

## Diversification and Efficiency in the Indonesian Banking Industry

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### ABSTRACT

The global financial crisis in 2008 caused banks to look for business models that can increase efficiency levels. Several previous studies of developed markets suggest that diversification has a positive effect on efficiency. This study aims to analyze the effect of diversification on Indonesian banking efficiency as one of the emerging markets. We used the stochastic frontier analysis (SFA) to measure efficiency; the results showed that the majority of Indonesian banks operate at relatively low efficiency. Using the panel data, this study found the same result: diversification can improve Indonesian bank efficiency. Diversification can optimize the output without additional input costs that cause an increase in Indonesian bank efficiency. Other factors such as the level of bank capital also has an impact on increased efficiency. In addition, the influence of bank size and global financial crisis is not statistically significant.

**Keywords:** Diversification, Efficiency, Global Financial Crisis, Banking

**JEL Classification:**G01, G21

### INTRODUCTION

The global financial crisis of 2007 to 2009 had a major impact on the global financial system. The crisis led to the bankruptcy of several major investment banks and disrupted the expansion of the banking industry. According to Bank Indonesia (2010), the global financial crisis in 2008 caused disruption and turbulence in the Indonesian economy and the banking industry. Economic disruption experienced by Indonesia consists of the depreciation of the rupiah against the US dollar, driving inflation up to 12.56 percent, and a decrease in foreign

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exchange reserves, which amounted to 15 percent. Disruption of the banking industry typically happens through increased capital outflow, decrease in foreign ownership of SBI and SUN, and a shortage of funds.

These major changes in financial conditions encourage regulators, policymakers, and scholars to discuss creating more efficient business model for the banking industry (Curi *et al.*, 2015). A bank business model consists of diversification and focus models or so-called concentrated (Curi *et al.*, 2015). Banks that choose to focus on this business model will have a high proportion of noninterest income or interest income because banks only focus on one business activity. Meanwhile, banks with a diversification business model will have a proportion that is not much different between interest income and noninterest income due to its various business activities.

The Indonesian banking industry before and during the global financial crisis implemented various business models. Figure 1 shows that, during the crisis period (2007–2009), especially in 2007–2008, the growth of non-interest income in Indonesian banks had increased significantly. Fadhillah (2014) argued that the higher interest income indicated that banks focused on credit activities. Meanwhile, higher noninterest income indicated that banks were beginning to consider to diversifying its business activities. It showed that, during the crisis period (2007–2009), Indonesian banks began to diversify its business activities.

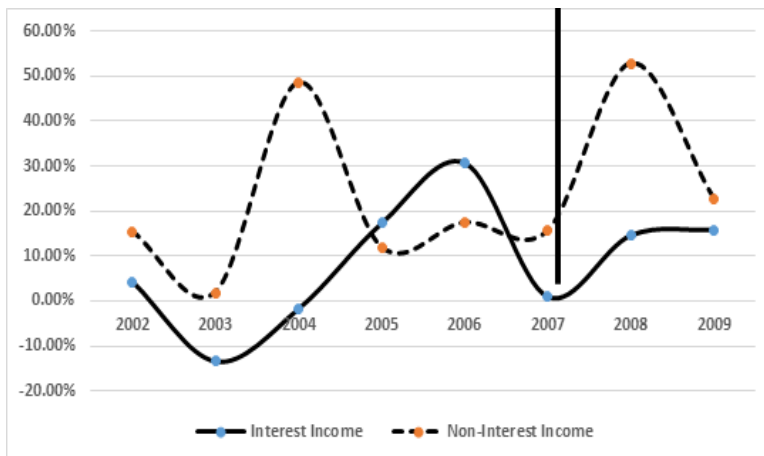


Figure 1: Growth in Interest Income and Non-Interest Income in Indonesian Banks

Source: Indonesian Banking Statistics, [www.bi.go.id](http://www.bi.go.id) (reprocessed 2016)

