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Liquidity Risk Exposure and its Determinants in the Banking Sector: A Comparative Analysis between Islamic, Conventional and Hybrid Banks

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Abstract

This study aims to explore and examine the liquidity risk that Islamic banks are exposed to in a comparison with conventional and hybrid banks in the case of 145 commercial banks for the period of 1996–2015. This study examines the factors determining the liquidity risk exposure of the sampled banks by employing a panel data regression model with the random effect technique by considering bank specification, macroeconomy, governance and ownership-related variables. The findings for the sampled banks demonstrate that Islamic banks are more exposed to liquidity risk than conventional and hybrid banks. In addition, the results show that the stringency of capital regulations and credit risk have a negative and significant impact on liquidity risk. Moreover, the results demonstrate that liquid assets and long-term debts are positively associated with liquidity risk exposure. While the empirical results show that long-term debt significantly affects liquidity risk, the results indicate an insignificant impact of liquid assets on the liquidity risk exposure of the sampled banks. The results also depict that bank size, governance and ownership concentration as well as GDP are important control variables in reducing the liquidity risk exposure of Islamic banks.

Keywords: Liquidity risk exposure, conventional banks, Islamic banks, hybrid banks

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Abstract

This study aims to explore and examine the liquidity risk that Islamic banks are exposed to in a comparison with conventional and hybrid banks in the case of 145 commercial banks for the period of 1996–2015. This study also examines the factors determining the liquidity risk exposure of the sampled banks by employing a panel data regression model with the random effect technique by considering bank specification, macroeconomy, governance and ownership-related variables. The findings for the sampled banks demonstrate that Islamic banks are more exposed to liquidity risk than conventional and hybrid banks. In addition, the results show that the stringency of capital regulations and credit risk have a negative and significant impact on liquidity risk. Moreover, the results demonstrate that liquid assets and long-term debts are positively associated with liquidity risk exposure. While the empirical results show that long-term debt significantly affects liquidity risk, the results indicate an insignificant impact of liquid assets on the liquidity risk exposure of the sampled banks. The results also depict that bank size, governance and ownership concentration as well as GDP are important control variables in reducing the liquidity risk exposure of Islamic banks.

Keywords: Liquidity risk exposure, conventional banks, Islamic banks, hybrid banks

1. Introduction

Banking theory suggests that one of the key functions that banks conduct is the transformation of maturities (Distinguin *et al*., 2013) so that they can finance their illiquid risky assets by liquid liabilities. This is particularly important when banks face the early liquidation of their assets to meet their financial obligations for several reasons, such as a bank rush (Berger and Bouwman, 2009a: 3783). While in such cases a liquidity risk may cause an interruption in the economy due to the early liquidation of productive investments (Diamond and Dybvig, 1983), it may also result in bank defaults and failures. Even though liquidity risk has been an ongoing concern to managers as well as fund providers, the global financial crisis of 2007–2009 has intensely re-emphasised the importance of measuring, forecasting and understanding liquidity risk and its determinants (Papavassiliou, 2013; Weiß, 2013: 3334; Acharya and Naqvi, 2012: 349; Horvath *et al*., 2012; Sadka, 2011: 144; Jasiene *et al*., 2012: 190).

As intermediary institutions, banks hold large amounts of short-term liabilities to finance long-term assets (Saunders and Cornett, 2006: 470). However, due to the nature of the short-term liabilities contracts, the holders (mainly depositors) of these types of accounts have the right to claim their funds back at any given time. Consequently, liquidity risk occurs on the liability side when account holders withdraw their funds (deposits) simultaneously at a time when a bank cannot match such large and sudden demands. In such a case, to manage risk, banks tend to supply the withdrawals by selling their liquid assets or by borrowing funds from the money market. In the process of liquidating, although most of the assets are tradeable and transformable into cash, converting some of the assets can be costly when they are only sold at low prices (Saunders and Cornett, 2006: 470), which consequently may lead to insolvency risk. Liquidity risk, therefore, occurs when a bank is unable to cover its financial obligations when they fall due without unbearable costs (BCBS, 2008). Accordingly, the absence of effective models to measure and assess liquidity risk is a key factor that leads to unexpected mismatches in banks' balance sheets, resulting in liquidity risk for banks (Cucinelli, 2013: 51).

Islamic banking emerged as an alternative financing institution in the 1970s in response to the demand to have alternative financing solutions compliant with principles derived from Islamic law (*Shari'ah*) (Khediri, 2015). Similar to other banks in terms of functions, Islamic banks are believed to play an important intermediary role in facilitating the transformation of savings from the public for the purpose of reinvesting them in the economy through channelling the accumulated funds to entrepreneurs and financing activities that are expected to contribute to the real economy by abiding by the religious sensitivities. By conducting their financial operations within the norms of Islam and the parameters of Islamic finance, Islamic banks have to ensure that every financial contract must refer to a tangible and identifiable underlying asset (Cox and Thomas, 2005: 171). Accordingly, due to the unique nature of the Islamic financial principles, products and operations, Islamic banks, theoretically, are perceived to be key contributors in promoting economic growth (Aggarwal and Yousef, 2000; 94; Asutay, 2007; Khan, 2010) through financing economic activities, generating jobs, and fostering social welfare (Khan, 2010; Asutay, 2012; Ali *et al.*, 2013). In addition, as an essential feature, based on the substance of the objectives of Islamic financial law, Islamic banks are expected to utilise financing instruments oriented more towards equity or profit-loss-sharing and risk-sharing based financing activities that are mainly illiquid investments, rather than the debt/sale-based modes of financing activities. Due to such distinctive features, Islamic banks are exposed to more complexity in managing their assets and liabilities, implying that Islamic banks are

expected to face a wider financing gap and, hence, greater exposure to liquidity risk than conventional banks and hybrid banks. Importantly, this becomes an issue, as the tools and instruments of managing such risks are further restricted in the case of Islamic banking due to the attachment to the norms and parameters of Islamic finance. Thus, given that liquidity risk is an essential area in the financial system, it has different implications for Islamic banks as compared to conventional and hybrid banks (conventional banks with Islamic windows).

This paper, hence, aims to measure and analyse the liquidity risk exposure of Islamic banks compared to conventional and hybrid banks covering the period between 1996 and 2015. The sample consists of 145 banks from 21 countries, and the data are analysed through a panel data regression model. In addition, this paper examines the determinants of liquidity risk exposure by the sampled banks with particular reference to the stringency on capital regulations, credit risk, liquid assets and long-term debt.

As for the contribution of this study, despite the significant role of liquidity creation and the critical impact of liquidity risk on the economy, these issues remain unexplored within Islamic banking and finance through empirical research. In addition, comparative research on the subject matter between Islamic, conventional and hybrid banks in general, and in the case of the GCC region in particular, either does not existed or is scarce. This research, hence, contributes to the literature in these two areas. Firstly, it measures the key determinants of the liquidity creation function and the liquidity risk exposure and, more specifically, it assesses the impact of the stringency of related banking regulatory and supervisory standards on the liquidity creation function and liquidity risk exposure in the banking sector in a comparative manner between Islamic, conventional and hybrid banks, which the existing body of knowledge has not provided. Secondly, since the GCC region is considered the home of a dynamic banking sector where Islamic, conventional and hybrid banks operate in parallel under similar economic conditions and banking standards, this research provides empirical analyses of the liquidity creation behaviour of GCC banks and their exposure to liquidity risk in a comparative manner.

Regarding the structure of this paper, Section 2 presents a literature review while Section 3 presents the hypotheses development. Section 4 explains the research methodology and modelling. This is followed by the descriptive statistics of the examined data. Before running the regressions analysis, statistical tests are performed to check the nature and validity of the assessed data and the examined variables are presented. Then, the developed hypotheses are

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tested through panel data regressions with a random effects model in Section 5, where the results of the sensitivity tests are also presented to evidence the robustness of the obtained results. Section 6 presents the concluding remarks.

2. Liquidity Risk Exposure: A Literature Review

Since liquidity provision is the focal purpose of the banking sector (Holmstrom and Tirole, 2000: 296), banks by definition are exposed to liquidity risk. The key task of risk managers in banks and other financial institutions, hence, is to mitigate the effects of such risk (Jasiene *et al.*, 2012: 189). In the banking industry, therefore, liquidity risk and its management is a critical factor that impacts the financial stability and profitability of banks as well as their customer assurance and the decisions they make. Furthermore, liquidity risk is one of the serious elements that trigger other risks which negatively affect the business operations of banks. Consequently, although banks face different types of risk, liquidity risk remains the critical risk that can eventually lead to insolvency risk (Jasiene *et al.*, 2012: 186).

According to Diamond (1991: 709), liquidity risk refers to the risk of losing expected revenues that investors face as a result of early excessive withdrawals by fund suppliers. In a similar manner, Papavassiliou (2013: 184) defines liquidity risk as the risk of failing to buy or sell assets at the market price when required. Within this context, liquidity risk is classified into two categories: funding liquidity risk and market liquidity risk. While market liquidity risk occurs as an inability of banks to sell their illiquid assets at market price within short notice, funding liquidity risk signifies the inability of banks to cover the liquidity needs of funds providers (IFSB, 2012: 31; Haan and End, 2013: 3930). In this regard, it is significant to state that the focus of this research is funding liquidity risk. Along parallel lines, funding liquidity risk is defined as the inability of banks to settle their obligations in a timely manner (The European Central Bank, 2009; Drehmann and Nikolaou, 2013: 2173). Giannotti *et al.* (2010: 99) state that liquidity risk is the possibility that a bank during a particular period of time becomes unable to honour its duties with immediacy. Hence, liquidity is the ability of a bank to meet the financing demands of increases in assets and meet its financial obligations as they become due without incurring intolerable costs (Giannotti *et al.,* 2010: 99); thus, failure to meet this results in liquidity risk.

