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# A Gold Mine: The Importance of Information and Communication Technology (ICT) on Bank Liquidity in Asia and the Pacific

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## Abstract

Financial systems are the entities in charge of promoting, growing, and enhancing economic growth and development. To be viable in the market, financial institutions must maintain enough liquid assets to meet any unforeseen demand from customers at any time needed. Currently, banks are pursuing cutting-edge technologies to survive and thrive in an ever-changing market environment. This paper aims to examine the relationship between information and communication technology (ICT), macroeconomics and bank liquidity risk in Asia and the Pacific. The research took place between 2012 and 2018 and the nations were chosen based on data availability; as a result, the sample included 24 Asian and Pacific countries. Stata 15 software was used to run the static panel data to evaluate the finding. The result was tested using the Hausman Specification test. The finding showed that mobile cellular and ATM have a positive relationship with liquid assets ratio. While the interest, fixed broadband, and secure internet server have a positive relationship with cash deposits ratio. The GDP and interest are inconsistent with the expected finding. The result highlighted the importance of secure internet servers in doing transactions which affect customers' perceptions specifically the increase in the cash deposits ratio. The increase in ATM has a positive impact on liquid assets ratio. The contribution of this paper suggests that the improvement in transaction security may increase payment transparency because every transaction is traceable, reducing the possibility of fraud and crime; and does not face as many flurries. The bank should adapt to the changing market environment by considering the latest technological resource that can help facilitate the transactions to improve the quality of bank liquidity risk.

**Keywords:** Bank liquidity risk, ICT, Technology, Commercial bank, Financial institutions

## 1. Introduction

Technology is fast infiltrating economics, resulting in new dangers that will impact the economy, particularly financial institutions. As a result, it is critical to emphasize the impact of ICT on banking institutions, particularly liquidity risk.

Public participation in banking would increase bank liquidity through ICT, which would help to improve the level of liquidity. Bank liquidity was described by Casu et al. (2015) as a bank's capacity to fulfil unexpected or anticipated short-term obligations as they become due and as a result of their involvement in the maturing conversion of short-term



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liabilities into long-term assets. It promotes the flow of funds between savers and borrowers by allowing financial intermediation to take place. Vodová (2013) stressed that bank liquidity is one of the essential factors in a bank's ability to continue operating. Additionally, The Basel Committee on Banking Supervision (BCBS) also emphasized the importance of bank liquidity for financial institution viability. The Basel Accord was updated to strengthen bank capital requirements by boosting bank liquidity (Gomes & Khan, 2011). This is mainly due to the importance of bank liquidity as a critical component in the bank's stability.

Furthermore, the determinants of bank liquidity concerning macroeconomic issues can be deemed to have a substantial impact on the banking system after the global financial crisis. They were resulting in a decline in banking operations and, as well as a decline in the liquidity ratio. Presently, customer service delivery in the banking business must move beyond the traditional approach. Banks should make use of technology to improve bank liquidity and client participation. ICT has also given the banking industry the tools to deal with the new economy's issues. The reform of the new financial sector to boost the speed and reliability of economic activities and attempts to strengthen the banking sector has been a cornerstone of the new financial sector (Dangolani, 2011). Moreover, to encounter with the recent liquidity issues and economic uncertainties, most banks are not planning to reduce their spending on technology. According to S&P Global Market Intelligence (2023) survey revealed that about 65% of banks anticipate a slight increase in tech spend, while 14% expect a significant increase. This trend suggests that banks see technology investment as crucial, even in challenging economic times.

Due to that, the effects of information and communication technology (ICT) and other macroeconomic variables on bank liquidity should be explored. According to the World Economic Forum

(WEF), Asia and the Pacific have led the way in terms of the growth of information and communication technology (ICT) over the last ten years. Based on the report from the International Telecommunication Union (ITU, 2015), the Organization for Economic Co-operation and Development (OECD) countries have the most advanced ICT development, followed by Asia, the Pacific, and the Arab States.