Elsas *et al.* (2010) found that diversification would improve the profitability and value of a bank. Additionally, Curi *et al.* (2015) found that diversification could be implemented by banking institutions in conducting business activities amid a crisis situation. Downturn in the financial system typically forces banks to remain focused on traditional activities (lending) or to diversify its business activities by seeking sources of revenue other than through interest (noninterest income). Previous studies have shown a relationship between diversification with bank efficiency levels (Vivas & Pasiouras, 2010; Klein & Saidenberg, 1997; & Alhassan, 2015). Some of the findings showed a positive relationship between; several others showed

the opposite. In addition, most of the studies were conducted in developed countries, and still a few did so in emerging countries, especially in Indonesia. In fact, most financial systems in developing countries have heavy reliance on banking systems. Basically, diversification of banking in Indonesia has been longstanding. Initially, diversification began to grow through foreign banks that relied on fee-based income in its business activities. Moreover, diversification of banking can be used to deal with the fluctuations of the economy (Elsas *et al.*, 2010). The global financial crisis caused Indonesian banks to reduce the number of loans. Furthermore, Indonesian banks began to increase the growth of noninterest income. It showed the tendency of Indonesian banks to diversify during a global financial crisis. Therefore, this study aims to analyze whether diversification undertaken during the global financial crisis had an impact on the efficiency of Indonesian banks while also considering other factors such as the level of capital and the size of the bank. Based on these descriptions, this study provides significant research contributions.

First, studies related to a bank's diversification and efficiency have not had much of an impact on emerging markets. Indonesia is one of the world's emerging markets and has a banking industry with a lot of experience in dealing with financial crisis. During the monetary crisis in 1997–1998, Indonesia's banking industry experienced tremendous shocks but bounced back in a relatively short period of time. During the global financial crisis in 2007–2008, the banking industry in Indonesia remained relatively strong and stable to face the financial impact. Second, the business model of the Indonesian banks began to shift from traditional banking to modern banking, which has diversified its revenue.

This study found that diversification increases efficiency for Indonesian banks. In addition, this study also found that a good capital level can improve efficiency. Meanwhile, the size of banks and the global financial crisis does not significantly affect efficiency levels.

The remainder of the paper is structured as follows: Section 2 reviews the prior literature on diversification and efficiency in banking; Section 3 presents data sample, variables, and empirical research strategy; Section 4 discusses the empirical results; Section 5 concludes.

## LITERATURE REVIEW

### Bank Income Diversification

Tortosa and Ausina (2003) argued that a decline in traditional activities of the bank (lending and funding using the deposits) and the expansion of nontraditional activities such as fee-based service in United States' banks led to serious discussions on banking. The increase in revenues generated from net interest income indicates that a bank is concentrated on lending activities. Meanwhile, the increase in noninterest income shows that a bank offered diversification in its business. From a theoretical standpoint, a bank's decision to diversify income sources is desirable for improving efficiency and risk management. According to Klein and Saldenberg (1997), income diversification will improve the efficiency of the bank due to economies of scope. According to Pyndick and Rubinfeld (2013), a business would achieve an economies of scope condition when the joint output of a single firm is greater than the output that could be

achieved by two different firms, each producing a single product (with equivalent production inputs allocated between them). Therefore, diversification in various financial services was considered to increase a bank's profitability. Based on a bank's financial statements published by Bank Indonesia, noninterest income consists of commissions, provisions, fees and administrative, gain from investment in shares, foreign exchange transaction revenue, and other revenue. Sanya and Wolfe (2010) suggested four benefits of diversification: improvement in profitability and efficiency; hedging for insolvency risk of the bank; increase in a bank's intermediation function; and increase in competitiveness and innovation from the banking industry.

### Banking Efficiency

Coelli *et al.* (2005) argued that efficiency was a measure of the company's performance, which indicates how optimal a company is in converting inputs into outputs. The relationship between input and output can be described using frontier, which shows the level of efficiency. Frontier is the line that represents all possible combinations of input and output. Frontier also can be used as a proxy of the maximum output that can be produced using the company's inputs (resources) owned (Coelli *et al.*, 2005). The measurement of efficiency consists of a parametric and nonparametric approach. The familiar methods used to measure efficiency is stochastic frontier analysis (parametric) and data envelopment analysis (nonparametric).

Stochastic frontier analysis (SFA) is an alternative method for frontier estimation, which had an error term in two components, one to account for random effects and another to account for technical inefficiency. This model can be expressed in the following form:

$$\ln(Y_{it}) = X_{it}\beta + V_{it} - \mu_{it}$$

$$i=1, \dots, N \quad t=1, \dots, T$$

Where:

$Y_{it}$  is the production of the  $i$ -th firm in the  $t$ -th time period

$B$  is vector of unknown parameters

$X_{it}$  is output and input variables of the  $i$ -th firm in the  $t$ -th time period

$V_{it}$  is error term or random variables

$\mu_{it}$  is non-negative random variables, which are assumed to account for technical inefficiency

$V_i$  is the random error used to calculate the error and other random factors, such as weather, luck, and so on, the value of the output variable, along with the combined effects of input variables in the production function (Coelli *et al.*, 1998). While  $U_i$  is the other error components distributed independently of the  $V_i$  and describes the technical inefficiency. The value of the technical efficiency of the method is obtained from the error term components ( $V_{it}$  and  $U_{it}$ ).