As stated by Drehmann and Nikolaou (2013: 2174), "liquidity risk arises because revenues and outlays are not synchronised". Therefore, as the main function undertaken by banks is the

financing of long-term assets by short-term liabilities, liquidity risk is an inherent characteristic of banks and, hence, inevitable (Haan and End, 2013: 3930; Eichberger and Summer, 2005: 550; Carletti *et al.*, 2007: 1069; Distinguin *et al.*, 2013: 3295). Such a critical function leads to market and funding liquidity risk (Diamond and Dybvig, 1983). The criticality of liquidity risk also stems from its implications for portfolio diversification strategies and investment activities, as it also plays a vital role in asset prices (Papavassiliou, 2013: 184).

Despite liquid assets being considered as a solid shield against liquidity shortages, holding high levels of liquid assets incentivises banks to increase their lending activities, which leads to an increase in their financing gaps and negatively impacts their stability, which is associated with banking insolvency (Wagner, 2007: 121; Haan and End, 2013: 3933). In a similar argument, as evidenced by Wager (2007: 122), among others, when banks enjoy a substantial access to asset sales markets, undertaking risky investments is expected, as banks' loans or financing activities are known to be illiquid and risky. However, with the recent developments and sophistications in the financial markets, banks are provided with different types of instruments that facilitate a variety of options to transfer risk through an easy access to asset sales markets (Wagner, 2007: 122; Holmstrom and Tirole, 2000: 296).

In exploring the sources of liquidity risk, banks mainly depend on equity capital and deposits to finance their lending and investment activities (Silva and Divino, 2013: 266). However, a low level of bank profitability may lead to some fund providers withdrawing their capital at inconvenient times. For Islamic banks, this is even more critical, as in their case the deposits hold equity features, which are based on a risk-sharing concept that may escalate the ambiguity on depositors' return, which, in return, may increase the withdrawals (Beck *et al.*, 2013: 436). In addition, the complexity in Islamic banking products and operations increases costs and, thus, lowers the efficiency of Islamic banks and exposes them to higher degrees of risk (Beck *et al.*, 2013: 436). In such a process, the creditors may panic, which in turn may cause liquidity risk that may trigger insolvency risk. To survive from such a critical situation and honour their obligations, banks use their reserves and liquid assets. In extreme scenarios, in responding to a high demand for deposit withdrawal, banks liquidate their loans at high costs, as a result of the fire-sale price (Wagner, 2007: 122; Silva and Divino, 2013: 266). In further exploring this, Holmstrom and Tirole (2000: 295) suggest that long-term debts can also play a vital role in allowing banks to cover their liquidity shocks. Moreover, the interbank market enables the transfer of risk from banks with low levels of equity to banks with higher levels of equity

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(Eichberger and Summer, 2005: 553).

Banking regulatory and supervisory agencies play an important role in overseeing the banks' operations and activities to prevent or reduce problems of asymmetric information, adverse selection and moral hazard. The responsibilities of such bodies include regulating the governments safety net through deposit insurance, restrictions on banks activities, capital requirements, bank supervision, information disclosure requirements, costumer protection and restrictions on banking competition (Mishkin, 2001; Barth *et al*., 2004). Although such regulatory and supervisory monitoring and restrictions enhance the financial stability of the banking sector, high supervisory restrictions may lead to an increase of banks' incentives to undertake risky activities (Mishkin, 2001; Barth *et al*., 2004).

Accordingly, liquidity risk has always been a top priority for regulatory bodies, as it is believed that enhancing banks' ability to have an adequate access to the asset trading market, as well as developing banking market segmentation by enhancing the diversity of the market players and products, may improve the liquidity position and make banks less exposed to such systematic risk (Wagner, 2007: 122). To reduce the possibilities of banks' exposure to liquidity risk, banking regulators may promote financial stability and efficiency by adopting new regulations and standards (Silva and Divino, 2013: 266). For example, in response to the recent financial crisis, in December 2010 Basel III issued new principles and guidelines on liquidity risk management, whereby two new liquidity ratios are introduced, namely the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR) (BCBS, 2010; Haan and End, 2013: 3930; Silva and Divino, 2013: 266). It is important to state that these two ratios have still not been enforced on all banks yet and it is proposed that they be implemented gradually between 2015 and 2019 (Haan and End, 2013: 3930; Silva and Divino, 2013: 266).

Although liquidity risk in the banking sector is not a very fresh topic, the systematic literature has not focused adequately on approaches to measuring liquidity risk exposure. In the banking-related empirical studies that examine liquidity position indicators, they use balance sheet ratios based on accounting data (Matz, 2008: 4; Distinguin *et al*., 2013: 3300), such as loans to deposits ratio (Iannotta *et al*., 2007: 2132; Bourke, 1989: 72; Molyneux and Thornton, 1994: 439; Demirguc-Kunt *et al*., 2004: 603; Klomp and Haan, 2012: 3198). In addition, Saunders and Cornett (2006: 476) state that the ratio of loans to deposits, borrowed funds to total assets, and loan commitments to assets are also widely utilised to proxy liquidity risk. Moreover, other researchers measured liquidity risk through the ratio of loans to total assets (Athanagolou *et*

al., 2006: 9), loans to customer and short-term funding ratios (Pasiouras and Kosmidou, 2007: 227; Kosmidou, 2008: 150; Naceur and Kandil, 2009: 77). However, it is argued that depending on such ratios in measuring liquidity risk could be insufficient (Matz, 2008: 4; Distinguin *et al*., 2013: 3300). Saunders and Cornett (2006) propose a proxy for liquidity risk based on the financing gap, which is used in this research to measure the distance magnitude of likelihood of banks' inability to meet their financial obligations in a timely fashion. However, the existing empirical research that examines the determinants of liquidity risk remains relatively scarce.

Despite liquidity risk exposure remaining one of the most challenging issues within the Islamic banking industry, it is quite striking that the existing literature lacks empirical studies that focus on liquidity risk exposure measurement and its determinants. Notwithstanding such a reality, some researchers have identified different sources of liquidity risk in the Islamic banking industry. For example, Khan and Ahmed (2001), Ahmed (2011: 60) and Ali (2012) state that one of the fundamental reasons for liquidity risk in Islamic banking is the limited accessibility of the *Shari'ah*-complaint money market and the slow development of financial instruments, which prevent Islamic banks from raising external funds when needed. It is also argued that, due to the predominance of debt-based assets (such as *murabahah* as a debt-based contract, which occupies about 97.5 percent of Islamic financial transactions in Malaysia; see Asutay, 2007 and 2012; Khediri, 2015), Islamic banks face difficulties in liquidating them when needed due to the restrictions on sale of debt (Ahmed, 2011: 60). In addition, most available conventional instruments that are used for liquidity management are interest-based, and Islamic banks are not permitted to deal with them. It is also argued that due to the unique characteristics of some of the Islamic financial instruments, Islamic banks face additional exposure to liquidity risk including the inability to trade *murabahah* or *bay' al salam*, which can be traded only at par value (Iqbal and Mirakhour, 2007).

Furthermore, with regards to the liability side, Islamic banks depend heavily on current accounts, which demand deposits and can be withdrawn at any time, which may lead to a bank run (Iqbal and Mirakhour, 2007). A small number of Islamic banks, compared to their conventional counterparts and with different interpretations of *Shari'ah* teachings (Islamic financial law), can have other critical sources of liquidity risk. For example, the contract of *bay' al-dayn* (sale of debt) is allowed and commonly practiced in Malaysian financial markets. This type of contract, however, is not permitted by the mainstream *Shari'ah* scholars outside of Malaysia, who maintain that debt can only be traded at face value. If trade is not at face

value, it involves an element of *riba,* namely interest. Therefore, *Shari'ah* scholars should engage in finding solutions to such issues (Greuning and Iqbal, 2008). In addition, "the restrictions of Islamic banks to certain asset classes, the limited use of hedging instruments and the lack of high-quality liquid assets such as *Shari'ah*-compliant government bonds can also increase the riskiness of Sharia-compliant financial institutions" (Beck *et al.*, 2013: 436).

To conclude, through reviewing the liquidity risk related literature, it can be stated that the literature suffers from a shortage of research that focuses on measuring liquidity risk exposure and assessing its determinants in the banking sector in general and in the case of Islamic banks in particular. Furthermore, the literature lacks the provision of empirical evidence of assessing the liquidity exposure of Islamic banks in a comparative manner with conventional and hybrid banks. This, therefore, makes this study rather timely and also rationalises its conduct.

3. Hypotheses Development

This section provides a detailed discussion on the construction of the hypotheses aiming to examine liquidity risk exposure in Islamic, conventional and hybrid banks as well as the key determinants that may affect such exposure.

Measuring the Impact of Bank Type: Islamic Banks (IB), Conventional Banks (CB) and Hybrid Banks (HB)

In order to have a clear understanding of the expected liquidity risk exposure of Islamic banks compared to conventional and hybrid banks, it is important to determine some implications related to the unique nature of Islamic financial operations and products on liquidity risk, as discussed earlier. Such a unique nature imposes more complications on Islamic banks in managing their asset and liability positions. Hence, it is theoretically accepted that Islamic banks are more exposed to liquidity risk than conventional and hybrid banks. For instance, due to *Shari'ah* restrictions on the sale of debt, Islamic banks face difficulties in liquidating debt-based assets when needed (Ahmed, 2011: 60). This causes greater complexity and limited accessibility in obtaining capital from the money market (Ahmed, 2011: 60). Moreover, Islamic banks do not have access to many common conventional financial tools and instruments in managing their liquidity risk due to the involvement of *gharar* (uncertainty), including, among others, options and derivatives (El-Gamal, 2006: 61-62; Khan, 2010: 807), which leave Islamic banks with wider financing gaps and, hence, more vulnerable to liquidity risk.