Fig. 1 reveals that bank liquidity has a parallel influence with macroeconomics, as opposed to ICT, which refers to the Number of internet users, mobile cellular subscribers, fixed broadband subscribers, and ATMs. The difficulties are addressed if the Number of subscribers grows but bank liquidity declines. Theoretically, many subscribers would lead to a large amount of bank liquidity. It is primarily due to customers' use of internet banking services. On the other hand, the trend for bank liquidity and internet subscribers is in the opposite direction. Hence, this paper aims to examine the relationship between information and communication technology (ICT), macroeconomics and bank liquidity risk in Asia and the Pacific.

## 2. Literature review

The financial intermediation theory postulates that the intermediary is due to the two central roles done by banks in the economy under the fractional reserve theory; first, the bank creates liquidity, and the second is transforming the risk (Berger & Bouwman, 2009). According to the fractional reserve theory, banks are financial intermediaries that can only lend out money that has previously been deposited with them. Liquidity risk is the risk of an institution's inability to satisfy its commitments or the increase in fund assets as they become due (SBP, 2008). As a result, the availability of enough cash significantly impacts a bank's viability and efficiency. Banks must meet their obligations and make payments on time; otherwise, they risk being

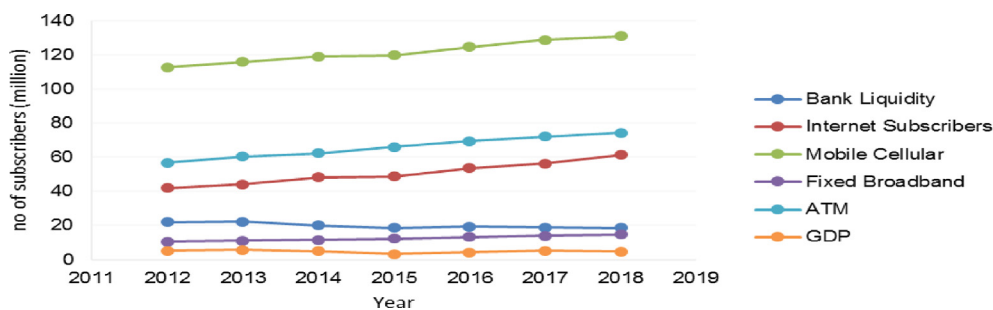


Fig. 1. The Macroeconomic and ICT Effects on Bank liquidity in Asia and the Pacific. Source: ITU.

deemed illiquid (Crockett, 2008). Funding risk and market risk are the two types of bank liquidity risk. The possibility that banks will not settle their holdings immediately is known as funding or liability risk.

In contrast to market risk, liquidity risk is the risk where a bank would experience financial loss due to its inability to swiftly and profitably sell an asset (Islamic Financial Services Board, 2012). Internal and external forces in a bank are key determinants of a bank's liquidity position for maintaining financial stability and preventing bank liquidity shortages (ElMassah, 2015). The external factor is vulnerable to macroeconomic variable fluctuations (Eichengreen & Arteta, 2002; Hutchison & McDill, 1999). Such a situation is related to the economic state, such as rising inflation which leads to an increase in interest rates and impacts real GDP growth; as a result, the bank's liquidity position is affected. Due to that, the Basel Accord designed Basel III to address the liquidity risk issues that arise.

Some studies measured the bank liquidity risk using the liquid assets to total assets ratio proposed by Molyneux & Thornton (1992). This ratio evaluates the overall bank liquidity risk, and the components of bank liquidity are cash on hand, the bank's institutional balance, cash on call, and short notice. The purpose to hold the bank's liquidity is to meet the anticipated cash demand by the customer. Other than the Liquid assets ratio, Demirgüç-Kunt & Levine, 1999 and Athanasoglou et al. (2005) stated that the loans to deposit ratio are another measurement of bank liquidity risk to determine how much the bank lends out of the deposits it has mobilized. It also measured how much of a bank's essential funds are used for noteworthy lending and borrowing services. This ratio is used to assess financial institutions' lending practices and financial institutions' ability to fulfil the customers' withdrawals. The reason is that loans are the most illiquid assets and deposits are the major funding source (Trenca et al., 2015). According to Vodová (2011), the determinants of bank liquidity risk are bank-specific characteristics and macroeconomic factors. Macroeconomic indicators such as GDP, inflation rate, unemployment rate, monetary policy, and crises were employed as external factors influencing the bank's liquidity risk (Vodová, 2011; Trenca et al., 2015; Singh & Sharma, 2016; Al-Harbi, 2017; El Chaarani, 2019). Change in the external environment is also considered part of the major revolution in financial services that have contributed to commercial bank activities concerning bank liquidity risk. Moreover, the Basel Committee on Banking Supervision (BCBN) had pinned the

financial innovations known as financial technology contribute to the effectiveness of financial services (Kolesova & Girzheva, 2018, pp. 215–220). As a result, ICT factors have become critical in terms of bank liquidity risk.

