is significant. Finally, a check on VIF (Table 2, column number 3) shows that there is no multicollinearity problem. The regression was done with White's correction so it ensured that heteroskedasticity was controlled in the results of the current work.

The specified linear dynamic panel data model was estimated and the results in Table 3 are a summary of the results attained for the determinants of NIM. It is worth noting that the results reported are based on the estimations obtained from the two-step GMM panel data procedures[1].

Necessary diagnostic tests were also conducted, and the results showed that all the tests are satisfactory in all regressions. The Sargan test did not reject the over identification restriction of the models. The Wald chi-squared test is statistically significant at the 0.01 probability level. The Arrelano–Bond AR (2) tests showed no second-order serial correlation was detected, so the results from the GMM estimation are consistent. Finally, the significance of a lagged dependent variable gave a good reason for the use of dynamic panel data model; therefore, it could be relied upon to carry out statistical inference associated with the model.

The test statistics in Table 3 shows that the lagged dependent variable, NIM, is positive and significant. It can be interpreted as verification of persistence in NIM in the commercial banks. In this study, δ takes the value of about 0.49, which means that net interest margin continued to be just moderate, so the level of competitive market structure is quite high in Japan's banking sector.

[1]Windmeijer (2005) suggested this procedure to correct the estimated asymptotic standard errors since the two-step GMM estimators are downward biased.

TABLE 3
GMM regression (NIM as the dependent variable)

Variables	Different GMM		
	0ne step	Two steps	Two steps with robust SE
constant	-2.405 ***	0.219	0.219
	(-3.01)	*(0.33)*	*(0.12)*
NIM_{t-1}	0.562 ***	0.491 ***	0.491 ***
	(12.36)	*(9.4)*	*(4.25)*
LR	0.699 ***	0.455 ***	0.455 **
	(5.38)	*(3.42)*	*(1.81)*
CR	0.001	-0.269	-0.269
	(0.00)	*(-0.84)*	*(-0.55)*
CA	-0.002 ***	-0.002 ***	-0.002 ***
	(-7.04)	*(-8.49)*	*(-5.27)*
AQ	1.107 ***	0.945 ***	0.945 ***
	(3.8)	*(4.6)*	*(2.55)*
ME	28.210 ***	27.060 ***	27.060 ***
	(6.7)	*(5.52)*	*(3.06)*
ID	0.973	2.804	2.804
	(0.54)	*(1.58)*	*(0.75)*
LTA	0.244 ***	0.074 **	0.074
	(4.47)	*(1.78)*	*(0.64)*
CONCEN	-0.001	0.015 ***	0.015
	(-0.08)	*(3.38)*	*(1.23)*
GDPG	-0.005	-0.010 ***	-0.010 **
	(-1.53)	*(-5.54)*	*(-2.24)*
M2	-0.006 ***	-0.008 ***	-0.008 ***
	(-4.43)	*(-8.52)*	*(-3.62)*
INF	-0.006	-0.004	-0.004
	(-0.69)	*(-0.75)*	*(-0.45)*
Wald χ^2	3454.84 ***	106003.8 ***	3477.13 ***
Hansen p-value	0.000	0.0802	
AR(1) p-value		0.0349	0.0550
AR(2) p-value		0.8925	0.8925
Number of observations	1033	1033	1033

Notes: ***, ** and * indicate significance at 1, 5 and 10-percent levels, respectively. Values in parentheses are Z-statistics. Hansen test is a test of over-identification restrictions. Arellano–Bond order 1 and 2 are the tests for the first- and second-order correlation, respectively, asymptotically N (0, 1), test the first-differenced residuals in the GMM estimation. The two-step errors are computed according to Windmeijer's (2005) finite-sample correction. Time dummies were included to capture period-specific effect but are not reported.

Now, the bank-specific factors were examined; Liquidity risk (LR) is positively related to net interest margin. This is consistent with the literature that argues that banks have a propensity to pass their liquidity risk to consumers by increasing the interest rate margin. The banks that hold more liquid assets will be able to meet the unforeseen events which are not predictable. Due to the quality of the services that is provided after the recent financial crises, banks have been paying more attention to improving liquidity risk management. As satisfactory liquidity level to meet unexpected contingencies is costly, in practice, it keeps a balance between short-term and long-term situations.

