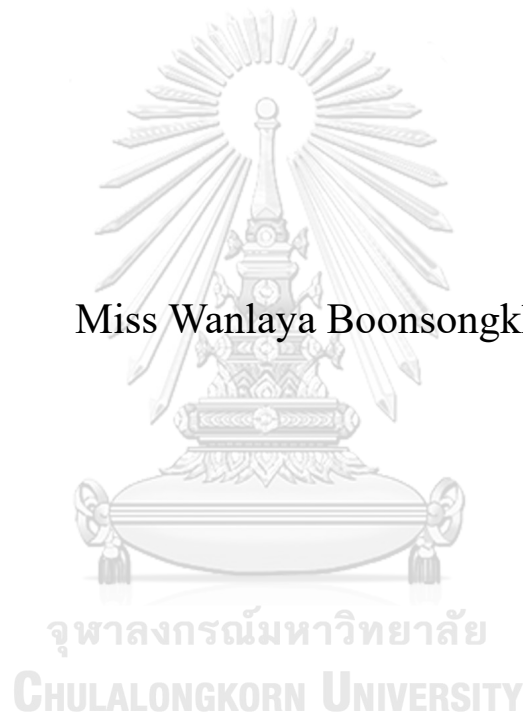The effect of bank liquidity creation on performance and stock returns: Evidence from Thailand

Miss Wanlaya Boonsongkhoh

ผลกระทบของการสร้างสภาพคล่องของธนาคารต่อผลการดำเนินงานและผลตอบแทนของหุ้น:
หลักฐานจากประเทศไทย

น.ส.วัลยา บุญสงเคราะห์

Independent Study Title	The effect of bank liquidity creation on performance and stock returns: Evidence from Thailand
By	Miss Wanlaya Boonsongkhoh
Field of Study	Finance
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วัลยา บุญสงเคราะห์ : ผลกระทบของการสร้างสภาพคล่องของธนาคารต่อผลการดำเนินงานและผลตอบแทนของ หุ้น: หลักฐานจากประเทศไทย. (The effect of bank liquidity creation on performance and stock returns: Evidence from Thailand) อ.ที่ปรึกษาหลัก : ผศ. ดร.รุ่งเกียรติ รัตนบานชื่น

การศึกษานี้มีจุดประสงค์เพื่อค้นคว้าความสัมพันธ์ระหว่างการสร้างสภาพคล่องของธนาคาร (bank liquidity creation) ผลการดำเนินงาน และผลตอบแทนของหุ้นจากธนาคาร 11 แห่งในประเทศไทย ตั้งแต่ปี 2555 ถึง 2564 ซึ่งครอบคลุมถึงวิกฤตเศรษฐกิจในประเทศไทยและวิกฤตโควิด-19 การสร้างสภาพคล่องวัดปริมาณเงินที่ธนาคารสร้างให้กับ ภาคเอกชน โดยแบ่งออกเป็นสภาพคล่องที่สร้างขึ้นจากกิจกรรมในงบดุลและสภาพคล่องที่สร้างขึ้นจากกิจกรรมทั้งในและนอก งบดุล หลังจากควบคุมตัวแปรเศรษฐศาสตร์มหภาคและคุณลักษณะเฉพาะของธนาคารแล้ว ผลลัพธ์ของแบบจำลอง fixed-effects regression เผยให้เห็นว่าผลการดำเนินงานและผลตอบแทนของหุ้นในไตรมาสถัดไปของธนาคารจะลดลงเมื่อ ระดับการสร้างสภาพคล่องเพิ่มขึ้น และพบว่าการสร้างสภาพคล่อง (ไม่รวมกิจกรรมนอกงบดุล) และผลการดำเนินงานในไตร มาสถัดไปมีความสัมพันธ์แบบ inverted U-shaped ชี้ให้เห็นการแลกเปลี่ยนระหว่างความสามารถในการทำกำไรและ การบริหารความเสี่ยง ยิ่งไปกว่านั้นในช่วงวิกฤต การสร้างสภาพคล่องมีผลกระทบด้านลบต่อผลการดำเนินงานของธนาคารและ ผลตอบแทนของหุ้น อย่างไรก็ตามความสัมพันธ์นี้ไม่มีนัยสำคัญเมื่อพิจารณาถึงการสร้างสภาพคล่องจากกิจกรรมในและนอกงบ ดุลและผลตอบแทนของหุ้น สาเหตุนี้อาจเกิดจากการที่นักลงทุนให้ความสำคัญกับกิจกรรมในงบดุลเนื่องจากมีผลกระทบ โดยตรงต่อสุขภาพทางการเงินของบริษัท ในขณะที่กิจกรรมนอกงบดุลมักเกี่ยวข้องกับเครดิตที่ไม่ใช่รายการเงินสด และอาจมี ผลกระทบต่อผลตอบแทนของหุ้นในระยะสั้นน้อยกว่า นอกจากนี้ยังมีการใช้ Mann-Whitney U test เพื่อสนับสนุน สมมติฐาน ผลการทดสอบในภาพรวมแสดงให้เห็นว่าการสร้างสภาพคล่องที่เพิ่มขึ้นนั้นสัมพันธ์กับผลการดำเนินงานที่ลดลง การค้นพบนี้ให้ข้อมูลเชิงลึกที่มีคุณค่าสำหรับผู้กำหนดนโยบาย หน่วยงานกำกับดูแล และนักลงทุนเกี่ยวกับการสร้างสภาพคล่อง และผลกระทบต่อผลการดำเนินงานของธนาคารและผลตอบแทนของหุ้น

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สาขาวิชา	การเงิน	ลายมือชื่อนิสิต ....
ปีการศึกษา	2566	ลายมือชื่อ อ.ที่ปรึกษาหลัก ....

Wanlaya Boonsongkhoh : The effect of bank liquidity creation on performance and stock returns: Evidence from Thailand . Advisor: Asst. Prof. ROONGKIAT RATANABANCHUEN, Ph.D.

This study investigates the relationship between bank liquidity creation, performance, and stock returns across 11 banks in Thailand from 2012 to 2021, spanning the economic crisis in Thailand and the COVID-19 pandemic. Liquidity creation measures the extent to which banks generate a money supply for the public, classified into liquidity created on the balance sheet and liquidity created both on and off the balance sheet categories. After controlling for macroeconomic and bank-specific variables, the results of a fixed-effects regression model reveal that next-period performance and stock returns deteriorate as liquidity creation levels increase. An inverted U-shaped relationship between liquidity creation (excluding off-balance sheet activities) and subsequent period performance is also observed, suggesting a trade-off between profitability and risk management. Furthermore, during a crisis, liquidity creation has a negative impact on bank performance and stock returns; however, this relationship is not significant when considering liquidity created on- and off-balance sheet activities and stock returns. This might be attributed to investors prioritizing on-balance sheet activities due to their immediate impact on a company's financial health, while off-balance sheet activities often involve non-cash credit and may have less short-term influence on stock returns. Additionally, a Mann-Whitney U test is employed to support the hypotheses; overall, it shows that increased liquidity creation is associated with lower performance. These findings provide valuable insights for policymakers, regulators, and investors regarding liquidity creation and its implications for bank performance and stock returns.

Field of Study:	Finance	Student's Signature
		....
Academic Year:	2023	Advisor's Signature
		....

ACKNOWLEDGEMENTS

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INTRODUCTION
Background and significance of the problems

The growth of the economy is significantly influenced by the vital role of banks. At its core, the purpose of a bank is to transfer capital from those who save to those who need it. In the process, the bank generates liquidity by utilizing easily convertible liabilities to fund its customers' less liquid assets. Through lending, the bank adds a new deposit to the borrower's account, effectively generating newly created funds. This process expands the overall money supply in the economy and is an important tool for banks to manage their own liquidity and support economic growth.

Accordingly, bank liquidity creation refers to the process by which banks create new money for the public. Therefore, bank liquidity creation is a measure of how much new money a bank creates through the process of lending. For instance, if a bank has a high liquidity creation rate, indicating that it is issuing a large amount of loans and creating a significant amount of new money in the economy. This can have both positive and negative consequences.

Positively, generating significant levels of liquidity can assist in maintaining the smooth operation of the banking system by enabling banks to fulfill their clients' requests for both loans and other financial offerings. Negatively, high liquidity creation could lead to increased leverage and risks of default.

Overall, the creation of liquidity by banks is a crucial aspect of ensuring financial system stability and driving economic development. It enables banks to meet the demand for funds from their customers, manage their risks, and maintain their capital adequacy. In Thailand, commercial banks are crucial to the financial system as they offer a diverse range of financial services such as deposits, loans, and payment services. They are also a significant source of credit for individuals, businesses, and the government. The primary depository corporations in Thailand are commercial banks and Special Financial Institutions (SFIs), with a combined market share of 62.9%.[1] This dominance is attributed to their wide branch networks, which allow them to cater to a more extensive range of customers compared to other financial institutions.

Thailand is considered an emerging country. The role of commercial banks, however, can vary significantly between developed and emerging countries, reflecting differences in their respective financial systems and economic conditions. In developed countries, commercial banks often have a more mature and sophisticated financial sector with a wide range of financial institutions and products available. They play a key role in facilitating economic growth and development by providing credit and other financial services. Commercial banks in these countries typically have strong regulations, advanced technology, and well-established risk management systems in place.

In contrast, commercial banks in emerging countries often face greater challenges, such as limited access to credit and financial services, weak regulatory frameworks, and a lack of infrastructure.

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[1]according to data from the Bank of Thailand

In many cases, commercial banks in these countries may focus more on providing basic banking services, such as deposits and loans, to meet the needs of their underserved populations. They may also play a more prominent role in supporting economic growth and development by financing infrastructure projects and supporting businesses that are relatively small or medium in size.

Thus, the ability of banks in Thailand to create liquidity might not be as robust as in developed countries. This paper aims to investigate whether bank liquidity creation would associate with bank performance and its stock returns. The importance of liquidity creation in the financial system cannot be overstated. It is a critical area of research and study, as it has a far-reaching extent to economic output and stability of financial markets. Additionally, bank liquidity creation can affect a bank's fundamentals in several ways, including its capital holding, profitability, financial stability, performance, and risk.

While high levels of liquidity creation can increase a bank's growth potential, leading to higher stock returns, this higher growth can also translate into higher earnings and stronger performance, making the bank more attractive to investors and increasing demand for its stock. Nevertheless, excessive liquidity creation can elevate the bank's risk level and create susceptibilities that may result in decreased stock returns.

For example, if a bank creates excessive liquidity and then experiences a sudden drop in demand for its loans, it might be forced to rapidly dispose of its assets at a loss, which could hurt its stock price. In addition, if the bank's lending practices are perceived as risky, investors might lose confidence in the bank, which can lead to lower stock returns.

In recent years, the connection between bank liquidity creation and performance has received considerable attention, as well as its stock returns. Several research studies have reported a direct relationship between greater generation of liquid assets and enhanced effectiveness. This is due to the increased lending capacity and profit generation from loan activities. According to a study conducted by Duan and Niu (2020) that utilized a sample of US banks, there is a connection between increased liquidity creation and improved profitability. They found that this relationship holds for banks of varying sizes and during both regular periods and financial crises. Furthermore, profitability has been found to have a positive association with the creation of liquid assets through obligation activities that are not provided in the statement of financial position and liabilities. On the asset side, however, it has an adverse relationship with profitability.

Conversely, some other research studies have reported a negative relationship between increased levels of liquidity generation by banks and their performance. Due to the risks associated with elevated levels of liquidity creation such as loan default risk and the risk of disposing of illiquid assets, some studies have discovered an inverse correlation between bank liquidity creation and performance.

Sahyouni and Wang (2019) discovered a significant and negative correlation between liquidity creation and bank performance in MENA countries, as measured by the return on average equity (ROAE).

The correlation between bank liquidity creation and performance, as well as its stock returns, is a complex and multifaceted issue that deserves further investigation. The findings from previous studies are mixed, and there is a need for more study to better understand the relationship between bank liquidity creation and performance, as well as its stock returns. The objective of this paper is to bridge the existing research gap by evaluating the relationship between liquidity creation measurements and the performance of banks in the subsequent period, along with their stock returns.

The findings of this paper hold significant implications for various stakeholders, particularly investors seeking valuable insights to inform their investment decisions. By investigating the relationship between liquidity creation, stock returns, and bank performance, this study offers valuable information that can assist investors in assessing the potential risks and rewards associated with their investment choices. Understanding how liquidity creation influences stock returns can help investors make more informed decisions about allocating their resources and managing their investment portfolios.

Moreover, the outcomes of this research hold relevance beyond the realm of individual investors. Bank managers, policymakers, and regulators can also benefit from the insights provided by this study. As liquidity creation plays a vital role in the banking sector, understanding its impact on stock returns and bank performance can help bank managers devise effective strategies for managing liquidity and optimizing their overall performance.

Policymakers and regulators can utilize these findings to develop policies and regulations that foster a healthy balance between liquidity creation, financial stability, and investor protection. By identifying the relationship between liquidity creation, stock returns, and bank performance, this research contributes to the broader understanding of the factors influencing the banking industry and can guide decision-making at both the micro and macro levels.

Objectives

1. To investigate how bank liquidity creation measurement affects next period performance for commercial banks listed in Thailand.

2. To investigate how bank liquidity creation measurement affects next period stock returns for commercial banks listed in Thailand.

3. To investigate the use of the liquidity measurement factor in leading a trading approach.

Research Hypothesis

H1: The relationship between liquidity creation measurement is negatively associated with next period performance for commercial banks listed in Thailand.

Previous research investigations into the connection between liquidity creation and bank performance have produced mixed findings. Berger and Bouwman (2009) found that increased liquidity creation in US banks leads to higher returns on interest on loans and more surplus distributed to shareholders, resulting in increased bank value, Duan and Niu (2020) discovered a positive relationship between liquidity creation and bank profitability during both normal and crisis periods. They argued that profitability is positively influenced by liquidity creation through liabilities and obligation activities that are not provided in the statement of financial position, but negatively affected by liquidity creation through assets.

Bordeleau and Graham (2010) demonstrated that maintaining a greater amount of liquid assets (lower liquidity creation) can decrease illiquid risk and the chances of default, leading to lower funding expenses and increased net income for banks. Based on this reasoning, Tran, Lin et al. (2016) presented evidence that banks with high liquidity creation and liquidity risk tend to have lower profitability. Allen and Gale (2004) document that increased liquidity creation raises the likelihood of financial trouble and worsens the loss incurred when assets are sold to satisfy liquidity demands. Sahyouni and Wang (2019) found an adverse correlation between liquidity creation and banking performance.
Fidrmuc, Fungáčová et al. (2015) showed that liquidity creation increases the likelihood of banks experiencing failure.

Summarizing the literature on liquidity creation, this study expects a negative relationship between liquidity creation and the next period bank performance in Thailand. In emerging countries like Thailand, the regulatory and supervisory frameworks for banks may not be as developed or as well-enforced as those in developed countries. This can result in banks taking on more risk and engaging in more speculative activities, leading to greater risks from created liquidity. If the bank is unable to manage the risks associated with high liquidity creation effectively, leading to potential losses and financial instability.