The studies by Ghodrati & Khah (2014) and Kajuju (2016) stressed that using ICT tools can enhance bank liquidity risk. The ICT tools used to represent the variables are mobile phones and internet banking. Kajuju (2016) further mentioned that adopting technology can increase the bank's efficiency, accessibility, and flexibility. The increase use of ATM may be related to the increase in liquidity and, in part, to the reduction of long line-ups at banks. The study was supported by Luka & Frank (2012). They found that ICT can assist banks in boosting their competitive position in remote places as they face changes in emerging economies. In addition, Jameaba (2020, pp. 1–44) research stated that the financial services offered via mobile phones include digitizing financial transactions and increasing the benefits individuals gain from having accounts as technology improves. The prominent finding from the research conducted by Raju (2016) and Singh & Tigga (2012) was that security and privacy issues in internet banking transactions have become critical; as a result, some customers are hesitant to reveal their information details to complete the transaction. The research also stressed that security became serious when the fraudsters used information technology to break into the bank's system and acquire access to the information of bank clients and customers, allowing them to freeze and default on some of the customers' accounts. Also, Udin et al. (2021) highlighted the importance of security for the growth of e-commerce, and internet banking allows security to support better security, specifically in banking transactions with confidentiality in the transaction.

### 3. Methodology/materials

This research was focused on Asia and the Pacific due to the United Nations' assessment of the high appearance of trends and development in the field of ICT for development in terms of fixed and mobile broadband access. The data was gathered between 2012 and 2018 the selection was made based on the emergence of ICT in the banking sector. Following the filtration process, only 24 countries from Asia and the Pacific with data availability were chosen for this paper. The dependent variable in this paper is liquidity ratios. It was determined using two ratios: the liquidity ratio (L1) is measured by liquid assets to total assets, or L1 (model 1 in percent) and the

cash deposits ratio (CDR) (L2) is measured by loans to deposits, or L2 (model 2 in percent). As independent variables, proxies are utilized to determine the relationship between macroeconomic and ICT tools. As data is based on a regional basis, an average ratio was chosen. The use of the average is related to the alignment of the calculation of the independent variable using the region's data. As a result, the analytical model for this paper is presented below, and the list of variables and projected results is shown in [Table 1](#).

#### Empirical Model 1

$$L_1 = \alpha + \beta_1 \text{Internet}_{it} + \beta_2 \text{Mobile}_{it} + \beta_3 \text{ATM}_{it} + \beta_4 \text{BB}_{it} + \beta_5 \text{IntSec}_{it} + \beta_6 \text{GDP}_{it} + \beta_7 \text{IR}_{it} + \epsilon_{it}$$

#### Empirical Model 2

$$L_2 = \alpha + \beta_1 \text{Internet}_{it} + \beta_2 \text{Mobile}_{it} + \beta_3 \text{ATM}_{it} + \beta_4 \text{BB}_{it} + \beta_5 \text{IntSec}_{it} + \beta_6 \text{GDP}_{it} + \beta_7 \text{IR}_{it} + \epsilon_{it}$$

Where,

L1 = Liquid Assets Ratio

L2 = Cash Deposits Ratio

Internet = Number of internet subscribers

ATM = Number of Automated Teller Machine

Mobile = Number of Mobile Cellular subscribers

BB = Number of Fixed Broadband

IntSec = Number of Secure Internet server

GDP = Gross Domestic Product

IR = Interest Rate Spread

The null hypothesis for this research postulates a negative association between ICT and macroeconomics toward bank liquidity risk (L1). On the other hand, the alternate hypothesis proposes a positive relationship between ICT and macroeconomics toward bank liquidity risk (L2). Static panel data were utilized to test the empirical model. In this paper, descriptive statistics were employed to check the data. If the data was not normal, the data transformation was conducted, and the natural logarithm was employed to alter the data (Ln). The unit root test was then used to determine whether the model is stationary and whether estimates produce a misleading regression to the model's main assumption. To obtain the p-value for the significance and relationship of the data, the Poolability test was performed using either the Pooled OLS or the Hausman Specification. The diagnostic test was frequently used to test the data, and it was typically subjected to non-stationarity, multicollinearity, heteroskedasticity, and autocorrelation. This is done to ensure that the entire model is accurate, consistent, and devoid of bias. The entire test was conducted using STATA 12.0 software.

