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PROFIT EFFICIENCY AND LIQUIDITY RISK: LESSONS FROM MALAYSIA

(Kecekapan Keuntungan dan Risiko Kecairan: Konteks Malaysia)

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ABSTRACT

This study investigates the relationship between profit efficiency and liquidity risk for Malaysian banks involving 16 Islamic and 26 conventional banks from 1995 to 2015. Profit efficiency scores are estimated using the Stochastic Frontier Approach (SFA), while liquidity risks are measured by the Basel III liquidity risk requirements: liquidity coverage ratio (LCR) and net stable funding ratio (NSFR). The results show that the profit efficiency of both Islamic and conventional banks is positively related to liquidity risk in the short run. However, the negative effect of profit efficiency on liquidity risk is only present in Islamic banks in the long run. The findings highlight two important notions: (1) The effect of profit efficiency on liquidity risk is sensitive to the term of liquidity; and (2) profit efficiency requires time to reduce liquidity risk in banking.

JEL Classification: G01, G12, G21
Keywords: Profit efficiency; stochastic frontier; liquidity risk; Islamic banks; Malaysia

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ABSTRAK

Kajian ini menyelidik hubungan antara kecekapan keuntungan dan risiko kecairan bagi institusi perbankan di Malaysia yang melibatkan 16 institusi perbankan Islam dan 26 institusi perbankan konvensional dari tahun 1995 hingga 2015. Skor kecekapan keuntungan dianggar melalui Pendekatan Sempadan Stokastik (SFA), manakala risiko kecairan dianggar menggunakan ukuran risiko kecairan Basel III, iaitu, nisbah perlindungan kecairan (LCR) dan nisbah pembiayaan stabil bersih (NSFR). Keputusan kajian mendapati bahawa kecekapan keuntungan kedua-dua institusi perbankan Islam dan konvensional berhubungan positif dengan risiko kecairan jangka pendek. Walau bagaimanapun, hubungan negatif antara kecekapan keuntungan dan risiko kecairan jangka panjang hanya terdapat dalam isntitusi perbankan Islam. Penemuan ini menunjukkan dua inferens penting: (1) Kesan kecekapan keuntungan ke atas risiko kecairan adalah sensitif kepada terma kecairan sama ada jangka pendek atau panjang; dan (2) impak kebaikan kecekapan keuntungan bank memerlukan satu sela masa jangka panjang untuk mengurangkan risiko kecairan.

Klasifikasi JEL: *G01, G12, G21*
Kata Kunci: *Kecekapan keuntungan; Pendekatan Sempadan Stokastik; risiko kecairan; perbankan Islam; Malaysia*

INTRODUCTION

The banking crisis episodes have provided clear evidence on the importance of liquidity risk management in banking. The failure of managing liquidity risk does not only harm a single bank, but it also affects the entire financial system, which results in a domino effect across economies (Aragon & Li 2019; Denbee et al. 2021). The liquidity problem could create a severe blow to the economy, as in the case of Greece in 2015. The country had recorded the highest cost of a banking crisis in history, with 43 percent output loss to GDP and 27.3 percent fiscal cost to GDP (Dungey & Gajurel 2015). Recently, the transformation of the banking industry in the course of deregulation, technological innovation, and internationalisation has accentuated the pressure on liquidity risk management. In such an environment, liquidity issues have triggered critical concern among researchers and policymakers.

In the last three decades, the emergence of Islamic banking has intensified the competition within the banking sector. Unlike traditional banking, the Islamic bank has distinguished business model and risk profile features. All banking activities must comply with the underlying *Shariah* principles (i.e., free from *riba, maysir, gharar*, and prohibited activities). Besides profitability, Islamic banking has embarked on both

social and economic ventures to promote the *Maqasid Shariah* and spur economic growth. The involvement in both social and economic activities has incurred substantial operational costs, which will constrain the long-run sustainability of the sector. In this regard, efficient management practice is undoubtedly the key factor to minimize risk, boost bank profitability, and maintain sustainability in the long run.

From the theoretical perspective, there are two hypotheses that link efficiency and risk in banking (Berger & DeYoung 1997). The bad management hypothesises that poor management quality results in a more extensive accumulation of problem loans, which reduces the bank's profitability. It predicts a negative relationship between profit efficiency and bank risk. On the other hand, the cost skimping hypothesises that profit-oriented banks may reduce resources allocated for credit monitoring, exposing the bank to high risk. It predicts a positive relationship between profit efficiency and bank risk. Although the efficiency literature is abundant, most prior studies focused on efficiency types and measures, and very few related the efficiencies with bank risk. Emerging studies have started to incorporate this interest by examining the efficiency-risk relationship in the context of market risk (Ab-Hamid et al. 2017; Alam 2012), insolvency risk (Tamadonnejad et al. 2017; Othman et al. 2017), credit risk (Alam 2012; Altunbas et al. 2007; Berger & DeYoung 1997; Fiordelisi 2011; Miah & Sharmeen 2015; Rossi et al. 2009), and banking crises (Othman et al. 2018). Only a few studies have examined efficiency within the liquidity risk context (Amin et al. 2017; Khalib et al. 2016).