This aligns with the hypothesis of anticipated bankruptcy costs suggests that there is a negative correlation between liquidity creation and bank profitability. Raising the level of liquidity creation can amplify illiquidity risk, reduce bank profitability, and heighten their likelihood of experiencing insolvency. In contrast, a bank with more liquid assets (lowly created liquidity) reduces its risks. This results in a reduction in financing costs, which boosts the bank's profitability and lowers its risk of bankruptcy. This study therefore hypothesizes that the relationship between liquidity creation measurement is negatively associated with next period bank performance in Thailand.

H2: The relationship between liquidity creation measurement is negatively correlated to next period bank stock returns in Thailand.

Previous studies have aimed to examine how the liquidity factor affects stock returns. According to Gharaibeh (2014) research, there is a negative correlation between stock returns and liquidity. Liquidity is critical because failure to meet obligations can result in a company's bankruptcy. Therefore, banks that create high liquidity for the public, which means they tend to hold more illiquid assets and face a higher likelihood of not being able to meet all their obligations at maturity. In this case, investors might perceive the company as having a higher risk of default and might be unwilling to invest in the company's stock, which could lead to lower stock returns.

Furthermore, bank performance is a crucial determinant of stock returns. Nurazi and Usman (2016) found that return on equity (ROE) has a positive and significant influence on Indonesian bank stock returns, while net interest margin (NIM) has a negative effect. Higher ROE indicates better performance in using equity, while an increase in NIM is associated with lower stock returns, possibly due to transitory effects like the global financial crisis that impacted banks' profit management. Thus, any price increases may be temporary and not have a lasting impact on overall prices.

Ioannidis, Molyneux et al. (2008) explored the relationship between efficiency changes and stock returns in 19 banking sectors across Asia and Latin America, finding a positive and strong connection between profit efficiency changes and stock returns. Moradi-Motlagh, Saleh et al. (2012) investigated whether changes in banks' performance can explain their stock market returns, finding a positive and statistically significant relationship between performance changes and total shareholder return over the 10-year study period. Essentially, well-performing banks have a greater tendency to generate higher returns for their stockholders.

On the contrary, if a company is experiencing low performance, such as declining revenues or profits, it may negatively impact its stock returns, which could lead to a decrease in demand for its stock and a subsequent decrease in price. According to the first hypothesis suggests that liquidity creation and bank performance are negatively correlated. This suggests that there might be a negative relationship between liquidity creation and bank stock returns. This is because an increase in liquidity creation can lead to a higher probability of facing bankruptcy, resulting in a decrease in bank performance. Hence, lower performance can have a negative impact on stock returns. Therefore, when a bank creates more liquidity for the public, this can result in a reduction of the bank's performance and lead to lower stock returns.

Based on the research studies and banking practices discussed above, it is believed that liquidity creation measurement variables linked to a bank's traditional and obligation activities that are not provided in the statement of financial position

hold crucial information regarding the expected returns of financial institutions. Therefore, this paper aims to investigate the relationship between liquidity creation measures and the next period stock returns. As such, this study expects to see a negative correlation between the liquidity creation measure and the next period bank stock returns in Thailand, which aligns with the first hypothesis. As a result, the disclosure of this outcome would assist investors in comprehending the variables that can impact returns and guide their trading strategies.

Conceptual Framework

Several academic articles attempt to measure the degree to which banks engage in liquidity creation. This paper employs the method proposed by Berger and Bouwman (2009) which is a commonly used approach to assess bank liquidity creation by examining their role in generating liquidity through converting liquid liabilities into illiquid assets. The method focuses on the extent to which banks create liquidity that is not directly available from the market. The basic idea of the Berger and Bouwman method is to estimate liquidity generation by a bank as the difference between the cash flows generated by its assets and liabilities. Then, the method applies a weighting and calculates the net liquidity creation.

This approach provides a useful way to assess the liquidity creation potential of banks and compare their liquidity creation abilities. The Berger and Bouwman method classifies the statement of financial position items by both maturity and category. However, this paper only uses the category classification to estimate the relationship, the convenience, expense, and duration for banks to liquidate their obligations for acquiring liquid funds are the key factors to consider when measuring liquidity creation. The ability to turn loans into securities is a better indicator of this concept than the time it takes for the assets to be sold by themselves. Thereby, this paper uses "LC (on-off-B/S)" and "LC (on-B/S)" as dependent variables, which pertain to the measurement of liquidity creation through both the statement of financial position items and other obligations items that are not disclosed in the statement of financial position and the statement of financial position items only, respectively.

As liquidity creation is perceived as a product of banks, it can affect their performance. A high level of created liquidity may lead to an increase in financing costs, causing the bank's profitability to decrease, and making it more vulnerable to the risk of distress. Several studies attempt to explore how bank liquidity creation is connected to both performance and profitability through measurement of return on assets and return on equity.

For a more precise assessment of a bank's long-term performance, this paper utilizes two chief accounting measures of bank profitability, namely Return on Average Assets (ROAA) and Return on Average Equity (ROAE). ROAA is used to evaluate a bank's ability to generate profits from its assets, taking into consideration

fluctuations in asset value over time. Furthermore, the examination of the ROAE disregards financial leverage and the corresponding risk. Therefore, ROAA and ROAE indicate the effectiveness of a bank's management in utilizing its assets to generate profits.

The primary focus of this research study is to examine stock returns, and to achieve this, the study adopts the use of the total return index gross dividend. By incorporating both the price appreciation and dividends received, this measure provides a comprehensive representation of stock returns. Furthermore, the utilization of the total return index gross dividend enables a more complete view of the overall returns obtained from holding a stock.

This study incorporates control variables to minimize the impact of potentially misleading factors on performance and stock returns. The selected control variables commonly utilized in financial research include Gross Domestic Product (GDP), Consumer Price Index (CPI), policy interest rates, capital adequacy ratio, deposits to assets ratio, efficiency ratio, loan to deposits ratio, crisis, and bank's size. Additionally, four additional control variables are included for stock returns analysis which are market index, dividend yield, P/E ratio, and book to market ratio.

These control variables assist in assessing the influence of macroeconomic conditions, inflation, central bank decisions, financial strength, funding stability, operational efficiency, loan activity, credit risk, economic downturns, and company size on performance and stock returns.

Considering all the factors mentioned earlier, the framework is presented as follows.
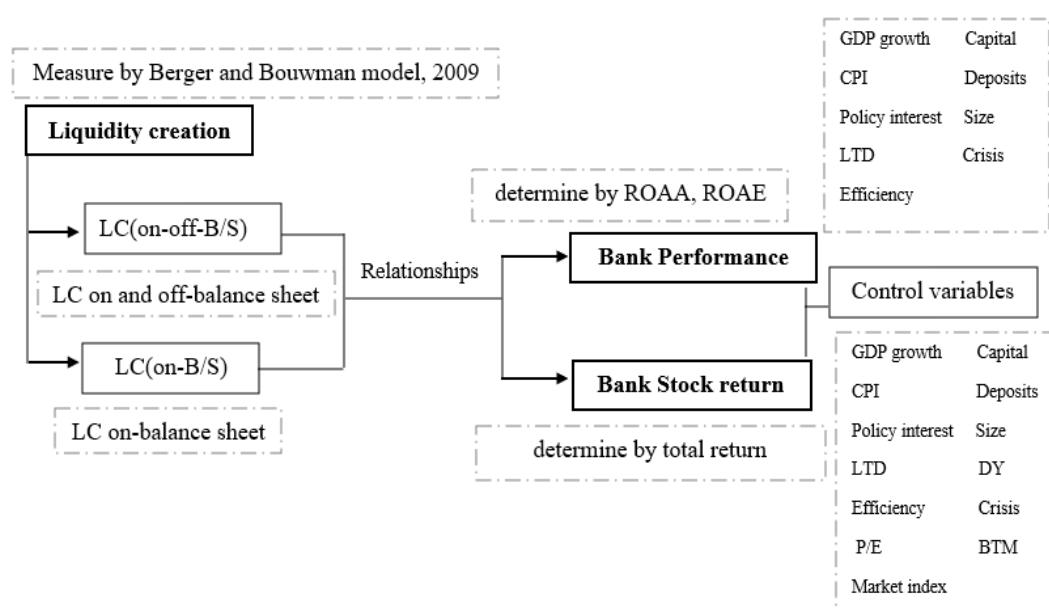
LITERATURE REVIEW

This section includes a concise overview of relevant literature to contextualize the framework. Specifically, this paper is connected to three areas of literature: the measurement of bank liquidity creation, empirical research on liquidity creation and performance, and theoretical discussions on the connection between liquidity creation and stock returns. This paper goes on to discuss each of these three fields of literature in detail.

Liquidity creation

Bank liquidity creation has been the subject of numerous researches in the fields of finance and economics. Nevertheless, there is currently no all-inclusive metric for measuring the degree of bank liquidity creation. The bank is essential to delivering liquidity through lending and investments in illiquid assets. Their proficiency in evaluating potential borrowers and keeping tabs on their activities gives them an upper hand in extending credit (Ramakrishnan and Thakor 1984);(Diamond 1984). By doing this, banks help counterparties execute tangible investments and participate in actions that they would lack the resources to finance otherwise.

Banks can create liquidity through deposits, which allows investors and account holders to remove their funds whenever, but this puts banks at risk of bank runs (Diamond and Dybvig 1983);(Berger, Bouwman et al. 2016). Additionally, investors can gain liquidity through items which are not included in the statement of financial position like credit arrangements and assurances. However, this can also pose a credit risk due to a lack of proper regulation. Deep and Schaefer (2004) measured liquidity conversion in the midst of the most sizeable US banks from 1997 to 2001. They define the liquidity conversion gap called the "LT gap," which is calculated as (liquid liabilities − liquid assets)/total assets.

They considered all debt with a duration of one year or less as being liquid but excluded credit arrangements and additional obligation activities that are not provided in the statement of financial position exposures because of their uncertain character. After analyzing a sample of large banks, they identified that the average LT gap was around one-fifth of the overall assets, leading them to conclude that these banks did not have a substantial liquid asset.

Berger and Bouwman (2009) conducted a more comprehensive study that included all commercial banks and arranged credits based on type instead of their term of repayment. They discovered that the level of liquidity generated by American banks rose every year from 1993 to 2003, and that both the statement of financial position items and other obligations activities that are not disclosed in the statement of financial position had a noteworthy impact. Fungáčová and Weill (2012) documented that the most significant liquidity creators were the big banks, while Rauch, Steffen et al. (2010) showed that German savings banks improved their liquidity from 1997 to

2006. Lei and Song (2013) discovered that Chinese banks created more liquidity over time, from RMB22bn in 1988 to RMB11.404tn in 2008.

Further research has shown that the level of liquidity generated by banks has increased over time, with both the statement of financial position items and other obligations activities that are not disclosed in the statement of financial position playing a significant role in liquidity creation. Different studies have highlighted the liquidity creation contributions of banks in various countries, including the United States, Germany, and China.

Liquidity creation and Performance

The topic of bank profitability and its drivers has been a subject of research for many years. Despite this, there has been relatively little investigation into the relationship between the generation of liquidity and bank profitability, and existing studies have produced varying outcomes due to variations in data sets, time periods, geographical contexts, and other factors. To supervise their liquidity, banks would often endeavor to limit their liquidity creation by possessing additional easily convertible assets as a mitigate liquidity risk, which arises from the imbalance of asset and liability duration.

However, since liquid assets tend to yield lower returns than illiquid assets, holding more of them can reduce a bank's revenue. Therefore, there may be a positive correlation between the generation of liquidity and the financial success of a bank. Berger and Bouwman (2009) suggest that greater liquidity creation leads to increased sharing of earnings with involved parties and the general public, resulting in a positive impact on the value of the bank. Berger and Bouwman (2015) carried out a study to examine the association between standardized liquidity generation and the financial success of American banks. The results showed that while a direct correlation exists between liquidity creation and profitability for large banks, the reverse is the case for medium and small banks.

Duan and Niu (2020) examined the impact of liquidity creation on the profitability of banks in the United States. They utilized a dataset consisting of several US banks and found that profitability is higher in banks that create more liquidity. This outcome remained consistent during normal times as well as during the market crash, and for banks of various sizes. They conducted a further analysis by breaking down liquidity creation into its individual components and found that the creation of liquidity on the liability side and obligation activities that are not provided in the statement of financial position is associated with higher profitability. However, asset-side liquidity creation is linked to lower profitability.

Meanwhile, Bordeleau and Graham (2010) suggest that increasing the proportion of assets held in liquid form helps to mitigate the risk of illiquidity of bank and subsequently the likelihood of failure to pay. This ultimately results in lower financing expenses and increased profit. The benefits of having higher liquid assets

and the resulting reduced default risk might be more significant than the drawbacks of having lower yields. However, apart from the advantages of reduced default risk through higher liquid assets, Tran, Lin et al. (2016) concluded that banks that engage in higher levels of liquidity creation and carry greater liquidity risk tend to have lower profitability.

Chen, Shen et al. (2018) examined the factors affecting liquidity risk and the relationship between liquidity risk and bank profitability. They analyzed data from 12 developed countries and found that liquidity risk, which was measured using the financing gap, was significantly and inversely related to both return on average assets (ROAA) and return on average equity (ROAE). They found that a higher financing gap, which represents higher liquidity creation, resulted in lower bank profitability as measured by ROAA and ROAE.

Sahyouni and Wang (2018) investigated the relationship between bank liquidity creation and profitability using a data of 4,995 banks from 11 developed and emerging countries. They discovered that banks that create more liquidity tend to have lower profitability, while asset management, bank size, and capital ratio are positively associated with bank profitability. In contrast, creditworthiness and operating effectiveness have negative effects on bank profits.

In addition, they examined the correlation between bank profitability and liquidity creation by banks in the Middle East and North Africa region. The findings indicated a negative relationship between banking performance and liquidity creation. (Sahyouni and Wang 2019)

Liquidity creation and Stock returns

There is no paper directly determining the relationship between liquidity creation and its stock returns. This paper attempts to contribute from the relevant literature. Diamond and Rajan (2001) observed that loans become illiquid when lenders require specialized skills to collect them. As a result, if the lender needs funds before the loan matures, they may need to liquidate early or demand a higher return when lending directly. Borrowers also face the risk of losing funding, if the relationship lender is a bank with a fragile capital structure that is susceptible to runs, the costs of illiquidity can be avoided. Banks with fragile capital structures are committed to creating liquidity to allow depositors to withdraw when needed, while also buffering borrowers from depositors' liquidity needs.

Salehi, Talebnia et al. (2011) examined the correlation between stock returns and liquidity ability in companies listed on the Tehran Stock Exchange. According to the results, there is a negative correlation between stock returns and liquidity. The study's findings support the belief that there is a negative relationship between stock returns and liquidity ability. A company with low liquidity ability may struggle to pay its debts and may be at risk of default.

Ioannidis, Molyneux et al. (2008) conducted a study to determine the correlation between profit efficiency changes and stock returns in 19 banking sectors across Asia and Latin America. Their findings indicated a strong positive correlation between the two variables.

Meanwhile, Moradi-Motlagh, Saleh et al. (2012) explored whether banks' changes in performance could account for changes in their stock market returns over a 10-year period. The results showed a significant positive association between performance changes and total shareholder return, indicating that well-performing banks tend to provide higher returns for their stockholders. Nurazi and Usman (2016) found that the relationship between certain financial ratios and banks' stock returns is a bit different from what the theory suggests. They discovered that ROE (Return on Equity) and LDR (Loan to Deposit Ratio) have a positive and significant impact on banks' stock returns.

