Future Business Journal

RESEARCH Open Access

The impact of size on income diversification: an empirical study on commercial banks in Vietnam

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Abstract

Banks are the engine of the economy. Therefore, bank performance has a direct impact on the development and security of the entire economy. The main source of income for commercial banks comes from lending and capital mobilization activity. Competition in the banking industry is increasingly fierce, not only among domestic banks but also with foreign banks. Thus, banks are trying to diversify their income sources, especially from non-interest activity. Most previous studies study the relationship between the bank's income diversification and the increase in the proportion of income from non-interest products and services. However, the relationship between income diversification and bank scale has not been studied as much. This paper examines the relationship between income diversification and commercial bank size in Vietnam. The study applies a panel data regression model with a sample of 23 commercial banks in Vietnam in the period 2012–2020, using the generalized least squares method to overcome variable variance and autocorrelation in the research model. Our results show that bank size has a positive impact on the degree of income diversification. At the same time, size has a larger impact on income diversification at large banks than small banks. Therefore, smaller banks need to concentrate on developing modern technology systems as well as improving the quality of personnel and operating experience rather than investing in new products and services. Further research may expand to include commercial banks of countries or regions in order to get a deeper look at the impact of size and some economic factors on income diversification.

Keywords Bank income diversification, Bank size, Commercial banks

Introduction

The main sources of income for commercial banks are lending and mobilizing capital. Because of increasing competitive pressure from other financial institutions, the rapid development of technology, and increasing demands and requirements by customers, banks have continuously developed new financial services to increase their income. In fact, banks around the world have combined many innovations in business strategy to increase income from nontraditional activities. In particular, at US banks, non-interest income accounted for 43 percent of net operating revenue in 2001 compared with only 25 percent in 1984 [30]. From 1980 to 2001, non-interest income in US commercial banking increased from 0.77 percent to 2.39 percent of total banking industry assets and from 20.31 percent to 42.20 percent of the total operating income of the banking industry [7]. In Italy, the interest income of commercial banks fell from 3 percent in 1993 to 1.8 percent in 2003 whereas non-interest income increased from about 1 percent to 1.4 percent of total assets [5]. In Africa, the proportion of

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banks' non-interest income on total revenue increased from 34 percent in 1996 to 43 percent in 2014. This figure is higher than in most developed countries as well as other emerging markets [25]. Data on commercial banks in China from 2008 to 2016 shows that they have actively implemented diversification strategies. Their financial statements show that profit increasingly comes from non-interest activities [17]. According to theglobaleconomy.com, as of 2017, the 20 Asian countries with the highest proportion of non-interest income have a proportion of non-interest income of from 33.5 percent (Oman) to 75.6 percent (Iran). In 2017, among the top 20 European countries, this figure ranges from 42.59 percent (Slovenia) to 78.67 percent (Andorra). In Vietnam, the ratio of non-interest income to total income was 14.61 percent in 2012 and increased to 25.05 percent in 2017.

These statistics show that non-interest income plays a very important role, greatly influencing current bank operations. Most previous studies on this issue discuss the relationship between income diversification and the increasing proportion of income from non-interest products and services [5, 7, 20, 21]. In Vietnam, commercial banks have accelerated the implementation of income diversification strategies for more than a decade. This is an important issue in commercial bank operations, so many studies look at the issue of income diversification, such as Ho and Vo [16], Nguyen et al. [26], and Quyen [27]. However, not many studies have been conducted on the direct relationship between size and income diversification at commercial banks in Vietnam. Thus, the study is with the main to explore the correlation between bank size and income diversification as well as to provide implications for commercial banks in dealing with the subject matter.

Literature review

Commercial banks and sources of income

In Vietnam, joint-stock commercial banks are divided into state-owned and private commercial banks. According to Decree 59/2009/ND-CP, a commercial bank is entitled to perform all banking functions and other related business activities for the purpose of earning profit in accordance with the Law on Credit Institutions. This decree also defines a state commercial bank as a commercial bank for which the state owns more than 50 percent of charter capital and a joint-stock commercial bank as a commercial bank organized in the form of a joint-stock company.