Islamic banks also hold large amount of current accounts that can be withdrawn at any time (Iqbal and Mirakhour, 2007), which may cause wider financing gaps. Considering the small number of Islamic banks (Greuning and Iqbal, 2008) and the slow growth of financial products (Khan and Ahmed, 2001), the lack of an integrated and sophisticated payment and settlement scheme to ensure that all payment transactions are made according to *Shari'ah*, and differences in the standardisation of documentation, product, process and accounting criteria impose different degrees of liquidity risk on Islamic banks (Greuning and Iqbal, 2008; Abdullah, 2011: 14). Moreover, the equity characteristics of deposits and the risk-sharing concept of Islamic financial products can cause an increase in uncertainty regarding depositors' return and increase the possibility of withdrawals, which can lead to bank runs. Moreover, the complex nature of Islamic financing modes also leads to higher costs that reduce efficiency of Islamic banks.

Islamic financing principles, thus, play a critical role in increasing the riskiness of Islamic banks (Beck *et al.*, 2013: 436; El Gamal, 2006; Ben Arab and Elmelki, 2008: 80). Accordingly, such principles make both the nature of financial operations in Islamic banking and the Islamic financial products themselves more complex. Such a complex nature implies that Islamic banks are expected to face a wider financing gap and greater difficulties in obtaining the required funds to manage their liquidity risk than conventional and hybrid banks. On the other hand, since hybrid banks are a mixture of Islamic and conventional bank operations in the form of conventional commercial banks having Islamic windows, they are expected to be in a middle position between Islamic and conventional banks in facing liquidity risk. As a result, the following hypotheses are developed:

Hypothesis 1: Islamic banks are exposed to higher degrees of liquidity risk than conventional and hybrid banks.

Hypothesis 2: Hybrid banks that offer Islamic windows are less exposed to liquidity risk than Islamic banks yet are more exposed than conventional banks.

Banking Capital Regulation (CAP)

Capital regulation remains a top priority of banking supervisory regulations as a key determinant of liquidity (Distinguin *et al.*, 2013: 3304). Since capital regulations may vary across countries, it is important to control for potential country effects (Barth *et al.*, 2004; Distinguin *et al.*, 2013: 3302).

CAP is considered as a critical factor influencing the behaviours of the banks, as emphasised by the Basel Committee (Laeven and Levine, 2009: 263; Distinguin *et al.*, 2013: 3302), which is calculated as an index based on the World Bank guidance for banking regulation and supervision in conjunction with the Basel Accords (Barth *et al.*, 2004; Distinguin *et al.*, 2013: 3303; Laeven and Levine, 2009: 260). Accordingly, a greater value of bank capital regulation index implies a stricter regulatory oversight under which banks operate (Barth *et al.*, 2004; Klomp and Haan, 2012: 3201; Distinguin *et al.*, 2013: 3303; Laeven and Levine, 2009: 260). It is, hence, important to point out that such an index does not measure bank capital requirements ratios. It does, however, gauge the supervisory behaviour of assessing and validating the capital level at risk (Laeven and Levine, 2009: 263).

According to Laeven and Levine (2009: 260), the purpose of setting stricter capital regulation is to lessen the risk-taking behaviour of influential bank shareholders by forcing them to provide further funds at risk to meet the capital requirement. Distinguin *et al.* (2013: 3303) argue that stricter capital oversight incentivises banks to enhance their capital ratio and hence hold a higher capital level. Accordingly, holding a high level of capital implies narrower financing gaps, which directly decrease the liquidity risk that banks may face.

As capital adequacy determines the amount of a bank's loans that must be covered by its equity, it prevents them from taking excessive leverage to avoid insolvency risk. This suggests that high restrictions on capital adequacy ratio may limit banks' lending capacity (Eichberger and Summer, 2005: 550), and, hence, it may have negative association with their financing gap, which could decrease the possibilities of banks facing liquidity risk. Moreover, applying stricter capital adequacy leads to higher acceptance standards and screening processes for generating new loans (Bolt and Tieman, 2004; Thakor, 1996), which has a direct impact on minimising the banks' financing gap and, hence, lessening the possibility of liquidity risk that banks may face. Consequently, in line with this argument, it is expected that a high level of stringency on capital requirement is negatively associated with the liquidity risk exposure that banks may face. Accordingly, the following hypothesis is developed:

Hypothesis 3: The tighter the capital regulations, the less is the financing gap and, accordingly, the less is the liquidity risk exposure that banks face.

Credit Risk (CR)

The ratio of loan loss provision to gross loans has been widely used as a proxy for credit risk

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(Dietrich and Wanzenried, 2011: 311; Klomp and Haan, 2012: 3198; Bouvatier and Lepetit, 2008: 521; Athanasoglou *et al.*, 2008: 27-28; Dietrich and Wanzenried, 2011: 311; Iannotta *et al.*, 2007: 2132). Dietrich and Wanzenried (2011: 311) state that a high loan loss provision to gross loans ratio indicates a deterioration in credit quality that leads to worsening bank profitability and productivity. Hence, it can be argued that in a rational banking industry, such low credit quality may negatively impact the banks' lending and financing activities, which immediately narrows down the banks' financing gaps. This, as a result, can have a negative impact on the credit risk regarding banks' ability to borrow additional funds from the money market to cover their liquidity needs, as it may raise other money market players' concerns, which may interfere with heir incentives to respond to such banks' liquidity needs. On the other hand, even if other money market members agree to lend, the funds will be available only at a high cost.

In these cases, the rational position for such banks with a high credit risk is to narrow their financing gap by reducing their lending activities or by raising more funds through offering high rates to attract more deposits. Hence, it can be stated that a high possibility of credit risk may push a bank to minimise its financing gap to mitigate the potential liquidity risk exposure. Accordingly, this research develops the following hypothesis:

Hypothesis 4: The higher the level of credit risk, the narrower the financing gap and, hence, the lower levels of liquidity risk the banks will face.

Liquid Assets (LA)

The illiquid nature of banks' assets is considered as one of the critical sources of the fragility of the banking sector (Wagner, 2007: 121). Therefore, it is required by regulatory bodies that all banks have in place liquid assets to protect against liquidity risk. Liquid assets that banks hold can be considered as a 'net defensive position' against liquidity risks (Davis, 2088: 114). Hence, a bank can enhance its capability to fund any liquidity scarcity by increasing its liquid assets (Gatev and Strahan, 2006: 867).

Among others, Cebenoyan and Strahan (2004: 19) and Wagner (2007: 121) state that an active bank in the loan sales market would have a lesser degree of liquidity shocks through risk diversification and transformation. Nowadays, banks try to evade stocking liquid assets due to lower profits that they generate (Iannotta *et al.*, 2007: 2132) as well as because of "the low frequency of crises, limited liability of shareholders, and the safety net" (Davis, 2008: 114). A

good testimony to this argument is the decline in the liquid assets of banks. For instance, in the UK, banks' liquid assets were 30 percent of the total assets in the 1950s. However, nowadays they are only 1 percent of their total assets (Davis, 2008: 114).

Holding high levels of liquid assets, therefore, may lead banks to "offset risks they have transferred from their balance sheet by taking on new risks. They may also be encouraged to increase their risk because a higher liquidity of loans allows them to liquidate more easily in a crisis" (Wagner, 2007: 122). A high level of liquid assets, therefore, would boost the banks' confidence in gaining easy access to the loan sales market. As a result, this may decrease the possibility of bank runs, which may boost banks' incentives to invest in risky assets or increase risk-taking activities (Cebenoyan and Strahan, 2004: 19). Based on this argument, the following hypothesis is developed:

Hypothesis 5: The higher the levels of liquid assets that banks hold, the greater the risk taking incentives of banks and, hence, the higher the liquidity risk the banks are exposed to.

Long-Term Debt (LTD)

Long-term debt is considered as one of the critical components of the capital structure of banks (Gill *et al.*, 2011: 4; Bhagat *et al.*, 2011: 1582). Since debts are exempted from corporate taxes, bank managers may be incentivised to increase their lending and financing activities depending on such external funds (Bhagat *et al.*, 2011: 1583), which will increase the financing gap and hence negatively affect the liquidity position (Drudi and Giordano, 2000: 961). Therefore, banks' exposure to insolvency may occur. On the other side of the balance sheet, such a high degree of riskiness makes a negative impression on the bank management as managers seek external funds to cover their liquidity needs when they are unable to raise them internally (Bhagat *et al.*, 2011: 1583). This, in turn, can lead to a customer panic, which may result in a large amount of withdrawals that may lead to a bank run.

It can be also argued that "because long-term debt lowers the manager's continuation value through the likelihood of bankruptcy, the manager chooses lower long-term debt to lower the probability of bankruptcy" (Bhagat *et al.*, 2011: 1583). However, an increase in the risk aversion attitude of bank managers decreases the productivity that managers can generate in each period, and, hence, the anticipated compensation declines. Therefore, managers focus on their own initial pay-off by raising external funds to boost the business activities rather than their continuation value. Managers choose greater long-term debt to exploit the positive effects

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of *ex post* debt tax shields on the surplus they generate from external financing to increase their initial pay-off (Bhagat *et al*., 2011: 1584).

Furthermore, Kapopoulos and Lazaretou (2007: 150) state that a large debt-to-assets ratio indicates lower fractions of shares possessed by bulk shareholders, which implies a fragile structure of the firm's ownership. High levels of debt may also hinder investigating innovative businesses and, thus, negatively impact bank profitability (Barnett and Salomon, 2012: 1310; Kapopoulos and Lazaretou, 2007: 150) as high debt levels are associated with larger expenses (Perrini *et al*., 2008: 319; Chhibber and Majumdar, 1999: 229; Gill *et al*., 2011: 5). Accordingly, lower bank profitability and higher expense levels may easily discourage new investors and depositors, thereby causing a dramatic decline in deposits. This in turn, leaves banks with wider financing gaps and, hence, larger liquidity risk exposure is expected to be faced by banks. Accordingly, the final hypothesis is developed:

Hypothesis 6: The higher ratio of long-term debt is positively associated with higher degrees of liquidity risk exposure that banks face.