This implies that banks can benefit more by increasing their loans to customers, which would result in higher profits based on the spread generated by their activities. This is consistent with the theory and previous research, which suggests that a higher LDR ratio indicates more loans disbursed in the form of third-party funds, leading to increased stock returns from higher income derived from the distribution of funds.

In contrast, NIM (Net Interest Margin) and BOPO (operating expense divided by operating income) showed negative signs in the Indonesian banking sector. According to Gharaibeh (2014), there is a negative correlation between stock returns and liquidity. Liquidity is crucial as the failure to meet obligations can result in a company's bankruptcy. Therefore, banks that create high liquidity for the public tend to hold more illiquid assets and are more likely to be unable to meet all of their obligations at maturity. As a result, investors may perceive the company as having a higher risk of default and may be unwilling to invest in the company's stock, leading to lower stock returns.

The literature exploring the relationship between bank liquidity creation and performance is characterized by its complexity and multidimensional nature. Researchers have yet to establish a universally accepted measure for bank liquidity creation due to the diverse nature of financial institutions and their operations. Existing studies indicate that the link between liquidity creation and performance is not a simple one and can be influenced by numerous factors. These factors encompass a range of variables, including different datasets, varying time periods, geographical contexts, and additional factors specific to each study. Consequently, the relationship between liquidity creation and performance remains a nuanced and context-dependent topic that necessitates comprehensive investigation.

Considering the complex nature of bank liquidity creation and performance, this paper focuses specifically on the characteristics of banks operating in Thailand. The objective is to assess the extent to which these banks contribute to liquidity creation within the economy and to examine how this liquidity creation is associated

with their overall performance and stock returns. By delving into the specific context of Thailand, this study aims to shed light on the dynamics of liquidity creation in a particular geographical setting and provide insights into the interplay between liquidity creation, bank performance, and stock market outcomes.

The findings of this research will contribute to a broader understanding of the complexities surrounding bank liquidity creation and its implications for financial institutions operating in Thailand.

DATA

Sample

This research centers on 11 banks listed on the Securities Exchange of Thailand (SET) as indicated in Table 1. The data collected spans a duration of 10 years, ranging from 2012 to 2021. The data for this research was collected on a quarterly basis, including bank stock returns sourced from Bloomberg, as well as the statement of financial position and obligation activities that are not provided in the statement of financial position.

Table 1: List of Banks Listed on the Securities Exchange of Thailand

No.	Company Name	IPO Year	Market Cap (Millions of Baht)
1	Bank of Ayudhya PCL	1977	213,317.09
2	CIMB Thai Bank PCL	1978	27,509.59
3	Kiatnakin Phatra Bank PCL	1988	53,345.32
4	Krung Thai Bank PCL	1989	266,942.77
5	Bangkok Bank PCL	1975	311,141.39
6	Kasikornbank PCL	1976	313,935.91
7	TMBThanachart Bank PCL	1983	152,908.70
8	TISCO Financial Group PCL	2009	77,062.14
9	LH Financial Group PCL	2011	22,454.68
10	Thanachart Capital PCL	1975	52,692.34
11	Siam Commercial Bank PCL	1976	343,444.94

Source: Securities Exchange of Thailand (SET), Data Retrieved on May 26, 2023

Independent variable
Liquidity creation

This study builds on existing research on bank liquidity creation and adopts the model developed by Berger and Bouwman in 2009 and 2015 to measure liquidity creation. This involves categorizing the statement of financial position items into different categories, as shown in Table 1, and using formulas for "LC(on-off-B/S)" which means that loans are category based and off-balance sheet items are included, and "LC(on-B/S)" which means that loans are category based and obligation activities that are not provided in the statement of financial position are excluded, as presented in Panel B. The process involves the following three steps:

1. Categorization of items on the statement of financial position based on liquidity into liquid, semiliquid, or illiquid

In the initial phase, assets and liabilities of the bank are classified into liquid, semi-liquid, or illiquid based on the convenience, expenditure, and duration required to convert them into liquid funds. This classification is crucial in determining the capacity of banks to fulfill the demands of their customers. Other obligations activities that are not disclosed in the statement of financial position are treated similarly to on-balance sheet items and are also categorized based on their liquidity.

2.Assigning weight ½, 0 and -½ to each item

According to the hypothesis, banks generate liquidity on their financial statements by converting illiquid assets into liquid liabilities. This involves banks holding onto illiquid items while giving liquid ones to the public, resulting in the creation of liquidity. Therefore, both non-liquid assets and cash-based liabilities are attributed with positive allocations. For instance, if a dollar of liquid liabilities such as transaction deposits is used to fund a dollar of illiquid assets such as business loans, the liquidity creation would be calculated as $0.5 \times ฿1 + 0.5 \times ฿1 = ฿1$. The half proportion is assigned to both non-liquid assets and cash-based liabilities due to both are necessary for liquidity creation, and the source of the funds alone only determines half of the liquidity created.

When banks convert liquid assets into illiquid liabilities, it leads to the destruction of liquidity. Thus, banks assign negative weights to both liquid assets and illiquid liabilities, including equity. Suppose a dollar of liquid assets is financed by a dollar of illiquid liabilities or equity, such as treasury securities. In that case, the liquidity creation is calculated as $-0.5 \times ฿1 + -0.5 \times ฿1 = -฿1$, indicating that the optimum liquidity is diminished.

The categorization of semiliquid activities implies that when banks employ cash-based obligations such as transaction deposits to fund highly convertible assets like treasuries, they do not generate liquidity. Similarly, they don't create liquidity when banks utilize non-liquid liabilities or equity to fund non-liquid assets such as corporate borrowing. This is because the liquidity of the items held by banks is roughly the same as the liquidity of the items given to the public. Therefore, they assign a weight of 0 to semiliquid assets and liabilities, since semiliquid activities are considered to fall midway between liquid and illiquid activities.

3. Aggregating items based on the categories assigned in the initial step and applying weights from the subsequent step.

The calculation for the LC (on-B/S) involves assigning weights to different asset and liability categories. It includes positive weights for illiquid assets and liquid liabilities, zero weights for semiliquid assets and semiliquid liabilities, and negative weights for liquid assets, illiquid liabilities, and equity.

The LC (on-off-B/S) calculation involves assigning weights to different asset, liability, and activity categories. It includes positive weights for illiquid assets and activities, and negative weights for liquid assets and activities, illiquid liabilities, and equity. It also includes zero weights for semiliquid assets, liabilities, and activities.

The classification of assets into categories based on their liquidity is preferred over maturity when measuring liquidity creation on the asset side because the ease, cost, and time it takes for banks to obtain liquid funds by disposing of their obligations is what matters. The ability to convert loans into securities is a more suitable measure for this concept than the time it takes for the assets to be sold on their own.

Bank liquidity creation in Thailand
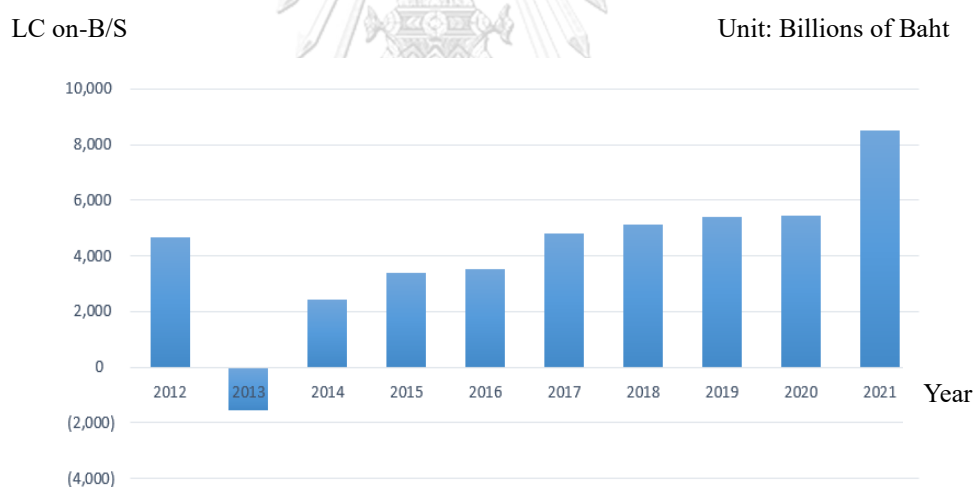
Figure A: Total Bank Liquidity Creation (On-Balance Sheet) from 2012 to 2021

Figure A illustrates the total bank liquidity creation values for the period spanning 2012 to 2021. In 2012, there was a substantial liquidity creation value of 4,600 billion baht. However, in 2013, the value turned negative due to an economic crisis in Thailand. The crisis was primarily triggered by political instability and the government's introduction of economic policies that faced strong opposition, resulting in widespread protests. This situation led to a decline in investor confidence and a slowdown in economic growth.

During an economic crisis, banks experience a contraction in liquidity creation. This occurs when banks face difficulties in extending new loans or meeting the demand for withdrawals from depositors. Small banks do not significantly create positive liquidity because the proportion of both assets and liabilities held in their financial statements does not dramatically change.

However, large banks destroy liquidity to the tune of approximately 1,400 billion Baht, while medium banks destroy around 176 billion Baht. This is due to the imbalance between liquid assets and illiquid liabilities items, such as long-term debt and other deposits, exceeding liquid liabilities and illiquid assets like demand deposits and commercial loans.

Following the crisis, there was a gradual increase in liquidity creation from 2014 to 2019. During the COVID-19 pandemic between 2019 and 2020, the value remained relatively stable. Notably, the largest increase in liquidity creation is observed in 2021, with a significant expansion in the LC-on-B/S value.
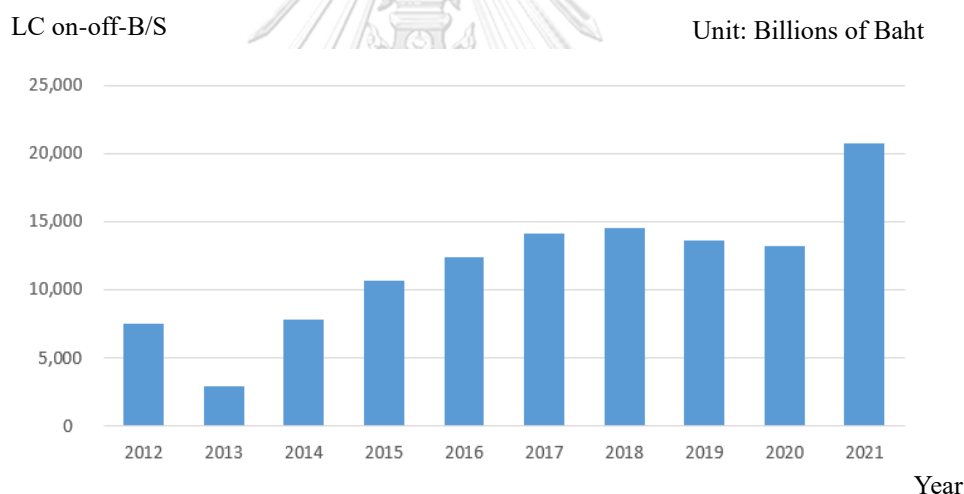
Figure B: Total Bank Liquidity Creation (On and Off Balance Sheet) from 2012 to 2021

Figure B provided showcases the values for liquidity creation on the balance sheet and off-balance sheet activities for the years 2012 to 2021. A noteworthy observation is that the liquidity creation values consistently surpass the corresponding LC-on-B/S values. This indicates that the banks' activities beyond their balance sheets, such as off-balance sheet activities, play a significant role in generating additional liquidity.

Additionally, there is a noticeable upward trajectory in liquidity creation between 2014 and 2018. This indicates a positive growth in the banks' capacity to generate liquidity through both on-balance sheet and off-balance sheet activities over

the specified period. Conversely, during the economic crisis, banks experienced adverse effects that resulted in a decline in liquidity generation.

The highest recorded value for liquidity creation occurs in 2021, reaching around 20,000 billion baht. This substantial increase reflects a significant surge in the banks' ability to generate liquidity. These findings emphasize the significance of considering not only the information presented on the balance sheet but also taking into account the off-balance sheet activities when assessing the liquidity creation capabilities of banks.

Dependent variables

Performance is assessed using two indicators: return on assets (ROA) and return on equity (ROE). ROA and ROE are commonly used metrics to evaluate a company's performance. ROA measures how efficiently a company uses its assets to generate profits, while ROE indicates how effectively it generates profits for shareholders' equity. These metrics provide valuable insights into a company's financial performance, profitability, and efficiency.

The stock return is assessed by utilizing the total return index in the Stock Exchange of Thailand (SET), which represents the comprehensive measure of investment returns generated by a portfolio consisting solely of banking stocks listed on the SET. It takes into account both the price appreciation and dividend income of the component stocks within the banking sector.

Control variables

To control and minimize the impact of variables that may produce misleading results on performance and stock returns, this study integrates measures to account for potentially confounding factors. The selected control variables in this study are commonly utilized in financial research and include the following:

GDP: The Gross Domestic Product provides a measure of overall economic activity and assists in assessing the impact of macroeconomic conditions on a bank's performance and stock returns.

CPI: The Consumer Price Index reflects inflationary pressures in the economy and including it as a control variable helps assess the effects of inflation on bank performance and stock returns.

Policy interest rates: By incorporating policy interest rates, the model considers the influence of central bank decisions on the overall cost of borrowing and lending, which can impact on a bank's performance and stock returns.

Capital adequacy ratio: This ratio measures a bank's capital reserves in relation to its risk-weighted assets, indicating its ability to absorb losses. Including it as a control variable account for the impact of capital strength on performance and stock returns.

Deposits to assets ratio: This ratio represents the proportion of a bank's assets financed by customer deposits. It helps assess the stability of funding sources and their potential influence on performance and stock returns.

Efficiency ratio: The efficiency ratio, which relates costs to revenues, helps assess a bank's cost management and operational efficiency, providing a control for its impact on performance and stock returns.

Loan to deposits ratio: This ratio indicates the level of loans granted compared to customer deposits, reflecting a bank's lending activity and its reliance on deposits for funding.

Crisis: The inclusion of the crisis variable accounts for the specific impact of economic downturns or financial crises on a bank's performance and stock returns.

Bank's size: Considering the bank's size as a control variable helps evaluate the potential influence of scale and economies of scale on performance and stock returns.

In addition to the previously mentioned control variables, this paper includes four additional commonly utilized control variables specifically for the analysis of stock returns. (Vo and Bui 2016) These extra control variables aim to mitigate and reduce the impact of factors that could influence stock returns.

Market index: Incorporating a market index from the Stock Exchange of Thailand (SET) helps control for overall market movements and systematic risks that affect all stocks in the market.

Dividend yield: Dividend yield reflects the ratio of dividends paid by a company relative to its stock price and can provide insights into investor income and expectations of future cash flows.

P/E ratio: The Price-to-Earnings ratio compares a company's stock price to its earnings per share and helps assess valuation levels and investor sentiment towards the stock.

Book to market ratio: This ratio compares a company's book value (assets minus liabilities) to its market value and is used as a proxy for distinguishing between undervalued stocks and overvalued stocks.

Table 2: Definition of variables

     This table provides an overview and definition of the dependent and independent variables utilized in the regression analysis conducted within this research, along with the sources from which data was obtained.