In contrast to the study by Khalib et al. (2016) and Amin et al. (2017), which focused on cost efficiency, the present study examined profit efficiency in the banking industry. In addition, this study differs from Amin et al.'s (2017) in two aspects. First, this study computed profit efficiency using the stochastic frontier analysis (SFA), whereas Amin et al. (2017) examined cost efficiency using the data envelopment analysis (DEA). Second, the current study measured liquidity risk using Basel III liquidity requirements, namely the liquidity coverage ratio (LCR) and net stable funding ratio (NSFR), while Amin et al. (2017) only used the financing-to-deposit and short-term funding to measure liquidity risk. Therefore, unlike past studies, this study aimed to examine the impact of profit efficiency on liquidity risk for banks in Malaysia from 1995 to 2015 using the static panel technique.

In contrast to other dual banking system countries, Malaysia is facilitated with relatively developed Islamic money and capital markets. The secondary market for *Sukuk* and Commodity *Murabahah* allows Islamic banks to manage liquidity risk. Besides, Malaysia is renowned for its tremendous government support to enhance Islamic banking development. The country's comprehensive regulatory and supervisory framework in terms of separate Islamic banking regulations and the two-

tier Shariah governance permits better surveillance to discipline Islamic banking activities. In light of the current state of the Malaysian Islamic banking system, it is therefore, a phenomenon that is interesting for this study to investigate within the context of the relationship between profit efficiency and liquidity risk.

This research contributes to banking studies threefold. First, it provides empirical evidence on profit efficiency-liquidity risk relationship for the case of emerging countries by focusing on Malaysian banks. Second, it establishes the efficiency-risk theory by testing the bad management and cost skimping hypotheses. Third, it extends Islamic banking studies by comparing between Islamic and conventional banks' findings. The implications of the study will not only be beneficial to the body of knowledge but also to the industry and regulators. Banks should understand the trade-off concept between risk and return. In addition, not only that bank needs to improve efficiency to boost profitability, but at the same time, they should also provide liquidity to avoid insolvency problem. For regulators, the findings of this study provide insights into developing appropriate regulation and supervision standards to discipline banks from excessive risk-taking, while at the same time, such moves do not restrict the banking growth.

This paper is organized into several sections. Section 2 provides a review of past literature on efficiency and liquidity risk. Section 3 explains the data collection, methodology, and model specifications. Section 4 discusses the findings and results, and lastly, Section 5 presents the research conclusion.

LITERATURE REVIEW

As earlier mentioned, prior studies that specifically focused on the relationship between profit efficiency and liquidity risk are scarce; hence, the present study focuses on reviewing the literature on efficiency and liquidity risk separately. The review was then synthesized to provide an overview of past literature that relates efficiency to various types of risk in general.

Bank Efficiency

Bank efficiency is often discussed as measuring bank performance along with bank stability and profitability. Banks with higher efficiency are perceived to be more stable and gain more profit. There are several ways to estimate bank efficiency scores. Recently, the top two frontier efficiency methods in the financial literature are SFA and DEA. DEA is a non-parametric efficiency method, suggested by Charnes et al. (1978), that considers all deviations from the efficiency frontier as inefficiency since

there are no random errors engaged in the estimation. Meanwhile, SFA is a parametric efficiency method developed by Aigner et al. (1977) that requires a functional form and assumption to estimate the efficiency score. The significant differences between these two methods are that SFA includes random noise into the frontier and allows statistical tests on the estimates compared to DEA. Contrarily, a specific functional form for production function and a distributional form for inefficiency terms are not requirements for DEA (Kuosmanen et al. 2013). Therefore, researchers' preference depends on the trade-off between a misspecification bias (in SFA) and a measurement error (in DEA).

The studies on comparing these two approaches on bank efficiency have been done in various countries for the banking industry. Fiorentino et al. (2006) found that the mean cost efficiency was substantially higher for SFA compared to DEA for German universal banks between 1993 and 2004. This finding is consistent with the results obtained from Bauer et al.'s (1998) and Resti's (1998) studies. In a different context, Chen (2002) conducted a study on Taiwanese banks from 1994-2000. Chen found that the efficiency scores estimated significantly differed between chance-constrained DEA and stochastic frontier production function. In a more recent year, Gayval and Bajaj (2015) conducted a study on 19 nationalized Indian banks from 2011-2012. They concluded that Indian banks operated at the same level of efficiency, given that the 2-sample t-test summary resulted in both methods being statistically significant. The latest research conducted by Nguyen et al. (2016) on Vietnamese banks for the period 2000 to 2014 found that the two-stage SFA and two-stage DEA produced consistent results. In another study, Kuchler (2013) analysed the development in the relative efficiency of Danish banks for the period 2001-2012 using SFA and DEA. The results show that both methods produced different efficiency rankings. Kuchler suggested that future research should consider different methods to produce robustness in findings related to efficiency.