The effect of credit risk (CR) is negative on the net interest margin, although statistically not significant; this indicates that banks with higher credit risk tend to demonstrate lower profitability. One explanation for this result is sensitivity of the bank's NIM to credit risk. Credit risk (loan loss provisions over total loans) tends to be a forward-looking indicator. The result shows that, like all other studies elsewhere, credit risk is important in determining NIM. Correct actions on credit risk will help banks to become more efficient to avoid moral hazard exposure.

Capital adequacy (CA) is statistically significant and is negatively related to NIM. The capital adequacy ratios indicate the credit worthiness of the bank and the bank's capital adequacy level is the result of a combination of factors such as regulatory costs and the bank's business strategy. So, the expected sign between net interest margin and capital adequacy ratio depends on the magnitude of the transfer of these factors to the customers (Claeys & Vander-Vennet, 2008). Another possibility is that a negative relationship between net interest margin and capital adequacy ratio would be considered if the risk of default is very low resulting in lower capital cushions; this is perhaps true given the tenacity of the central bank in Japan not to punish banks for bad behaviour in this period of turmoil. According to the signal hypothesis, managers may have private information about future performance. It may be less expensive for low-risk institutional managers to signal quality by maintaining a high ratio of CA than manager of high-risk institutions (Hughes & Mester, 1998).

As for asset quality (AQ), bad credit occurs when the bank manager in prior periods, facing competitive conditions, increased loans with less stringency to meet short-term profit targets (Berger & Udell, 2003). Problems will occur when dealing with impaired assets and direct them by creating a reserve for write off. The results of the current study showed that AQ (non-performing loan over total loans) has positive and statistically significant relationship with NIM. These results indicate that the commercial bank, despite having experienced financial crises, did not make rational decision concerning their loans.

The results also showed that managerial efficiency (operating expenses to total asset) is positively affecting NIM. This

result provides evidence that banks must manage their performance, and irrespective of their size, the more profits they have, the more efficient the banks are. The finding is consistent with the bad management hypothesis of Berger and DeYoung (1997). Low level bank profitability is a signal of poor management practices. Obviously, proper management cost is needed so as to improve the efficiency of the banking sector everywhere.

On the subject of income diversification, previous research has shown contrary results (see DeYoung & Rice, 2004; Mercieca *et al*., 2007). Better performing banks use less non-interest income. On the other hand, other research reports such as that of Baele *et al*. (2007) argue that non-interest income can increase efficiency of bank. The results of the current study showed a positive but statistically insignificant relationship between income diversification (ID) and NIM. This result revealed that managers of banks proceeded to use non-interest income more slowly and is consistent with the findings of many other studies.

Meanwhile, research carried out on bank size reveals that the relationship between size and performance of banks is more complex, and is connected to many other factors such as economic growth, market discipline, country, etc. A recent study distinguishes between absolute size as measured by the logarithm of total assets and the systemic size as measured by liabilities-to-GDP ratio. The empirical results of these studies are mixed. For instance, Demirgüç-Kunt and Huizinga (2011) found banks with large systemic size tend to be less profitable, while Pasiouras and Kosmidou (2007) found economies of scale and scope for smaller banks or diseconomies for larger financial institutions; and Ben Naceur and Goaied (2008) revealed that size impacts negatively on profitability. In contrast, Kosmidou (2008), and Beltratti and Stulz (2009) reported a positive relationship. In this study, size of bank (logarithm of total asset) was found to be positive but there was no statistically significant relationship observed between bank size (LTA) and NIM for commercial banks in Japan.

The concentration is not statistically significant in explaining NIM: in a sense, it helps us to reject the Structure–Conduct–Performance (SCP) hypothesis and the Relative-Market-Power (RMP) hypothesis. This study has shown that macroeconomic variables (GPD growth, money supply, and inflation) affect NIM as well. All the macroeconomic variables are negatively associated with commercial bank margins. These results are statistically significant for GDP growth and money supply (M2), but are not significant for inflation. Macroeconomic control variables such as inflation clearly affect the performance of the banking sector. For instance, Maudos and Guevara (2004) argued that the reduction in the interest margin in Europe in the 1990s to be correlated to economic growth that reduces costs. Angelini and Cetorelli (2003) considered negative association between GDP growth and NIM

for European banks.