Variables Dependent	Data source	Description
RETURN	Bloomberg	Measures total stock return (gross dividend)
ROA	Bloomberg	Measures of performance. Calculate as: (Net income/Average Total assets)*100
ROE	Bloomberg	Measures of performance. Calculate as: (Net income available for common shareholders/Average Total common equity)*100
Independent		
LC ON-B/S	Self-calculated	Measures of how bank create liquidity to the public based on statement of financial position
LC ON-OFF-B/S	Self-calculated	Measures of how bank create liquidity to the public based on statement of financial position and off-balanced sheet activities
Control		
EFF Ratio	Bloomberg	Measures costs compared to revenues
DTA	Bloomberg	Calculate as: (Customer Deposits/ Total Assets)*100
LTD	Bloomberg	Calculate as: (Total loans/Total deposits)*100
CAR	Bloomberg	Capital adequacy ratio. Measure total risk-based capital to risk-weighted assets
POLICY RATE	Bank of Thailand	Policy interest rate
GDP	Bloomberg	Nominal GDP
CPI	Bloomberg	Consumer price index
Market index	Bloomberg	SET market index
Dividend Yield	Bloomberg	Percentages of dividend income
P/E ratio	Bloomberg	The price-to-earnings ratio compares a company's stock price to its earnings per share (EPS). It represents the market's valuation of a company's earnings.
BTM ratio	Bloomberg	The book to market ratio, compares a company's book value (its net asset value) to its market value (its market capitalization).
Crisis (Dummy)	-	Dummy variable indicates an economic crisis by taking a value of 1 if it occurs in the years 2013, 2019, and 2020, and 0 otherwise
Sized	Bloomberg	Natural logarithm of total assets for each financial institution

METHODOLOGY

Independent Variable: Liquidity creation

Table 3: Categorization of bank items based on liquidity.

Illiquid assets (weight = 0.5)	Semiliquid assets (weight = 0)	Liquid assets (weight = -0.5)
Assets		
Corporate commercial loans Investment in property Investments in Associates, Joint Ventures, and Unconsolidated Subsidiaries Property, Plant & Equipment Goodwill Intangible assets Other assets	Loans - Consumer & Installment Loans - to Customers Loans - Mortgage/Real Estate Lending & Long-Term Deposits Due from Banks Collateralized Agreements, Reverse REPOs & Securities Borrowed – Assets Receivables – Other Insurance Related Assets - Bank	Cash & Short-Term Deposits Due from Banks Derivative Financial Instruments - Hedging - Total Investment Securities - Held for Trading Investment Securities Available for Sale & Held to Maturity Investment Securities - Other
Liquid liabilities (weight = 0.5)	Semiliquid liabilities (weight = 0)	Illiquid liabilities (weight = -0.5)
Liabilities and equity		
Deposits - Demand - Customer Deposits - Savings – Customer Derivative Liabilities – Hedging	Deposits - Other – Customer Deposits - Due to Banks & Financial Institutions Short-Term Debt & Current Portion of Long-Term Debt Short-Term Debt & Notes Payable Short-Term Banking Borrowings excluding Collateralized Financing	Long-Term Debt excluding Capitalized Leases Debt - Non-Convertible - Long-Term Deferred Tax & Investment Tax Credits - Long-Term Payables & Accrued Expenses Other liabilities Total equity
Off-balance-sheet activities		
Illiquid activities (weight = 0.5)	Semiliquid activities (weight = 0)	Liquid activities (weight = -0.5)
Acceptances and documentary Credits reported off-balance -sheet Committed credit lines Net letter of credit Other contingent liabilities	Managed securitized assets reported off-balance -sheet Other off-balance -sheet exposure to securitizations Guarantees	

Table 4: LC(on-B/S) and LC(on-off-B/S) formulas

LC(on-B/S) =	+0.5 × illiquid assets +0.5 × liquid liabilities	0 × semiliquid assets 0 × semiliquid liabilities	-0.5 × liquid assets -0.5 × illiquid liabilities -0.5 × equity
LC(on-off-B/S) =	+0.5 × illiquid activities +0.5 × illiquid assets +0.5 × liquid liabilities	0 × semiliquid activities 0 × semiliquid assets 0 × semiliquid liabilities	-0.5 × liquid activities -0.5 × liquid assets -0.5 × illiquid liabilities -0.5 × equity

Source: Adopted from Lei and Song (2013), Berger and Bouwman (2009)

Based on panel data that includes multiple individuals observed over several years, a fixed effects model is suitable. This model enables the control of unobserved heterogeneity specific to each firm and controls for potential confounding effects, allowing for accurate estimation of the specific effects of other variables of interest over time. Additionally, it allows for the estimation of effects within individuals and their variations over time.

1.Measurement performance

To investigate the Hypothesis 1: The relationship between liquidity creation measurement is negatively associated with next period bank performance in Thailand. The model could be shown as follows:

Performance (ROA)$_{i,t}$ = $\beta i + \beta_1$LC(on-B/S)$_{i,t-1} + \beta_2$LC(on-B/S)$^2_{i,t-1} + \sum\beta_j$Controls$_{i,t} + \varepsilon_{i,t}$ (1)

Performance (ROA)$_{i,t}$ = $\lambda_i + \lambda_1$LC(on-off-B/S)$_{i,t-1} + \lambda_2$LC(on-off-B/S)$^2_{i,t-1} + \sum\beta_j$Controls$_{i,t} + \varepsilon_{i,t}$ (2)

Performance (ROE)$_{i,t}$ = $\beta i + \beta_1$LC(on-B/S)$_{i,t-1} + \beta_2$LC(on-B/S)$^2_{i,t-1} + \sum\beta_j$Controls$_{i,t} + \varepsilon_{i,t}$ (3)

Performance (ROE)$_{i,t}$ = $\lambda_i + \lambda_1$LC(on-off-B/S)$_{i,t-1} + \lambda_2$LC(on-off-B/S)$^2_{i,t-1} + \sum\beta_j$Controls$_{i,t} + \varepsilon_{i,t}$ (4)

This is a panel data regression model where 'i' refers to the bank, 't' refers to a specific quarter, and 'Performance' represents the dependent variable, which is a measure of return on average assets and return on average equity. 'Controls' represents other control variables.

In equation (1) and (3), the coefficient $\beta1$ corresponds to the liquidity creation measurement variable, indicating the relationship between the measurement of liquidity creation and the next period bank performance. Similarly, in equation (2) and (4), the coefficient $\lambda1$ also measures the relationship between the liquidity creation variable and the next period bank performance. However, the independent variable in

equation (2) and (4) represents both the LC derived from the statement of financial position and other obligations that are not disclosed in the statement of financial position.

This paper examines the relationship between liquidity creation and the performance of banks, focusing on the variables $\beta 1$ and $\lambda 1$. It is expected to find a significant negative effect of liquidity creation on performance. When banks engage in higher levels of liquidity creation, it increases the risk of illiquidity. By allocating more resources towards creating liquidity, banks may find themselves with fewer liquid assets available to meet their obligations in a timely manner. This increased illiquidity risk exposes the banks to potential financial distress or even bankruptcy.

Conversely, the paper suggests that reducing liquidity creation can potentially yield positive effects on bank performance. By limiting liquidity creation, banks can mitigate the risk of illiquidity, enhance profitability, and consequently reduce the likelihood of financial distress. This can lead to lower financing costs and an improvement in overall performance.

2. Combining the effects of Liquidity Creation and economic crisis on the bank's performance

As we can observe a downward trend in bank liquidity creation during economic crises in 2013, 2019, and 2021, this section aims to further investigate the specific relationship between bank performance and liquidity creation, especially during these crisis periods. It is anticipated that the joint effects of the crisis period and liquidity creation would influence the bank's performance. The following models present regression equations.

$$\text{Performance (ROA)}_{i,t} = \beta i + \beta_1 \text{LC(on-B/S)}_{i,t} + \beta_2[\text{LC(on-B/S)}_{i,t}*\text{Crisis}] + \sum \beta_j \text{Controls}_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$\text{Performance (ROA)}_{i,t} = \lambda i + \lambda_1 \text{LC(on-off-B/S)}_{i,t} + \lambda_2[\text{LC(on-off-B/S)}_{i,t}*\text{Crisis}] + \sum \lambda_j \text{Controls}_{i,t} + \varepsilon_{i,t} \quad (6)$$

$$\text{Performance (ROE)}_{i,t} = \beta i + \beta_1 \text{LC(on-B/S)}_{i,t} + \beta_2[\text{LC(on-B/S)}_{i,t}*\text{Crisis}] + \sum \beta_j \text{Controls}_{i,t} + \varepsilon_{i,t} \quad (7)$$

$$\text{Performance (ROE)}_{i,t} = \lambda i + \lambda_1 \text{LC(on-off-B/S)}_{i,t} + \lambda_2[\text{LC(on-off-B/S)}_{i,t}*\text{Crisis}] + \sum \lambda_j \text{Controls}_{i,t} + \varepsilon_{i,t} \quad (8)$$

The variable 'Crisis' is incorporated as a dummy variable, taking the value of 1 during the crisis period and 0 during the normal period. The interaction terms, LC(on-B/S)*Crisis and LC(on-off-B/S)*Crisis, capture the joint effect of liquidity creation on balance sheet and crisis period on bank performance and liquidity creation on and off-balance sheet and crisis period on bank performance.

The coefficient $\beta 2$ and $\lambda 2$ measure the strength and direction of these interaction effects. After conducting the analysis, the specific direction (positive or negative) of these coefficients will be determined, providing further understanding of

how the economic crisis period influences the interaction between liquidity creation and bank performance.

3.Measurement stock returns

To investigate the Hypothesis 2: The relationship between liquidity creation measurement is negatively correlated to next period bank stock returns in Thailand. The model could be shown as follows:

$$\text{Return}_{i,t} = \propto_i + \propto_1 \text{LC(on-B/S)}_{i,t\text{-}1} + \textstyle\sum \propto_j \text{Controls}_{i,t} + \eta_{i,t} \quad (9)$$

$$\text{Return}_{i,t} = \gamma_i + \gamma_1 \text{LC(on-off-B/S)}_{i,t\text{-}1} + \textstyle\sum \gamma_j \text{Controls}_{i,t} + \eta_{i,t} \quad (10)$$

Equation (9) represents the coefficient $\propto_1$, which pertains to the measurement of liquidity creation. This coefficient illustrates the connection between liquidity creation measurement and subsequent bank returns in the next period. Likewise, equation (10) incorporates the coefficient γ_1, which also evaluates the relationship between the liquidity creation variable and subsequent bank returns. Nonetheless, the independent variable in equation (10) represents both the LC derived from the statement of financial position and obtained from the statement of financial position and additional obligations that are not explicitly revealed in the statement of financial position.

This paper predicts a significant negative impact of $\propto_1$ and γ_1, suggesting an expected correlation between higher liquidity creation and lower stock returns in both the current and subsequent periods. This anticipation aligns with the initial hypothesis proposed in the study.

To explain this relationship, it is observed that banks often generate more liquidity for the public, resulting in a larger proportion of assets that are difficult to convert into cash quickly. Consequently, banks face an increased risk of being unable to meet their obligations when they are due. This intensified default risk may lead investors to perceive the company as carrying a higher level of risk. As a response, investors may hesitate to invest in the bank's stock, fearing potential losses. This hesitation and decreased demand for the stock ultimately lead to lower stock returns.

In contrast, the paper expects that lower levels of liquidity creation would correspond to higher stock returns. When banks engage in less liquidity creation, they are likely to have a smaller portion of illiquid assets and face lower default risk. This reduced risk perception may attract investors who consider the bank a safer investment option. As a result, the demand for the bank's stock may increase, leading to higher stock returns.

4. Combining the effects of Liquidity Creation and economic crisis on the bank's returns.

To gain a deeper understanding of liquidity creation and bank returns during a crisis period, this section aims to investigate how the correlation of bank's returns is influenced by the combined impact of liquidity creation and crisis. The subsequent models illustrate regression Equations (11) and (12).

$Return_{i,t} = \propto i + \propto 1 \ LC(on\text{-}B/S)_{i,t} + \propto 2[LC(on\text{-}B/S)i,t*Crisis] + \sum \propto jControls_{i,t} + \eta_{i,t}$
(11)

$Return_{i,t} = \gamma i + \gamma 1 \ LC(on\text{-}off\text{-}B/S)_{i,t} + \gamma 2[LC(on\text{-}off\text{-}B/S)i,t*Crisis] + \sum \gamma jControls_{i,t} + \eta_{i,t}$
(12)

The variable 'Crisis' is introduced as a categorical variable, with a value of 1 assigned to the crisis period and 0 assigned to the normal period. The interaction terms, LC(on-B/S)*Crisis and LC(on-off-B/S)*Crisis, capture the combined influence of liquidity creation on the balance sheet and the crisis period on bank stock returns, as well as the combined impact of liquidity creation on and off the balance sheet and the crisis period on bank stock returns.

The coefficients $\propto 2$ and $\gamma 2$ quantify the magnitude and direction of these interaction effects. Through the analysis, the specific direction (positive or negative) of these coefficients will be determined, providing further insight into how the economic crisis period affects the interplay between liquidity creation and bank stock returns.

5. Supportive Analysis Hypotheses

To provide comprehensive support for the hypothesis, it is advisable to employ both statistical and visualization techniques. By combining these two approaches, the strengths of each can be leveraged. Statistical tests offer thorough quantitative analysis that evaluates the statistical significance of the observed variables of interest. Meanwhile, visualization provides an intuitive and visually appealing way to represent the data, enabling a deeper understanding of relationships and patterns. This dual approach enhances the strength of the evidence, boosts the credibility of the analysis, and ensures a thorough and convincing assessment of the research objective.

Statistical Test: Mann-Whitney U Test

This paper explores the analysis using the Mann-Whitney U test, also known as the Wilcoxon rank-sum test. The Mann-Whitney U test is a non-parametric test used to compare the distributions of two groups when the data do not meet the assumptions of normality. By employing this method, the paper aims to explore additional avenues for validating the hypothesis. This method serves to broaden the analysis, allowing for a more thorough examination of the research question.

By considering multiple perspectives and approaches, the paper seeks to enhance the overall findings and provide a well-rounded assessment of the hypothesis.

The following are the steps involved in conducting the analysis:

1. Define the groups:
- Divide the data into two groups based on the level of liquidity creation, distinguishing between high-liquidity creation banks and low-liquidity creation banks.
- Identify banks with high liquidity creation by examining a liquidity creation measure that falls within the range of the 80th and 90th percentile in a given quarter, surpassing the threshold of the 90th percentile.
- Categorize banks with low liquidity creation by determining if their liquidity creation measure falls within the range of the 10th and 20th percentile in a given quarter or falls below the threshold of the 10th percentile in the distribution.

2. Calculate separate descriptive statistics for each group:
- Calculate the relevant performance and stock return metrics for both groups separately.
- Provide a comprehensive overview of the characteristics of the variables within each group.
- Use this information to understand the data, assess the assumptions of the Mann-Whitney U test, and accurately interpret the results.

3. Formulate hypotheses:

H0a: There is no significant difference between the distributions of bank performance in the high-liquidity creation group and the low-liquidity creation group.

H1a: There is a significant difference between the distributions of bank performance in the high-liquidity creation group and the low-liquidity creation group.

H0b: There is no significant difference between the distributions of stock returns in the high-liquidity creation group and the low-liquidity creation group.

H1b: There is a significant difference between the distributions of stock returns in the high-liquidity creation group and the low-liquidity creation group.