For the dual banking system, a vast number of studies are conducted on the estimation of efficiency scores using the SFA method. Insofar, no study has focused solely on the Malaysian dual banking system. Abdul-Majid et al. (2010) investigated the output efficiency in 10 countries (Malaysia, Sudan, Bangladesh, Tunisia, Jordan, Lebanon, Yemen, Indonesia, Bahrain, and Iran) for the period 1996-2002 by using SFA. They concluded that Islamic banks are, on average, more efficient than conventional banks in Malaysia and Tunisia but less efficient in all other countries. However, this interpretation is subject to the assumption that all of the reduced output of Islamic banks is attributable to the differences in the operating environment and applicable technology relative to conventional banks. These results align with the conclusion made by Bakour and Gallali (2015) based on their research in MENA countries for both banking systems. They found that Islamic banks are more efficient than conventional

banks for the majority of the countries, especially after 2008, which was the year of the banking crisis. The latest study by Ara (2016) also supports this result as the overall profit efficiency of Islamic banks is better than that of conventional banks in Bangladesh over the period 2004-2008.

On the other hand, Mohamad et al. (2008) found no significant difference between the overall (cost and profit) efficiency results of conventional versus Islamic banks in 21 OIC countries over 1990-2005. Different results were obtained by Srairi (2010), who conducted a study in the Gulf Cooperation Council (GCC) countries for the period 1999-2007. Conventional banks, on average, are more cost and profit efficient than Islamic banks, thus suggesting that the lower profit efficiency is due to the lower amount of risk carried by Islamic banks' transactions. In another study, Ferhi & Chkoudali (2015) found similar results where the average value of the conventional banks' efficiency was slightly higher than that of the Islamic banks for 14 MENA countries over the years from 1990 to 2010.

For banking efficiency studies, the researchers' most significant challenge is determining the measurement of inputs and outputs as there is no standard view on such issues (Janoudi 2014). Therefore, two main approaches that can be used in this matter; production approach and intermediation approach. The most recent literature indicates the adoption of the intermediation approach since banks are considered financial intermediaries that connect the savers and depositors by channelling funds. This approach was advocated by Sealey and Lindley (1977), and it tallies with the principle of the Islamic financial system, which involves profit-loss sharing that needs the participation of intermediaries and the nature of the banking system in general. Several recent studies on profit efficiency using SFA that adopted this approach are Ab-Hamid et al. (2021); Ab-Hamid et al., (2018b); Ab-Hamid et al. (2017); Mghaieth and El-Mehdi (2014), Reddy and Nirmala (2013), Viverita and M. Ariff (2011) as well as Tahir et al. (2010).

Bank Liquidity Risk

Liquidity is defined as a bank's ability to meet its commitments on time and finance its assets at a reasonable cost (BCBS 2008). Inadequate liquidity does not only cause the failure of one bank, but also threaten the stability of the whole financial system (Othman et al. 2018; Tamadonejad et al. 2017 & 2016). The role of banks as financial intermediaries is to shift liquid liabilities (deposits) to illiquid assets (loans) (Amin et al. 2021). This intermediation role exposes banks to market and funding liquidity risk (Amin & Abdul-Rahman 2020). Banks are exposed to market liquidity risk when they are unable to offset a financial transaction at the market price due to market

inefficiency. Meanwhile, banks face funding liquidity risk when banks are incapable of meeting the unexpected demand of assets and liabilities (Ab-Hamid et al. 2018a; Yaakub et al. 2017).

Liquidity risk issues have been highlighted since the reoccurrence of financial crises. Scholars are interested to understand the factors affecting liquidity risk in banking. The scope of liquidity studies is several, including regulation (Amin et al. 2021; Amin & Abdul-Rahman 2020), competition (Abdul-Rahman et al. 2018b; Ali et al. 2019; Kim 2018; Toh et al. 2020), capital (DeYoung et al. 2018; Dahir et al. 2019; Zheng & Cronje 2019), bank diversification (Hou et al. 2018; Toh et al. 2020), and lending structure (Abdul-Rahman et al. 2018a; Yaakub et al. 2017). In terms of sample countries, past studies on determinants of liquidity risk have been carried out in Bosnia Herzegovina (Mehmed 2014), European Union (Cucinelli 2013; Wójcik-Mazur & Szajt 2015;), Romania (Munteanu 2012), Czech Republic (Vodova 2011), OIC countries (Amin et al. 2021), Indonesia (Abdul-Rahman et al. 2019), and Malaysia (Yaacob et al. 2016). The evidence that numerous studies have been conducted on liquidity risk management indicates that this aspect is a great concern in the industry.

Efficiency and Risk Relationship

The theory of efficiency-risk in banking is developed by Berger and DeYoung (1997). It is based on four hypotheses: cost-skimping, bad management, bad luck, and moral hazard behaviour. Cost-skimping hypothesises a positive relationship between efficiency and risk. It suggests that managers tend to cut the budget on resource allocation for credit underwriting and monitoring, which may raise default risk. Even though the skimping behaviour may seem efficient in the short term, it may increase risk in the long run. Meanwhile, the bad management hypothesis predicts a negative efficiency-risk relationship. It assumes that low efficiency increases credit risk as a result of poor management. Inefficient managers tend to make wrong judgements regarding investment opportunities, credit screening and monitoring, leading to high liquidity risk exposure. The bad luck hypothesis assumes an indirect negative relationship between efficiency and risk. It hypothesises that non-performing loans tend to increase during the economic crisis, deteriorating bank efficiency, consequently increasing liquidity risk. Finally, the moral hazard theory hypothesises an indirect positive efficiency-risk relationship due to bank capital. Low capitalised banks tend to take more risk because they have less capital to lose. Moral hazard occurs when low capitalised-inefficient banks engage in high-risk activities, which leads to increased liquidity risk.