### Diversification and Efficiency

Klein and Saldenberg (1997) argued that diversification would enhance the efficiency of the banks due to economies of scope. A business would achieve an economies of scope condition when the joint output of a single firm was greater than the output that could be achieved by two different firms, each producing a single product (Pyndick & Rubinfeld, 2013). Therefore,

diversification in the types of financial services is considered to increase a bank's profitability. Diversification also can help banks gain economies of scope via the deployment of fixed costs through product and region (Drucker & Puri, 2009). Through diversification, banks will be able to increase efficiency because, with fixed input costs, banks can generate more diverse output then efficiently increase profits with which to operate.

## DATA AND METHODOLOGY

The data used in this study relate to 102 commercial banks in Indonesia, consisting of four state-owned banks, 22 private nonforeign-exchange commercial banks, 29 private foreign-exchange commercial banks, nine foreign banks, 12 joint venture banks, and 26 local government banks (BPD). We obtained the data from income statements and balance sheets provided by the Indonesian Banking Directory. This study will be divided into two periods of research, namely, the pre-crisis (2001–2006) and crisis periods (2007–2009). As previously discussed, the global financial crisis in the United States allegedly affected the Indonesian banking industry.

### Research Model

The research model used in this study adopts from Claudia Curi *et al.* (2015). We made modifications to the model because Claudia Curi *et al.* (2015) only used foreign banks as research samples. This study aims to analyze whether diversification applied by commercial banks in Indonesia affect a bank's efficiency in regards to income diversification in the periods before and during the global financial crisis. The efficiency also will be influenced by some of a bank's special characteristics such as bank size and risk level. This study uses panel data for estimating the research model. Based on these items, we use the following empirical specifications:

$$TE_{i,t} = \alpha + \beta_1 IDIV_{i,t} + \beta_2 Logsize_{i,t} + \beta_3 ETA_{i,t} + \beta_4 Crisis_{i,t} + \mu_{i,t} \quad (1)$$

$i=1, \dots, n; t=1, \dots, T$

where

$TE_{i,t}$  is technical efficiency of bank  $i$  at time  $t$

$IDIV_{i,t}$  is the income diversification of bank  $i$  at time  $t$

$Logsize_{i,t}$  is logarithm of total assets of bank  $i$  at time  $t$

$ETA_{i,t}$  is the ratio of equity to total assets of bank  $i$  at time  $t$

$Crisis_{i,t}$  is the dummy variable for the global financial crisis.

### Measurement of Efficiency

The measurement of efficiency in this study uses stochastic frontier analysis (SFA). Data envelopment analysis (DEA) is not used in this study due to the efficiency generated, which is not affected by the error term and has a strong correlation with the explanatory variables. It can make the estimation produced biased, so that the score efficiency should be treated with bootstrap approach to be used as the dependent variable (Simar & Wilson, 2007).

We use an output-oriented measure to obtain the score of technical efficiency. This study uses the profit efficiency adopted from Vivas and Pasiouras (2010), which uses noninterest income as a variable output. Using the multiproduct translog specification, the profit function is given as