Bank income comes from lending, investment, service provision, and other activities. Specifically, income from lending activities means interest on loans to customers. Income from investment includes trading securities, investment securities, capital contributions to buy shares, and income from foreign exchange. Income from service provision comes from the provision of payment, guarantee, and asset management services and insurance. Income from other activities often comes from unusual income that the bank does not plan and does not perform on a regular basis, such as the liquidation or sale of assets or penalties for a breach of contract. In general, based on the characteristics of business activities, the sources of bank income can be divided between interest and non-interest income. Interest income is the difference between interest income from lending activities and the cost of raising capital. Non-interest income is not directly related to lending activities and includes service fees collected on deposit accounts other service fees [7]. In Vietnam, the ratio of non-interest income is mentioned in reports that analyze and evaluate commercial bank operations. When this ratio is higher, the bank's diversification of non-interest products and services is shown more clearly and so is the dispersion of risk between bank products and services. But when this ratio is lower, a bank's business activities are more limited, or the commercial bank is heavily dependent on traditional credit services.

The diversification of commercial bank income

According to Ansoff [3], the term "diversification" is often associated with a change in the characteristics of a company product line or market. Diversification often requires new skills, new technologies, and new facilities. As a result, it leads to changes in the structure of the business, which represents a difference from past experience. The diversification of bank income is explained by internal changes in non-interest income and interest income.

Stiroh and Rumble [31] argue that income diversification by commercial banks is due to the conversion of traditional activities with income from interest to business activities that charge fees, taking income from other non-interest activities. According to Mercieca et al. [23], income diversification activities by banks are income-generating activities through the development of diversified products and services from traditional interest or non-interest activities or a combination of the two activities at the same time. According to Lee et al. [19], the level of income diversification is based on the type of income structure. Basic bank income consists of interest income, commission income, income from transaction fees, and other income. At the same time, Nguyen et al. [25] argue that income diversification demonstrates that banks seek additional sources of income to increase their revenue by developing additional income sources from nontraditional services. In general, through product diversification and revenue streams, banks strengthen

the role of transaction arbitrators. Also, income diversification reduces the risk of a financial crisis due to the rapid growth of credit [12, 13].

Theory of economies of scale

Economies of scale implies that larger the business, the more the cost savings. Dietsch [8] demonstrates the existence of economies of scale in the French banking industry. Clark and Speaker [6] show that banks can gain efficiency from increased size and overall operation. Allen and Liu [1] confirms, with unchanged business conditions, on average banks can save costs by at least 6% by doubling their scale. Elsas et al. [10] find the existence of economies of scale and scope in banks exploited through revenue diversification. In addition, while large banks can increase systemic risk, they can also provide efficiency benefits, such as the ability to better provide some other financial services needed to realize economies of scale [18]. Through the above studies, it can be seen large banks are in more advance position in performing activities than small banks including income diversification.

Hirshmann–Herfindahl index (HHI)

Sanya and Wolf [28], Chiorazzo et al. [5], Ferreira et al. [11], Mercieca et al. [23], Stiroh and Rumble [31], Stiroh [30], and Brighi and Venturelli [4] used the Hirshmann–Herfindahl Index (HHI), as a basis for measuring the level of income diversification. HHI is measured with the following equation:

$$\mathrm{HHI} = \left(\frac{\mathrm{NON}}{\mathrm{NETOP}}\right)^2 + \left(\frac{\mathrm{NET}}{\mathrm{NETOP}}\right)^2$$

where NON is non-interest income, NET is interest income, and NETOP is total bank income.

After the value of HHI is obtained, the level of income diversification is calculated by following equation:

$$\mathrm{REV} = 1 - \mathrm{HHI}$$

The diversification index (REV) takes a value from 0.0 to 0.5. A value of 0.5 represents full diversification of bank income, and a value of 0.0 is the lowest level of income diversification [5, 31].