4. Methodology and Model Selection

4.1. Sample and Data

As identified in the introduction section, this study aims to examine commercial banks on a global level as the main reason for the sample selection is the quantitative nature of the examined data, due to the fact that a panel data regressions analysis requires a considerably large number of observations, as a small population may lead to inconsistent outcomes (Baltagi, 2005: 53, 151, 194). In addition, due to the small number of Islamic banks compared to conventional banks, global data can provide a sufficient sample to obtain sizable data. Thus, the sample in this study consists of 145 commercial banks from 21 countries including, for the period of 1996 to 2015, Bahrain, Bangladesh, Brunei Darussalam, Egypt, Indonesia, Iran, Kuwait, Malaysia, Oman, Pakistan, Qatar, Saudi Arabia, Sudan, Switzerland, Syria, Thailand, Turkey, United Arab Emirates, United Kingdom, and Yemen. It is worth mentioning that that the choice of the sampled banks is purely based on the data availability from various databases, including the Bankscope database.

Since this research aims to examine the implications of the unique nature of the Islamic financial principles on Islamic banks' liquidity risk, and considering a comparative approach

will provide a more meaningful understanding of the obtained findings, the sample of this research consists of Islamic banks and conventional banks to test the developed hypotheses in a comparative manner. As an important distinction, the nature of bank types in this study also includes hybrid banks to examine whether such a mixed nature of conducting banking activities has different implications for the liquidity position compared to full-fledged Islamic and conventional banks. It should also be noted that this type of bank has an undeniable market size that needs to be explored in relation to liquidity risk.

The data period covers from 1996 to 2015 and the number of observations with unbalanced panel data is 1454. As for the period covered, the observations commence in 1996, as most of the Islamic banks were established from 1996 onwards, which corresponds to the commencing of the internationalisation stage of the Islamic banking industry formation process (Asutay, 2015; Platonova *et al*., 2016), as in 1980s, the one-country one-Islamic bank model reigned as a strategy (Asutay, 2015).

In ensuring the reliability of the examined data, it is important to elaborate on the approaches and sources followed in the data collection process. With regards to bank-specific variables, following Agoraki *et al*. (2011: 43), Naceur and Omran, (2011: 7) and Poon and Firth (2005), the individual bank balance sheet data and income statements were obtained from Bankscope. Following Naceur and Omran (2011:7), this research used unconsolidated financial statements and consolidated statements when the unconsolidated statements are not accessible, with the confirmation that each bank is contained only once in the dataset. In addition, following Barth *et al*. (2004), Fernandez and Gonzalez (2005), Pasiouras *et al*. (2006: 413-414), Agoraki *et al*. (2011: 42) and Klomp and Hann (2012: 3200), the bank capital regulatory and supervisory data were collected from the World Bank survey data (World Bank: 2017), which was set by the Basel Committee on Banking Supervision in cooperation with the World Bank and the International Monetary Fund (IMF). Moreover, in line with Fernandez and Gonzalez (2005), Dinger and Hagen (2009), Naceur and Omran (2011: 7), the macroeconomic variables and the governance indicator variables were obtained from World Bank survey data (World Bank: 2017). In addition, GDP data were obtained from the IMF's World Economic Outlook (WEO) database (2017).

4.2. Definitions and Measurement of the Variables

This section aims to provide the definitions and measurements of the dependent and

independent variables.

Measuring liquidity risk

Following Saunders and Cornett (2006: 477-78), this research measures liquidity risk exposure based on the 'financing gap' method, which according to Saunders and Cornett (2006: 478) is defined as the difference between average bank loans and average bank core deposits. According to Saunders and Cornett (2004: 376), the core deposits include demand deposits, money market deposit accounts, negotiable order of withdrawal (NOW) accounts, money market deposit accounts, other saving accounts and retail certificates of deposits (CDs). In addition, to have a meaningful analysis, the financing gap is standardised by the average total assets. Thus, the research develops the following financing gap ratio, as expressed in equation (5.4):

$$FGR = \frac{AL - ACD}{ATA}$$

where: *FGR* refers to the financing gap ratio; *AL* refers to average loans; *ACD* refers to average core deposits; *ATA* refers to average total assets.

The FGR indicates that a higher value of financing gap ratio indicates a greater degree of liquidity risk that the bank is exposed to (Saunders and Cornett, 2006: 477).

Bank type: Islamic banks (IB), conventional banks (CB), and hybrid banks (HB)

The most effective way to represent the bank type in an econometric model is through the dummy variable. When the independent variables have a qualitative nature, such as group categories (in this research it is banking industry type, such as Islamic, conventional and hybrid banks), the dummy variable can be used to represent the effects of these explanatory variables in the regressions analysis (Maddala, 1992: 306). Accordingly, the effect of Islamic banks type on liquidity risk is captured by a dummy variable that equals 1 if the bank is a fully fledged Islamic bank and 0 otherwise. The same method is applied to conventional and hybrid banks.

Since there is a constant term in the regression equation, the number of defined dummy variables should be lessened by one, and, hence, only two dummy variables are included in the model. The excluded dummy variable is taken as the base banking type industry, which is that

of the Islamic banks in this case. The Islamic banks dummy variable is excluded and taken as a base industry in the regressions equations for three reasons. First, the inclusion of all three dummy variables leads to multicollinearity, which will either prevent the econometric package from running the regression or will omit one of the dummy variables mechanically (Maddala, 1992: 308). The second reason is to give control of choosing the base dummy variable to the researcher rather than to the econometric package, which would randomly omit one of the dummy variables. The third reason, excluding the Islamic bank dummy and taking it as the base for other two dummy variables, conventional and hybrid banks, is in line with the aim of this study in examining the liquidity risk of Islamic banks compared to conventional and hybrid banks.

Capital requirement regulations (CAP)

Following Barth *et al.* (2004: 213), Fernandez and Gonzalez (2005: 475), Pasiouras *et al.* (2006: 425), Agoraki *et al.* (2011) and Klomp and Hann (2012: 3201), the CAP index is measured through a survey conducted by the World Bank. Table 1 presents the construction of the CAP index.

Table 1: Capital Requirement Regulations Index (CAP)

Variable	Definition	Quantification	World Bank Guide Questions
(a) Overall capital stringency	Whether the capital requirement reflects certain risk elements and deducts certain market value losses from capital before minimum capital adequacy is determined.	World Bank Guide Overall capital stringency = 3.1.1 + 3.3 + 3.9.1 + 3.9.2 + 3.9.3 + (1 if 3.6 < 0.75) Yes = 1; No = 0	3.1.1 Is the minimum capital-asset ratio requirement risk weighted in-line with the Basel guidelines? Yes/No 3.3 Does the minimum ratio vary as a function of market risk? Yes/No 3.9.1 Are market values of loan losses not realised in accounting books deducted? Yes/No 3.9.2 Are unrealised losses in securities portfolios deducted? Yes/No 3.9.3 Are unrealised foreign exchange losses deducted? Yes/No 3.6 What fraction of revaluation gains is allowed as part of capital?
(b) Initial capital stringency	Whether certain funds may be used to initially capitalise a bank and whether they are officially verified.	Initial capital stringency = 1.5 + 1.6 + 1.7 1.5: Yes = 1, No = 0 1.6 and 1.7: Yes = 0, No = 1.	1.5 Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? Yes/No 1.6 Can the initial disbursement or subsequent injections of capital be done with assets other than cash or government securities? Yes/No 1.7 Can initial disbursement of capital be done with borrowed funds? Yes/No
CAP index		= (a)+(b)/2	Higher values indicate greater stringency.

Source: Modified version of Barth *et al.* (2004)

The CAP index consists of nine variables that reflect the degree of stringency on the capital regulations to assess whether certain risk issues, such as credit risk and liquidity risk, in-line with the Basel guidelines, are considered in gauging the capital requirements. It also measures whether certain market value losses are deducted before fixing the minimum capital

requirements. Moreover, it also refers to the extent to which the sources of funds that are used as capital are required to be proved officially by supervisory and regulatory bodies (Barth *et al.*, 2004; Klomp and Haan, 2012: 3201). The variables definitions and the index calculation methods of CAP are explained in Table 1.

Credit risk (CR)

Credit risk is measured by the ratio of loan loss provision to gross loans (Klomp and Haan, 2012: 3198; Bouvatier and Lepetit, 2008: 521; Athanasoglou, 2008; Dietrich and Wanzenried, 2011: 311). The ratio is formulated as below:

$$LLP = \frac{loan\ loss\ provision}{gross\ loans}$$

Dinger and Hagen (2009: 499) state that the ratio of loan loss provision to gross loans is widely used as a measurement of the riskiness of banks' business activities. According to Berger and Bouwman (2009a), it is important to carefully control for bank risk, as the main reason for banks to hold capital is to absorb risk. "The inclusion of risk measure helps to isolate the role of capital in supporting the liquidity creation function of banks from the role of capital in supporting banks' function as risk transformers" (Berger and Bouwman, 2009a: 3812). In addition, since high levels of loan loss provisions reflect the deterioration of credit quality, it is important to examine its interaction with liquidity risk.

Long-term debt (LTD)

The long-term debt variable is calculated as long-term debt scaled by total assets (Waddock and Graves, 1997; Kapopoulos and Lazaretou, 2007; Barnett and Salomon, 2012) as follows:

$$LTD = \frac{long - term\ debt}{total\ assets}$$

Long-term debt funding is the sum of senior debt maturing after one year as well as preference shares and hybrid capital accounted for as debt (as defined by Bankscope, 2012). This indicator is used as long-term debt is considered one of the critical components of the banks' capital structure (Gill et al., 2011: 4; Bhagat *et al.*, 2011: 1582). It should be noted that a higher level of debt implies a lower equity ratio (Berríos, 2013: 107), and it also indicates the inability to raise the required funds internally and, hence, it is important to proxy for such a variable to test its impact on liquidity risk exposure.

Liquid assets (LA)

The liquid assets ratio is measured as the ratio of liquid assets to total assets (Iannotta *et al*., 2007: 2132; Bourke, 1989: 72; Demirguc-Kunt *et al*., 2004: 603; Klomp and Haan, 2012: 3198). The ratio is calculated as follows:

$$LA = \frac{liquid\ assets}{total\ assets}$$

This ratio is used to control for differences in bank liquid assets (Demirguc-Kunt *et al*., 2004: 603) as liquid assets are considered as the 'net defensive position' against liquidity risks (Davis, 2088: 114) and enhance banks' capability to fund any liquidity scarcity (Gatev and Strahan, 2006: 867). Due to the interrelationship of liquid assets with the banks' behaviour towards the liquidity position, it is taken into consideration to examine its impact on liquidity risk (Gatev and Strahan, 2006).