## 4. Results/findings

Based on the descriptive statistics [Table 2](#), ICT indicates the average internet subscription is 50.68991 million, with the lowest and maximum Number of users of 3.5 million and 148.45 million subscribers, respectively. The average Number of

Table 1. List of variables and expected signs.

| Variables                | Model 1      | Model 2      | Sources   |
|--------------------------|--------------|--------------|---|
| Internet                 | Positive (+) | Positive (+) | Luka & Frank (2012), Ghodrati & Khah (2014), Kajuju (2016), Raju (2016), Udin et al. (2021) |
| Automated Teller Machine | Positive (+) | Positive (+) |   |
| Mobile Cellular          | Positive (+) | Positive (+) |   |
| Fixed Broadband          | Positive (+) | Positive (+) |   |
| Secure Internet Server   | Positive (+) | Positive (+) | Singh & Sharma (2016); Tran & Nguyen (2019) and Mahmood et al. (2019)                       |
| GDP                      | Negative (-) | Positive (+) |   |
| Interest Rate Margin     | Negative (-) | Positive (+) | Vodová (2012), Tseganesh (2012), Vodová (2013) and Udin et al. (2021)                       |

Table 2. Descriptive statistics.

|                   | Mean      | Standard Deviation | Min      | Max        | Skewness | Kurtosis |
|-------------------|-----------|--------------------|----------|------------|----------|----------|
| Internet          | 50.6899   | 33.3242            | 3.5000   | 148.4488   | 0.6343   | 2.9058   |
| Mobile Cellular   | 121.8074  | 62.1958            | 5.3177   | 345.3245   | 1.2256   | 5.5564   |
| Fixed Broadband   | 12.5264   | 12.5562            | 0.1206   | 41.5969    | 0.7538   | 2.0840   |
| ATM               | 66.0025   | 73.2110            | 4.0476   | 324.6050   | 1.8810   | 5.9574   |
| Internet Security | 2165.6410 | 8726.8550          | 0.7351   | 84713.8600 | 7.1413   | 60.0960  |
| GDP               | 4.7796    | 3.2636             | -21.5945 | 13.5438    | -2.9424  | 27.0305  |
| Interest Rate     | 4.9870    | 3.9863             | 0.1100   | 22.1104    | 2.0753   | 8.1981   |
| L1                | 0.4080    | 8.2970             | -103.402 | 13.0555    | -11.7316 | 147.695  |
| L2                | 20.0172   | 7.9902             | 7.8296   | 47.0200    | 0.8259   | 3.3518   |



mobile cellular subscribers in the region is 121.81 million, with a low number of subscribers of 5.32 million and a high of 345.32 subscriptions. However, fixed broadband users have the lowest subscription of only 0.120609 million subscribers, with an average of 12.52636 million and a maximum of 41.6 million subscriptions. The average Number of ATM machines is 66.01 million. The average Number of secure internet servers in Asia and the Pacific is 2165.64 million. According to the results for GDP and interest, the average GDP and interest rate are 4.78 percent and 4.99 percent, respectively. The minimum and maximum percentages are –21.59 percent and 11 percent, respectively, with GDP at 13.5 percent and interest at 22.11 percent. The average liquid assets ratio in Asia and the Pacific is 0.4080 percent. The lower liquid asset ratio recorded was –103.402 percent and the most prominent absorption of liquid assets of 13.0555 percent. According to the L2 or loan to deposits ratio, the average loan offer is 20.0172 percent, while the minimum and maximum loan to deposits ratio recorded was 7.8296 percent and 47.0200 percent. Skewness and kurtosis have a rule of thumb: skewness must be less than 2, and kurtosis must be larger than 2. Based on the result, some of the variables were processed as natural logarithms based on the outcome (Ln).

