

**Funding Diversification, Income Diversification and Bank Liquidity Creation:
Evidence from Vietnamese Commercial Banks**

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ABSTRACT. In the context of a persistently volatile financial market and increasingly fierce competition, the ability to create liquidity is considered the "lifeblood" of survival for banks - a key factor in maintaining the role of financial intermediaries and ensuring the stability of the economic system. This paper investigates the impact of diversification strategy (including funding and income diversification) on the liquidity creation of 27 Vietnamese commercial banks from 2003 to 2023. We adopt panel data regression approaches, integrating endogeneity correction and robustness tests to ensure the accuracy of the results. The findings reveal that while income diversification has a positive impact on liquidity creation, funding diversification, conversely, tends to diminish the liquidity generation capacity of Vietnamese commercial banks. Furthermore, the quantile regression results indicate that the negative impact of funding diversification is more apparent in banks with low liquidity creation. In contrast, for banks with superior liquidity capacity, income diversification is more beneficial. The results obtained not only contribute to the development of banking management theory but also provide useful suggestions for policymakers and managers in building sustainable development strategies for the Vietnamese banking system.

1. Introduction

Liquidity creation is one of the most important core functions of commercial banks in ensuring a continuous flow of capital and supporting economic growth [1]. Liquidity risk,

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however, remains a severe threat not only to the stability and safety of individual banks but also to the security of the whole economic system [2]. The global financial crisis in 2008 serves as a paradigmatic example. A lack of liquidity led to the collapse of several major institutions, thereby inflicting grave repercussions across the global financial system. As stated by the [3], liquidity within the banking system was not accorded adequate attention, ultimately emerging as the primary factor behind the crisis. Therefore, research into liquidity has become the foremost priority, aiming to ensure the ability to create liquidity of commercial banks, which in turn plays a critical role in stabilizing and promoting the macroeconomy.

Liquidity creation is of critical importance for countries with bank-based economies like Vietnam. According to the General Statistics Office of Vietnam (2023) [4], the banking sector is among the six leading contributors to Vietnam's GDP in the first quarter of 2023, accounting for 5.29%. Moreover, in the context of an underdeveloped capital market, the Vietnamese banking system serves as the principal source of capital, thereby playing a pivotal role in meeting financial needs and driving overall economic development [5]. This significant impact is further underscored when considering the impressive growth rate of the economy. Since being a member of the World Trade Organization in 2007, Vietnam has emerged as one of the countries experiencing remarkably rapid economic growth, achieving the average GDP growth rate of around 6% [6]. In this context, the demand for capital among enterprises increases sharply, requiring the urgency of continuously maintaining and improving commercial banks' liquidity creation ability to sustain the economic momentum.

Toh et al. (2020) [7] proposed that to achieve this objective, banks should implement effective strategies, among which diversification is identified as a critical approach. Previous studies have evaluated the impact of diversification on various aspects of banking, including profitability and risk [8;9;10]; stability [11;12]; and costs [13;14]. However, the specific effect of diversification on liquidity creation has not yet reached a consensus among studies, and research focusing on the Vietnamese context is still notably scarce. In addition, it is rather surprising that earlier studies predominantly focused on the impact of income diversification while the role of funding diversification has been overlooked. Consequently, there remains a lack of comprehensive information on how these two factors combine to influence banks' liquidity generation. To our knowledge, this study is among the first to investigate this relationship, thereby offering recommendations for regulators and policymakers in enhancing liquidity generation ability in banks. Accordingly, this study examines the impact of diversification strategies on liquidity creation from two distinct perspectives: income diversification and capital diversification. In addition, the Vietnamese banking system has unique characteristics and properties; therefore, the application of the liquidity measurement method following Berger and Bouwman (2009) [1] requires careful consideration to ensure suitability with practical conditions.

Previous studies mostly provided general classifications without detailed analysis according to the specific characteristics of banking activities. In this study, in addition to the classification based on the nature of assets, liabilities, and off-balance sheet activities, we also applied Decision No. 486-TCTK/CN in 1966 on industrial classification to develop a suitable classification scheme that most accurately reflects the spirit of the original methodology.