4.3. Control Variables

In extending the analysis, several control variables are used in this study relating to ownership, governance and macroeconomy.

Following the related banking literature (Iannotta *et al*., 2007; Klomp and Haan, 2012; Berger *et al*., 2007; Athanasoglou *et al*., 2008; Berger and Bouwman, 2009a; Demirguc-Kunt, 2004; Agoraki *et al*., 2011), we include bank size and GDP as control variables. Following Claessens *et al.* (2002) and Gorton and Schmid (2000), this study measures bank size by the logarithm of total assets. With regards to GDP, following Bernanke and Gertler (1989), Distinguin *et al*. (2013: 3303), Kiyotaki and Moore (1997) and Naceur and Omran (2011: 6), this research measures economic growth by the percentage change in GDP at constant prices. Since real GDP is adjusted for inflation, controlling for real GDP is meaningful and relevant to liquidity risk, as it indicates the changes in physical production, which gives a clearer sign of the strength of the economy than nominal GDP. Moreover, real GDP provides brighter indicators for business cycles than nominal GDP. In addition, nominal GDP involves both quantity and changes in price, which may lead to disregarding the changes in physical production in the

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economy. Hence, real GDP offers a better gauge of the economic growth and performance inclusively.

As regards to 'ownership', following Laeven and Levine (2009), Chalermchatvichien *et al.* (2014: 226), Shehzad *et al.*, (2010), Cao and Petrasek (2014), Karyani and Utama (2015), this study measures the ownership concentration, which is defined as "the largest shareholder's percentage ownership of the cash-flow rights attributable to a bank's total equity" (Chalermchatvichien *et al.*, 2014: 226).

In considering the governance variables, on a macro level, we have included four 'governance indicators' for the sampled countries, among others, in line with Kaufmann *et al.* (2010):

(i) 'political stability and absence of violence/terrorism', which assesses the "perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism and it ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance" (Kaufmann *et al.*, 2010: 4). The performance of banks in general and Islamic banks in particular is by definition affected by the political environment and the political stability a country has through ensuring business confidence. Therefore, the liquidity conditions of banks can be affected by the political stability of the country, as bank rushes can be result of political instability along with financial and economic crisis, which was evident, for example, in the 1999 and 2000 financial crises in Turkey (Altunbas *et al.*, 2009).

(ii) 'government effectiveness', which measures the "perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies and it ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance" (Kaufmann *et al.*, 2010: 4). Since public policy making can affect the banking sector through various means, including the nature and operation of regulations, banks, including Islamic banks, are affected by government effectiveness and therefore it is included as a control variable in this study.

(iii) 'regulatory quality' refers to the "perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development and it ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance" (Kaufmann *et al.*, 2010: 4). Regulatory quality is essential for the efficient operation and performance of the economy and the financial sector, which is also necessary in

moderating the consequences of liquidity risk. Thus, an effective regulative environment aiming for the promotion of the banking sector will help to ease the liquidity risk exposure for the banking sector, including for Islamic banks.

(v) 'rule of law', which "reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence and it ranges from approximately -2.5 (weak) to 2.5 (strong) governance performance" (Kaufmann *et al*., 2010: 4). Since rule of law relates to enhancing confidence in the working nature of the entire political economy of a society, it is essential for the efficient working of banking and financial instruments and institutions. Hence, provision of an effective environment ensured by the 'rule of law' enhances confidence in customers and deposit account, which moderates and eases liquidity risk exposure beyond facilitating an effective political economy for the entire working of the banking system, including Islamic banks.

4.4. Model Specification

In order to investigate the association between the liquidity risk exposure as the dependent variable and the bank industry type, bank capital regulation and control variables, following the related banking literature (Saunders and Cornett, 2006; Ahmed, 2011; Barth *et al*., 2004; Beck *et al*., 2013; Berger and Bouwman, 2009; Bhagat *et al*., 2011; Bouvatier and Lepetit, 2008; Cebenoyan and Strahan, 2004; Dietrich and Wanzenried, 2011; Dietrich and Wanzenried, 2011; Dinger and Hagen, 2009; Distinguin *et al*., 2013; Gatev and Strahan, 2006; Gill *et al*., 2011; Iannotta *et al*., 2007), this study develops the following panel data regressions model using random effects model with robust standard error:

$$LRE_{bit} = \propto + \beta_1 CB_{bit} + \beta_2 HB_{bit} + \beta_3 CAP_{it} + \beta_4 LA_{bit} + \beta_5 CR_{bit} + \beta_6 LTD_{bit} + \beta_7 PV_{it}$$
$$+ \beta_8 GE_{it} + \beta_9 RQ_{it} + \beta_{10} RL_{it} + \beta_{11} OC_{bit} + \beta_{12} SIZE_{bit} + \beta_{13} GDP_{it} + \acute{\varepsilon}$$

where:

LRE_{bit} is the level of liquidity risk exposure that bank b in country i during the period t faces;

α: the intercept;

$\beta_1...\beta_n$: the regression coefficients;

$\acute{\varepsilon}$: the error term;

CB_{bit} denotes for conventional banks. It is a binary dummy variable with a value of '1' if the bank is fully conventional and '0' otherwise;

HB_{bit} signifies the hybrid banks (*i.e.* the conventional banks that offer Islamic financial services). The Islamic bank dummy is excluded and taken as the base for the other two dummies in the regression model.

CAP_{it} stands for the bank capital regulatory stringency that bank b operates under in the country i during the period t;

LA_{bit} denotes the ratio of liquid assets to total assets ratio of bank b in country i during the period t;

CR_{bit} refers to the credit risk of bank b in country i during the period t;

LTD_{bit} stands for the long-term debt-to-total-assets ratio of bank b in country i during the period t;

PV_{it}, as defined above, measures political instability in the country i during the period t that bank b operates in;

GE_{it} denotes government effectiveness in the country i during the period t that bank b operates in;

RQ_{it} stands for regulative quality in the country i during the period t that bank b operates in;

RL_{it} denotes rule of law in the country i during the period t that bank b operates in;

OC_{bit} refers to the ownership concentration of bank b in country i during the period t;

$SIZE_{bit}$ refers to the size of the bank b in the country i during the period t;

GDP_{it} refers to the economic growth of the country i during the period t that bank b operates in.

Table 2 displays the definitions of the dependent and independent variables of the empirical model.

Table 2: Definitions of Variables

Variable name	Variable abbreviation	Variable description
Liquidity risk exposure	LRE	Liquidity risk exposure is measured by the financing gap that measures the possibility of banks being unable to meet their financial obligations in a timely manner.
Conventional banks	CB	It is measured by a dummy variable that takes a value of '1' if the bank is fully conventional and '0' otherwise.
Hybrid banks	HB	It is measured by a dummy variable that takes a value of '1' if the bank is hybrid and '0' otherwise.
Bank capital regulation	CAP	The index measures the capital requirement and standards and consists of nine variables. The index equals the total score of variables scaled by the total number of variables.
Credit risk	CR	Credit risk is measured by the ratio of loan loss provision to gross loans.
Long-term debt	LTD	Long-term debt ratio is divided by total assets.
Liquid assets	LA	Ratio of liquid assets to total assets.
Political stability and absence of violence/terrorism	PV	Political stability and absence of violence/terrorism measures perceptions of the likelihood of political instability and/or politically motivated violence, including terrorism.
Government effectiveness	GE	Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
Regulatory quality	RQ	Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.
Rule of law	RL	Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
Ownership concentration	OC	Refers to the largest shareholder's percentage ownership of the cash-flow rights attributable to a bank's total equity
Bank size	SIZE	Bank size is measured by the log of total assets.
Economic growth	GDP	GDP is measured by the percentage change in real gross domestic product (GDP), constant prices.

5. Results and Discussion

5.1. Descriptive Data Analysis

This section provides the descriptive statistics of the examined variables from the sampled banks, which helps to develop a better understanding of the liquidity position of the sampled banks and establishes a good platform for testing the developed hypotheses.

Table 3: Descriptive Statistics

stats	LRE	IB	CB	HB	CAP	CR	LA	LTD	RQ	PS	GE	RL	OC	SIZE	GDP
mean	-0.40	0.26	0.41	0.33	0.69	0.03	0.13	0.04	0.44	0.28	0.44	0.48	37.26	3.71	4.9

max	0.54	1	1	1	0.89	1.21	0.79	0.78	1.13	1.21	1.54	1.05	100	4.89	50.69
min	-30.28	0	0	0	0.33	-0.02	0	0	-0.2	-1.35	-0.39	-0.04	6.59	1.87	-4.1
sd	2.5	0.44	0.49	0.47	0.14	0.09	0.14	0.11	0.36	0.62	0.47	0.23	25.95	0.63	4.76

As shown in Table 3, the magnitude of LRE of the examined banks ranges between a minimum value of -30.28 and maximum value of 0.54 with a standard deviation of 2.5, which indicates the variation of the degrees of liquidity risk exposure between the examined banks during period in question. The overall liquidity risk of the examined banks recorded a mean value of -0.490, which implies that, overall, banks keep a good distance from being exposed to liquidity risk.