The result in Table 3 indicates the impact of ICT and macroeconomics on L1 and L2. The BPLM test was performed, and the p-value is 0.0001, which is less than 0.05. The p-value indicates the likelihood of obtaining results from the statistical test. As a result of the null hypothesis being rejected, data cannot be pooled. The statistical panel data proves that three out of five ICT tools are significant to the

L1. In addition, the Number of mobile cellular and ATM machines indicates a positive relationship with the L1. Hence, the study rejected the null hypothesis as a positive relationship exists between the mobile cellular and ATM toward liquid assets ratio in Asia and the Pacific. In terms of the ICT, the result shows the GDP contradicts with the expected finding as the result shows a positive relationship with the liquid assets ratio. Hence, the null hypothesis failed to reject, showing the negative result.

As for the L2, the result found that internet subscription, fixed broadband, and internet security have a positive relationship with the cash deposits ratio. Furthermore, the fixed broadband and ATM show a significant relationship with L2. The effects of macroeconomics towards L2 tend to reject the null hypothesis.

## 5. Discussion and conclusion

For L1, ATM banking has the most significant impact on banking liquidity compared to other ICT tools; thus, this finding is consistent with [Kajuju \(2016\)](#). The data shows that the average Number of ATM in Asia and the Pacific area is 66.01 million, with Macao, China having the most ATM (324.61 million). ATM can be used to provide worldwide payment services, which necessitate cross-border data flows. Aside from ATM, fixed broadband has had a significant and favourable impact on liquidity. According to the ITU data for 2015, member nations of the United Nations Economic and Social Commission for Asia and the Pacific account for more than 52.3 percent of worldwide fixed broadband customers (ESCAP). The Internet's negative result was low penetration, particularly in rural areas of

Table 3. Result of static panel data for Asia and the Pacific.

| Variables          | L1                  |            | L2                   |          |
|--------------------|---------------------|------------|----------------------|----------|
|                    | Coefficient         | Sign       | Coefficient          | Sign     |
| InInternet         | –0.0134678          | (0.844)    | 0.0300519            | (0.629)  |
| Inmobile           | 0.4213564           | (0.369)    | –0.3298876           | (0.149)  |
| Infixedbb          | –0.1646862          | (0.001)*** | 0.081706             | (0.071)* |
| Inatm              | 0.3851783           | (0.050)*   | –0.1541684           | (0.064)* |
| Inintsec           | –0.0589172          | (0.044)**  | 0.0050428            | (0.736)  |
| Ingdp              | 0.0991739           | (0.172)    | –0.0279033           | (0.558)  |
| Ininterest         | –0.0469574          | (0.338)    | 0.0536943            | (0.107)  |
| R-Squared          | 0.1145              |            | 0.1611               |          |
| BP LM              | 126.23 (0.0001)***  |            | 192.96 (0.0001)***   |          |
| Hausman            | 18.05 (0.0208)**    |            | 4.5 (0.8091)         |          |
| Heteroscedasticity | 4842.24 (0.0001)*** |            | 71137.18 (0.0001)*** |          |
| Serial Correlation | 60.902 (0.0001)***  |            | 46.179 (0.0001)***   |          |
| Observation        | 168                 |            | 168                  |          |
| No of Countries    | 24                  |            | 24                   |          |

Notes: values in parentheses are p-values \*\*\*, \*\* and \* indicates rejecting the null hypothesis of non-stationary at the 1%, 5% and 10% at level, respectively.

some countries. This would put a strain on the digital divide in access that exists between regions and countries. Such disparities within countries disproportionately affect rural areas and the poor. In other words, while some people may have internet access, their use is confined to activities other than banking (World Bank, 2018). It demonstrates that the growing Number of subscribers in Asia and the Pacific has impacted the increase in the liquid assets ratio. Because it impacts the relevance and perception of security, internet security substantially impacts liquidity risk. This aligns with Singh & Tigga's (2012) discovery that internet security influences security perception. Depositors lack trust and the necessary assistance for their privacy risks. Udin et al. (2019) study also underlined the necessity of safe internet servers in transactions. Hence, the secure internet servers may affect the banks' liquid assets. It shows the importance of depositors' perceptions of security when they lack confidence and want assistance in dealing with privacy threats. The result on GDP and interest is inconsistent with the expected finding; an increase in the interest margin encourages banks to boost their lending operations. As a result, the proportion of liquid assets decreases, indicating a negative relationship.