Efficiency-risk studies include several scopes, such as single vs multi-countries, Islamic vs conventional banks, and various bank risk categories. Saeed et al. (2016)

conducted a study examining the relationship between default risk and efficiency for Islamic and conventional banks in GCC and three non-GCC countries over 2002-2010. The findings reveal that the distance to default affects the profit or cost efficiency and vice versa for the samples except for Islamic banks. For both banks, increasing cost efficiency increases the default risk due to moral hazards. Meanwhile, they found that increasing profit efficiency could improve financial stability and reduce default risk for Islamic banks.

Another study on the dual banking system was conducted by Alam (2012), which analysed the efficiency and risk-taking from 11 emerging markets between 2000 and 2010. In Alam's study, the relationship between these two factors was determined and different results were obtained for the dual banking system. By using SFA to estimate the inefficiency, a positive relationship occurs between inefficiency and risk for conventional banks, while a negative relationship occurs for Islamic banks. The profit efficiency for Islamic banks in Malaysia and Bahrain has outperformed the other countries due to the separated banking laws that govern the Islamic banking system. Hence, it is important to explore the Malaysian and Bahraini dual banking systems so that other countries that operate the dual banking system could grasp the framework, especially on efficiency.

A comparative study for dual banking system in Bangladesh by Miah and Sharmeen (2015) focused on the relationship between capital, risk, and efficiency. From 2001 to 2011, conventional banks are more cost-efficient than Islamic banks. In their study, a positive relationship was obtained between risk and efficiency for Islamic banks, while a contrast result was found for conventional banks. A similar study was conducted on European banking by Altunbas et al. (2007) from 1992 until 2000. However, no positive relationship was found between inefficiency and bank risk-taking in their study. Hence, they concluded that inefficient European banks tend to hold more capital while taking less risk.

Notwithstanding the well-known conceptual argument of the efficiency-risk relationship, a limited study empirically investigated the impact of efficiency on bank liquidity risk. Focusing on the cost inefficiency (estimated using SFA) of Islamic and conventional banks in Malaysia, Khalib et al. (2016) found cost inefficiency has no significant effect on short-term liquidity risk (measured by LCR) but positive effect on long-term liquidity risk (measured by NSFR). Similarly, Amin et al. (2017; 2018), who examined the same issue for 16 OIC countries, found a positive relationship between cost efficiency (estimated using DEA) and liquidity risk (measured by loan to deposit ratio).

The literature discussed thus far provides incomprehensive findings on the role of efficiency on bank risk. Meanwhile, the focus on liquidity risk in banking is still limited, and the impact of profit efficiency is questionable. Hence, the present study attempted to fill the gaps in the literature by examining the profit efficiency-liquidity risk relationship by using the proposed liquidity risk measures by Basel III.

DATA AND METHODOLOGY

This study was conducted on Islamic banks and conventional banks in Malaysia for the period 1995-2015. By using the Bankscope database provided by Bureau van Dijk, the data for profit efficiency score measurement and the determinants of liquidity risk were collected from the balance sheet and income statements (unconsolidated financial statements) of the banks while the macroeconomic data were collected via The World Bank website. All data collected were in Malaysian Ringgit. Based on data availability, the study used a sample of unbalanced panel data consisting of 17 Islamic banks and 26 conventional banks.

A two-stage research method was employed in this study. First, the stochastic frontier analysis (SFA) was used to estimate banks' profit efficiency scores. Second, based on the estimation results, the scores obtained were used as independent variables to identify a relationship between these independent variables with liquidity risk through the panel data regression. This method was applied to both Islamic banks' and conventional banks' data set.

Profit Frontier Models and Specification

The apparent advantage of estimating profit efficiency compared to cost and output efficiency is optimising both cost and revenue, involving cost minimisation and revenue maximisation. Such estimation will help provide better information to the management in improving the bank's performance. There are two types of profit function; standard profit function and alternative profit function. This study chose the alternative profit function because it measures how close a bank is to producing the maximum feasible profits, given a particular level of input prices and output quantities in imperfect market competition. Based on Berger and Mester's (1997) arguments, this study comprises different levels of market competition and different qualities of banking services; thus, the alternative profit function was preferred. The alternative profit efficiency of bank *i* can be measured by the ratio of the actual profit (π_i) to the maximum feasible profit (π_{max}) that the best-practice banks can achieve:

$$PE_{it} = \frac{\pi_i}{\pi_{max}} = \frac{exp[f(y,w)].exp(v_{it}).exp(-u_{it})}{exp[f(y,w)].exp(v_{it})} = exp(-\hat{u}_{it})$$

The error term can be expressed as $\varepsilon_{it} = v_{it} - u_{it}$. The inefficiency term (u_{it}) has a negative sign because inefficient banks earn low profits.