As for CAP stringency, its value ranges between 0.33 and 0.89 with a mean value of 0.69. Such fluctuation suggests that the sampled countries do not stay on the same level of restriction in regulating capital requirements for the banking sector during the sample period. With regards to CR level, its magnitude ranges between -0.02 and 1.21 with a mean value of 0.03. The data indicate relatively low levels of external long-term debt or LTD funds that the examined banks hold indicated by the mean value of 0.04. On other the hand, LA, or the liquid assets of the examined banks, on average scores 0.13, representing 11.3 percent of total assets. As for the governance indicators, the results show that the regulatory quality scores 0.44 on average and ranges between -0.2 and 1.13, while the political stability scores 2.28 on average, and government effectiveness reached 0.44 on average. The results also show that the rule of law scores 0.48 and the ownership concentration of the examined banks are relatively well concentrated, with a mean value of 37.26. In relation to the size of total assets, the statistics show the average log of total assets of the examined banks ranging between 4.89 and 1.87, implying that the sampled banks had a different volume of total assets over the sample period. Finally, the real GDP growth rates of the assessed countries where the examined banks operate score 4.9 on average and with a maximum and minimum of 50.69 and -4.1, respectively, suggesting different economic conditions that may positively or negatively affect their exposure to liquidity risk.

Based on the results of this study, Islamic banks are more exposed to liquidity risk than conventional banks with a mean value of -.1064218 and -.1788504, respectively, as expected by hypothesis 1. However, inconsistent with hypothesis 2, the descriptive data analysis shows that hybrid banks are illustrated to be the safest in terms of facing liquidity risk, with a mean value of -1.18497. The obtained exposures to liquidity risk are consistent with the actual asset

size of Islamic, conventional and hybrid banks, where the overall mean value of their total assets records US$ 8038.558, US$ 9320.807 and US$ 22030.9 million dollars, respectively.

It can be argued that such differences in facing liquidity risk exposure are a direct result of the unique nature of Islamic banks' financial operations and products, which are different from those of their conventional counterparts. This unique style leaves Islamic banks with more complications in managing their assets and liabilities positions. These results are consistent with the theoretically developed hypothesis 1. However, this is inconsistent with hypothesis 2, as the lowest exposure to liquidity risk is obtained in the case of hybrid banks; this could be a result of being a mixture of both Islamic and conventional banking and thus attracting higher levels of funds from clients of both systems. Based on the trend analysis in this section, it can be stated that the descriptive statistics indicate that Islamic banks are more exposed to liquidity risk in comparison to conventional and hybrid banks. It also evidences that hybrid banks were in a better liquidity position compared to conventional banks during the period in question.

5.2. Empirical Findings

After presenting the results of the descriptive analysis in the preceding section, this section presents the empirical results of the panel data regression with the random effects model to test the developed hypotheses. However, before presenting the results, this section initially presents some econometric tests that are conducted to confirm the reliability of the examined variables. To examine the normality of the data, skewness and kurtosis standards are applied. In order to have normally distributed data, following Dhaliwal *et al*. (2012: 732), this research uses the winsorising method. The winsorised data appear to be normally distributed, whereby the skewness results are between ± 1.96 and the coefficient of kurtosis ranges between ±3, as shown in Table 4.

Table 4: Normality Test

Stats	LRE	IB	CB	HB	CAP	CR	LA	LTD	RQ	PS	GE	RL	OC	SIZE	GDP
Skewness	-1.3	1.08	0.37	0.73	-0.22	1.06	1.99	5.00	-0.19	-0.53	0.09	-0.18	1.12	-0.28	1.65
Kurtosis	1.55	2.16	1.14	1.53	1.75	2.91	1.78	2.94	1.96	2.38	2.27	2.73	2.70	2.44	2.25

Due to the normally distributed data, this study applies the Pearson correlation matrix to investigate the multicollinearity between the examined variables. The results of the Pearson correlation matrix in Table 5 do not indicate a correlation value equivalent of or higher than 0.8, which is considered as a threshold level by many authors in the literature (such as Brooks,

2008; Haniffa and Cooke, 2005; Jing *et al.*, 2008), which implies that the assessed variables are not highly correlated, as presented in Table 5.

Table 5: Pearson Correlation Matrix Test

	LRE	CB	HB	CAP	CR	LA	LTD	RQ	PS	GE	RL	OC	SIZE	GDP
LRE	1.00													
CB	-0.10	1.00												
HB	-0.19	-0.58	1.00											
CAP	-0.12	0.46	-0.42	1.00										
CR	-0.04	-0.09	-0.09	-0.17	1.00									
LA	0.03	0.12	0.11	-0.08	-0.07	1.00								
LTD	0.07	-0.08	-0.13	0.07	-0.05	-0.16	1.00							
RQ	-0.06	0.16	-0.27	0.44	0.05	-0.48	0.26	1.00						
PS	-0.09	0.23	-0.12	0.38	0.08	-0.12	-0.16	0.30	1.00					
GE	-0.06	0.20	-0.24	0.49	0.07	-0.43	0.20	0.73	0.54	1.00				
RL	-0.06	0.22	-0.24	0.22	0.15	-0.22	0.04	0.60	0.61	0.61	1.00			
OC	-0.15	-0.06	0.00	0.14	0.08	-0.02	0.10	0.09	0.09	0.11	0.12	1.00		
SIZE	-0.10	-0.25	0.46	-0.20	-0.05	0.14	-0.08	0.41	-0.06	-0.23	-0.23	0.05	1.00	
GDP	0.01	-0.04	0.01	-0.23	0.18	-0.13	0.02	0.19	0.27	0.16	0.36	0.09	-0.13	1.00

In analysing the data, the Hausman test is employed to examine the fitness of using panel data regressions with either the fixed effects model or the random effects model. As presented in Table 6, the Hausman test results demonstrate that the null hypothesis is accepted (0.182; $p > 0.1$), implying the difference in coefficients is not systematic and hence suggests that the random effects is the most suitable method to estimate the determinants of liquidity risk.

The use of random effect modelling is further rationalised due to the nature of some of the variables used in the modelling, namely the bank type variables, whether Islamic, conventional or hybrid, which are time-invariant. According to Nwakuya and Ijomah (2017: 277) a key "advantage of random effects is that you can include time invariant variables". Given such nature, fixed effects model is not suitable as it does not estimate the effects of variables that do not change over time. Therefore, the fixed effects model is applied when the aim is only to analyse the impact of variables that vary over time (Bell *et al.*, 2019; Nwakuya and Ijomah, 2017). In addition, another key characteristics of the fixed effects model, in the case of time-invariant variables, is that it controls for them rather than measures their impact, which is the key purpose of this paper, where the aim is to measure the impact of the bank type (whether Islamic, conventional or hybrid) on liquidity risk. Furthermore, given that the results of the fixed effects model, as presented in Table 8, are consistent with the results generated by random effects model as depicted in Table 6, it can be suggested that the difference in coefficients is not systematic, suggesting that the random effect is the most suitable model in the case of the examined variables (Bell *et al.*, 2019; Bell and Johns, 2015).

As can be seen from the results, the overall model is significant (F-test = 0.000, $p < 0.01$), with R^2 equal to 0.441, indicating that the goodness of fit statistics of the examined model are high, as presented in Table 6.

As the results in Table 6 depict, the panel data regressions model with the random effects model reports consistent results with hypotheses 1 and supports the theory of Islamic banking, wherein conventional banks are less exposed to liquidity risk than Islamic banks by 0.336. Furthermore, the results show that hybrid banks are less exposed to liquidity risk than Islamic by 1.437. However, in contradiction with hypothesis 2, the empirical results detect that hybrid banks are even less exposed to liquidity risk than conventional banks, with a coefficient value of -1.437 compared to -0.336, suggesting a better liquidity position of the hybrid banks than Islamic and conventional banks. Such empirical results are supported by the descriptive data, where the overall liquidity risk mean scores of Islamic, conventional and hybrid banks are -0.1064, -0.1788 and -1.1849, respectively.

Table 6: Estimating the Determinants of Liquidity Risk Exposure: Panel Data Regressions with Random Effects Model with Robust Standard Error

LRE	Coef.	z-value
CB	-0.365	-3.58***
HB	-1.437	-5.37***
CAP	-4.941	-6.05***
CR	-0.238	-1.75*
LA	0.128	0.360
LTD	1.522	4.23***
RQ	-0.974	-3.79***
PV	-0.125	-1.99*
GE	0.954	3.22**
RL	-1.016	-2.68**
OC	-0.011	-3.95***
SIZE	-0.179	-2.5*
GDP	-0.005	-0.430
_cons	4.996	6.6***
R-Square		0.441
Prob > chi2		0.000
Hausman		0.182
Obs No		1454

Notes: *p < .10; **p < .05; ***p < .01

The empirical findings, thus, are theoretically acceptable, whereby the unique style of Islamic financial operations and products lead to different implications for the liquidity risk of Islamic banks compared to conventional and hybrid banks. This imposes greater degrees of complication on Islamic banks in managing their positions on both sides of the balance sheet.

Due to the Islamic finance principles of prohibition of *riba* and *gharar* as well as profit-and-loss and risk sharing (Khediri *et al*., 2015), Islamic banks need to operate under certain standards and restrictions on both sides of the balance sheet. In relation to such constraints, all financial contracts need to refer to a particular tangible underlying asset (Cox and Thomas, 2005: 171). Such principles also imply that Islamic banks face more difficulties in selling debt-based assets due to the constraints on sale of debt (Ahmed, 2011: 60). Thus, Islamic banks have less access to raising external funds in a *Shari'ah*-compatible manner from money markets (Ahmed, 2011: 60). Moreover, Islamic banks are restricted in their use of options and derivatives and other common conventional financial products due to the involvement of *gharar* features (El-Gamal, 2006: 61-62; Khan, 2010: 807), which reflects the wider range of difficulties in raising funds to cover their liquidity risk.

The findings can also be explained by the relatively small size of the Islamic banking sector, the underdeveloped Islamic financial products, the absence of a multifaceted payment settlement scheme in accordance with *Shari'ah,* variances in standardisation of documentation, product, process and accounting standards, all of which impose different degrees of liquidity risk on Islamic banks (Greuning and Iqbal, 2008; Abdullah, 2011: 14). Moreover, due to the equity nature of the deposits, the uncertainty regarding depositors' return expectation may increase the level of withdrawals (Beck *et al*., 2013: 436; El Gamal, 2006; Ben Arab and Elmelki, 2008: 80) and hence may cause higher degrees of liquidity risk to be faced by Islamic banks compared to conventional and hybrid banks, as evidenced by the obtained results in Table 6.