Apart from the introduction, the remainder of the paper is structured as follows: Section 2 reviews the theoretical foundations and the existing literature on the impact of funding and income diversification on banks' liquidity creation; Section 3 shows the research methodology; Section 4 summarizes the key findings and results; and finally, Section 5 discusses the conclusions along with the recommendations.

2. Literature review and hypothesis development

2.1. Liquidity creation

Liquidity refers to the ability of assets to be swiftly converted into cash without encountering substantial difficulties [15]. It is a key factor in ensuring the stable and efficient operation of banks, thereby driving economic development, particularly in bank-based economies. Based on the financial intermediation theory, the primary function of banks is to satisfy market capital demand through lending activities, and in the process of asset conversion, they take on two roles as liquidity providers and risk transformers [1].

In terms of liquidity providers, Berger and Bouwman (2009) [1] define liquidity creation as the process whereby illiquid assets or illiquid OBS activities are financed by liquid liabilities. To put it simply, banks use transaction deposits (liquid liabilities), which can be withdrawn at any time, to create business loans (illiquid assets). These loans, however, are typically long-term and cannot be immediately converted back into cash. Banks furnish borrowers with the essential capital required for investment while also accepting deposits that bolster liquidity and payment services. Additionally, liquidity is also created when illiquid assets are transformed into liquid liabilities [1]. On the other hand, as claimed by Fu et al. (2016) [16], liquidity is destroyed by using a dollar of illiquid liabilities, or equity, to finance a dollar of liquid assets, like government bonds. Liquidity creation takes place on both the balance sheet and through off-balance sheet.

Berger and Bouwman (2009) [1] developed a comprehensive liquidity creation measurement approach by creating four different metrics. Accordingly, in the first step, the authors categorized all assets, liabilities, equity, and off-balance-sheet activities into three groups—high, low, and medium liquidity. In the second step, they assign weights to the items classified earlier based on the theory of maximum liquidity creation, which posits that banks optimize liquidity by converting illiquid assets into highly liquid liabilities and vice versa. Finally, activities are classified by either category (CAT) or maturity (MAT), and liquidity creation is divided between off-balance-sheet (FAT) and on-balance-sheet (NONFAT) activities. Based on

this, Berger and Bouwman (2009) [1] propose four measurement methods: catfat, catnonfat, matfat, and matnonfat. The Catfat measure is favored as it provides a comprehensive assessment of both on- and off-balance-sheet activities. Consequently, liquidity creation in this study is calculated using the following equation:

$$\begin{aligned} \text{Catfat} = & \left[\frac{1}{2} \times (\text{Illiquid assets} + \text{Liquid liabilities} + \text{Illiquid OBS activities}) \right. \\ & + 0 \times (\text{Semlliquid assets} + \text{SemiLiquid liabilities} + \text{SemiLiquid OBS activities}) \\ & \left. - \frac{1}{2} \times (\text{Liquid assets} + \text{Illiquid liabilities} + \text{Equity} + \text{Liquid OBS activities}) \right] \\ & \div \text{Total asset} \end{aligned}$$

When applying this method to Vietnamese commercial banks, the authors not only rely on the nature of the characteristics of assets, liabilities, and off-balance-sheet activities but also incorporate Decision No. 486-TCTK/CN of 1966 for industrial classification, thereby establishing a framework that most closely aligns with the original approach of Berger and Bouwman (2009) [1]. Moreover, the study also refers to previous research by Le (2019) [17] and Fu et al. (2016) [16] regarding the classification activities in Vietnamese commercial banks.

2.2. Funding diversification and bank liquidity creation

Funding diversification refers to the process by which enterprises seek to raise capital from various distinct sources rather than relying solely on certain sources such as deposits and equity [8]. For Vietnamese commercial banks, this study adopts the methodology proposed by Nguyen (2018) [13], Pham and Nguyen (2023) [8], and Vo (2018) [18] in calculating funding diversification as shown in Table 1. Accordingly, FDIV takes the value from $(0; 1-1/n)$, where n is the number of capital sources of the bank, i.e., FDIV belongs to $(0; 0.875)$. The larger the FDIV, the higher the level of diversification.