$$\begin{aligned} \ln \frac{|PBT|}{W3} = & \beta_0 + \beta_1 \ln(Q1) + \beta_2 \ln(Q2) + \beta_3 \ln(Q3) + \beta_4 \ln \left( \frac{W1}{W3} \right) + \beta_5 \ln \left( \frac{W2}{W3} \right) + \\ & \beta_6 \frac{1}{2} (\ln(Q1))^2 + \beta_7 \ln(Q1) \ln(Q2) + \beta_8 \ln(Q1) \ln(Q3) + \beta_9 \frac{1}{2} (\ln(Q2))^2 + \\ & \beta_{10} \ln(Q2) \ln(Q3) + \beta_{11} \frac{1}{2} (\ln(Q3))^2 + \beta_{12} \frac{1}{2} \left( \ln \left( \frac{W1}{W3} \right) \right)^2 + \beta_{13} \ln \left( \frac{W1}{W3} \right) \ln \left( \frac{W2}{W3} \right) + \\ & \beta_{14} \frac{1}{2} \left( \ln \left( \frac{W2}{W3} \right) \right)^2 + \beta_{15} \ln(Q1) \ln \left( \frac{W1}{W3} \right) + \beta_{16} \ln(Q1) \ln \left( \frac{W2}{W3} \right) + \\ & \beta_{17} \ln(Q2) \ln \left( \frac{W1}{W3} \right) + \beta_{18} \ln(Q2) \ln \left( \frac{W2}{W3} \right) + \beta_{19} \ln(Q3) \ln \left( \frac{W1}{W3} \right) + \\ & \beta_{20} \ln(Q3) \ln \left( \frac{W2}{W3} \right) + \beta_{21} T + \beta_{22} \frac{1}{2} T^2 + \beta_{23} \ln(Q1) \times T + \beta_{24} \ln(Q2) \times T + \\ & \beta_{25} \ln(Q3) \times T + \beta_{26} \ln \left( \frac{W1}{W3} \right) \times T + \beta_{27} \ln \left( \frac{W2}{W3} \right) + V_{i,t} - \mu_{i,t} \end{aligned} \quad (2)$$

where

*PBT* is profit before taxes of bank

*Q1* is output variable, namely, loans of bank

*Q2* is output variable namely other earning assets of bank

*Q3* is output variable namely non-interest income of bank

*W1* is cost of borrowed funds, calculated as ratio of interest expenses to customer deposits and short-term funding

*W2* is cost of physical capital calculated by dividing overhead expenses other than personnel expenses by the book value of fixed assets

*W3* is cost of labour calculated by dividing the personnel expenses by total assets

*T* is time or trend.

Berger and Mester (1997) argued that cost efficiency and profit efficiency were both important efficiency concepts. This study uses profit efficiency because the concept is better than cost efficiency, where profit efficiency includes the calculation of income and expenses. Measurement of profit efficiency will generate values between 0–1, where the greater value or close to 1 indicates banks are increasingly efficient in terms of profits.

### Income Diversification Index

Income diversification index is measured using the Herfindahl Hirschman Index (HHI). HHI is commonly used to measure market concentration and can be calculated by the formula

$$HHI = \sum_{i=1}^n Pi^2 \quad (3)$$

In the formula above, *Pi* is the portion of the sector *i*. The value of HHI cannot be smaller than 1/*n*, where 1/*n* indicates that the level of diversification is perfect. Meanwhile, if the HHI is equal to 1, it will indicate the level of perfect concentration (focus).

Following Elsas *et al.* (2010), this study modifies the Herfindahl Hirschman Index (HHI) to measure the index of income diversification. The following is the equation for the Herfindahl Hirschman Index for income diversification:

$$\text{Non interest income (Non)} = \text{CI} + \text{TRAD} + \text{OTH} \quad (4)$$

$$\text{Net Interest Income (Net)} = \text{Interest Income} - \text{Interest expense} \quad (5)$$

$$\text{Total Operating Income (TOI)} = \text{Non} + \text{Net} \quad (6)$$

$$IDIV_{i,t} = 1 - \left[ \left( \frac{non_{i,t}}{TOI_{i,t}} \right)^2 + \left( \frac{net_{i,t}}{TOI_{i,t}} \right)^2 \right] \quad (7)$$

where *non* is noninterest income, calculated by sum-commission income, trading income, and other income. Net interest income (NET) is calculated by subtracting interest income with interest expenses. Total operating income is the sum of noninterest income and net interest income, which is owned by the bank. Elsas *et al.* (2010) reduced the HHI from unity (1) to see the level of income diversification. Its value will range between 0–0.5, wherein the value of 0.5 indicates that the bank is fully diversified on income. It further means that, when the value of IDIV is closer to 0.5, the bank's diversified income comes from the four operations (interest income, commission income, trading income, and other operating income). Meanwhile, when the value of IDIV is lower or close to zero, the bank's business activities focus only on one operational activity (Elsas *et al.*, 2010).

## RESULTS

### Efficiency of Commercial Banks in Indonesia

Technical efficiency is used because it can describe the overall economic efficiency (Kumbhaker & Lovell, 2000). The highest score of technical efficiency was owned by PT Bank Mayapada International in 2004 with a value of 0.9606. This is because Bank Mayapada was able to optimize output using input prices that were relatively affordable.