4. Perform the Mann-Whitney U test:
- Calculate the U statistic by comparing the ranks of the variables of interest (bank performance and stock returns) between the two groups.
- This non-parametric test assesses whether there are statistically significant differences in the variables between the groups.

5. Analyze the results:
- Examine the p-value associated with the U statistic.
- If the p-value is less than the significance level, it indicates that there are statistically significant differences between the high and low liquidity creation groups for bank performance and stock returns.
- If the test yields statistically significant differences, it supports the hypotheses and provides evidence for the relationship between liquidity creation and bank performance and stock returns.

6. Visualization Analysis:

Visualizations have been created to enhance understanding and gain comprehensive insights into the differences between the high-liquidity creation group and the low-liquidity creation group. While the Mann-Whitney U test provides statistical evidence of a significant difference between the groups, visualizations can help to better understand and communicate the nature of that difference. The Mann-Whitney U-test determines the presence of a significant difference between the groups but does not directly indicate which group exhibits higher or lower bank performance.

These visualizations help to highlight trends, patterns, and variations in performance and stock returns between the groups, thereby enhancing the understanding and interpretation of the data. It is important to note that their primary function is not to justify the results, but rather to provide valuable insights and support the interpretation process.

In order to support hypothesis 1, if the U test demonstrates a statistically significant difference between the groups and the visualization assists in determining whether there is a decrease in bank performance within the high liquidity creation group, this confirms the hypothesis. Thus, it indicates a connection between higher levels of liquidity creation and lower bank performance in the subsequent period.

To support hypothesis 2, evidence can be obtained by examining whether a significant difference exists between the groups using the U test. Additionally, visualizing the data allows for the identification of potential decreases in bank stock returns within the high liquidity creation group. If these findings align, it confirms the hypothesis and implies a connection between higher levels of liquidity creation and lower bank stock returns in the next period.

Overall, incorporating the Mann-Whitney U test analysis and visualization allows for enhanced empirical evidence supporting the methodology. By examining various aspects and perspectives related to liquidity creation, bank performance, and stock returns, it provides a more robust and comprehensive analysis of the research topic, increasing the credibility and effectiveness of the findings.

RESULTS AND DISCUSSIONS
1.Descriptive of variables

Table 5: Overall Descriptive Statistic

Variables	Obs	Mean	Std. Dev.	Min	P25	Median	P75	Max
Dependent Variables								
ROA	440	1.203	.586	-.292	.806	1.170	1.455	4.421
ROE	440	11.237	4.953	-3.069	7.972	10.745	14.197	23.445
RETURN	440	2.279	14.237	-47.549	-6.471	1.933	10.363	60.21
Independent Variables								
LC-ON-BS	440	.949	2.933	-13.169	-.788	.102	2.618	11.734
LC-ON-OFF-BS	440	3.232	5.013	-10.969	-.341	1.950	5.326	21.656
Control Variables								
EFF RATIO	440	47.119	8.278	20.37	41.804	46.356	51.304	92.075
DTA	440	63.903	15.7	0	62.352	68.138	73.104	78.71
LTD	440	109.143	27.157	71.005	94.971	102.326	118.099	337.506
CAR	440	17.184	2.236	11.93	15.54	17.275	18.585	24.18
INT.RATE	440	1.619	.721	.5	1.5	1.5	2	3
GDP	440	3.777	5.294	-14.8	2.65	4.4	6.3	21.7
CPI	440	.923	1.353	-2.67	.18	.79	2	3.39
MKT INDEX	440	1,491.765	163.029	1,125.86	1,379.71	1,505.245	1,591.685	1,776.26
DY	440	3.703	2.66	0	2.113	3.376	4.654	24.138
BTM	440	.992	.462	.289	.679	.869	1.179	2.817
PE RATIO	440	13.731	11.733	4.473	8.626	10.599	12.793	115.49
lnSIZE	440	13.715	1.099	11.356	12.581	13.841	14.798	15.282
D.CRISIS	440	.225	.418	0	0	0	0	1

The dataset consists of 440 observations, encompassing data from 11 banks for the years 2012-2021, on a quarterly basis. It includes dependent, independent, and control variables. These descriptive statistics provide a comprehensive overview of the dataset, offering insights into the central tendency, variability, and distribution of each variable. The statistics indicate the range of values and potential outliers, aiding in further analysis and interpretation.

Regarding the dependent variables, ROA (return on assets) and ROE (return on equity) serve as key performance metrics for banks. On average, ROA is approximately 1.203%, indicating a moderate level of variability around this mean. For ROE, the average is 11.237%, but it has a higher standard deviation of 4.953%. This suggests that, while banks have an average ROE of 11.237%, there is greater variability in this metric compared to ROA.

The distribution of both ROA and ROE is right-skewed. As for return, this variable has an average of 2.279% and exhibits substantial variation, with a minimum of -47.549% and a maximum of 60.21%. The distribution is left-skewed.

In terms of independent variables, LC-ON-BS (Liquidity Creation on the Balance Sheet) averages 0.949 (100 billion baht) with a relatively high standard deviation of 2.933, signifying significant data dispersion. LC-ON-OFF-BS (Liquidity Creation on and off the Balance Sheet) has an average of 3.232 (100 billion baht) and a standard deviation of 5.013, also indicating considerable data dispersion. Both variables show positive means and exhibit positive skewness, suggesting that, on average, banks in the sample engage in liquidity creation activities.

For control variables, the Efficiency ratio (EFF RATIO) has a mean of 47.119%, reflecting variability in cost management. The deposit-to-total-assets ratio (DTA) and loan-to- deposit-ratio (LTD) distributions are right-skewed and have averages of 63.903% and 109.143%, respectively, indicating variation. The capital adequacy ratio (CAR) measures capital sufficiency, averaging 17.184%.

The market index (MKT INDEX) represents the performance of the overall market. In this dataset, it has an average value of approximately 1,491.765 with some variability. The dataset shows an average dividend yield (DY) of 3.703%, with variations among different investments. Some investments have no dividend yield, while others exhibit higher yields, as indicated by the percentiles.

The BTM (book-to-market ratio) has an average of 0.992 with a standard deviation of 0.462, indicating that companies may have lower book values relative to their market values. The PE ratio (price-to-earnings ratio) has a mean of 13.731, with variability among different companies. Some companies have lower PE ratios, indicating potentially undervalued stocks, while others have higher PE ratios, indicating potentially overvalued stocks. On average, the PE ratio among these companies is 13.731.

The size, represented by the natural logarithm of total assets for each financial institution (lnSIZE), has an average of 13.715, with values ranging from 11.356 to 15.282. The distribution is symmetric, with P25 and P75 at 12.581 and 14.798. As for D.CRISIS (Dummy for Financial Crisis), this binary variable has a mean of 0.225, indicating the proportion of observations with a financial crisis.

Concerning market attributes, INT.RATE (policy interest rate) averages 1.619%, with little variation, reflecting central banks' interest rate policies. GDP (gross domestic product) averages 3.777% with a standard deviation of 5.294, indicating variability in economic growth. CPI (consumer price index) averages 0.923% with a standard deviation of 1.353, measuring inflation rates. The distribution exhibits right-skewness.

Table 6: The matrix of correlation for hypothesis 1

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) ROA	1.000												
(2) ROE	0.709***	1.000											
(3) LC-ON-BS	-0.135***	-0.179***	1.000										
(4) LC-ON-OFF-BS	-0.445***	-0.492***	0.595***	1.000									
(5) EFF_RATIO	-0.426***	-0.388***	-0.009	0.306***	1.000								
(6) DTA	0.247***	0.099**	0.282***	0.097**	-0.022	1.000							
(7) LTD	-0.079*	0.030	-0.199***	-0.147***	0.094**	-0.357***	1.000						
(8) CAR	0.205***	-0.168***	0.067	0.140***	-0.187***	-0.029	-0.009	1.000					
(9) INT.RATE	0.009	0.319***	-0.128***	-0.214***	0.172***	0.014	0.045	-0.569***	1.000				
(10) GDP	0.004	0.112**	-0.037	-0.083*	0.063	0.032	0.042	-0.217***	0.507***	1.000			
(11) CPI	0.004	0.152***	-0.042	-0.105**	0.153***	0.010	0.064	-0.254***	0.636***	0.588***	1.000		
(12) SIZE	-0.086*	-0.080*	0.401***	0.236***	-0.216***	0.467***	-0.449***	0.020	-0.098**	-0.037	-0.065	1.000	
(13) CRISIS	-0.036	-0.005	-0.014	-0.013	0.039	-0.013	-0.085*	0.128***	-0.193***	-0.547***	-0.222***	0.013	1.000

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 7: The matrix of correlation for hypothesis 2

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) RETURN	1.000															
(2) LC-ON-BS	-0.038	1.000														
(3) LC-ON-OFF-BS	-0.024	0.595***	1.000													
(4) EFF_RATIO	0.001	-0.009	0.306***	1.000												
(5) DTA	0.009	0.282***	0.097**	-0.022	1.000											
(6) LTD	0.101**	-0.199***	-0.147***	0.094**	-0.357***	1.000										
(7) CAR	-0.001	0.067	0.140***	-0.187***	-0.029	-0.009	1.000									
(8) INT.RATE	0.041	-0.128***	-0.214***	0.172***	0.014	0.045	-0.569***	1.000								
(9) GDP	0.047	-0.037	-0.083*	0.063	0.032	0.042	-0.217***	0.507***	1.000							
(10) CPI	-0.085*	-0.042	-0.105**	0.153***	0.010	0.064	-0.254***	0.636***	0.588***	1.000						
(11) MKT.INDEX	0.169***	0.040	0.088*	-0.094**	0.075	-0.041	0.314***	-0.257***	0.238***	0.004	1.000					
(12) DY	-0.136***	-0.058	-0.329***	-0.263***	-0.286***	0.118**	0.251***	-0.315***	-0.365***	-0.297***	-0.153***	1.000				
(13) BTM	-0.183***	0.151***	0.293***	-0.003	-0.032	-0.084*	0.359***	-0.656***	-0.476***	-0.381***	-0.080*	0.261***	1.000			
(14) PERATIO	0.023	-0.045	0.417***	0.447***	-0.055	0.067	-0.076	0.176***	0.169***	0.148***	0.100**	-0.411***	-0.157***	1.000		
(15) SIZE	-0.024	0.401***	0.236***	-0.216***	0.467***	-0.449***	0.020	-0.098**	-0.037	-0.065	0.066	-0.168***	0.134***	-0.264***	1.000	
(16) CRISIS	-0.245***	-0.014	-0.013	-0.039	-0.013	-0.085*	0.128***	-0.193***	-0.547***	-0.222***	-0.340***	0.315***	0.359***	-0.126***	0.013	1.000

*** p<0.01, ** p<0.05, * p<0.1

Table 6 represents the correlation matrix that provides insights into the connections among various variables within the dataset related to hypothesis 1. LC-ON-BS shows a slight adversely significant correlation with both return on assets and return on equity. Similarly, LC-ON-OFF-BS demonstrates a moderately negative and significant correlation with return on assets and return on equity. The result consists of the hypothesis that banks that create more liquidity for the public tend to hold more liquidity risk, which they are likely to face with default losses and poor performance.

Several control variables also exhibit significant correlations with performance metrics, potentially influencing the relationships under investigation in this research. Bank-specific factors such as the deposit-to-total-assets ratio and capital adequacy ratio exhibit modest associations with return on assets. However, the capital adequacy ratio demonstrates a minor negative relationship with return on equity.

As for the efficiency ratio, it exhibits a strong negative correlation with bank performance metrics, particularly return on assets, whereas the loan-to-deposit ratio and the bank's size demonstrate a weak negative correlation with liquidity creation of both types. Regarding size, it exhibits a slightly adverse correlation with performance metrics.

Furthermore, other variables for controlling economic factors, such as the policy interest rate, GDP, and CPI, show significant positive correlations with return on equity. This suggests that changes in these economic variables are associated with changes in return on equity and should be considered when analyzing or predicting a company's financial performance.

Table 7 shows the connection between liquidity creation and stock returns is statistically insignificant. However, there is a marginal negative correlation between liquidity creation on the balance sheet (LC-ON-BS) and stock returns, with a correlation coefficient of 0.038. Liquidity Creation on and off the Balance Sheet (LC-ON-OFF-BS) displays a slight negative correlation with stock returns, with a coefficient of -0.024.

This indicates a minimal inverse relationship between liquidity creation on and off the balance sheet and stock returns, which aligns with hypothesis 2 that high liquidity creation intensifies default risk and may lead investors to perceive the company as carrying a higher level of risk. As a response, investors may hesitate to invest in the bank's stock, fearing potential losses. This hesitation and decreased demand for the stock ultimately lead to lower stock returns.

Regarding control variables, there is a weak but statistically significant positive correlation between the loan-to-deposit ratio and stock returns. Additionally, the market index (MKT INDEX) shows a moderately positive correlation with stock returns, indicating a positive relationship between overall market performance and stock returns. Similarly, the price-to-earnings ratio (PE ratio) exhibits a moderately positive but statistically insignificant correlation with stock returns.

In contrast, dividend yield (DY) exhibits a moderate negative correlation with stock returns. This implies that stocks with higher dividend yields tend to have lower returns. Similarly, the book-to-market ratio (BTM) displays a moderate negative correlation with stock returns, suggesting that companies with lower book values relative to their market values may experience lower stock returns. During economic crises, there is a significantly negative correlation with stock returns.

2. The results of hypothesis 1: The relationship between liquidity creation measurement is negatively associated with next-period bank performance in Thailand.

Table 8: The relationship between bank liquidity creation and next-period return on assets

Performance ROA	Model (1)	Model (2)
Lagged LC(on-B/S)	-0.0190**	
	(0.00773)	
Lagged LC(on-B/S)^2	-0.00237**	
	(0.00105)	
Lagged LC(on-off-B/S)		-0.0328***
		(0.00874)
Lagged LC(on-off-B/S)^2		-0.000409
		(0.000512)
EFF_RATIO	-0.0112***	-0.0112***
	(0.00263)	(0.00259)
DTA	0.00416***	0.00275*
	(0.00141)	(0.00143)
LTD	-0.00127*	-0.000915
	(0.000700)	(0.000697)
CAR	0.0411***	0.0500***
	(0.00927)	(0.00950)
INT.RATE	-0.0586	-0.0508
	(0.0372)	(0.0366)
GDP	0.00129	0.00106
	(0.00432)	(0.00429)
CPI	0.00627	0.00177
	(0.0164)	(0.0161)
SIZE	-0.881***	-0.831***
	(0.0598)	(0.0608)
D.CRISIS	-0.0307	-0.0105
	(0.0446)	(0.0441)
Constant	13.10***	12.36***
	(0.841)	(0.860)
Time FE	Yes	Yes
Individual FE	Yes	Yes
R^2	0.462	0.474
Observations	439	439
Number of id	11	11

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Model 1 analyzes the relationship between bank liquidity creation on the balance sheet and the next period's return on assets. The results reveal that for every 100 billion baht increase in liquidity creation on the balance sheet, there is an associated 0.019% decrease in the next period in the return on assets.

Furthermore, the negative sign and statistical significance of the squared term of liquidity creation suggest that the relationship between liquidity creation and bank performance is inverted U-shaped and changes depending on the level of liquidity creation.

Specifically, as the level of liquidity creation on the balance sheet increases, return on assets in the following period increases. However, the rate of increase diminishes as liquidity creation increases. It continues to rise until it reaches an optimal level, beyond which further liquidity creation could potentially lead to a decline in return on assets in the subsequent period.