With regards to hybrid banks, their mixed nature enhances their liquidity position through the advantage of accumulating larger funds from customers of both systems. This is evidenced by the descriptive statistics, whereby the 'size' of hybrid banks scored the highest overall mean value of US$ 22,030.9 compared to Islamic and conventional banks, while size of Islamic banks scored a mean value of US$8,038.558 and the conventional banks' size scored a mean value of US$9,320.807. In confirmation of this statement, the hybrid banks hold the largest amount of deposits with a mean value of US$18,108.82 million, while Islamic banks hold the lowest amount of deposits with a mean value of US$5,716.176 million. Thus, the sampled conventional banks hold lower levels of deposits than hybrid banks, yet higher than Islamic banks with a mean value of US$6,093.142 million. Such statistics support the statement that

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hybrid banks take advantage of their mixed nature of doing banking, which contradicts the expectation of hypothesis 2.

As can be seen in Table 6, consistent with hypothesis 3, a negative relationship between stringency on bank capital regulatory requirement and the liquidity risk exposure of the banks is reported, which is statistically significant at 0.01 with a coefficient value of -4.94. This implies that an increase of 1 percent in the level of stringency on capital regulations of the sampled banks leads to a decrease in liquidity risk exposure by 4.94 percent, which suggests the important role that capital regulations play in the financial stability of the examined banks as a crucial element in influencing the bank activities, as highlighted by the Basel Committee (Laeven and Levine, 2009: 263; Distinguin *et al.*, 2013: 3302). The results as depicted in Table 6 are also consistent with the expectation that a greater value of bank capital regulation implies greater oversight standards under which the banks work, as stated by Barth *et al.* (2004), Klomp and Haan (2012: 3201), Distinguin *et al.* (2013: 3303) and Laeven and Levine (2009: 260). Such negative association can be explained by the argument that stricter capital regulation enhances banks' capital ratio, as suggested by Distinguin *et al.* (2013: 3303) and enhances banks' risk absorption capacity. Furthermore, the obtained results are supported by the 'financial fragility structure' and 'crowding-out of deposits theory', thus expecting a negative association between capital regulatory stringency and banks' lending activities (Distinguin *et al.*, 2013: 3304) and, accordingly, narrowing down the bank financing gap. Since capital fragility decreases with a high ratio of equity capital, banks' incentives to monitor borrowing decreases, accordingly, as argued by Diamond and Rajan (2000, 2001), which may reduce the financing gaps of the banks. Moreover, the empirical results are consistent with Thakor's (1996) position that high capital requirements stringency leads to a stricter screening process of generating new loans or expanding financing activities. Thus, applying such high standards on capital requirements minimises the financing gaps and hence lowers the level of liquidity risk exposure that banks face, as shown in Table 6.

As the results in Table 6 depict, in verifying hypothesis 4, credit risk is negatively associated with the liquidity risk exposure of the examined banks and is statistically significant at 0.10 with a coefficient value of -0.238. This indicates that an increase of 1 percent in the degree of the examined banks' loan quality deterioration leads to a decrease in the liquidity risk exposure by 0.238 percent. The generated results can theoretically be supported by arguing that a high loan-loss provision to gross loans ratio implies an increase in the depreciation level in the credit

quality, which leads to a deterioration in bank profitability and productivity (Dietrich and Wanzenried, 2011: 311). In the case of a high deterioration of loan quality, a conscientious and effective bank management would focus on minimising the financing gap by reducing its lending activities by applying higher standards for generating new loans. Moreover, when a bank faces a high level of credit risk, it negatively impacts incentives for extending the existing loan and financing activities. Such behaviour may occur during the deterioration of loan or financing quality as a result of a negative impact of credit risk on banks' ability to raise additional funds from the money market to meet their liquidity needs, as other money market participants are concerned about their high degrees of credit risk. It is commonly accepted that, in a rational money market, funds are costlier for a bank with high levels of credit risk. Considering such an environment, the rational position for banks with a high credit risk is to tighten their financing gap by reducing their lending and financing activities. In addition, the negative association between credit risk and liquidity risk exposure can be explained by arguing that an increase in bad loans may erode banks' capital as they have to use their capital to cover their liquidity gaps, which, in turn, would negatively interrupt the banks' ability to expand their lending and investment activities (Bouvatier and Lepetit, 2008: 525), which would narrow their financing gap and, hence, decrease their exposure to liquidity risk, as evidenced in Table 6.

In regard to hypothesis 5, the expectation of a positive association between liquid assets and liquidity risk exposure is supported by the empirical results, as depicted in Table 6, where a positive coefficient is detected; however, the results fail to detect any significant impact, which is in contradiction with the proposed hypothesis 5. Nevertheless, the detected positive association between long-term debt and liquidity risk exposure is in line with the hypothesis arguing that liquid assets are considered a 'net defensive' that protects banks against liquidity shocks (Davis, 2088: 114); hence, holding high levels of liquid assets induces banks to increase their risk-taking behaviour, as suggested by Wagner (2007: 122). The results support the argument that a bank with high liquid assets has confidence in obtaining easy access to the loan sales market, which makes the bank less exposed to bank runs and, hence, boosts its incentive to invest in risky assets or increase risk-taking activities, as stated by Cebenoyan and Strahan (2004: 19), which positively impacts the financing gap and, hence, exposes it to higher degrees of liquidity risk.

In relation to the association between long-term debt and liquidity risk, the findings in Table 6 are consistent with hypothesis 6, which suggests that long-term debts are positively correlated with liquidity risk and this is statistically significant at 0.01 with a coefficient value of 1.522, indicating that a 1 percent increase in the level of the long-term debts leads to an increase of liquidity risk by 1.522 percent. The detected positive association between long-term debt and liquidity risk exposure is in line with the hypothesis arguing that mangers may increase the debt ratio to increase their initial payoffs by expanding the business operations based on external debt financing (Bhagat *et al*., 2011: 1583). Moreover, high levels of long-term debt indicate the inability of banks' management to internally raise the needed funds, which leaves banks with a negative reputation, as suggested by Bhagat *et al*. (2011: 1583). This in turn may lead to a customer panic, which in turn can lead to large amounts of withdrawals, which causes a wider financing gap and, hence, generates greater liquidity risk for banks. Furthermore, holding a high amount of debt may also discourage innovative business approaches that negatively impact bank productivity, as stated by Barnett and Salomon (2012: 1310) and Kapopoulos and Lazaretou (2007: 150), as high debt levels imply higher costs (Perrini *et al*., 2008: 319; Chhibber and Majumdar, 1999: 229; Gill *et al*., 2011: 5). Hence, high levels of debt can lead to a decline in deposits and other funds, especially for Islamic banks, as deposits have some equity features. This, in turn, leaves banks with wider financing gaps, as is evidenced by the obtained results, as presented in Table 6.

As for the control variables, the findings in Table 7 demonstrate a negative association between liquidity risk and regulatory quality, political stability, rule of law, ownership concentration and bank size at the 0.01, 0.1, 0.05, 0.05, 0.01 and 0.1 statistical significance levels, respectively. The negative relationship for governance variables implies that better regulatory quality, political stability, and rule of law help to reduce the liquidity risk exposure, which should be considered as a positive impact in terms of providing an efficient and facilitating political economy environment. It should also be noted that, as the results report, government effectiveness has a positive relationship with liquidity risk exposure. indicating that government performance increases liquidity risk exposure rather than decreases it. This can be explained by the mistrust of public policy and government policy making in the sampled countries due to political pressure and the strong nature of the state as opposed to strong market forces, which can have a negative impact on the banking sector, including increasing the liquidity risk exposure.

As regards to ownership concentration, it is significant at the one percent level with a rather small coefficient level of -0.011, which suggests that high ownership concentration helps to moderate the liquidity risk exposure. Therefore, the results suggest that the higher the ownership concentration the lower the liquidity risk exposure, suggesting a positive consequence. However, the political economy of ownership concentration is an important issue with further implications, which should be further explored in a critical manner.

In addition, the results report a negative relationship between GDP and liquidity risk exposure, which implies that the expansion of the economy eases the liquidity constraints in the economy and contributes to the diminished liquidity risk exposure. However, the results indicate a very small impact, as indicated with the coefficient, and it seems to be statistically insignificant.

5.3. Sensitivity Tests

In order to examine the robustness of the results generated by this study based on panel data regressions with the random effects model and with the objective of controlling for potential interaction effects between the bank types (Islamic, conventional and hybrid banks) variables and the other independent variables on liquidity risk exposure, three further panel data regressions models with random effects are applied.

Model I includes only bank type dummy variables, while model II includes bank type variables and control variables. In model III, all variables are included, however, with regards to the bank type variables, three dummy variables are included. The Islamic bank dummy variable is not taken as the base and it is left to the Stata econometric software to omit one of the three dummies. The omitted variable, then, becomes the reference point against other dummies. This approach is conducted to leave the freedom of omitting one of the three dummy variables to the Stata software system to control for any bias impact of selecting a dummy variable as a base for the other two dummies (Brooks, 2008). The results of all three panel data regressions models are reported in Table 7; these have produced consistent outcomes with the main random effects regressions model presented in Table 6; however, different coefficient values are obtained due to controlling for the interaction effects of the examined variables.

As can be seen in Table 7, model III reports that the Islamic banks dummy is omitted, suggesting the robustness of the main model as presented in Table 6. With regards to the direction of the coefficients of the dummy variables, models I, II and III report consistent results with the main model in the preceding section (see Table 6). The results suggest that

conventional banks are less exposed to liquidity risk than Islamic banks, while hybrid banks are less exposed to liquidity risk than Islamic and conventional banks. This finding substantiates the argument that Islamic banks face higher levels of liquidity risk exposure than conventional and hybrid banks. Such results confirm that the unique nature of Islamic banking operations and financial products have different implications for the liquidity position.