Meanwhile, the lowest score of technical efficiency was owned by PT Bank Internasional Indonesia in 2001, with a score 3.20916E-09. BII decreased interest income and increased operating costs. This is because BII had decreased interest income and increased operating costs. It shows that, during the research period, PT Bank Mayapada International in 2004 was the most efficient bank, optimizing output for generate profit. Meanwhile, PT Bank Internasional Indonesia in 2001 was not able to efficiently optimize the number of ouputs that cause losses (inefficiency profit).

On the pre-crisis period, the efficiency of commercial banks showed mixed results. In 2001, The Bangkok Bank had the highest score efficiency. That was because The Bangkok Bank can generate output (loans, other earning assets, and noninterest income) that is quite large in the form of traditional activities as well as nontraditional using input prices (cost of borrowed funds, cost of physical capital, and cost of labor), which are relatively cheap. In contrast, Bank Internasional Indonesia (BII) had the lowest score efficiency in 2001 due to



the bank's profits before tax were in the negative (loss). The loss was caused by a decrease in interest income and a high increase in operating expenses. Bank Mayapada International had the highest efficiency score in 2002. Meanwhile, Artha Graha bank had the lowest efficiency score in 2002. The low efficiency score is due to the high cost of borrowed funds and the cost of physical capital owned. The high cost of borrowed funds is due to the higher interest expense than the number of three-party funds and certificates of deposits. Meanwhile, the high cost of physical capital due to overhead costs are greater than fixed assets owned by the bank. In 2003, The Bangkok Bank had the highest score efficiency due to the cheap input costs that helps banks to generate maximum output and be more efficient. Meanwhile, Bank Negara Indonesia (BNI) had the lowest score efficiency because the total labor cost is quite high. The labor costs owned by BNI also are relatively high compared with those of other banks. It makes BNI inefficient in generating profits from output (loans, other earning assets, and noninterest income) owned. Additionally, BNI also experienced an increase in operating expenses, resulting in profits before a tax decrease.

From 2004 to 2008, Mayapada International, Windu Kentjana, Resona, Victoria Internasional, and ICBC had the highest efficiency score. Resona Perdania bank was the most efficient bank again in 2009. This is because Resona Perdania Bank was able to produce a number of outputs (loans and other earning assets) greater than the number of inputs (third party funds and certificates of deposit), which generated larger net interest. Meanwhile, Maluku bank, Deutsche Bank, Royal Bank of Scotland, Bank Andara, and Anz Panin Bank had the lowest score efficiency in 2004 to 2009. Deutsche Bank had the lowest score efficiency twice, in 2005 and 2007.

Table 1. Descriptive Statistics of Indonesian Banks Score Efficiency

Score Efficiency	Pre-Crisis						Crisis		
	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean	0.625	0.572	0.579	0.633	0.522	0.563	0.596	0.597	0.619
Std.Deviation	0.169	0.166	0.171	0.158	0.236	0.139	0.139	0.146	0.146
Median	0.650	0.595	0.569	0.622	0.499	0.542	0.580	0.576	0.602
Minimum	3.2E-09	0.190	0.151	0.292	0.059	0.313	0.332	0.285	0.345
Maximum	0.913	0.886	0.911	0.961	0.943	0.880	0.908	0.916	0.921

Note: Descriptive statistics of Indonesian banks efficiency scores are obtained using stochastic frontier analysis. Each year consists of 102 banks and divided into the pre-crisis period and crisis period. Its score will range between 0–1; getting close to 1 indicates banks are more efficient. Sources: Own calculations.

In 2005, Deutsche Bank suffered a loss in profit before taxes due to higher operating expenses compared with operating income. In addition, the cost of borrowed funds and the cost of physical capital owned are higher than those of other banks. In 2007, Deutsche Bank had a high cost of physical capital caused by overhead expenses, which were much greater than the number of its fixed assets. In addition, the number of third-party funds and certificates of deposit held by Deutsche Bank are much higher than the total loans. It caused the Deutsche Bank to have higher interest expenses and become less efficient. The average of the total efficiency score of commercial banks in Indonesia in 2001–2009 amounted to 0.5894. This demonstrates that commercial banks in Indonesia had potential profit until 58.94 percent with



good management held by the banks, whereas 41.06 percent became inefficient banks.