According to Abbas and Ali (2022) [11], funding diversification mitigates risk and increases the stability of banks. When banks diversify their funding sources, they lessen their reliance on a single type of financing, thereby reducing the risks associated with financial volatility and economic shocks. This process enables banks to maintain a continuous, stable cash flow and be ready to meet customers' liquidity needs. Furthermore, by avoiding an overreliance on deposits, banks can expand their lending capacity to satisfy credit demands in the economy without being constrained by the current deposit base. More importantly, diversified capital sources also help banks better exploit profitable investment opportunities, accumulate more available capital, and thereby improve the ability to create liquidity (Goddard et al. 2008) [19]. Research by Pham and Nguyen (2023) [8] further indicates that banks with a higher degree of funding diversification tend to generate superior profitability, thereby reinforcing their financial position and overall liquidity.

Funding diversification also enables banks to be more agile in addressing sudden liquidity demand from customers. With a diversified structure, banks can convert and mobilize capital quickly and at lower costs, thereby reducing liquidity risk. Not only does this enable banks to maintain seamless operations, but it also bolsters their liquidity generation capacity, enabling them to promptly meet customers' withdrawal or credit requests.

⇒ *H1a: Funding diversification increases liquidity creation*

On the other hand, funding diversification may reduce liquidity creation because it entails moral hazard. Gupta and Kashiramka (2020) [20] supposed that although diversified funding allows banks to mitigate liquidity risk, risk-averse managers may paradoxically opt for decisions that involve risks exceeding optimal levels, thereby subjecting the bank to significant losses and curtailing its liquidity creation capacity. Indeed, Vuong et al. (2023) [21] indicate that funding diversification significantly increases non-performing loans among Vietnamese commercial banks, while Tran (2020) [22] explores an inverse relationship between non-performing loans and liquidity. Moreover, in the presence of moral hazard, banks may refrain from adjusting their liquidity creation levels due to heightened funding risk [23]. Kladakis et al. (2022) [24] further demonstrate that the negative relationship between funding diversification and liquidity creation originates from the influence of moral hazard motives.

Secondly, capital diversification requires managers to devote additional effort to managing the cost of capital from various sources rather than focusing exclusively on enhancing asset quality—such as screening and monitoring loans [18]. The increase in capital costs, combined with a dispersion of resources, ultimately leads to a decline in bank profitability—the available capital that could otherwise be used to bolster lending.

Thirdly, according to Kladakis et al. (2022) [24], banks primarily funded by insured deposits are more capable of extending less liquid loans without encountering maturity transformation risks. In contrast, banks that diversify their funding sources—especially those relying on wholesale funding—frequently face rollover risk, which constrains their ability to create liquidity. To mitigate this risk, banks may opt to retain a greater proportion of liquid assets and reduce their portfolio of less liquid loans. While this strategy enhances safety, it simultaneously diminishes their liquidity creation.

⇒ *H1b: Funding diversification decreases liquidity creation*

2.3. Income diversification and bank liquidity creation

Income diversification involves banks broadening and shifting the proportion of revenue derived from interest to non-interest sources. In this study, we apply a method developed from the Herfindahl-Hirschman Index (HHI)—a more comprehensive approach that has been employed in previous research by Meslier et al. (2014) [9]; Stiroh and Rumble (2006) [25]; Sanya and Wolfe (2011) [26].

$$IDIV = 1 - HHI_{Income} = 1 - \sum_{k=1}^n \left(\frac{Q_k}{NETOP} \right)^2$$

When applied to the Vietnamese commercial banking system, k ranges from 1 to 7, corresponding to interest income, service income, gold and foreign exchange trading income, income from trading securities, investment securities income, income from other activities, income from capital contributions, and share purchases. IDIV takes values from $(0; 1-1/n)$ with n being the number of income sources, i.e., IDIV belongs to $(0; 0.857)$. The larger the IDIV, the higher the level of diversification.