Initially, as banks engage in more liquidity creation, they often experience efficiency gains. This is because they can use the additional liquidity to invest in more profitable assets, generating interest income. These actions can lead to an improvement in the return on assets. According to Berger and Bouwman (2009) and Duan and Niu (2020), they identified a positive correlation between liquidity creation and profitability. When a bank increases liquidity creation, it is associated with higher returns on interest and might contribute to an enhanced net interest margin, which measures a bank's ability to manage earning assets.

In contrast, when banks assume more risk and become involved in speculative activities, they expose themselves to heightened risks stemming from their liquidity creation. In cases where a bank is unable to effectively manage the associated risks of high liquidity creation, it can potentially incur losses due to defaults, resulting in financial instability. This finding is consistent with the research conducted by Bordeleau and Graham (2010) and Tran, Lin et al. (2016). Therefore, this presents a significant trade-off for banks to balance between efficiency, profitability, and risk management.

The results for the other control variables generally align with those of other studies. The results reveal a significant and positive correlation between the capital adequacy ratio and the return on assets. Specifically, for every 1% increase in capital adequacy ratio, there is a corresponding increase of 0.0411% in return on assets. This supports the idea that banks with robust capital positions require less external funding, resulting in a positive impact on their profitability. (Iannotta, Nocera et al. 2007) Similarly, a 1% increase in the deposit-to-total-assets (DTA) ratio results in a 0.00416% increase in return on assets, signifying that banks with higher DTA ratios can generate greater profits by reducing funding costs, boosting interest income from loans, and enhancing risk management.

Conversely, the efficiency ratio, indicating effective expense management, exhibits a significant negative correlation with return on assets. This inefficiency can lead to reduced profitability as expenses eat into income. Additionally, a 1% increase in the loan-to-deposit ratio, signifying liquidity risk, is associated with a 0.00127% decrease in return on assets. High loan-to-deposit ratios can heighten credit risk and result in higher provisions for loan losses, potentially impacting profitability. (Ahmad, Nafees et al. 2012)

Regarding size, a negative relationship with return on assets is observed, where larger banks tend to yield lower returns on assets. Regehr and Sengupta (2016) suggest that smaller banks can derive substantial advantages from expanding, but as their growth persists, the benefits of expansion slowly diminish. The overall R-squared value of 0.462 indicates that the independent variable explains 46.2% of the return on assets.

The regression of model 2 illustrates the relationship between a bank's liquidity creation, which includes off-balance-sheet obligations, and its return on assets in the subsequent period. The outcome indicates that a 100 billion baht increase in liquidity creation is associated with a decrease of 0.0328% in return on assets during the following period. This result aligns with the findings of the first model, reinforcing the notion that an increase in liquidity creation, encompassing both on- and off-balance-sheet activities, might result in losses from defaults and negatively impact returns from its profitability.

The squared term of liquidity creation, comprising both on- and off-balance-sheet activities, exhibits a non-significant negative coefficient. This implies that the relationship between liquidity creation (on and off the balance sheet) and return on assets in the following period can be adequately explained by a linear model.

With respect to the control variables, all significant findings align with the first model. The results indicate a substantial and positive correlation between the capital adequacy ratio and the return on assets. Specifically, a 1% increase in the capital adequacy ratio is associated with a 0.05% rise in return on assets. Likewise, the deposit-to-total-assets ratio demonstrates a positive connection, where a 1% increase in the ratio corresponds to an approximate increase of 0.00275% in return on assets.

In contrast, the remaining control variables show a negative correlation with return on assets. For instance, a 1% increase in the efficiency ratio is associated with a decrease of approximately 0.0112% in profitability. Furthermore, there is a negative relationship between the size of banks and their return on assets.

The overall R-squared value of 0.474 in the statistical model suggests that the independent variables used in the model explain approximately 47.4% of the variations or fluctuations observed in the dependent variable.

Table 9: The relationship between bank liquidity creation and next-period return on equity

Performance ROE	Model (3)	Model (4)
Lagged LC(on-B/S)	-0.265***	
	(0.0876)	
Lagged LC(on-B/S)²	-0.0198**	
	(0.00942)	
Lagged LC(on-off-B/S)		-0.392***
		(0.0770)
Lagged LC(on-off-B/S)²		-0.00702
		(0.00460)
EFF_RATIO	-0.0931***	-0.0969***
	(0.0235)	(0.0237)
DTA	0.0240*	0.0131
	(0.0126)	(0.0123)
LTD	-0.00863	-0.00291
	(0.00626)	(0.00657)
CAR	-0.236***	-0.190*
	(0.0829)	(0.0889)
INT.RATE	1.926***	2.343***
	(0.333)	(0.336)
GDP	0.0269	0.0396
	(0.0387)	(0.0417)
CPI	-0.0344	-0.0577
	(0.147)	(0.157)
SIZE	-1.244**	-0.497*
	(0.535)	(0.302)
D.CRISIS	-0.549	-0.274
	(0.399)	(0.430)
Constant	33.42***	30.71***
	(7.518)	(7.727)
Time FE	Yes	Yes
Individual FE	Yes	Yes
R²	0.328	0.338
Observations	439	439
Number of id	11	11

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The third model demonstrates a negative association between liquidity creation on the balance sheet and return on equity. In particular, with every additional 100 billion baht rise in liquidity creation on the balance sheet, the return on equity in the next period is expected to decrease by 0.265%. Moreover, the negative direction and statistical significance of the squared component of liquidity creation imply that the association between liquidity creation and bank performance follows a non-linear pattern, with variations depending on the level of liquidity creation.

More precisely, when the level of liquidity creation on the balance sheet rises, a positive effect on return on equity is observed, but the rate of increase diminishes. However, upon reaching an optimal threshold, additional increases in liquidity creation might potentially result in a decrease in return on equity in the following period.

This outcome aligns with model 1, which analyzes liquidity creation on the balance sheet and its relationship with return on assets. It suggests that as a bank increases its liquidity creation, it is associated with higher interest returns and the potential to improve the net interest margin, which gauges a bank's ability to manage its earning assets effectively. As a result, increasing liquidity creation up to a specific threshold could enhance return on assets and, consequently, return on equity.

On the other hand, a high level of liquidity creation, which may be viewed as banks taking on increased risk, could expose a bank to non-performing loans and default risk. This can lead to decreased profitability and ultimately result in a lower return on equity. Therefore, if a bank creates too much liquidity for the public, there is a chance that the drawbacks will outweigh the benefits.

Regarding the control variables, for every 1% increase in the efficiency ratio, there is an expected reduction of 0.0931% in return on equity. This correlation arises from a higher efficiency ratio indicating less effective expense management, which, in turn, can lead to decreased profitability and, consequently, a decline in returns on equity.

Likewise, an increase of one unit in the capital adequacy ratio (CAR) is associated with a decrease in return on equity. While a high CAR empowers the bank to expand its asset base and potentially achieve higher overall profitability, it can come at the cost of reduced returns for equity investors due to the bank's commitment to maintaining a strong capital position. As for size, an increase in size could lead to lower profitability.

In contrast, a 1% increase in the deposit-to-total-assets ratio is related to an approximate 0.024% increase in return on equity. Moreover, the policy interest rate has a strong positive correlation with the return on equity.

The results from Kumar, Acharya et al. (2020) also suggest that an increase in the short-term interest rate leads to increased bank profitability.

The overall R-squared value is 0.328, explaining approximately 32.8% of the variability in the dependent variable. However, a significant portion of the variability remains unexplained.

The fourth model extends the analysis to include both on- and off-balance sheet liquidity creation to explore its correlation with return on equity. The result reveals a negative correlation with the subsequent return on equity. Specifically, for every additional 100 billion baht in liquidity creation, there is an expected decrease of 0.392% in return on equity in the next period, which is slightly larger than in the third model. This broader perspective underscores the consistent negative relationship between balance sheet liquidity creation and return on equity.

The squared term of liquidity creation, comprising both on- and off-balance-sheet activities, exhibits a non-significant negative coefficient. This suggests that a linear model can effectively describe the relationship between liquidity creation (on and off the balance sheet) and return on equity in the subsequent period.

The significant control variables align with the third model. The efficiency ratio, size and capital adequacy ratio demonstrate significant and negative associations with return on equity. An increase in the efficiency ratio, there is an expected decline in return on equity. As for the capital adequacy ratio, it is negatively related to return on equity. In contrast, the policy interest rate has a positive correlation with return on equity, suggesting an increase in the policy interest rate leads to increased bank profitability.

However, the remaining control variables are not statistically significant. This implies that these variables do not have a statistically meaningful impact on return on equity in this model. The R-squared value of 0.338 suggests that the model fits the data, accounting for approximately 33.8% of the variations in return on equity.

Overall, the results in Table 8 and Table 9 both support Hypothesis 1, showing a negative relationship between liquidity creation measurements and next-period bank performance in Thailand. In terms of magnitude, return on equity generally exhibits larger coefficients compared to return on assets, indicating that the impact of liquidity creation on return on equity is more pronounced than on return on assets.

Interaction term: Combining the effects of liquidity creation and the economic crisis on the bank's performance.

Table 10: Combined effects of liquidity creation and economic crisis on return on assets

Performance ROA	Model (5)	Model (6)
LC(on-B/S)	-0.0349***	
	(0.00787)	
Interaction term	-0.0295***	
	(0.0102)	
LC(on-off-B/S)		-0.0334***
		(0.00586)
Interaction term		-0.00513**
		(0.00655)
EFF_RATIO	-0.00934***	-0.0122***
	(0.00281)	(0.00277)
DTA	0.00443***	0.00300**
	(0.00143)	(0.00144)
LTD	-0.00137*	-0.00139*
	(0.000729)	(0.000729)
CAR	0.0323***	0.0401***
	(0.0110)	(0.0109)
INT.RATE	0.189***	0.191***
	(0.0622)	(0.0619)
GDP	0.000561	0.00297
	(0.00971)	(0.00971)
CPI	0.0311	0.0374
	(0.0295)	(0.0295)
SIZE	-0.952***	-0.875***
	(0.0623)	(0.0619)
D.CRISIS	-0.0194	-0.0139
	(0.116)	(0.115)
Constant	14.31***	13.41***
	(0.914)	(0.905)
Time FE	Yes	Yes
Individual FE	Yes	Yes
R^2	0.520	0.521
Observations	440	440
Number of id	11	11

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Models 5 and 6 investigate whether the presence of an economic crisis influences the impact of liquidity creation on the return on assets. Model 5 focuses on balance sheet liquidity creation, while Model 6 extends the analysis to include both balance sheet and off-balance sheet liquidity creation.

The interaction term between liquidity creation and a crisis negatively affects the return on assets. This implies that when economic crises occur, banks with higher balance sheet liquidity experience a significant reduction in return on assets. More precisely, during an economic crisis, each additional 100 billion baht increase in balance sheet liquidity creation on balance sheet and both on and off-balance sheet could result in a decrease in return on assets of 0.0295% and 0.00513%, respectively.

According to a study by Abdelaziz, Rim et al. (2022), an increase in liquidity risk significantly and negatively affects bank profitability, resulting in declines in both return on assets and return on equity. Therefore, when banks hold illiquid assets, such as commercial loans, the risk of loan defaults or the need for debt restructuring is heightened, ultimately leading to reduced earnings. Additionally, as demonstrated by Bloem and Gorter (2001), elevated levels of nonperforming loans in financial institutions can erode depositor trust, potentially leading to the withdrawal of their savings.

Regarding the relationship between liquidity creation and return on assets, the findings are consistent with previous models that analyzed return on assets. In both cases, the main effect coefficients are statistically significant at a high level and negative.

Other control variables, including the efficiency ratio, loan-to-total-assets ratio, and bank size, also demonstrate statistically significant negative associations with return on assets. In contrast, the deposit-to-total-assets ratio, capital adequacy ratio, and policy interest rate exhibit statistically significant positive correlations with return on assets. The overall R-squared values for both models are 0.520 and 0.521, respectively.

Table 11: Combined effects of liquidity creation and economic crisis on return on equity

Performance ROE	Model (7)	Model (8)
LC(on-B/S)	-0.243***	
	(0.0708)	
Interaction term	-0.391***	
	(0.0914)	
LC(on-off-B/S)		-0.213***
		(0.0538)
Interaction term		-0.0387**
		(0.0601)
EFF_RATIO	-0.0666***	-0.0896***
	(0.0253)	(0.0254)
DTA	0.0217*	0.0102
	(0.0129)	(0.0133)
LTD	-0.00793	-0.00814
	(0.00656)	(0.00669)
CAR	-0.0840	-0.0245
	(0.0989)	(0.1000)
INT.RATE	1.563***	1.612***
	(0.559)	(0.568)
GDP	0.00577	0.0269
	(0.0873)	(0.0892)
CPI	-0.163	-0.120
	(0.265)	(0.271)
SIZE	-1.053*	-0.432
	(0.560)	(0.568)
D.CRISIS	-0.408	-0.914
	(1.044)	(1.058)
Constant	27.73***	20.22**
	(8.225)	(8.309)
Time FE	Yes	Yes
Individual FE	Yes	Yes
R^2	0.394	0.370
Observations	440	440
Number of id	11	11

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Models 7 and 8 examine whether the occurrence of an economic crisis affects or modifies the relationship between liquidity creation and return on equity. Model 7 concentrates on liquidity creation within the balance sheet, whereas Model 8 broadens the scope to encompass both balance sheet and off-balance sheet liquidity creation.

The interaction between balance sheet liquidity creation and a crisis has a negative impact on return on equity. This implies that during economic crises, banks with higher balance sheet liquidity experience a significant reduction in return on equity. To be more precise, for each additional 100 billion baht increase in balance sheet liquidity creation during an economic crisis, there could be a decline in return on equity by 0.391 and 0.0387 percentage points, respectively. This result is consistent with similar conclusions drawn from the models presented in 5 and 6.

The findings for the existing variables align with models 3 and 4, which represent the relationship between liquidity creation and return on equity. Liquidity creation shows a negative and statistically significant correlation with return on equity.

Among the control variables, the efficiency ratio demonstrates statistically significant negative correlations with return on equity. Furthermore, model 7 indicates that a 1% increase in the deposit-to-assets ratio is associated with a 0.217% increase in return on equity, while size is negatively correlated with return on equity.

On the other hand, the policy interest rate exhibits a statistically significant positive relationship with return on equity. The overall R-squared values for both models are 0.394 and 0.370, respectively.

In summary, the result demonstrates that during an economic crisis, liquidity creation has a significant negative impact on both return on assets and return on equity. Specifically, liquidity creation on the balance sheet becomes more critical during economic crises, while the effect of liquidity creation, including on and off the balance sheet, is less influenced by changes in economic conditions.