Research hypotheses

Bank size and income diversification

Large banks benefit from broader investment opportunities, including better access to capital [7, 17, 29]. The combination of experience, scale, and expertise enables larger banks to tap into the potential for diversification [7]. Nguyen et al. [24] show that larger banks have more experience and expertise in using advanced technology to facilitate the development of nontraditional services. Nguyen et al. [24] also suggest that bank size increases the influence of banks in negotiating with customers, thereby helping banks to expand opportunities for developing nontraditional areas of operation. Therefore, with the advantage of scale, diversified banks have stabler sources of income. This variable is measured as the natural logarithm of total assets and is used by DeYoung and Rice [7], Jiang and Han [17], Lepetit et al. [20, 21], Mercieca et al. [23], and Nguyen et al. [24, 25], in researching the same issue.

Hypothesis 1a (H1a) *Ceteris paribus, bank size as measured by the natural logarithm of total assets is positively correlated with the degree of income diversification of commercial banks in Vietnam.*

In addition to using the natural logarithm of total assets, to compare the impact of size on income diversification between large and small banks, we also distinguish banks by size into two groups: large and small. Large banks have total assets worth VND 100 trillion (equivalent to 4.2 billion USD at the exchange rate of $1 = VND23,620 on February 2023) or more and are generally said to be more inclined to engage in diversification [21]. Small banks are exposed to higher risk as their proportion of income from commissions and fees increases [20]. They also face challenges in employing diversification strategies because of their lack of expertise, available capital, and sufficient market share to take advantage of these strategies [27]. Mercieca et al. [23] argue that small banks can raise their operational efficiency by expanding resources in their existing traditional business lines, rather than expanding into other activities.

Hypothesis 1b (H1b) Ceteris paribus, the size of small banks is negatively correlated with the degree of income diversification of commercial banks in Vietnam.

The ratio of equity to total assets and income diversification

Customers might view banks with a low ratio of equity to total assets as too risky, affecting the earning capacity of these banks [20, 21]. Banks are likely to engage in nontraditional activities if they have a high ratio of equity to total assets [24]. In addition, increasing equity tends to promote income diversification [22].

Hypothesis 2 (H2) Ceteris paribus, the ratio of equity to total assets is positively correlated with the degree of income diversification of commercial banks in Vietnam.

Loan ratio and income diversification

The loan ratio is determined by the ratio of total outstanding loans to customers to total bank assets. This ratio is used by Ho and Vo [16], Lepetit et al. 20, 21, Stiroh [30], Mercieca et al. [23], and DeYoung and Rice [7]. In general, banks with a larger share of income from non-interest activities are less dependent on traditional intermediary activities, such as deposits and loans [20, 21]. Net margins, loans, and deposits represent traditional operations, so they are thought to have an inverse relationship with income diversity [16]. Banks with strong lending strategies rely on interest income, rather than non-interest income [7].

Hypothesis 3 (H3) Ceteris paribus, the loan ratio is negatively correlated with income diversification of commercial banks in Vietnam.

Capital mobilization rate and income diversification

The bank capital mobilization ratio is calculated as the total mobilized capital to total debt and has been used in the studies of Ho and Vo [16], Ammar and Boughrara [2], and Lepetit et al. [20]. A bank with a prominent level of non-traditional activity leads to a smaller proportion of income from traditional activity. Loans and deposits represent interest-related activities, so they are thought to be negatively correlated to income diversity [16, 20].

Hypothesis 4 (H4) Ceteris paribus, the capital mobilization ratio is negatively correlated with income diversification of commercial banks in Vietnam.

Liquidity ratio and income diversification

This ratio represents a bank's liquidity risk, calculated as the amount of highly liquid assets divided by total assets. This ratio is used by Meng et al. [22], Ho and Vo [16], Ammar and Boughrara [2], Duho et al. [9], and Quyen et al. [27]. Meng et al. [22] find a positive association between liquidity risk and higher non-interest income, implying that lower liquidity from lending activities is the driving force for banks in developing new non-interest products and services. Meanwhile, according to Duho et al. [9], banks that engage in income diversification are exposed to more liquidity risk based on the fact that they hold less cash and cash equivalents.

Hypothesis 5 (H5) Ceteris paribus, the liquidity ratio is negatively correlated with income diversification of commercial banks in Vietnam.