According to the portfolio theory developed by Ramakrishnan and Thakor (1984) [27], diversification across revenue sources with low correlations helps reduce profit variance. Consequently, banks that implement effective income diversification strategies can better mitigate the effects of financial shocks and face lower levels of credit risk, early liquidation risk, and large liquidity outflows [28]. Le and Pham (2021) [29] find an inverse relationship between credit risk and liquidity creation, suggesting that effective credit risk management enhances liquidity creation. Furthermore, research on the Kenyan commercial banking system from 2001 to 2020 indicates that higher income diversification improves liquidity creation by reducing the likelihood of pre-payment defaults, such as bank runs, and by mitigating systemic risk [30]. Similarly, the study of Toh et al. (2020) [7] on Malaysian banks from 2001 to 2017 demonstrates that income diversification improves liquidity creation by providing a stronger buffer against the negative impacts of competitive pressures while also enhancing resilience in the face of narrowing net interest margins.

Secondly, based on the economics of scale theory, the average cost of enterprises tends to decrease as they broaden operations into various fields [31]. This decrease is attributed to the more efficient utilization of shared resources across multiple sectors, which in turn lowers costs and boosts profitability. Moreover, Tran (2020) [22] and Umar and Sun (2016) [32] identified a positive relationship between bank profitability and liquidity creation, arguing that greater availability of funds enables banks to extend more loans, thereby enhancing their liquidity creation ability.

Moreover, banks can benefit from reducing information asymmetry through income diversification [33]. Data generated from lending activities can be effectively repurposed for non-traditional services such as product personalization, securities underwriting, and asset management [34]. In contrast, non-interest income information for example upfront fees that lead banks collect from participating banks in syndicated loan facilitates a comprehensive evaluation of customers, leading to more risk-appropriate lending strategies, enhanced reliability, and improved monitoring [35]. According to Hoang et al. (2020) [36], effective loan planning and

monitoring help banks reduce non-performing loans, which in turn boosts their liquidity creation capacity. Consequently, this study proposes the following hypothesis:

⇒ ***H2a: Income diversification increases liquidity creation***

However, Sanya and Wolfe (2011) [26] contend that a firm producing a diversified range of products is generally less efficient than one specializing in a single product, implying that income diversification may undermine economies of scale. Acharya et al. (2006) [28] explain that this is due to a lack of experience as well as deficient oversight and management capabilities. Moreover, the theory of comparative advantage suggests that a high degree of specialization allows banks to accumulate more profound knowledge in a specific area. This focused approach provides a competitive edge that enhances monitoring and facilitates optimal resource allocation, which in turn boosts profitability and liquidity creation [37]. Hou et al. (2018) [38] found that, during the period from 1996 to 2015, Chinese banks demonstrated lower liquidity creation as income diversification increased—largely due to the dispersal of managerial resources and escalating conversion costs among different activities, which impaired their ability to effectively meet liquidity demands. A similar relationship has been observed in the neighboring country of Vietnam, as documented in studies by Hoang et al. (2020) [36], Dang (2020) [39], Dang and Huynh (2022) [40], and Huynh (2024) [41].

Furthermore, Denis et al. (1997) [42] argue that income diversification may exacerbate agency problems by increasing the opacity and complexity of banks. As diversification leads to larger bank sizes and greater information asymmetry, shareholders may find it challenging to closely monitor management, thus paving the way for moral hazard. This environment can encourage managers to pursue inefficient, high-risk diversification strategies driven by personal gains such as higher compensation [43], entrenchment [44], and reputation [45]. Consequently, income diversification raises costs and risks, deteriorates portfolio quality, and ultimately diminishes liquidity creation. This outcome aligns with the research of Tran (2020) [22] on U.S. bank holding companies, which indicates that income diversification negatively affects liquidity creation—an effect that is more pronounced in larger banks and less severe in smaller ones.

⇒ ***H2b: Income diversification decreases liquidity creation***

3. Data and methodology

3.1. Data

The study uses an unbalanced annual panel dataset of 27 Vietnamese commercial banks in the period from 2003 to 2023 with 475 observations. The dataset is collected from the FiinPro database; in addition, GDP and INF are taken from the World Development Indicators of the World Bank. In addition, Stata 16 software is used to conduct a quantitative analysis of the relationship between capital and income diversification and liquidity creation of Vietnamese

commercial banks. The data has been winsorized at the 1st and 99th percentiles to ensure estimation accuracy and eliminate the impact of outliers.