3. The results of hypothesis 2: The relationship between liquidity creation measurement is negatively correlated to next-period bank stock returns in Thailand. *Table 12: The relationship between bank liquidity creation on balance sheet and next-period stock returns*

Return	Model (9)	Model (10)
Lagged LC(on-B/S)	-0.321**	
	(0.162)	
Lagged LC(on-off-B/S)		-0.240**
		(0.116)
EFF_RATIO	-0.0499	-0.0283
	(0.0635)	(0.0643)
DTA	0.0213	0.00429
	(0.0329)	(0.0328)
LTD	0.0111	0.0129
	(0.0186)	(0.0186)
CAR	-0.186	-0.0927
	(0.273)	(0.274)
INT.RATE	2.320	2.065
	(2.589)	(2.595)
GDP	2.436***	2.442***
	(0.601)	(0.601)
CPI	-1.351	-1.399
	(2.319)	(2.318)
MKT. INDEX	0.0135**	0.0119*
	(0.00683)	(0.00697)
DY	-0.0325	-0.187
	(0.227)	(0.234)
BTM	-4.703***	-4.257***
	(1.472)	(1.500)
PE RATIO	-0.0135	0.0174
	(0.0468)	(0.0503)
SIZE	0.168	0.225
	(0.522)	(0.528)
D.CRISIS	-7.514*	-7.479*
	(4.198)	(4.196)
Constant	-41.44**	-41.72**
	(18.50)	(18.51)
Time FE	Yes	Yes
Individual FE	Yes	Yes
R^2	0.6610	0.6614
Observations	439	439
Number of id	11	11

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The analysis focuses on testing Hypothesis 2, which investigates the relationship between liquidity creation measurements and next-period bank stock returns in Thailand. Models 9 and 10 are presented to explore this relationship. Model 9 focuses primarily on liquidity creation on the balance sheet. The results highlight a significant negative correlation between liquidity creation and next-period stock returns. Specifically, a 100 billion baht increase in liquidity creation is associated with a decrease of approximately 0.321% in subsequent stock returns. This suggests that higher liquidity creation on the balance sheet is linked to lower subsequent stock returns.

In Model 10, the analysis extends to encompass both on- and off-balance sheet liquidity creation. Similarly, this model also reveals a statistically significant negative correlation with next-period stock returns. A boost of 100 billion baht in liquidity creation leads to a decline of roughly 0.24% in stock returns in the following period. This reaffirms the negative association between liquidity creation and stock returns.

These findings support hypothesis 2, in line with Gharaibeh (2014) observation of a negative correlation between liquidity and stock returns, implying that banks with higher illiquid asset holdings might face increased default risk, leading to decreased stock returns. Additionally, Nurazi and Usman (2016) established a positive connection between return on equity and stock returns, suggesting that efficient equity utilization enhances bank performance, positively influencing stock returns. Therefore, considering the demonstrated negative association between liquidity creation and return on equity in models 3 and 4, it is plausible that liquidity creation could also lead to reduced stock returns.

Both models incorporate various control variables. In terms of GDP, a 1% rise in GDP is associated with an approximate 2.436% and 2.442% increase in stock returns, respectively. This finding aligns with Johansen and Juselius (1990), who similarly demonstrate a significant positive influence of real GDP on the stock price index. In terms of the market index, a 1% rise in the market index corresponds to a stock return increase of 0.0135% in model 9 and 0.0119% in model 10. The market index reflects overall stock market performance and is generally positive for stock returns, indicating investor optimism about the economy.

The significant negative relationship between the book-to-market (BTM) ratio and stock returns suggests that high BTM values, indicating undervalued stocks, tend to result in lower returns. However, these findings contradict other studies conducted in developing countries. One possible explanation is that the book value of equity relies on past data and the accountant's historical valuation of the company, rather than reflecting the current value of the company.

Investors might be concerned, as they may believe that the historical accounting values do not reflect the company's true financial situation. This can lead to lower demand for these stocks. This interpretation is consistent with the observations made in emerging markets by Dash, Kantheti et al. (2018), who discovered substantial adverse correlations between the book-to-market ratios of banking stocks and both their average and risk-adjusted returns.

During an economic crisis, there is a clear negative relationship between stock returns. This is because businesses often face decreased demand for their goods and services, resulting in lower income and profits, consequently leading to a decrease in stock market returns. (Singh and Makkar 2014) The R-squared values are 0.6610 and 0.6614, indicating that the model accounts for a moderate proportion of the variation in stock returns.

Interaction term: Combining the effects of liquidity creation and the economic crisis on the bank's returns.

Table 13: Combined effects of liquidity creation and economic crisis on stock returns

Return	Model (11)	Model (12)
LC(on-B/S)	-0.584***	
	(0.218)	
Interaction term	-0.535*	
	(0.282)	
LC(on-off-B/S)		-0.614***
		(0.167)
Interaction term		-0.0639
		(0.196)
EFF_RATIO	-0.0325	-0.0310
	(0.0772)	(0.0760)
DTA	-0.0543	-0.0426
	(0.0436)	(0.0429)
LTD	0.00416	0.00301
	(0.0201)	(0.0201)
CAR	0.302	0.189
	(0.304)	(0.299)
INT.RATE	7.580***	7.730***
	(2.116)	(2.097)
GDP	3.650***	3.651***
	(0.263)	(0.261)
CPI	-2.350***	-2.371***
	(0.829)	(0.825)
MKT. INDEX	0.0478***	0.0500***
	(0.00827)	(0.00820)
DY	-0.926***	-0.832**
	(0.325)	(0.329)
BTM	-8.541***	-10.77***
	(2.171)	(2.265)
PE RATIO	0.0961*	0.0676
	(0.0538)	(0.0556)
SIZE	3.909*	3.329*
	(2.022)	(1.974)
D.CRISIS	-26.38***	-25.96***
	(2.825)	(2.819)
Constant	-41.34**	-42.17**
	(18.50)	(18.47)
Time FE	Yes	Yes
Individual FE	Yes	Yes
R^2	0.683	0.687
Observations	440	440
Number of id	11	11

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Models 11 and 12 investigate how the presence of an economic crisis influences or alters the connection between liquidity creation and stock returns. Model 11 specifically explores liquidity creation within the balance sheet, while Model 12 extends the analysis to include both balance sheet and off-balance sheet liquidity creation. The interplay between balance sheet liquidity creation and a crisis leads to an adverse impact on stock returns. This signifies that during economic crises, banks with greater liquidity creation on the balance sheet tend to experience a significant decrease in their stock returns. To be more specific, for each additional 100 billion baht increase in balance sheet liquidity creation during an economic crisis, there may be a decrease in stock returns of 0.584%.

However, the lack of a statistically significant negative relationship between the combined influence of liquidity creation on both the balance sheet and off the balance sheet and crises on stock returns indicates that the overall effect of liquidity creation on stock returns remains consistent and is not significantly altered during periods of economic turmoil.

This might be attributed to the possibility that, during crises, investors may assign greater importance to specific risks associated with on-balance sheet liquidity creation while placing less emphasis on other obligations related to off-balance sheet activities. This is because on-balance sheet activities have a more immediate and significant effect during a crisis, especially when a company cannot meet its banking obligations. These activities are abbreviated using initials that reflect their potential to generate interest income or lead to default losses. In contrast, off-balance sheet activities may have a delayed impact or may not exert as much influence on stock returns in the short term. This is because they often involve non-cash credit, such as letters of credit, letters of guarantee, or contingent liabilities, which may not have immediate financial consequences. Therefore, during economic crises, liquidity creation that includes off the balance sheet does not have a significant impact on stock returns.

Additionally, there is a direct relationship between liquidity creation and crises in stock returns. Liquidity creation in both categories shows a statistically significant negative correlation with stock returns. The results suggest that a 100 billion baht increase in liquidity creation categories is associated with a decrease in stock returns by 0.584% and 0.614%, respectively.

Similarly, in both tables, the coefficients for economic crises are -26.38 and -25.96, signifying that during an economic crisis, stock returns could decrease due to heightened uncertainty and negative sentiment in financial markets. Additionally, Al-Awadhi, Alsaifi et al. (2020) conducted a study that assessed the impact of the COVID-19 pandemic on the Chinese stock market. Their results demonstrated that the disease had a detrimental effect on stock market returns for all companies.

Regarding the other control variables, a 1% growth in GDP and policy interest rates is linked to an increase in stock returns. Furthermore, a 1% increase in the market index is expected to lead to an approximate 0.05% increase in returns. In contrast, the consumer price index displays a negative correlation with stock returns, consistent with earlier findings. This suggests that high inflation rates can erode the purchasing power of a nation's currency. As pointed out by Al-Abadi and Al-Sabbagh (2006), expected inflation has a negative and noteworthy impact on bank stock returns. Moreover, crises can lead to lower stock returns.

The findings reveal an unfavorable correlation between the book-to-market ratio and stock returns. Similarly, they indicate a negative connection between dividend yield and bank stock returns, implying that a hig(Al-Abadi and Al-Sabbagh 2006)h dividend yield might be an indicator of a financially troubled company with a reduced stock price due to pecking order theory.

In the context of growth-oriented companies, these firms often reinvest their retained earnings into opportunities for expansion, resulting in returns for shareholders in the form of capital gains. (Masum 2014)

Conversely, the PE ratio exhibits a positive correlation with returns, supporting the findings of Ramcharran (2002). This implies that firms with high P/E ratios may effectively manage risk, boost investor confidence, and consequently lead to an increase in returns in emerging markets. A low PE ratio might indicate undervaluation, but it could also signal low growth prospects, potentially resulting in lower returns.

Furthermore, the positive relationship between size and stock returns suggests that larger banks, being indicative of their wealth and strong performance, serve as an incentive for investors, leading to upward movement in stock prices. This observation aligns with the findings of Adawiyah and Setiyawati (2019). The R-squared values of 0.683 and 0.687 indicate that the model explains a moderate proportion of the variation in stock returns.

4. The result from supportive analysis hypotheses

Two-sample Wilcoxon rank-sum (Mann-Whitney) test

Table 14: Return on assets between the high liquidity creation group (excluding off-balance sheet activities) and the low liquidity creation group

Group	obs	rank sum	expected
0	89	8241	7921
1	88	7512	7832
combined	177	15753	15753

Unadjusted variance	116174.67
Adjustment for ties	-0.13
Adjusted variance	116174.54

H0 : ROA (Group=0)   = ROA (Group=1)

z =   0.939

Prob > |z| =   0.3478
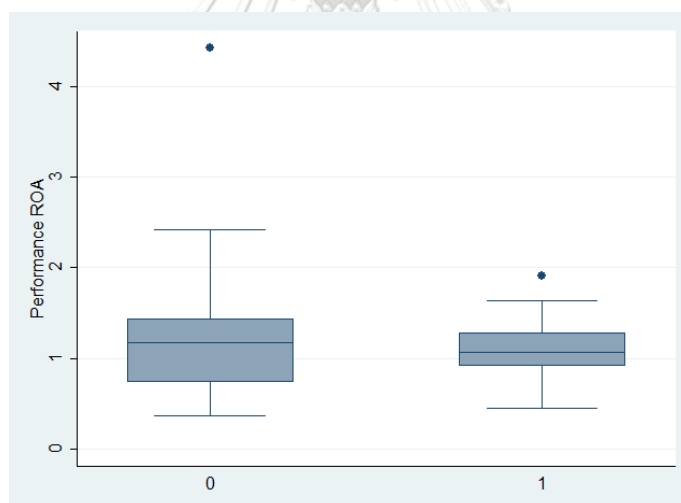
Figure C: ROA of high liquidity creation (group 1) and low liquidity creation (group 0)

Table 14 presents the results of the two-sample Wilcoxon rank-sum (Mann-Whitney) tests, comparing the return on assets between two groups: group 1 with high liquidity creation and group 0 with low liquidity creation. Table 14 focuses on liquidity creation, excluding off-balance sheet activities. The null hypothesis (H0) states that the return on assets in both groups is equal. The p-value associated with this test is 0.3478, which is greater than the typical significance level (e.g., 0.1). Therefore, we fail to reject the null hypothesis.

This suggests that there is no statistically significant difference in return on assets between the group with high liquidity creation (excluding off-balance sheet activities) and the group with low liquidity creation.

Figure C demonstrates the return on assets of high liquidity creation (group 1) and low liquidity creation (group 0) through a box plot. The line inside the box represents the median. The median return on assets for the high liquidity creation group (group 1) is slightly lower than the median return on assets for the low liquidity creation group (group 0). This indicates that, overall, group 0 has a higher return on assets performance. However, the boxes significantly overlap, indicating substantial overlap in the return on assets distributions of the two groups. This means that there are many individuals in group 1 who have a higher return on assets than some individuals in group 0.

The interquartile range represents the range between quartile 1 and quartile 3, indicating that the spread of the return on assets data is higher in the low liquidity group. The whiskers of a box plot show the minimum and maximum data points, excluding outliers. The low liquidity group exhibits potential outliers and visualizes the overall spread of data more prominently than the other group.

Taken together, the Mann-Whitney U test and box plot analysis reveal insignificant differences in return on assets between the high and low liquidity creation groups. Considering the overlap in return on assets distributions between the two groups, this indicates a greater spread. In practical terms, these findings imply that, while there might be some variability in return on assets between these groups, it is not substantial enough to draw meaningful conclusions regarding the impact of liquidity creation on return on assets.

Table 15: Return on assets between the high liquidity creation group (including on- and off-balance sheet activities) and the low liquidity creation group

Group	obs	rank sum	expected
0	89	10001	7921
1	88	5752	7832
combined	177	15753	15753

Unadjusted variance	116174.67
Adjustment for ties	0.00
Adjusted variance	116174.67

H0 : ROA (Group=0)   = ROA (Group=1)
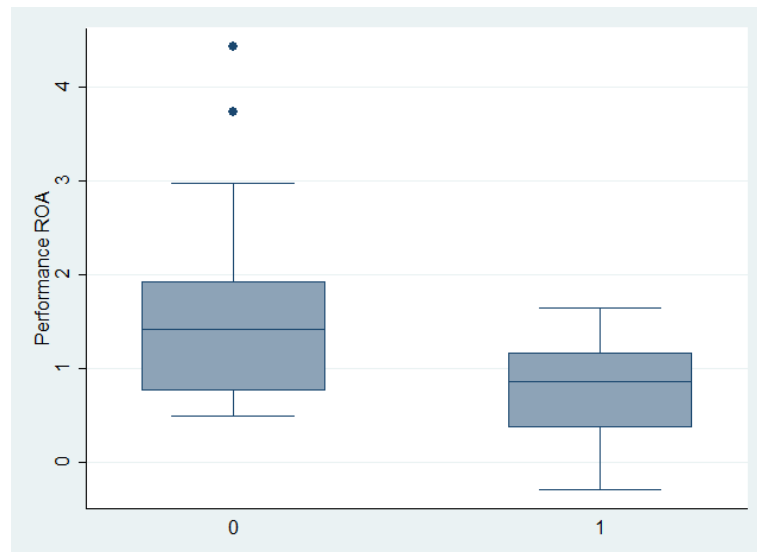
$z = 6.102$

$\text{Prob} > |z| = 0.0000$

Figure D: ROA of high liquidity creation (group 1) and low liquidity creation (group 0)

Table 15 provides a highly significant result, denoted by a p-value of 0.0000, leading to the rejection of the null hypothesis. This finding highlights a substantial and statistically significant disparity in return on assets between the group characterized by high liquidity creation (including on and off-balance sheet activities) and the group with low liquidity creation. In this context, the group with high liquidity creation exhibits a markedly distinct return on assets compared to the low liquidity creation group, and this discrepancy holds statistical significance.

Figure D presents a box plot illustrating the return on assets for two distinct groups: group 1 with high liquidity creation and group 0 with low liquidity creation. The median return on assets for group 0 slightly surpasses that of group 1, indicating superior overall performance in return on assets for the low liquidity creation group.

Additionally, group 0 displays a broader range of return on assets, signifying greater variability within this group. Both groups feature outliers, but group 0 contains a higher number of such data points.