Net interest margin and income diversification

Next, we look at the bank's net interest margin (NIM), which is measured by the net interest income on total earning assets [2, 21, 22, 24]. Banks with a high rate of income from fees lend at low interest rates, thereby leading to a decrease in net interest income and a lower NIM [21]. Nguyen et al. [24] also find a negative and significant coefficient between the NIM and bank income diversification.

Hypothesis 6 (H6) Ceteris paribus, the NIM is negatively correlated with the degree of income diversification of commercial banks in Vietnam.

Cost efficiency and income diversification

In previous studies, cost efficiency is calculated as total costs divided by total income [2, 16, 24, 27]. Specifically, Nguyen et al. [24] identify that more cost-effective banks also earn higher income from non-interest activities. Bank size and cost effectiveness are found to have a positive relationship with income diversity because larger banks tend to have more nontraditional activities and then generate more non-interest income [16].

Hypothesis 7 (H7) Ceteris paribus, cost efficiency is negatively correlated with income diversification of commercial banks in Vietnam.

Nonperforming loans (NPL) and income diversification

Nonperforming loans (NPL) is measured by the ratio of total bad loans to total outstanding loans and is often used by studies to evaluate the effect of credit quality on a bank's ability to diversify income [20, 24, 25]. Banks are likely to engage in nontraditional activities if they are exposed to high credit risk. This suggests that customers prefer less risky banks, thus enabling them to generate revenue through nontraditional business activities [20, 24].

Hypothesis 8 (H8) Ceteris paribus, nonperforming loans are positively correlated with income diversification of commercial banks in Vietnam.

Methods

Based on previous studies, such as those by Nguyen et al. [24, 25], DeYoung and Rice [7], Meng et al. [22], Duho et al. [9], and Ho and Vo [16], we construct a

Table 1 Definition of variables

Variables	Label	Measurement	Expected sign	Previous studies
A. Dependent variable				
REV	Income diversification index	$1-\left[\left(\frac{NON}{NETOP}\right)^2+\left(\frac{NET}{NETOP}\right)^2\right]$		Brighi and Venturelli [4], Chiorazzo et al. [5], Ferreira et al. [11], Mercieca et al. [23], Sanya and Wolf (2011), Stiroh [30], Stiroh and Rumble [31]
B. Independent variables				
SIZE	Bank size	Log (Total assets)	+	DeYoung and Rice [7], Duho et al. [9], Meng et al. [22], Mercieca et al. [23], Nguyen et al. [24, 25]
SIZE1	Bank size	Bank with total assets of less than VND 100 billion = 1; otherwise, 0	–	Chiorazzo et al. [5], DeYoung and Rice [7], Hidayat et al. [15], Lepetit et al. [20, 21], Mercieca et al. [23], Nguyen et al. [24]
C. Control variables				
EQT	Ratio of equity to total assets	$\frac{\text{Total equity}}{\text{Total assets}}$	+	Ho and Vo [16], Meng et al. [22], Nguyen et al. [24, 25]
LA	Loan ratio	$\frac{\text{Total outstanding loans to customers}}{\text{Total assets}}$	–	DeYoung and Rice [7], Ho and Vo [16]
DPS	Capital mobilization rate	$\frac{\text{Total mobilized capital from customers}}{\text{Total liabilities}}$	–	Ho and Vo [16]
LIQ	Liquidity ratio	$\frac{\text{Liquid assets}}{\text{Total assets}}$	–	Duho et al. [9], Meng et al. [22]
NIM	Net interest margin	$\frac{\text{Net interest income}}{\text{Total earnings asset}}$	–	Ho and Vo [16], Lepetit et al. [21], Nguyen et al. [24, 25]
EFF	Cost efficiency	$\frac{\text{Total operating costs}}{\text{Total revenue}}$	–	Ho and Vo [16], Nguyen et al. [24, 25]
NPL	Nonperforming loans	$\frac{\text{Total nonperforming loans}}{\text{Total loans}}$	+	Nguyen et al. [24]

research model on the effect of bank size on income diversification as follows:

$$\mathrm{REV}_{i,t} = \beta_0 + \beta_1 \mathrm{SIZE}_{i,t} + \beta_2 \mathrm{EQT}_{i,t} + \beta_3 \mathrm{LA}_{i,t} + \beta_4 \mathrm{DPS}_{i,t} + \beta_5 \mathrm{LIQ}_{i,t} + \beta_6 \mathrm{NIM}_{i,t} + \beta_7 \mathrm{EFF}_{i,t} + \beta_8 \mathrm{NPL}_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\mathrm{REV}_{i,t} = \beta_0 + \beta_1 \mathrm{SIZE1}_{i,t} + \beta_2 \mathrm{EQT}_{i,t} + \beta_3 \mathrm{LA}_{i,t} + \beta_4 \mathrm{DPS}_{i,t} + \beta_5 \mathrm{LIQ}_{i,t} + \beta_6 \mathrm{NIM}_{i,t} + \beta_7 \mathrm{EFF}_{i,t} + \beta_8 \mathrm{NPL}_{i,t} + \varepsilon_{i,t} \quad (2)$$

Table 1 defines the variables, listing prior studies that we used as references.

Research data

Vietnam has a total of 49 banks, made up of 4 state-owned commercial banks, 31 joint-stock commercial banks, 9 fully foreign-owned banks, 2 policy banks, 1 cooperative bank, and 2 joint venture banks. However, only commercial banks listed on the stock exchange provide full data for our research model. In the data collection process, after the banks with insufficient disclosure and information were omitted, 23 joint-stock commercial banks were identified as suitable for the research. The final sample consists of 207 observations for the period 2012–2020. The selection starting point of 2012 is aligned with the issue of Decree 57/2012/ND-CP categorizing for commercial bank incomes in Vietnam. The data come from financial statements, annual reports, and prospectuses publicly disclosed by commercial banks in Vietnam.

Results and discussion

Descriptive statistics

Table 2 lists the descriptive statistics, and Table 3 gives the mean of the variables for each year over the period 2012–2020.

In Table 2, the standard deviation of the variables is low: the highest is 1.1267 (SIZE) and the lowest is 0.0128 (NIM). REV has a statistical mean value of 0.2656, with a minimum of 0.0506 and a maximum of 0.4916. The statistical results show that the average diversification by banks is steadily increasing over the period studied, which demonstrates that banks are actively promoting diversification to reduce dependence on traditional activities.

Bank size (SIZE) has an average statistical value of 32.5913: the lowest is 30.3178, and the highest is 34,9553.

Table 2 Descriptive statistics of the variables

Variable	Obs	Mean	Std. Dev.	Min.	Max.
REV	207	0.2656	0.1140	0.0506	0.4916
SIZE	207	32.5912	1.1267	30.31783	34.9553
SIZE1	207	0.3478	0.4774	0	1
EQT	207	0.0884	0.0380	0.0269	0.2383
LA	207	0.5838	0.1158	0.2252	0.8006
DPS	207	0.6907	0.1009	0.4140	0.8937
LIQ	207	0.0154	0.0130	0.0026	0.0829
NIM	207	0.0294	0.0128	0.0043	0.0872
EFF	207	0.5408	0.1311	0.2874	0.9273
NPL	207	0.0213	0.0135	0.0033	0.0880

Table 3 Mean value of the variables, 2012–2020

	2012	2013	2014	2015	2016	2017	2018	2019	2020
REV	0.221	0.252	0.262	0.268	0.255	0.276	0.292	0.278	0.286
SIZE	31.98	32.16	32.32	32.43	32.60	32.77	32.87	33.01	33.14
SIZE1	0.478	0.478	0.435	0.391	0.348	0.304	0.304	0.217	0.174
EQT	0.115	0.100	0.090	0.089	0.082	0.077	0.080	0.081	0.081
LA	0.515	0.515	0.525	0.575	0.596	0.613	0.631	0.644	0.641
DPS	0.623	0.664	0.701	0.727	0.720	0.689	0.690	0.697	0.706
LIQ	0.021	0.016	0.018	0.014	0.013	0.014	0.013	0.014	0.017
NIM	0.037	0.028	0.026	0.028	0.028	0.028	0.029	0.030	0.030
EFF	0.556	0.594	0.555	0.558	0.559	0.533	0.525	0.506	0.482
NPL	0.035	0.029	0.022	0.017	0.020	0.019	0.017	0.016	0.017