From the above explanation, it can be concluded, on the period of pre-crisis and crisis, that the causes of inefficiency are quite varied. Sources of inefficiency in several banks come from the cost of borrowed funds and costs of physical capital. BUSN nonforeign exchange and foreign exchange, foreign banks, and joint venture banks are types of banks that typically suffer inefficiency due to the high cost of physical capital and the cost of borrowed funds. The high costs of borrowed funds due to third-party funds owned by banks is greater than the amount of the loan. It will increase interest expenses and increase the cost of borrowed funds.

Meanwhile, the high cost of physical capital will force a bank to suffer inefficiency due to higher input prices. In state-owned banks such as BNI, the high cost of labor can be a cause of inefficiency. The higher personnel expenses than total assets will cause the price of inputs (labor) to be high.

### **Income Diversification Index**

The income diversification index consists of net interest income and noninterest income. Noninterest income is derived from the sum of commission income, provision, and fees, securities trading and foreign exchange, and other income. According to Elsas *et al.* (2010), the low or close-to-zero value of income diversification index shows that banks only focus on the operating income. Meanwhile, banks with diversified income will show a higher value of income diversification index or approaching to 0.5, which indicates that the bank is fully diversified in its income.

In this study, the mean (median) is used to classify a bank that is focused and diversified. A middle value (median) is used because it does not absorb extreme values, so the results are not affected by the extreme values. On the other hand, the value of the average (mean) is still affected by the presence of extreme values in its calculations. Banks with a higher income diversification index than the mean (median) are categorized as relatively diversified in their income. Meanwhile, a focused bank is a bank with a lower income diversification index, which lies below the mean (median).

Standard Chartered Bank owned the highest value of average income diversification index in 2003, 2004, 2007, and 2008, with an index of 0.500. Meanwhile, PT Bank Mayapada International had the lowest average value in 2001 with an income diversification index of -1446. Negative income diversification index experienced by Bank Mayapada was due to the net interest income earned, which has a negative value as a result of higher interest expense than interest income.

On average, in a period of pre-crisis and crisis, conventional commercial banks in Indonesia remain relatively diversified in their income. BTN, Standard Chartered, Commonwealth Bank, Bank DKI, Bank of America, and Royal Bank of Scotland had the highest value of income diversification index during the study period. In contrast, Mayapada, Ina Perdania, Kesejahteraan Ekonomi, Tabungan Pensiunan Nasional, and Royal Indonesia had the lowest value of index diversification income.

In 2002, 2004, 2007, and 2008, Standard Chartered had the highest value of income diversification index. It shows that the bank Standard Chartered diversified its income or did not rely on just one business activity.

The highest noninterest income owned by Standard Chartered comes from commission income, provision, and fees, which are commission income and provisions resulting from derivative transactions as well as net fees resulting from credit management (Siamat, 2005). In 2001 and 2002, PT Mayapada International, Deutsche Bank, and PT Bank Ina Perdana had a negative value of index diversification index at -1446, -0828, and -0354, respectively. The negative value occurred because these banks suffered losses on net interest income. These losses are due to interest expenses greater than the interest income earned by both banks, resulting in low and negative value of income diversification index of total operating income obtained.

In the pre-crisis period, banks that prefer to focus on earnings is BUSN banks with nonforeign exchange and regional development banks. Whereas for the state-owned banks, BUSN banks with foreign exchange, foreign banks, and joint venture banks prefer to diversify their income. It was not much a different in the crisis period, but some nonforeign-exchange BUSN banks have just begun to diversify their earnings. For state-owned banks, Bank Rakyat Indonesia (BRI) was the only bank that chose to focus on earnings during the pre-crisis and crisis. It can be seen from the vigorous activity of BRI by lending for small and medium communities as well as SMEs. BPD DKI Jakarta was the only regional development bank that always diversifies its revenue during a pre-crisis and crisis. Large foreign-exchange banks such as BCA, CIMB Niaga, UOB, BII, Danamon, and OCBC NISP tend to diversify during pre-crisis and crisis periods. In a period of crisis, none of the foreign banks chose to focus; in other words, foreign banks prefer to diversify their income.