Profit Efficiency Model Specification

The translog functional form was adopted in this study, and the time trend was used to consider the technological change over time. Based on the SFA estimation procedure proposed by Battese and Coelli (1995), the translog stochastic profit frontier used to estimate the profit efficiency was as follows:

$$ln\left(\frac{\pi+\theta}{w_3}\right) = \alpha_0 + \sum_{j=1}^{2}\alpha_j ln\left(\frac{w_j}{w_3}\right) + \frac{1}{2}\sum_{j=1}^{2}\sum_{l=1}^{2}\alpha_{jl} ln\left(\frac{w_j}{w_3}\right) ln\left(\frac{w_l}{w_3}\right) + \sum_{k=1}^{3}\beta_k ln(y_k) + \frac{1}{2}\sum_{k=1}^{3}\sum_{m=1}^{3}\beta_{km} ln(y_k) ln(y_m) + \sum_{k=1}^{3}\sum_{j=1}^{2}\delta_{kj} ln(y_k) ln\left(\frac{w_j}{w_3}\right) + \varphi_1 lnEQ + \frac{1}{2}\varphi_1 (lnEQ)^2 + \sum_{K=1}^{3}\rho_k ln(y_k) lnEQ + \sum_{j=1}^{2}\tau_j ln\left(\frac{w_j}{w_3}\right) lnEQ + v_{it} - u_{it}$$

Subject to:

$$\alpha_{jl} = \alpha_{lj}, \beta_{km} = \beta_{mk}, \sum_{j}^{3}\alpha_j = 1, \sum_{j=1}^{3}\alpha_{jl} = 0, \sum_{k=1}^{3}\delta_{kj} = 0$$

The dependent variable in the above model is the pre-tax profit, where θ is a constant that is equal to one plus the absolute value of minimum profits over all sample banks. It is to allow for positive numbers only, while the inefficiency term has a negative sign.

Variables Specification and Definition

Table 1 shows the input and output variables adopted in this study. The variables specification was based on the intermediation approach. This approach was proposed by Sealey and Lindley (1977), and it treats banks as financial intermediaries between depositors and borrowers by channelling funds where deposits, other borrowed funds, capital, and labour are combined to produce loans and other earning assets. It also tallies with the Islamic banking concept that uses profit-lost sharing as one of the principles. For this study, the researchers adopted the alternative profit efficiency instead of the standard profit efficiency because the latter approach needs more information on output prices, which are not publicly available (Srairi 2010). Moreover, in reality, banks differ in their service qualities and could set the prices independently, resulting in significant variance in their output prices.

The specification of input-output variables follows those in Janoudi's (2014), where he conducted his research on the European Union banking system. The dependent variable was the profit function, represented by the pre-tax profit. Three input prices used in the estimation were the price of labour, physical capital, and borrowed funds, while the three outputs were total loans, other earning assets, and off-balance sheet items. Janoudi included the off-balance sheet items as the output because, in recent years, these items are important sources to help banks generate income (Jagtiani & Khanthavit 1996).

TABLE 1. Input and output variables

Variable	Symbol	Name	Description
Dependent Variable	π	Profit	Pre-tax profit
Input Prices (w)	w1	Price of labour	Personnel expenses/total assets*
	w2	Price of physical capital	Other operating expenses/fixed assets
	w3	Price of borrowed funds	total interest expenses/total funding
Outputs (y)	y1	Total loans	Sum of short- and long-term loans
	y2	Other earning assets	Total earning assets less total loans
	y3	Off-balance sheet items	Total off-balance sheet items
Other Variables	EQ	Equity ratio	Equity capital as a proportion of total assets

Note: * Personnel expense is divided by total assets instead because Bankscope does not provide information on the number of employees.

Bank Profit Efficiency Score

The Profit Efficiency Score For Islamic And Conventional banks was obtained from the maximum likelihood estimation (MLE) using the Stata software. The equation $PE_{it} = exp(-\hat{u}_{it})$ was used to generate the scores, and the results are only provided upon request. The scores obtained were the independent variable for liquidity risk measure.

Liquidity Risk Model Specification

Bank liquidity risk determinants' literature has provided some basic theory on the relationship of each determinant with liquidity risk. This study's liquidity risk

measurement model is based on the previous literature (Abdul-Rahman et al. 2019; Abdul-Rahman et al. 2018a). Both bank-specific characteristics and macroeconomics factors were taken into consideration, and the model is as follows:

$$LQ_{it} = \beta_0 + \beta_1 PE_{it} + \beta_2 SIZE_{it} + \beta_3 CAR_{it} + \beta_4 ROA_{it} + \beta_5 NPL_{it} + \beta_5 GDP_{it} + \beta_7 INF_{it} + \alpha_{it} + \mu_{it}$$