Average bank size shows a trend of continuous and stable growth throughout the research period. The average EQT is 0.0884, with a minimum of 0.0269, a maximum of 0.2384, and a standard deviation of 0.038. The average EQT of banks decreases year by year over the period 2012–2017 and then remains stable in the period 2017–2020. LA has a mean of 0.5838, a minimum of 0.2253, and a maximum of 0.8006. The average lending rate shows steady growth over the period 2012–2019 and slows down in 2020. DPS has an average of 0.6908, a minimum of 0.4141, and a maximum of 0.8937.

The average DPS of banks does not show a clear of trend of increasing or decreasing. It increased sharply in 2012–2015 and decreased in 2016 and 2017, then grew steadily again beginning in 2018. LIQ has an average of 0.0155, a minimum of 0.0026, and a maximum of 0.0829. The average LIQ is less volatile over the period studied. NIM has an average of 0.0294, with a low of 0.0043 and a high of 0.0873. Like LIQ, average NIM did not increase or decrease significantly and continuously over the period studied. EFF has an average of 0.5409, a minimum of 0.2875, and a maximum of 0.9274; in general the mean EFF tended to decrease during this period. Lastly, NPL has an average of 0.5409, a minimum of 0.2875, and a maximum of 0.9274. In general, the average NPL ratio decreases over the period 2012–2020, especially before 2015.

Correlation matrix

Table 4 gives the matrix of correlation between the independent variables to analyze the degree of correlation between pairs of variables, showing potential multicollinearity in the model.

Table 4 shows that the correlation coefficients of the pairs of independent variables fluctuate from 0.0031 to 0.6244. In general, our results show that, except for the pair of variables with the largest correlation coefficients—SIZE and EQT, whose correlation coefficient is 0.6244—the correlation coefficients of the pairs of variables in the model are lower than 0.5. If the correlation coefficient is above 0.8, multicollinearity becomes a severe problem [14]. Our results demonstrate that multicollinearity is unlikely in our model.

Table 4 Correlation of independent variables

	SIZE	EQT	LA	DPS	LIQ	NIM	EFF	NPL
SIZE	1.0000							
EQT	−0.6244	1.0000						
LA	0.2751	−0.0579	1.0000					
DPS	0.1421	−0.1960	0.4558	1.0000				
LIQ	0.1496	0.0031	−0.0122	0.0338	1.0000			
NIM	−0.0653	0.4476	0.1998	−0.2374	0.1881	1.0000		
EFF	−0.4480	−0.0629	−0.3109	0.0761	−0.1662	−0.4231	1.0000	
NPL	−0.3008	0.2631	−0.1916	−0.1389	−0.0559	0.1158	0.2950	1.0000

Table 5 VIF results

Variable	Model 1		Model 2	
	VIF	1/VIF	VIF	1/VIF
SIZE	2.80	0.356917	–	–
SIZE1	–	–	1.68	0.593973
EQT	2.55	0.391625	1.83	0.545428
EFF	2.11	0.474341	1.68	0.596642
NIM	1.82	0.549565	1.84	0.544045
LA	1.66	0.600723	1.64	0.610747
DPS	1.53	0.652846	1.53	0.652633
NPL	1.26	0.795601	1.26	0.795338
LIQ	1.10	0.906073	1.17	0.856137
Mean VIF	1.86		1.58	

Table 6 Heteroskedasticity test

	chi2 (23)	Prob > chi2
Model 1	5885.64	0.0000
Model 2	2938.59	0.0000

Table 7 Autocorrelation test

	F(1, 22)	Prob > F
Model 1	29.734	0.0000
Model 2	30.675	0.0000

Multicollinearity analysis

According to Gujarati [14], a variance inflation factor (VIF) of more than 5 might indicate a multicollinearity problem. The VIF results are in Table 5.

Table 5 shows that the VIF for the variables ranges from 1.1 to 2.8 in model 1 and from 1.17 to 1.84 in model 2. The mean VIF coefficient is 1.86 in model 1 and 1.58 in model 2. Therefore, multicollinearity is not a significant problem in the model.