Table 2. Descriptive Statistics of Income Diversification Index

IDIV	Pre-Crisis					Crisis			
	2001	2002	2003	2004	2005	2006	2007	2008	2009
Mean	0.198	0.207	0.221	0.219	0.226	0.212	0.225	0.218	0.218
Median	0.176	0.185	0.171	0.184	0.199	0.182	0.192	0.181	0.182
Std.Deviation	0.243	0.157	0.143	0.134	0.150	0.122	0.127	0.129	0.130
Minimum	-1.446	-0.354	0.019	0.016	0.004	0.022	0.020	0.009	0.009
Maximum	0.500	0.499	0.500	0.498	0.500	0.500	0.500	0.500	0.500
N data	102	102	102	102	102	102	102	102	102

Note: Income diversification index is calculated using the HHI equation modified by Elsas et al. (2010). Its value will range between 0–0.5, getting close to 0 indicates bank focus on its one business activity. Meanwhile, 0.5 shows that the bank fully diversified its business activities. Sources: Own calculations.

Based on the above presentation, it can be concluded that the number of banks that do focus and diversify were relatively the same during the study period. BUSN nonforeign exchange and regional development banks mostly focused on traditional activities to generate interest income. It showed that both banks are active in lending to the public. Meanwhile, other banks such as Persero Bank, BUSN foreign exchange, foreign banks, and joint venture banks engaged in a lot of diversification in its business activities. It shows that all four types of banks diversify their operations. Judging from their characteristics, four types of banks have a wholesale business model, where dependence on third-party funds is low, so the bank attempts to find other sources of income in its own business activities.

## Regression Analysis Results

This study did regression to analyze the effects of diversification on the efficiency of commercial banks in Indonesia. In addition, this study also analyzed the effect of the characteristics of banks, consisting of size and level of bank capital on the efficiency of the bank. In the regression results, income diversification index is symbolized by IDIV, which significantly and positively affects a bank's efficiency level. The coefficient of 0.07985 indicates that income diversification undertaken by conventional commercial banks in Indonesia would provide an increase in efficiency by 0.07985. These results support the research results; Klein (1997) claimed that the diversification of income would increase the efficiency of banking due to the economies of scope. According to Pyndick and Rubinfeld (2013), economies of scope are circumstances when the combined output of a company was greater than the output of two companies that produced the same goods. Thus, diversification of banking in Indonesia is how a bank can obtain larger output while providing diverse financial products and services than other banks that produce such financial products separately. More variety and breadth of financial services owned by banks will increase revenue. This increase will then affect the level of profits earned by the bank. With the same amount of inputs, the bank will receive additional output when doing diversification, which will increase levels of efficiency. In addition, the results of this study also were supported by the findings of Kohler (2013), which stated that the increase in noninterest income will create a diversified revenue structure of banks, so that they would have a lower risk and remain more robust when facing uncertain economic situations. Vivas and Pasiouras (2010) found that the addition of nontraditional activities (diversification) as a variable output would generate higher profit efficiency than by not adding it. This then shows that the diversification of income done by conventional commercial banks will increase a bank's efficiency.

Pardamean (2013) also found that the addition of noninterest income in the output variables done by commercial banks in Indonesia would increase the efficiency of profits. The finding emphasized that the diversification in income would increase the efficiency of commercial banks in Indonesia.

The size of the bank, symbolized by *logsize*, does not significantly affect the bank's efficiency level. Although it is not significant, a negative coefficient indicates the direction that the bigger banks will lead banks to become more inefficient. This finding was similar to results found by Viverita and Ariff (2011), stating that the size of the bank would significantly decrease profits. However, in regards to the negative effects on cost-efficiency, bank size was not statistically significant. Gasaymeh (2016) found that the relationship between total assets and bank efficiency was negative but insignificant. It showed that large banks would suffer diseconomies of scale. In the long term, the major banks would experience higher increase in cost.

Meanwhile, competition between banks will help small banks to survive by increasing efficiency. Ariff and Can (2008) also found that medium- and small-sized banks are more efficient than large-sized banks. The negative impact of the size of these banks can be caused by bureaucracy and other reasons that can hamper a bank's efficiency.

The ratio of equity to total assets (ETA) showed a significant positive impact on the efficiency level. It shows that the better the capital level of a bank, the more efficient the bank would be. Naceur and Kandil (2009) stated that a good capital level of banks would make a bank have a low cost to bear a debt, a smaller possibility of bankruptcies, and low funding costs. All three items show that a good bank's capital management will lower the risk experienced by the bank. In this study, the ratio of equity to total assets may only be a portrait to the level of risk in terms of capital. According to Peraturan Bank Indonesia No. 11 / 25 / PBI / 2009, bank-owned business risks can lead to credit, operational (fraud), market, strategic, legal, compliance, liquidity, and reputation risks.