Where LQ refers to the alternative measures of Basel III liquidity risk for different length of terms, which are LCR and NFSR. The LCR measures short-term liquidity while NFSR is long-term liquidity. A high LCR ratio indicates that the bank has a high stock of HQLA in the short term and, therefore, is exposed to low liquidity risk; hence high LCR means low short-term liquidity risk exposure. The LCR is expressed as follows, where HQLA measures cash and due from banks (Yaacob et al., 2016):

$$\text{LCR} = \frac{\text{Stock of high-quality liquid assets (HQLA)}}{\text{Total net cash outflows over the next 30 calendar days}} \geq 100\ \%$$

For the NFSR, the study followed the approach used in Gobat et al.'s (2014) study. The NFSR measures structural liquidity (with a one-year time horizon) or long-term liquidity. A high NFSR shows that the bank has a high amount of stable funding to finance its long-term assets (i.e., high-risk assets), and thus the higher the NFSR ratio infers a lower long-term liquidity risk. The NSFR is expressed as:

$$\text{NSFR} = \frac{\text{Available amount of stable funding}}{\text{The required amount of stable funding}} \geq 100\ \%$$

For the control variables, the study followed the liquidity risk determinants model as suggested in previous studies (Abdul-Rahman et al. 2017), which includes size (SIZE), capital (CAR), return on asset (ROA), and non-performing loans (NPL). Macroeconomics factors include the gross domestic product (GDP) and inflation (INF). Table 2 provides the detailed specification of the variables.

TABLE 2. Variables Specification

Variable	Symbol	Description
Short-term liquidity	*LCR*	Stock of high-quality liquid assets (HQLA) / Total net cash outflows over the next 30 calendar days
Long-term liquidity	*NSFR*	Available amount of stable funding / The required amount of stable funding
Profit Efficiency	*PE*	Profit efficiency score derived from SFA

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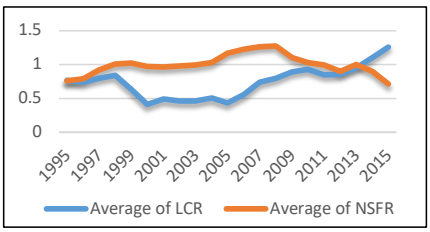
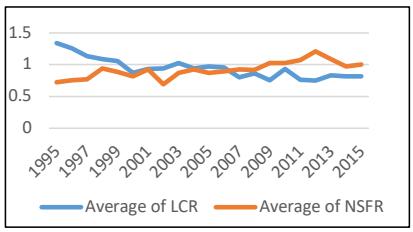
Size	*SIZE*	natural logarithm of total assets
Credit risk	*NPL*	total non-performing loans/total Loan
Capital	*CAR*	total capital/total assets
Return on Asset	*ROA*	net income/total assets
Economic output	*GDP*	growth of gross domestic product
Inflation	*INF*	inflation rate

FINDINGS AND DISCUSSION

Figure 1 shows the liquidity trend for Islamic and conventional banks from 1995 to 2015. For Islamic banks, the trend is upward for LCR, and interestingly for NSFR, the trend is upward until the year 2008 and downward in the following years, approaching the level of the year 1995. This finding shows that Islamic banks have increased their short-term liquidity throughout the years. For the long-term stable funding, the distributions are within small variations over the years The LCR trend is downward for conventional banks, while the NFSR trend is upward. In particular, conventional banks decreased their short-term liquidity and increased their long-term liquidity for 20 years.



Liquidity of Islamic Banks



Liquidity of Conventional Banks

FIGURE 1. Trend of Liquidity

Table 2 reports the descriptive statistical analysis of the banks' specific variables used in the study. Islamic banks have lower liquidity (based on LCR and NFSR) than conventional banks. Islamic banks are better than their conventional rivals in terms of profit efficiency. It also shows that Islamic banks are smaller and have higher credit risk, capital, and profitability than conventional banks.

TABLE 2. Descriptive Statistics for Conventional and Islamic Banks

	Conventional banks				Islamic banks			
Variables	Mean	Std Dev	Skewness	Kurtosis	Mean	Std Dev	Skewness	Kurtosis
LCR	0.9250	0.6730	0.0000	0.0000	0.8760	0.4050	0.0000	0.0013
NSFR	1.1320	3.6310	0.0000	0.0000	1.1210	1.3680	0.0000	0.0000
PE	0.9710	0.0536	0.0000	0.0000	0.9910	0.0062	0.0005	0.7497
SIZE	9.5410	1.6910	0.0327	0.0006	9.1240	1.2280	0.0001	0.0000
NPL	0.0626	0.0802	0.0000	0.0000	0.0469	0.0702	0.0000	0.0000
CAR	0.2550	0.3070	0.0000	0.0000	0.1990	0.2230	0.0000	0.0000
ROA	0.0105	0.0113	0.0000	0.0000	0.0029	0.0231	0.0000	0.0000
GDP	5.0934	3.4990	0.0000	0.0000	4.9842	2.5793	0.0000	0.0000
Inflation	3.5661	3.8819	0.0041	0.9200	3.0446	4.3646	0.0000	0.0000

Prior to conducting the static panel regression estimation, the study carried out the correlation matrix analyses for Islamic and conventional banks (Table 3). The result shows that the correlation coefficient for all variables is free from a severe multicollinearity issue, given that the values are less than 0.8 (Gujarati 2009).