Heteroskedasticity and autocorrelation tests

Heteroskedasticity and autocorrelation would be problems for proposed research model. In case of existing, they will make the model estimation become ineffective [14]. Table 6 gives the results of a heteroskedasticity test, and Table 7 lists the results for the autocorrelation test.

Both tests demonstrate the existence of autocorrelation and heteroskedasticity in the models. To deal with these problems, we use the generalized least squares (GLS) estimation model to perform our regression analysis [14].

GLS Results

The results of GLS regression are presented in Table 8.

Discussion

Bank size (SIZE) has a positive correlation with income diversification and is statistically significant at the 1 percent level, which supports H1a. This result is consistent with the conclusions of previous studies, such as DeYoung and Rice [7], Mercieca et al. [23], Nguyen et al. [24], Duho et al. [9], and Meng et al. [22]. When we

Table 8 GLS regression result

	Model 1			Model 2		
	Coeff.	P > |z|	Std. Err.	Coeff.	P > |z|	Std. Err.
SIZE	0.05484137***	0.000	0.0091076	–	–	–
SIZE1	–	–	–	−0.05218937**	0.004	0.0181904
EQT	0.90709725***	0.000	0.2443891	0.35893604	0.111	0.2249489
LA	−0.15079595**	0.034	0.0712185	−0.05088431	0.489	0.0736143
DPS	−0.00634914	0.925	0.0672404	0.00948709	0.894	0.0710938
LIQ	0.12137947	0.700	0.3148647	0.1713982	0.627	0.3531247
NIM	−1.4981492**	0.028	0.6812689	−2.3253728**	0.001	0.7244088
EFF	−0.1166997**	0.033	0.0547976	−0.2471508***	0.000	0.0537635
NPL	0.02642329	0.938	0.340471	0.13066306	0.708	0.3490517
_cons	−1.4169349***	0.000	0.3221432	0.46549856***	0.000	0.0658451
Wald chi2(8)	73.50			37.98		
Prob > chi2	0.0000			0.0000		

*, **, and *** 10%, 5%, and 1% statistical significance, respectively

divide banks into groups by size (SIZE1), the results also show that small banks are negatively correlated with the dependent variable at the 5 percent significance level, which supports H1b. Equivalent results are found by DeYoung and Rice [7], Mercieca et al. [23], and Nguyen et al. [24]. The empirical research results, show that bank size is always an important factor in expanding nontraditional activities. Large banks benefit from income diversification policies, as they take advantage of management techniques, a rich customer base, better brand awareness, and abundant capital better than smaller banks. In fact, the large commercial banks are pioneering in the issuance of new products and services.

Table 8 shows that EQT has a positive correlation with the dependent variable and is statistically significant at 1 percent in model 1, which supports H2. Our results are similar to those by Meng et al. [22], Nguyen et al. [24, 25], and Ho and Vo [16] but not Lepetit et al. [20, 21]. Banks with high equity ratios are more involved in nontraditional activities.

LA in model 1 has a negative coefficient and statistically significant at 5 percent. This suggests that, if other conditions are held constant, when the loan balance ratio is lower, the degree of income diversification is higher, and vice versa. H3 is supported. This result is also consistent with DeYoung and Rice [7]. In order to reduce risk from credit activities and find more secure and stable income sources, banks are trying to promote nontraditional activities. In fact, banks in Vietnam are also under pressure from risky and inefficient lending activities. Therefore, these banks must tighten their credit policy, so they must find other stable and safer sources of income.

DPS are insignificant in both models. Therefore, H4 is not supported. This result is inconsistent with Ho and Vo [16]. This can be explained by the fact that banks have limited capital, so they still depend on mobilized capital to invest in other activities.

LIQ has a positive correlation with the dependent variable in both models; however, the results are not statistically significant. This contrast with the results by Duho et al. [9] and Meng et al. [22], and fails to support H5. The results of our study are similar to those by Ho and Vo [16], in which no correlation is found. In other words, our results do not show whether banks with low cash and cash equivalents actively engage in income diversification strategies.