Table 3. Panel Data Regression Results

Variables	Model		
	PLS	Random Effect	Fixed Effect
Constanta	0.537*** (13.03)	0.5924*** (13.77)	0.5377*** (13.07)
IDIV	0.0798* (1.83)	0.0125 (0.27)	0.0798* (1.83)
LogSize	-0.00413 (-0.62)	-0.00493 (-0.73)	-0.00413 (-0.62)
ETA	0.4626*** (6.97)	0.1565** (2.07)	0.4626*** (6.99)
Krisis	0.0095 (0.8)	0.0192** (2.19)	0.0095 (0.8)
R-squared	5,99 percent	4,81 percent	5,98 percent
Breusch Pagan LM-Test (PLS VS REM)		Chi-square Prob > chi-square	883.01 0.00000
Hausman Test (FEM VS REM)		Chi-square (4) Prob > chi-square	11.11 0.0254

Note: We used fixed generalized least squares to estimate the research model. \*\*\*, \*\*, \* stand for statistically significant at 1 percent, 5 percent, and 10 percent, respectively. Sources: Author calculations.

Some of these risks can be measured by nonperforming loans as well as Tier 1 capital ratio (the specifications of Basel II). However, this study only measured the impact of the solvency risk (capital) on the level of efficiency. Crisis as a dummy variable indicates an insignificant efficiency. It shows that the global financial crisis (2007–2009) did not affect the efficiency level of banking in Indonesia. At the global financial crisis in 2008, banks in Indonesia had better fundamentals than during the crisis of 1998. This was shown by the increase in the BI rate, good CAR management, and an increase in limit guarantee on deposits by the deposit insurance agency (LPS).

## CONCLUSION

The study aims to analyze the influence of income diversification on the efficiency level of conventional commercial banks in Indonesia, in the pre-crisis period (2001–2006) and the global financial crisis (2007–2009). This study measures income diversification using HHI index and measures the efficiency with the approach of stochastic frontier analysis (SFA). The efficiency value obtained using SFA was put into a research model and then used to analyze the effect of diversification on the efficiency level.

This study offers quite a few insights. First, the levels of efficiency among banks that focus and diversify have differences in the period before and during the global financial crisis. In each of these periods, banks that diversify have higher efficiency levels than banks that focus.

Second, diversification revenue significantly affects efficiency level. Positive coefficient values indicate that the diversification of revenue will increase efficiency before and during a global financial crisis.

Furthermore, it was found that the size of the banks did not significantly affect efficiency levels. Negative coefficient values indicate that the bigger the bank, the lower the efficiency level. Then, the capital level significantly affects efficiency levels. Positive coefficient values indicate that a better capital level of a bank will improve its efficiency before and during a global financial crisis.

Overall, this study suggests the management of commercial banks to optimize diversification would increase bank performance. Diversification of revenue can be done through the deployment of business activities in a bank's four operating incomes: interest income; trading income (securities and foreign exchange); other operating income; and provisions, commissions, and fees. Banks can earn revenue through activities such as securities brokerage, investment banking, and insurance selling (bancassurance). In addition, by utilizing the development of technology, banks also can provide Internet banking services and electronic payments. Diversification activities of bank revenues in Indonesia need to be done so that banks will be more efficient in their operations. Regulators also are expected to create a policy that directs the activities of commercial banks to diversify their revenue sources. Bank Indonesia's regulations concerning operations and office networks (BUKU) can be a tool to drive the business model of commercial banks in Indonesia to diversification. Bank Indonesia (2012) imposed limits on the business activities undertaken by banks BUKU 1 and BUKU 2. Banks included in both of those categories can only perform basic activities or transactions using Indonesian rupiah (IDR). Meanwhile, banks BUKU 3 and BUKU 4 have flexibility in their business activities. Banks included in both categories have an extensive scope, which helps them to diversify business activities. Accordingly, this study suggests that Bank Indonesia should reduce limits given on banks BUKU 1 and BUKU 2. Thus, banks included in the BUKU 1 and BUKU 2 also can diversify activities on their earnings.

This study also provides additional empirical studies on the relationship between diversification and efficiency that, so far, have not reached a consensus.

Further study can add efficiency-level measurements using a nonparametric approach and also include cost-efficiency calculations. In addition, further study may add another proxy to describe the level of risk for a bank as well as using other measurements that are more relevant

in order to ascertain revenue diversification in conventional commercial banks in Indonesia, one of them by using a threshold in the kernel density estimator.

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