With regards to other determinants of liquidity risk exposure, model III, in consistence with the main model, as reported in Table 6, reports the same directions or signs of coefficients as well as the significant impact between liquidity risk exposure and the examined determinants. Models II and III report consistent results with the main model in Table 6 that indicate a negative and significant association between bank capital regulation stringency and liquidity risk exposure. In addition, model III detects negative and significant relationships between liquidity risk exposure and credit risk, a positive and insignificant association with liquid assets and a positive and significant association with long-term debts. In respect to the control variables, they are negatively associated with liquidity risk exposure through all the models. While bank size remains insignificant, as can be seen in the main model in Table 7, the GDP has a significant impact on liquidity risk.

Table 7: The Determinants of Liquidity Risk Exposures (Model I, II and III): Panel Data Regressions with Random Effects Model Applying Robust Standard Error

	Model I		Model II		Model III	
LR	Coef.	z-value	Coef.	z-value	Coef.	z-value
CB-	-0.079	3.58***	-0.032	-0.85*	-0.365	-3.58***
HB-	-1.083	5.54***	-1.152	4.26***	-1.437	-5.37***
CAP					-4.941	-6.05***
CR					-0.238	-1.75*
LA					0.128	0.36
LTD					1.522	4.23***
RQ			-1.212	3.7***	-0.974	-3.79***
PS			-0.476	-4.24***	-0.125	-1.99*
GE			0.541	1.99*	0.954	3.22**
RL			-0.314	-0.67	-1.016	-2.68**
OC			-0.013	4.05***	-0.011	-3.95***
SIZE			-0.168	3.05**	-0.179	-2.5*
GDP			-0.036	-2.51*	-0.005	-0.43
_cons	-0.102	12.16***	1.368	3.64***	4.996	6.6***
R-Square		0.36		0.889		0.441
Prob > chi2		0.000		0.000		0.000
Hausman						0.182
Durbin-Wu						0.115

Obs No	1996	1996	1454

Notes: *p < .10; **p < .05; ***p < .01

Furthermore, in order to check that the examined variables are exogenous, after running the regressions using the 2SLS instrumental variable test, the Durbin-Wu test is conducted to confirm the non-existence of an endogeneity threat. As can be seen in Table 7, the *p*-value of Durbin-Wu is insignificant at 0.115, which suggests that the null hypothesis cannot be rejected; this, hence, confirms that all examined variables are exogenous.

In order to examine the robustness of the obtained results of the random effects model as displayed in Table 6, this study conducts a further panel data regressions analysis using fixed effect model and the results are presented in Table 8. As it can be seen in Table 8, the fixed effect model results are consistent with the results of the random effect depicted in Table 6. It should be noted that while the results confirm the same direction of the association between the dependent and independent variables, the magnitude of the coefficients and the significance level of the examined variables are slightly different from the results of the random effect model, which is due to the different econometric characteristics of both models as suggested by Brooks (2008).

Table 8: Estimating the Determinants of Liquidity Risk Exposures: Panel Data Regressions with Fixed Effects Model with Robust Standard Error

LRE	Coef.	t-value
CB	-0.371	-3.46***
HB	-1.182	-6.04***
CAR	-4.298	-6.66***
CR	-0.448	-2.94***
LA	1.878	3.06*
LTD	0.680	3.11***
RQ	-0.271	-0.97*
PV	-0.423	-3.03***
GE	0.229	0.73**
RL	-1.035	-2.86***
OC	-0.012	-4.54***
SIZE	-0.910	-4.5***
GDP	-0.029	-2.21***
_cons	7.330	5.3***
R-Square		0.376
Prob > F		0.000
Hausman		0.182
Obs No		1454

Notes: *p < .10; **p < .05; ***p < .01

In an attempt to check the robustness of the estimation of the random effects model depicted in Table 6, this study conducts a further examination using panel cointegration tests, namely Kao, Pedroni and Westerlund test for which the results can be found in Table 9. The key characteristic of these tests is that, while, they all share a common null hypothesis of no cointegration, the alternative hypothesis suggests that the variables are cointegrated implying that they have a long-run association (Neal, 2014; Stata: 2019). Based on the results of all cointegration test in Table 9, where p-value < 0.01, it can be stated that all the tests reject the null hypothesis of no cointegration, and therefore, the results confirm the hypothesis of the existence of cointegrated relation among the examined variables verifying a stable and long-run association.

Table 9: Cointegration Tests

Kao test for cointegration	Statistic	p-value
Modified Dickey-Fuller t	-7.4955	0.0000
Dickey-Fuller t	-9.5632	0.0000
Augmented Dickey-Fuller t	-5.4680	0.0000
Unadjusted modified Dickey-Fuller t	-13.0947	0.0000
Unadjusted Dickey-Fuller t	-10.6150	0.0000
Pedroni test for cointegration	**Statistic**	**p-value**
Modified Phillips-Perron t	2.3588	0.0092
Phillips-Perron t	-8.8826	0.0000
Augmented Dickey-Fuller t	-5.9935	0.0000
Westerlund test for cointegration	**Statistic**	**p-value**
Variance ratio	13.1458	0.0020

*All panels are cointegrated when p-value < 0.01

6. CONCLUSION

Based on the assessed data of the sampled banks over the period of 1996–2015, this paper provides statistical evidence for the liquidity risk exposure of Islamic banks in a comparative manner with conventional and hybrid banks. The results demonstrate that Islamic banks are more exposed to liquidity risk than conventional and hybrid banks. In addition, the results empirically report that hybrid banks are less vulnerable to liquidity risk than Islamic and conventional banks. These empirical results are consistent with the theory of Islamic banking principles, whereby the unique nature of their financing and operation imposes higher degrees of complexity in managing their asset and liability positions and, hence, causes a greater

financing gap that increases their liquidity risk exposure.

With regards to the key determinants of liquidity risk exposure, this paper suggests that stricter capital regulations incentivise banks to apply sterner standards and a stricter screening process for new borrowers, which lessens their lending and financing activities, tightening the financing gap and accordingly lowering the level of liquidity risk exposure that the examined banks face. The empirical results, moreover, suggest that credit risk is negatively and significantly correlated with the liquidity risk exposures of banks. Consistent with the proposed hypothesis, the empirical results detect that the liquid assets ratio is positively associated with the liquidity risk exposures of the examined banks, yet without any significant impact. In addition, the results show that the long-term debt ratio positively affects the liquidity risk exposure and is statistically significant. The positive impact of the governance variables should also be considered as important factors in providing a facilitating political economy environment for the efficient operations of Islamic banks by moderating and decreasing the liquidity risk exposure. This also applies to the ownership concentration variable, as a higher ownership concentration seems to reduce the liquidity risk exposure, for which, however, further critical examination is suggested.

Based on the theoretical argument and the obtained results, this research alerts the commercial banks in general and commercial Islamic banks in particular to the importance of enhancing innovation in product development to overcome the consequences of early liquidation. Hence, this research suggests that more efforts need to be taken in research and development in product development related to liquidity easing and the money market within *Shari'ah*-compliancy. Accordingly, this implies that Islamic banks in particular and conventional banks in general need to allocate more funds for further research in the field of product development and financial engineering.

One of the key sources of liquidity risk in the Islamic banking sector are the different interpretations of Islamic law by scholars, such as in the case of *bay al-dayn* (sale of debt), which leads to a lack of globally accepted instruments for managing liquidity risk. In responding to this problem, this research highlights the importance of establishing national and international *Shari'ah* supervisory boards that would gather the majority of the worldwide-recognised *Shari'ah* scholars to standardise the approval of dynamic instruments which can be accepted globally for managing liquidity risk. The efforts by the AAOIFI for developing standards for national *Shari'ah* boards represent a welcoming initiative.

As mentioned previously, the unique nature of the Islamic financial products and operations have different implications for liquidity risk exposures. The empirical results of this study highlight the need for promoting the liquidity infrastructure of the banks in general and of Islamic banks in particular, such as International Islamic Liquidity Management Corporation in Malaysia, which plays a dynamic role in offering short-term *sukuk* to manage surpluses and the demands of liquidity for the entire Islamic banking industry.

This research also highlights the importance of the deposit insurance based on *takaful*, which may increase customers' trust in the Islamic banking industry. This, in turn, may lead to the accumulation of more funds, which will positively affect banks' liquidity positions.

Moreover, using authentic, namely non-organised or simple, *tawarruq* in the case of necessity may also be an option for managing liquidity needs. However, it is crucial to emphasise that it must be free of prearranged transactions to avoid any controversial aspects relating to organised nature of the practised *tawarruq*, which is not considered *Shari'ah* compliant. Practicing such an authentic instrument can be enhanced by promoting the role of independent agencies in facilitating the *tawarruq* transactions for all parties, that is, the bank, the commodity vendor and the commodity buyer. However, it is important to mention that using *tawarruq* may discourage innovation in the field of product development in the Islamic financial markets.

Furthermore, this research emphasises the significance of establishing internationally accepted financial criteria related to products, operations and accounting standards that would positively affect the promotion of the liquidity position of Islamic banks, which should be positively considered. Having said that, it is also important to stress that away from the mimicking process, Islamic banks and financial institutions should consider investing more in research and development and innovation to develop authentic products and solutions to overcome the liquidity management challenges along with other problems they face.

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Highlights:

- Examines the liquidity risk and the factors determining the liquidity risk exposure that Islamic banks are exposed to in a comparison with conventional and hybrid banks in the case of 145 commercial banks for the period of 1996–2015.

- The findings demonstrate that Islamic banks are more exposed to liquidity risk than conventional and hybrid banks.

- The results show that the stringency of capital regulations and credit risk have a negative and significant impact on liquidity risk.

- The results demonstrate that liquid assets and long-term debts are positively associated with liquidity risk exposure.

- The empirical results show that long-term debt significantly affects liquidity risk, but the results indicate an insignificant impact of liquid assets on the liquidity risk exposure of the sampled banks.

- The results demonstrate that bank size, governance and ownership concentration as well as GDP are important control variables in reducing the liquidity risk exposure of Islamic banks.

Credit Author Statement

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