Table 4 presents the results of the random effect model, i.e., the best model, as suggested by the findings of the Hausman test and Breusch-Pagan test. As liquidity risk has an inverse relationship with liquidity, the interpretation of efficiency towards liquidity risk is opposite the coefficient signs. To explain, firstly, the impact of PE on the liquidity of Malaysian banks is sensitive to the liquidity measures. For the LCR measure, the negative PE-LCR relationship shows that PE positively affects the short-term liquidity risk. The findings imply that profit-efficient banks have fewer incentives to hold liquidity, thus exposing them to higher liquidity risk in the short run. Besides, Saeed (2016) mentioned that banks tend to engage in excessive risk-taking behaviour for expansionary strategy due to competition, which results in higher liquidity risk. This condition is consistent with the cost skimping hypothesis, suggesting that in the short run, profit-oriented banks tend to cut resources for monitoring financing activities, which increase problem loans. Consequently, the built-up cases of these non-performing loans implicate an increase in liquidity risk.

TABLE 3. Correlation Matrix for Islamic and Conventional banks

	PE	*SIZE*	*CAR*	*ROA*	*NPL*	*GDP*	*Inflation*
				Islamic Bank			
PE	1.0000						
SIZE	-0.2241	1.0000					
CAR	0.6104	-0.1924	1.0000				
ROA	-0.3459	0.1728	-0.2485	1.0000			
NPL	0.5752	-0.1887	0.3088	-0.5494	1.0000		
GDP	0.0145	0.0485	-0.0602	-0.0337	0.0267	1.0000	
Inflation	-0.0271	-0.1218	0.0182	-0.1212	0.1023	0.6244	1.0000
				Conventional bank			
PE	1.0000						
SIZE	-0.3580	1.0000					
CAR	0.6452	-0.2321	1.0000				
ROA	0.0134	0.0069	0.1295	1.0000			
NPL	0.3124	-0.1720	0.1465	-0.2599	1.0000		
GDP	-0.0021	0.0179	0.0267	0.1001	-0.1023	1.0000	
Inflation	0.0568	-0.0985	0.0161	0.0452	0.0248	0.2870	1.0000

TABLE 4. Result of Regression Analysis for Conventional and Islamic Banks

		Conventional Banks		Islamic Banks	
Variables	Expected Coeff Sign	*LCR*	*NSFR*	*LCR*	*NSFR*
PE	+	-1.081***	-0.0424	-26.02***	23.61***
		(0.359)	(0.594)	(8.364)	(6.181)
SIZE	+	-0.00428	0.0303	-0.0890	0.0607
		(0.0297)	(0.0305)	(0.0544)	(0.0635)
NPL	-	0.285	-1.531***	-0.634	0.368
		(0.225)	(0.366)	(0.683)	(0.715)
CAR	+	-0.0232	1.112***	-0.760**	2.729***
		(0.120)	(0.199)	(0.334)	(0.566)

continue ...

... continued

ROA	+	1.472	-8.541***	-2.690	5.170*
		(1.456)	(2.563)	(2.712)	(2.935)
GDP	+	-0.00387	-0.0107	-0.0116*	-0.000518
		(0.00429)	(0.00769)	(0.00653)	(0.00646)
INFL	-	0.00174	0.00169	0.00388	0.00285
		(0.00374)	(0.00684)	(0.00434)	(0.00253)
C		1.967***	0.678	27.72***	-23.46***
		(0.365)	(0.576)	(8.667)	(6.517)
R squared		0.0603	0.1278	0.2810	0.5636
F-statistic		19.94	45.79	24.48	57.60
Prob-F		0.0057	0.0000	0.0009	0.0000
Hausman Test		2.30	2.87	7.55	3.86
Breusch-P Test		1294.33***	99.22***	469.12***	8.41**

Notes:

1. The dependent variables are *CR* and *NSFR*. Since *CR* and *NSFR* imply the liquidity position, a higher value indicates a lower liquidity risk. Hence, the interpretation for liquidity risk is the inverse of the findings in this table.
2. Robust standard errors in parentheses. *** represents $p < 0.01$; ** represents $p < 0.05$; and * represents $p < 0.1$.

On the other hand, for NFSR, the impact of PE is positively significant for Islamic banks and not significant in the case of conventional banks. The positive PE-NFSR relationship shows that PE has a negative effect on long-term liquidity risk. It shows that the profit efficiency factor plays a significant role in explaining liquidity risk variations for Islamic banks, while it is not the case for conventional banks. In other words, Islamic banks need to be profit-efficient to reduce their long-run liquidity risk. It is because the limited risk management tools and shallow secondary markets in managing liquidity risk have forced them to rely on deposit funding to create liquidity to finance their activities. Since deposits constitute the most stable funding for banks, they can manage the liquidity risk exposure relatively better. Furthermore, high profit-efficient banks have a higher capacity to absorb losses, should any adverse events occur. In line with the findings of Alam (2012), the inverse relationship supports the bad management hypothesis, conjecturing that less profit-efficient banks have a poor management quality, leading to an accumulation of problems in financing, and thus increasing liquidity risk. Nonetheless, the findings somehow contradict Khalib et al.'s (2016), which indicates that cost efficiency negatively correlates with NFSR for Malaysian banks. The contradictory findings support the previous findings of Berger and Mester's (1997) and Maudos et al.'s (2002). These researchers argued that profit

efficiency inversely correlates with cost efficiency as profit efficiency considers the effects of the choice of a vector of production on both cost and revenue. In addition, profit efficiency provides better value-added information on bank management because it includes in the model both the objectives of maximizing revenues and minimizing cost (Maudos et al. 2002). However, the insignificance of the profit efficiency-liquidity risk relationship in conventional banks could be due to the relatively sizable availability of liquidity risk management tools in the market that allows conventional banks to manage liquidity risk effectively.