Performance of banks after the recent financial crisis has been the worst; there are significant variations across the world in the stated period. In order to investigate the effects of this time factor on the variables in the model, the time dummy variables were considered in this study. Time was found to play an important role in the period of our study; the period 2007–09 was negatively and significantly associated to NIM. This result confirms that the global financial crisis has contributed significantly adversely. One reason for this negative association might be related to procyclicality of loan loss provisioning in Japan.

CONCLUSION

This study has reported the results of an investigation on the determinants and persistence of net interest margin of Japanese commercial banks over the most recent years, including the financial crisis years. The intention is to build a robust model while controlling for macroeconomic and time trend effects. The results presented with a large data set over a current 11-year period are interesting in a number of ways. First, the results showed that the most significant variables are bank-specific factors, which have highly significant coefficients, which are sensitive to NIM, attest strongly that net interest margin is the most important performance measure as a good proxy for performance. There are a lot of studies using return on assets or return on equity: NIM has been neglected certainly for Japan, and yet this is a reliable performance factor based on market-driven forces and strongly correlated with the identified determinants. Second, the multi-factor model with control variables appears to work very well, as supported by test statistics attesting to the model fitness. Compared to the results obtained using simpler methods such as OLS cross-sectional regressions, the method used (GMM) has considerably improved the results because of its advanced features to reduce errors in estimation[2].

Third, strong evidence is found for profit persistence, which several authors have connected to the present prevalent industry structure theory of Panzar-Rosse. A significant coefficient for the lagged dependent variable, δ, takes the value of about 0.49, which means that the net interest margin continues at this moderate level in the sector suggesting competitive market structure in Japan's banking sector. Significant coefficient of the lagged dependent variable, δ, can be interpreted as a measure of the extent to which NIM is stable for periods after the current period.

The results suggest that there is negative association between credit risk, capital adequacy and macroeconomic variables. It might be because of the low default risk resulting in lower capital cushions. The findings also indicate that the period 2007–09 is negatively and significantly associated with NIM. In this

[2]These test run outputs are recorded by the researchers, and are available for viewing if requested.

regard, it means that the global financial crisis has contributed significantly and adversely to the banking performance in Japan. Liquidity risk, asset quality and managerial efficiency have positive and significant influences on bank's NIM, while income diversification and size have positive but not significant impacts on NIM. Although many studies argue that banks with diversify in non-interest income are able to engage in reduction in margin lending business, a statistically significant relationship between non-interest income diversity and NIM between commercial banks is not found in the current work.

The current findings regarding concentration can be interpreted as not supporting both the Structure-Conduct-Performance (SCP) hypothesis and the relative market-Power (RMP) hypothesis. Thus, further research on various countries set by considering different economic blocs will reveal clear picture of the role of industry and macroeconomic factors in the banking performance. Moreover, performance testing on other dependent variables such as return of asset and return of equity may help researchers to have more relevant views of the factors affecting the performance of Japanese commercial banks.

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Appendix 1 Test results on multicollinearity

TABLE 1
Correlation Matrix (N x T = 1033)
This table shows multicollinearity test results indicating there is no concern about explanatory variables included in the model to run GMM panel regressions.

Variables	NIM	LR	CR	CA	AQ	ME	ID	LTA	CONCEN	GDPG	M2	INF
NIM	1.00											
LR	-0.17	1.00										
CR	0.17	0.04	1.00									
CA	-0.12	0.06	-0.02	1.00								
AQ	0.52	-0.06	0.45	-0.05	1.00							
ME	0.38	-0.05	0.18	0.58	0.30	1.00						
ID	-0.41	0.36	-0.01	-0.03	-0.17	-0.03	1.00					
LTA	-0.55	0.26	-0.06	-0.08	-0.34	-0.62	0.34	1.00				
CONCEN	-0.27	-0.03	-0.15	-0.03	-0.41	-0.16	-0.09	0.13	1.00			
GDPG	0.04	-0.01	-0.01	0.02	0.08	0.01	0.06	-0.01	-0.25	1.00		
M2	-0.32	-0.07	-0.21	-0.02	-0.36	-0.22	0.04	0.14	0.64	-0.19	1.00	
INF	0.05	0.03	0.06	0.02	0.01	0.04	-0.11	-0.02	-0.02	0.54	-0.39	1.00