3.2. Model specification

To conduct a quantitative analysis of the impact of capital and income diversification on liquidity creation of Vietnamese commercial banks, referring to the research of Tran (2020) [22], Dang and Huynh (2022) [40], and Sahyouni et al. (2021) [46], the study proposes the following equation:

$$LC_{i,t} = \beta_0 + \beta_1 FDIV_{i,t} + \beta_2 IDIV_{i,t} + \beta_3 control_{i,t} + u_i + \varepsilon_{it}$$

In which:

Table 1: Summary of variables

Dependent variable	
LC_{it}	Liquidity creation of bank i at time t
Independent variables	
$FDIV_{it}$	Funding diversification of bank i at time t: $FDIV = 1 - \left[\left(\frac{EQU}{FUND} \right)^2 + \left(\frac{GOV}{FUND} \right)^2 + \left(\frac{IBD}{FUND} \right)^2 + \left(\frac{CD}{FUND} \right)^2 + \left(\frac{DER}{FUND} \right)^2 + \left(\frac{FF}{FUND} \right)^2 + \left(\frac{VP}{FUND} \right)^2 + \left(\frac{OTHER}{FUND} \right)^2 \right]$
$IDIV_{it}$	Income diversification of bank i at time t: $IDIV = 1 - HHI_{Income} = 1 - \sum_{k=1}^n \left(\frac{Q_k}{NETOP} \right)^2$
Control variables	
ROA_{it}	Return on total asset of bank i at time t
$Growth_{it}$	Asset growth rate of bank i at time t
GDP_t	GDP growth rate of Vietnam at time t
INF_t	Inflation rate of Vietnam at time t
u_i	Random error
ε_{it}	Residual

The paper investigates the impact of diversification on liquidity creation among Vietnamese commercial banks by conducting three regression models: Pool ordinary least squares (POLS), Fixed Effects Model (FEM), and Random Effects Model (REM), and then uses subsequent tests to select the most appropriate model. Additionally, a multivariate fixed effects model is applied, controlling for both bank-specific and time-specific effects. To address endogeneity issues, the paper utilizes a two-step Generalized method of moments (GMM) approach, which is especially useful for short-term estimates given the nature of the data [47].

The study also performs several econometric tests, including the Newey-West regression to produce consistent estimates in the presence of autocorrelation and heteroscedasticity and two-way clustering to adjust for both cross-sectional and serial correlations [48]. Finally, drawing on the research of Nguyen et al. (2024) [49], the paper employs quantile regression to evaluate the impact of diversification on liquidity creation across different quantiles.

4. Research result

4.1. Descriptive statistics

Table 2: Descriptive statistical analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
FLC	475	0.066	0.212	-0.504	0.875
FDIV	475	0.525	0.113	0.195	0.773
IDIV	357	0.282	0.134	0.010	0.646
ROA	475	0.010	0.008	-0.055	0.060
GROWTH	449	0.288	0.512	-0.392	7.791
GDP	475	6.099	1.453	2.562	8.020
INF	475	6.408	5.581	0.631	23.115

Source: Authors' calculation

Table 2 shows the descriptive statistics of the data set. Accordingly, the liquidity creation of Vietnamese commercial banks in 2003-2023 reaches an average value of 0.066 with a standard deviation of 0.212. The smallest value is -0.504 for Tien Phong Commercial Joint Stock Bank in 2008, and the largest value is 0.875 for Vietnam Maritime Commercial Joint Stock Bank in 2023. For the explanatory variable, capital diversification has an average value of 0.525 with a standard deviation of 0.113 and ranges from 0.195 to 0.773. Meanwhile, income diversification averages 0.282 with a standard deviation of 0.134. The smallest value is 0.010, and the largest value is 0.646.

Table 3: Correlation matrix

	FDIV	IDIV	ROA	GROWTH	GDP	INF
FDIV	1.000					
IDIV	0.144	1.000				
ROA	0.330	0.316	1.000			
GROWTH	0.167	0.058	0.044	1.000		
GDP	-0.009	-0.087	-0.096	0.027	1.000	
INF	0.362	-0.120	0.075	0.127	0.021	1.000

Source: Authors' calculation

The correlation coefficient is a statistical measure that assesses the strength of the linear relationship between two variables. The results in Table 3 show that the correlation coefficients

of the variables are all lower than 80%, so these independent variables are suitable for regression [50;51].