Collectively, these findings align with the results of the Mann-Whitney U test, reinforcing the statistically significant differentiation in return on assets between the two groups. The box plot also suggests a discrepancy in return on assets between the two groups, with Group 1 exhibiting a lower median return on assets.

Table 16: Return on equity between the high liquidity creation group (excluding off-balance sheet activities) and the low liquidity creation group

Group	obs	rank sum	expected
0	89	9615	7921
1	88	6138	7832
combined	177	15753	15753

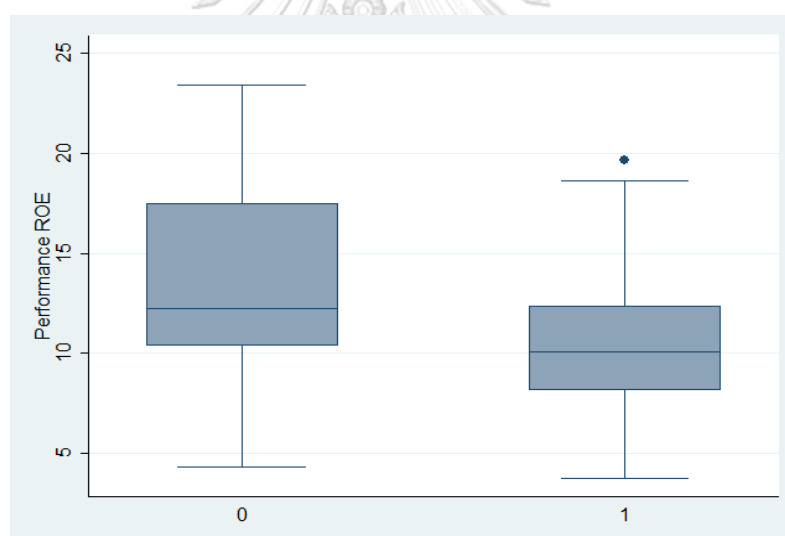|	
Unadjusted variance	116174.67
Adjustment for ties	0.00
Adjusted variance	116174.67

H0 : ROE (Group=0)　　= ROE (Group=1)

$z =$ 4.970

Prob $> |z| =$ 0.0000

Figure E: ROE of high liquidity creation (group 1) and low liquidity creation (group 0)

Table 16 displays the results of a two-sample Wilcoxon rank-sum (Mann-Whitney) test, comparing return on equity between two groups: group 1 with high liquidity creation (excluding off-balance sheet activities) and group 0 with low liquidity creation. The null hypothesis (H0) assumes no difference in return on equity between these groups. The p-value of 0.0000 allows us to confidently reject the null hypothesis, indicating a statistically significant difference in return on equity between the high liquidity creation group (excluding off-balance sheet activities) and the low liquidity creation group. The extremely low p-value emphasizes the high level of significance.

Figure E presents the performance of these two groups. The plot shows that the median return on equity for group 0 is higher than that for group 1, implying that high liquidity creation could lead to a lower return on equity. The box for group 0 is taller than the box for group 1, indicating a wider range of return on equity values. Additionally, the whiskers of group 0 are longer than those of group 1, suggesting more outliers or values significantly higher or lower than the median.

Both the Mann-Whitney U test and Figure E confirm a statistically significant difference in return on equity between the group with high liquidity creation (excluding off-balance sheet activities) and the group with low liquidity creation. This suggests that greater liquidity creation can lead to a reduced return on equity.

Table 17: Return on equity between the high liquidity creation group (including on- and off-balance sheet activities) and the low liquidity creation group

Group	obs	rank sum	expected
0	89	10881	7921
1	88	4872	7832
combined	177	15753	15753

Unadjusted variance	116174.67
Adjustment for ties	0.00
Adjusted variance	116174.67

H0 : ROE (Group=0)   = ROE (Group=1)

$z =$ 8.684
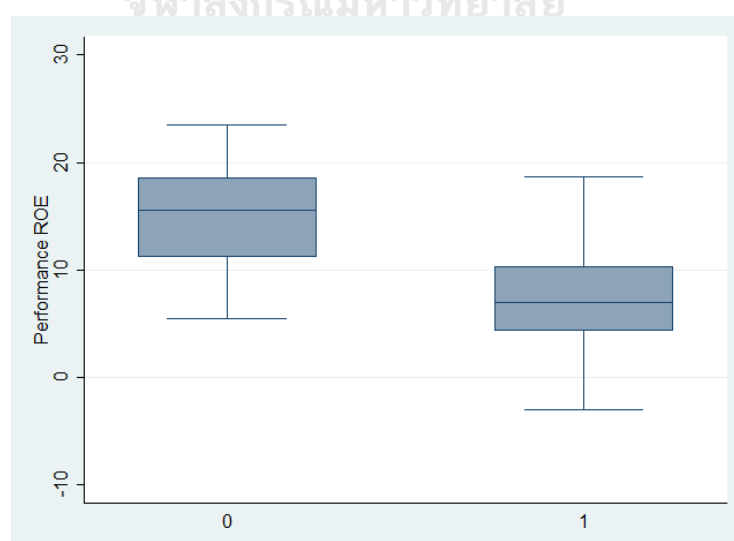
Prob > |z| =   0.0000

Figure F: ROE of high liquidity creation (group 1) and low liquidity creation (group 0)

Table 17 displays the return on equity comparison between two groups: group 1, characterized by high liquidity creation (including on and off-balance sheet activities), and group 0, characterized by low liquidity creation. The null hypothesis (H0) posits that there is no difference in return on assets between these groups. However, the p-value of 0.0000 allows us to confidently reject the null hypothesis. This implies a statistically significant difference in return on equity between the high liquidity creation group (including on and off-balance sheet activities) and the low liquidity creation group.

Figure F visually represents the comparison of return on equity between the two groups. Group 0 exhibits a higher median return on equity than group 1, indicating superior return on equity performance in Group 0. The interquartile range for group 1 is narrower, implying a tighter data cluster around the median compared to the broader data distribution in group 0. The extended upper whisker in group 0 suggests the presence of a few outliers with return on equity values exceeding those in group 1.

With respect to the Mann-Whitney U test, the visual representation in Figure F offers compelling evidence of a statistically significant difference in return on equity between the group focusing on high liquidity creation (including both on and off-balance sheet activities) and the group emphasizing low liquidity creation. This aligns with the results pertaining to liquidity creation on the balance sheet and its influence on return on equity, demonstrating a clear connection between an intensive focus on liquidity creation and reduced stock returns.

Table 18: Stock returns between the high liquidity creation group (excluding off-balance sheet activities) and the low liquidity creation group

Group	obs	rank sum	expected
0	89	7816	7921
1	88	7937	7832
combined	177	15753	15753

Unadjusted variance	116174.67
Adjustment for ties	-2.51
Adjusted variance	116172.15

H0 : Return (Group=0) = Return (Group=1)

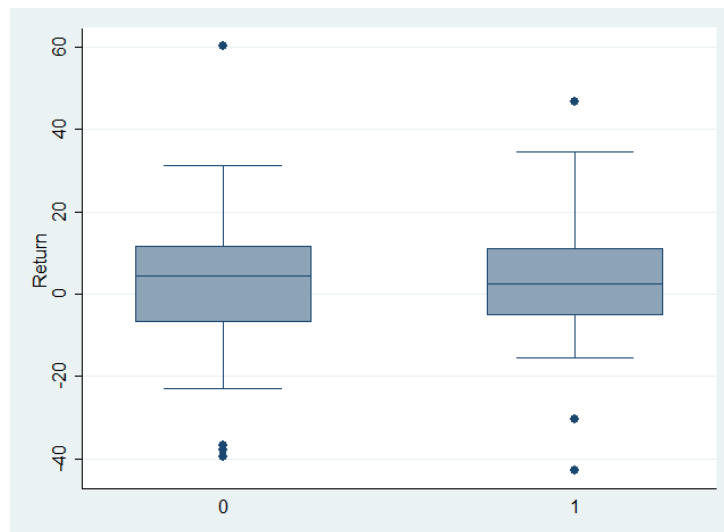$z =$ -0.308

Prob > |z| = 0.7580

Figure G: Return of high liquidity creation (group 1) and low liquidity creation (group 0)

Table 18 displays the results of a two-sample Wilcoxon rank-sum (Mann-Whitney) test, comparing stock returns between two groups: Group 1 with high liquidity creation (excluding off-balance sheet activities) and group 0 with low liquidity creation. The null hypothesis (H0) posits that there is no difference in stock returns between these groups. The p-value of 0.7580 indicates that we cannot reject the null hypothesis, signifying a lack of statistically significant differences in stock returns between the high liquidity creation group (excluding off-balance sheet activities) and the low liquidity creation group.

Figure G visually strengthens this comparison. It illustrates that the median return for the low liquidity creation group exceeds that of the high liquidity creation group, with the horizontal line in group 0's box positioned above that of group 1. The figure also emphasizes the higher variability in group 0's returns compared to the more consistent performance of group 1. Furthermore, the boxes show significant overlap, indicating a substantial intersection in the stock return distributions of both groups.

Regarding this matter, both the Mann-Whitney U test presented in Table 18 and the accompanying box plot displayed in Figure G confirm the lack of a statistically significant difference in stock returns between the high liquidity creation group (excluding off-balance sheet activities) and the low liquidity creation group. While there is a slight difference in medians, the substantial overlap in the return distributions of the two groups indicates their overall similarity.

Table 19: Stock returns between the high liquidity creation group (including on- and off-balance sheet activities) and the low liquidity creation group

Group	obs	rank sum	expected
0	89	8405	7921
1	88	7348	7832
combined	177	15753	15753

Unadjusted variance   116174.67
Adjustment for ties   -0.50
Adjusted variance   116174.16

H0 : Return (Group=0)   = Return (Group=1)
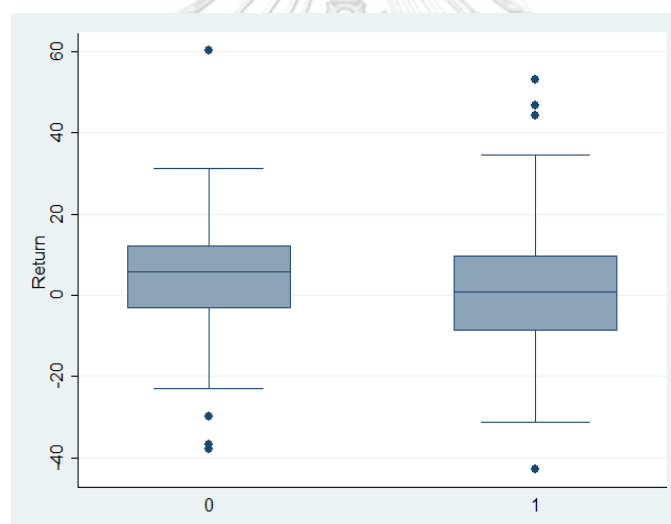z =   1.420
Prob > |z| =   0.1556

Figure H: Return of high liquidity creation (group 1) and low liquidity creation (group 0)

Table 19 presents the results of a two-sample Wilcoxon rank-sum (Mann-Whitney) test, which compares stock returns between two groups: Group 1 with high liquidity creation (including both on and off-balance sheet activities) and Group 0 with low liquidity creation. The null hypothesis (H0) assumes that there is no difference in stock returns between these two groups. The p-value of 0.1556 indicates that we lack sufficient grounds to reject the null hypothesis. Therefore, there is no statistically significant difference in stock returns between the high liquidity creation group (including both on and off-balance sheet activities) and the low liquidity creation group.

Figure H illustrates that the higher median value in Group 0 compared to Group 1 implies that, overall, the low liquidity group exhibits higher values than the high liquidity group. The similarity in the interquartile ranges for both groups indicates that the data is distributed similarly within each group. The box plot also highlights the higher variability in the high liquidity group.

The combination of the Mann-Whitney U test and the box plot demonstrates that there is no statistically significant difference in stock returns between the high liquidity creation group, which includes both on- and off-balance sheet activities, and the low liquidity creation group. While the median return for the low liquidity creation group is slightly higher than that for the high liquidity creation group, the substantial overlap in the return distributions of both groups indicates their significant similarity.

Overall, in support of hypothesis 1, the U test identifies a statistically significant difference between the groups, and the visual aids in assessing whether there is a decline in bank performance in terms of both return on assets and return on equity within the high liquidity creation group. This outcome aligns with the hypothesis regarding the relationship between liquidity creation and performance, indicating that banks generating high levels of liquidity creation tend to have lower returns on assets and equity. The visualization also suggests that high liquidity is associated with poor performance, consistent with the results obtained from the fixed model regression. However, concerning the varying levels of liquidity creation on the balance sheet and their impact on return on assets, the findings do not reach statistical significance.

To strengthen hypothesis 2, we can gather more evidence by investigating whether there is a notable distinction between the groups using the U-test. Nevertheless, it's crucial to emphasize that despite visual hints of potential decreases in bank stock returns within the high liquidity creation group, the outcomes from the U-test do not reveal statistical significance in this context. The observed differences are not significant enough to draw meaningful conclusions about the relationship between liquidity creation and stock returns.

The discrepancy between the results of the regression analysis and the Mann-Whitney U-test can be attributed to several factors. For instance, the U-test is less sensitive to outliers as it focuses on rank order rather than actual values. Additionally, it does not include relevant control variables in the model, unlike the regression analysis. Therefore, the results from fixed effect regressions might be more reliable and better explain the relationship between performance, returns and liquidity creation.

CONCLUSION

This research explores the connection between bank liquidity creation, performance, and stock returns across a sample of 11 banks in Thailand spanning from 2012 to 2021. The analysis employs a fixed-effects regression model, factoring in bank-specific and macroeconomic variables for control.

The findings indicate a significant negative correlation between liquidity creation on both the balance sheet and off the balance sheet and subsequent bank performance, both return on assets and return on equity. Additionally, the results show that liquidity creation is significantly and adversely correlated with future stock returns. Furthermore, the findings also revealed an inverted U-shaped relationship between liquidity creation (excluding off-balance sheet activities) and bank performance. This implies the existence of a trade-off between profitability and risk management.

In this paper, we examine the moderating effects of liquidity creation during a crisis by introducing an interaction term between liquidity creation and the crisis. The findings suggest that liquidity creation during a crisis could have a negative impact on bank performance and stock returns. However, the interaction term does not significantly affect stock returns when considering liquidity creation, which includes both on- and off-balance sheet activities. This suggests that the economic downturn has not led to changes in liquidity, including off-balance sheet obligations.

Additionally, a Mann-Whitney U test is conducted to comprehensively assess the differences between high and low liquidity creation groups. The results align with those of the fixed model regression, suggesting that increased liquidity creation by banks is associated with lower performance, except for liquidity creation on the balance sheet, where the U-test is not significant. However, there is no evidence indicating differences in stock returns between banks with high and low liquidity creation.

To conclude, this finding suggests that while liquidity creation can enhance profitability, it could come at the expense of bank performance, resulting in lower returns, indicating a trade-off between profitability and risk management. Moreover, it underscores that high liquidity creation might make banks more susceptible to underperformance during economic crises. Hence, policymakers and regulators can draw upon these insights to formulate comprehensive policies and regulations that prioritize liquidity creation while upholding financial stability and safeguarding the interests of investors. Likewise, investors can utilize this analysis to inform their preferences and decision-making.

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