NIM has a negative coefficient, showing an inverse relationship with income diversification, and is statistically significant. That said, other things being equal, when the profit margin is lower, the degree of income diversification is higher, and vice versa, which supports H6. This result is consistent with that by Lepetit et al. [21], Ho and Vo [16], and Nguyen et al. [24, 25]. In reality, when banks have to focus their resources on developing new products and services, they have fewer resources available for interest-related products. At the same time, some banks are under pressure from lending risks, so credit activities must be tightly controlled, and these banks must carefully screen customers before lending to them.

EFF has a negative coefficient and is statistically significant in both models, suggesting that when the efficiency ratio is lower, the degree of income diversification is higher, which supports H7. This result is consistent with that by Lepetit et al. [24, 25], but not Ho and Vo [16]. Banks with better operating efficiency conserve their resources to invest in new products and services, therefore, they have an advantage in promoting diversification. In addition, in practice, cost-effective banks are often large and experienced banks with well-established and controlled operating processes, and these banks also tend to be highly diversified.

NPL is positively correlated with income diversification, consistent with the work by Nguyen et al. [24]. However, the GLS regression results are not statistically significant in the two models. Therefore, H8 is rejected. This can explain by the fact that banks in Vietnam currently face many risks in lending activities. An increase in bad debts is pushing these banks to make provisions for them, and that reduces their business profits. It forces them to step up their diversification activities in order to find more income that will compensate for their losses. However, in Vietnam, several banks with limited capacity are focusing their resources on dealing with operating risks and increasing their bad debts in an effort to return their operations to a normal state, instead of promoting income diversification.

Conclusions

The study analyzes the impact of size on income diversification by commercial banks. To do so, we collected data on 23 commercial banks in Vietnam for the period 2012–2020. The results of our GLS regression have many similarities to those in previous studies that clarify the influence of bank size on income diversification. The study analyzes and assesses the impact of asset size as well as the influence of some control variables for bank operating status on the level of income diversification. Our findings show that SIZE and EQT have a positive and significant impact on bank income diversification. At the same time, the loan ratio (LA), net interest margin (NIM), and cost efficiency (EFF) are statistically significant and have a negative impact on income diversification, but the other variables, the mobilization ratio (DPS) and the liquidity ratio (LIQ), are insignificant. Thus, we confirm H1a, H1b, H2, H3, H6, and H7, but not H4, H5, and H8.

The results lead to the conclusion that bank size is a principal factor in dealing with external risks, helping banks to guarantee stability and safety in operations. At the same time, the size of the bank gives it advantages in improving their reputation, brand, and competitiveness, especially in diversifying income sources. With the advantage of scale, banks have a modern technology-technical foundation, a large network, strong capital resources, high-quality human resources, and an abundant customer base. It is easier for large banks to invest in new products and services. Therefore, banks normally maintain the same policies to increase their asset base.

Commercial banks invest in advanced information technology systems and equipment to modernize their operations. Applications in the management and operation of bank operations help to improve efficiency. At the same time, they foster and raise personnel qualifications to ensure that they could operate modern technology applications and thereby achieve high efficiency in innovation, technology development, and operational modernization. Banks can also burnish their reputation through standardization and transparency in financial information to attract investors.. However, small banks need to give careful consideration to their limited resources, infrastructure, technology or operating experience before implementing a plan to promote diversification. Correspondingly, these banks need to develop strict operating policies and procedures to minimize risk and conserve resources. It is also necessary for them to continue to invest in developing modern technology systems as well as improving the quality of personnel and operating experience.

Abbreviations

GLS	Generalized least squares
HHI	Hirshmann–Herfindahl Index
NPL	Nonperforming Loans
REV	The diversification index
VIF	Variance inflation factor

Acknowledgements
Not applicable.

Author contributions
Authors are equally contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

Funding
The authors received no financial support for the research, authorship, and/or publication of this paper.

Availability of data and materials
The data are not publicly available due to the fact the current dataset will be ultilised again in the next paper which is at similar topic (Bank Income Diversification).

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Received: 16 February 2023 Accepted: 5 November 2023
Published online: 18 November 2023

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