The L2 shows that the ICT variable reflects the importance of fixed broadband in transactions for persons in Asia and the Pacific. According to the WEF research, Asia and the Pacific have led the growth of information and communications technology (ICT), particularly fixed broadband, during the last decade. The research also stated that some of the region's ICT-advanced economies are top achievers in key ICT indices. The significant association with the loan to deposits is partly due to the use of broadband through their devices, which will extend access to fixed broadband among most people and enhance capacity in applying for the loan online. Furthermore, broadband has several advantages because it allows for internet access anywhere and whenever needed, without the need to pay fees for connecting to established networks. As a result, the significant and positive link conforms to UNCTAD's 2016 E-commerce Index, which shows that performing business-to-business (B2B) e-commerce is strongly correlated with access to fixed broadband connectivity. The increased use of broadband in business is linked to an increase in bank loans. The positive result between the secure internet server with L2 shows that the Number of secure servers contributes to customer scepticism while doing online transactions. As a result, it illustrates that internet protocol security is crucial (Udin et al., 2021). The results of interest rate

demonstrate the violation of the study's expected outcomes. Nevertheless, the negative sign in GDP does not match the findings of Singh & Sharma (2016), Mahmood et al. (2019), and Vodová (2013).

To conclude, the introduction of technology in the era of IR4.0 is currently a fast-entering economy. The introduction of new hazards will impact external economies, specifically financial institutions. Today, public participation in banking would enhance bank liquidity levels via ICT. It is critical to emphasize the impact of ICT on banking institutions, particularly liquidity risk. Hence, the finding shows the importance of ICT that preserve as a gold mine for banking activity to improve their operations specifically in bank liquidity.

The considerable effect demonstrates that the greater the banks' adoption of ATM banking, the greater their liquidity. This could be attributable in part to a more efficient automated cash deposit rather than long banking lines. As a result, it can save consumers from visiting a bank branch and filling out different slips for account assessment. Aside from ATMs, fixed broadband demonstrates that the overall result was significant. This is consistent with the ITU's report; in 2015, the United Nations Economic and Social Commissions for Asia and the Pacific accounted for more than 52.3 percent of worldwide fixed broadband customers (ESCAP). In 2016, the Networked Readiness Index ranked seven Asian and Pacific countries among the top 20 overall ICT readiness. Broadband use increases most people's access to fixed broadband, boosting their online ability to apply for a loan. Furthermore, broadband has several advantages because it allows for internet access anywhere and whenever needed, without the need to pay fees for connecting to established networks. The result emphasized the significance of secure server internet, as it substantially impacts bank liquidity. This occurs when depositors lack trust and the necessary assistance for their privacy risks. The customers' demand for safe internet software and related hardware for encryption programs and virus protection software is heavily highlighted during the transaction. The improvement in transaction security may increase payment transparency because every transaction is traceable from the source account to the destination account, reducing the possibility of fraud and crime; and does not face as many flurries of requirements for saving, withdrawing, or transferring money as is often associated with accounts in traditional financial institutions. As a result, ICT and deposit activities may be impacted. However, the Internet and mobile cellular do not substantially impact bank liquidity in Asia and the Pacific. This is also

mentioned by the Groupe Spécial Mobile Association (GSMA); smartphone services given by website operators in rising Asian nations are primarily focused on the entertainment market segment. Therefore, the use of online banking transactions was restricted. Hence, as further research in this area, it is recommended to put another variable in relation to banking in industrial revolution 4.0 (IR4.0) by emphasizing more elements in fintech to measure the financial inclusion hence directly increasing the bank liquidity. This is crucial for economic growth and poverty alleviation, particularly in emerging economies and post-pandemic recovery phases. Financial inclusion is closely associated with SDGs like Decent Work and Economic Growth (SDG 8).

### Conflict of interest

There is no conflict of interest occur since the author all academicians and no funder from specific institutions or organizations.

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