4.2. Main result findings

Table 4: Panel data regression results

Variable	Feasible generalized least squares (1)	Baseline (2)	Additional variables (3)	GMM (4)	Newey- West (5)	Two-way cluster (6)
L.FLC				0.779*** (0.023)		
FDIV	-0.305*** (0.072)	-0.333*** (0.093)	-0.159* (0.095)	-0.214*** (0.040)	-0.229*** (0.079)	-0.254*** (0.094)
IDIV	0.089 (0.058)	0.537*** (0.089)	0.028 (0.077)	0.123*** (0.043)	0.239*** (0.073)	0.170** (0.080)
ROA	5.492*** (1.333)		6.703*** (1.521)	4.229*** (0.889)	8.112*** (1.812)	12.374*** (2.001)
GROWTH	-0.042* (0.023)		-0.028 (0.038)	-0.039* (0.021)	-0.106*** (0.034)	-0.112*** (0.032)
GDP	-0.006** (0.003)		Omitted	-0.006*** (0.002)	-0.022*** (0.005)	-0.021*** (0.004)
INF	-0.005*** (0.001)		Omitted	0.001 (0.001)	-0.010*** (0.002)	-0.011*** (0.002)
Constant	0.282*** (0.038)	0.157*** (0.052)	0.156*** (0.047)	0.134*** (0.021)	0.317*** (0.050)	0.309*** (0.051)
Adj R ²		0.325	0.683			0.522
Bank FE	NO	YES	YES	NO	NO	NO
Time FE	NO	NO	YES	NO	NO	NO

Source: Authors' calculation

Notes: Robust standard errors are in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. All financial variables are winsorized at 1% level on top and bottom of the distribution.

Table 4 presents the results of the impact of income and funding diversification on liquidity creation in Vietnamese commercial banks. The REM was found to be the best after all the necessary tests were done. To fix problems with the initial model, feasible generalized least squares (FGLS) estimation was then used. Subsequent models use a multivariate fixed effects approach, controlling for unobserved, time-invariant bank-specific factors. Finally, Models (4) to

(6) implement two-step GMM, Newey-West, and two-way clustering methods, respectively, to validate the robustness of the results.

According to Table 4, funding diversification has a statistically significant negative impact on liquidity creation among Vietnamese commercial banks at the 1% level. This result is similar to the study of [24] and supports hypothesis H1b. Although diversifying in funding can reduce liquidity risk, it may also encourage managers to take on higher risks in pursuit of personal gains, thereby compromising the bank's interests. Such decisions can lead to an increase in non-performing loans or a decline in loan quality, which in turn forces the bank to allocate higher loan loss provisions or incur greater losses from impaired loans. This strain on retained earnings makes it more challenging for banks to maintain or expand their available capital, thereby reducing their ability to create liquidity. Furthermore, capital diversification requires banks to allocate additional resources for managing a broader array of funding sources, which increases management and maintenance expenses. State Bank of Vietnam requires issuing bonds or certificates of deposit to pay interest rates at least 2% per annum higher than those for traditional deposits, plus underwriting and listing fees amounting to approximately 0.2–0.3% of face value. Foreign-currency funding typically carries interest rates pegged to SOFR/LIBOR plus a margin of 3–4%, along with forward swap costs of 1–1.5%. Furthermore, Circular No.13/2018/TT-NHNN also mandates additional FX provisions, further raising capital costs. This dispersion of resources diminishes profitability and leads to inefficient utilization of assets, further constraining the bank's capacity to supply liquidity. In addition, holding a larger proportion of liquid assets to mitigate rollover and maturity transformation risks can further limit lending capacity.

Secondly, there is a positive relationship between income diversification and liquidity creation among Vietnamese commercial banks. It is noteworthy that, with the same research object as Vietnamese commercial banks, however, this result is contrary to previous research by Hoang et al. (2020) [36], Dang (2020) [39]. The finding is consistent with earlier studies by Toh et al. (2020) [7] and Kinini et al. (2023) [30] and confirms the validity of hypothesis H2a. In other words, income diversification enhances the liquidity generation ability by reducing risk and improving financial stability. When banks broaden their revenue streams into low-correlated sources, profit volatility diminishes, making them safer and less vulnerable to financial shocks. Reducing dependence on a single revenue source, such as deposits, also lowers both credit risk and early liquidation risk. Moreover, liquidity risk can be mitigated effectively by decreasing the likelihood of simultaneous withdrawals. The study of Le and Pham (2021) [29] on the inverse relationship between risk and liquidity creation further underscores the importance of income diversification in safeguarding bank operations and thereby enhancing liquidity. Furthermore, expanding operations and diversifying income not only reduce costs through economies of scale

and increase profitability but also generate a higher pool of available funds, which in turn improves lending capacity. Finally, developing a more diversified income base optimizes the efficiency of gathering and utilizing customer and market information, thereby reducing information asymmetry. This improvement in risk assessment leads to a reduction in non-performing loans and fosters the development of additional services and products, ultimately enhancing operational efficiency and liquidity creation.

Regarding control variables, profitability exerts a positive influence on liquidity creation, statistically significant at the 1% level. In essence, profitability provides abundant financial resources, enabling banks to sustain and expand their lending activities while also ensuring that sufficient funds are available to meet customer withdrawal demands without incurring liquidity problems. Secondly, banks exhibiting higher total asset growth tend to experience diminished liquidity creation, significant at the 1% level. When total asset growth is high, the capital adequacy ratio may decline if equity does not increase in proportion to asset expansion [52]. This scenario requires banks to maintain a minimum capital level to comply with regulatory requirements, thereby reducing the funds available for liquidity and ultimately curbing liquidity creation. Thirdly, GDP has a negative impact on liquidity creation. This result aligns with the findings in the studies of Toh et al. (2020) [7], Sinha and Grover (2021) [53], Sahyouni et al. (2021) [46], Huynh (2024) [41] explain that the rising loan demand in developing economies can overburden banks, leading to a reduction in liquidity creation. Furthermore, Čihák et al. (2012) [54] suggest that as economies develop, the stock market becomes more important for capital compared to banks, which further diminishes banks' liquidity creation capacity. Finally, there exists an inverse relationship between inflation and liquidity creation among Vietnamese commercial banks, statistically significant at the 1% level. Vodova (2011) [55] argues that high inflation creates an unstable economic environment, necessitating that banks hold more liquid assets to prepare for adverse situations. Indeed, Louhichi and Boujelbene (2017) [56] report that during inflationary periods, banks tend to reduce lending. Moreover, high inflation often signals that the central bank implements a tighter monetary policy, leading to increased interest rates and higher borrowing costs for banks. When this occurs, banks will face an increase in interest rates and borrowing costs, which will hinder their ability to effectively mobilize capital and increase the cost of loans and deposits, ultimately leading to a reduction in liquidity creation. Additionally, high inflation reduces the real rate of profit, which discourages banks from expanding their loan portfolios and incentivizes them to hold a larger share of liquid assets [57].

Table 5: Regression results using alternative variables

Variable	LC
FDIV2	-0.496*** (0.110)
IDIV2	0.204* (0.109)
ROA	12.356*** (1.860)
GROWTH	-0.139*** (0.031)
GDP	-0.021*** (0.004)
INF	-0.012*** (0.002)
Constant	0.283*** (0.040)

Source: Authors' calculation

Notes: Robust standard errors are in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. All financial variables are winsorized at 1% level on top and bottom of the distribution.

To enhance the credibility of the findings, this study substitutes the explanatory variables FDIV and IDIV with FDIV2 and IDIV2, representing funding diversification and income diversification, respectively. Funding diversification is measured based on the methodology of Shahriar et al. (2023) [58] and Wu et al. (2020) [59] using the following formula:

$$FDIV2 = \frac{\text{Total liabilities} - \text{Total deposits}}{\text{Total liabilities}}$$

Additionally, according to Tran (2020) [22] and Dang and Dang (2021) [60], income diversification is calculated based on the proportion of non-interest income to the total operating income of the bank.

$$IDIV2 = \frac{\text{Non interest income}}{\text{Total operating income}}$$

The results in Table 5 indicate that funding diversification, total asset growth, economic growth, and inflation negatively affect banks' liquidity creation, all significant at the 1% level. Conversely, profitability and income diversification play key roles in enhancing liquidity creation, statistically significant at the 1% and 10% levels, respectively. These findings show the consistency of results in the baseline model.

4.5. Quantile regression results

Table 6: Quantile regression results

	Q10 th	Q30 th	Q50 th	Q70 th	Q90 th
FDIV	-0.482***	-0.347***	-0.236***	-0.135	0.062
IDIV	-0.088	0.087	0.230***	0.361***	0.615***
ROA	5.071**	6.697***	8.031***	9.247***	11.614***
GROWTH	-0.057	-0.083**	-0.105***	-0.124***	-0.162***
GDP	-0.029***	-0.025***	-0.022***	-0.019***	-0.014
INF	-0.009***	-0.010***	-0.010***	-0.011***	-0.012***
Constant	0.422***	0.366***	0.320***	0.278***	0.196**

Source: Authors' calculation

*Notes: Robust standard errors are in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively. All financial variables are winsorized at 1% level on top and bottom of the distribution.*

To further analyze the relationship between diversification and liquidity creation of banks, the study uses the moments quantile regression (MMQR) on the dependent variable to examine the impact of factors on different quantiles. Table 6 indicates that among banks with low liquidity creation, the negative impact of funding diversification is particularly pronounced. In contrast, for banks with high liquidity creation, an increase in income diversification exerts a more robust positive effect. Similarly, in banks exhibiting high liquidity creation, a higher return on assets further enhances liquidity creation, although the adverse impact of asset growth is more marked. Regarding macroeconomic factors, economic growth tends to have a stronger negative effect on banks with lower liquidity creation, while the detrimental impact of inflation appears to decrease at the lower quantiles.

5. Conclusion, recommendations, and limitations

Based on an unbalanced annual panel dataset of 27 Vietnamese commercial banks from 2003 to 2023, along with the application of appropriate quantitative analysis methods, the study shows that although funding diversification reduces liquidity creation, income diversification plays a positive role in enhancing it. In addition, the higher the profit, the more the liquidity creation ability of banks is improved. Meanwhile, the growth rate of assets, economic growth, and inflation has a negative impact on liquidity creation.

This study also provides some policy implications based on the research findings to support Vietnamese commercial banks to operate more efficiently and safely. Firstly, commercial banks should be encouraged to diversify their revenue streams, particularly by expanding non-interest services such as payment systems, asset management, and financial advisory. Such diversification can provide stable and secure income, reducing reliance on lending activities and consequently mitigating credit risk. Secondly, banks should exercise caution in diversifying their

funding sources by establishing clear risk management standards, upholding ethical principles in financial management, and employing highly qualified personnel for diversification activities. Such measures may help improve governance and control processes and avoid resource dispersion, thereby ensuring that the bank's liquidity creation capacity is not impaired. Thirdly, given the critical role of profitability in enhancing liquidity creation, banks should focus on optimizing operational efficiency, improving financial management, and controlling costs to boost profitability. Furthermore, investment in technology and innovation – such as automated risk management systems, big data analytics, and blockchain technology – can help banks swiftly adapt to market trends, better serve customer needs, and enhance overall performance. These technological solutions not only improve operational efficiency and fund management flexibility but also enhance customer experience and foster a competitive edge in the industry. Fourthly, banks should carefully manage asset growth rates to ensure liquidity stability. This procedure includes setting realistic growth targets, monitoring associated risks, and balancing asset expansion with liquidity needs. Regularly reviewing and adjusting asset growth strategies can help banks avoid adverse financial impacts and maintain long-term stability. Finally, at the macroeconomic level, it is crucial for the government to implement measures that balance economic development and inflation at stable levels. Such regulatory interventions can prevent economic instability, runaway inflation, and overheated growth, thereby creating a conducive environment for sustainable banking operations.

In terms of limitations, firstly, this study only examines the impact of six factors on liquidity creation. There may be additional variables – such as industry characteristics, including competition and concentration – that could also influence liquidity creation but were not incorporated into the model. Moreover, the current research utilizes only a portion of the available data, analyzing the performance of 27 out of 35 commercial banks, as some banks are undergoing restructuring. Consequently, future studies will aim to complete the dataset to yield more precise and comprehensive conclusions.

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