Concerning the other determinants, NPL shows a significant negative relationship with the NFSR of conventional banks. Similar to previous studies, the positive relationship between NPL and liquidity risk was expected, as NPL is the bad debts that will affect the flow of the liquidity in the bank's balance sheet (Cucinelli 2013; Ghenimi & Omri, 2015). Disrupted cash flows due to bad loans will expose banks to a liquidity problem to meet the demand from depositors and borrowers. The CAR variable has a negative relationship with the LCR of Islamic banks. The findings support the earlier findings of Ghenimi and Omri (2015) and Anjum (2012). It validates the risk absorption theory that argues high-capitalised banks have a high-risk bearing capacity to pursue riskier business activities, exposing the bank to higher liquidity risk exposure. Nevertheless, the theory does not hold for conventional banks. The results in NFSR show that in line with Vodova's (2011) as well as Ghenimi and Omri's (2015) findings, liquidity risk is negatively related to capital. This finding implies that the capital fragility theory holds for both Islamic and conventional banks in the long run. The theory predicts that low capitalised banks allow a greater share of deposits and thus are able to offer aggressive lending.

Interestingly, the ROA effect is conflicting between conventional banks and Islamic banks. For conventional banks, ROA is positively related to liquidity risk, while the relationship is negative for Islamic banks. Profit-oriented conventional banks tend to take high-risk investments to boost return, consequently high in liquidity risk (Azam et al. 2013; Ghenimi & Omri, 2015). In contrast, in support of the moral hazard theory, intense competition has forced less profitable banks to venture into high-risk financings, which ends up increasing liquidity risk (Chen et al. 2015). For macro-economic factors, only GDP was found to be positively related in liquidity risk for Islamic banks in the short run. It highlights that during good economic conditions, businesses are flourishing, and the demand for credits increases. Given this opportunity, Islamic banks can provide more financing products, hence increasing the liquidity risk (Azam et al. 2013).

CONCLUSION

The present study investigated the effect of profit efficiency on liquidity risk in the Malaysian dual banking systems from 1995 to 2015. The findings suggest that the impact of profit efficiency is subject to liquidity risk measures. It shows that profit efficiency significantly impacts the liquidity risk of Islamic banks for both the short and long term, yet this finding is contradictory. The profit efficiency-liquidity risk relationship is positive in the short run, while the relationship reverses in the long run. The findings imply that although profit efficiency increases liquidity risk in the short run, it reduces liquidity risk in the long run. In other words, being profit efficient banks is essential, although the benefit requires a longer time to take effect. However, the positive profit efficiency-liquidity risk relationship only holds for the short run for conventional banks. The findings support the cost-skimping hypothesis for both Islamic and conventional banks in Malaysia in the short run. Meanwhile, the bad management theory holds only for the case of Islamic banks in the long run. Besides, NPL and ROA are positively related to the long-term liquidity risk of conventional banks, while CAR is negatively related. For Islamic banks, their short-term liquidity is positively affected by CAR and GDP while their long-term liquidity is inversely affected by CAR and ROA.

The findings contribute threefold. First, given the contradicting findings of (short-term) PE-LCR and (long-term) PE-NFSR relationship, it offers empirical evidence for future studies to revisit the issue by considering appropriate liquidity measures that capture both the short- and long-run liquidity context. This research also highlights the sensitivity of efficiency dimensions (i.e., profit efficiency, cost efficiency) in examining its impact on liquidity risk in banking. Second, the positive long-term effect of profit efficiency on liquidity risk emphasises the need for Islamic banking to be efficient by maximizing revenues and minimizing cost. This goal could be achieved by increasing quality financings not only in terms of volume per se, but also the financing compositions, i.e., by sectors, contracts, maturity, and securitisability. Hence, considering that Islamic banks are relatively small and restricted from liquidity risk management tools, the industry should re-evaluate their existing portfolios to reduce high-risk financing and strengthen credit-monitoring policies to improve profit efficiency. Third, for policy implication, facilitative monetary policies could be drafted to support the growth of Islamic banks for long-run sustainability. For instance, the fact that Malaysia is a bank-dominated country, attractive financing costs could be a good initiative in boosting the demand and supply of credits, which will translate to the real economy.

Nonetheless, this study has several limitations in terms of the sample size and setting, which was confined to the Malaysian context and the efficiency definition.

Hence, future studies could re-examine the efficiency-liquidity risk issue in a broader context involving cross-countries analyses by employing more robust approaches, such as the multi-efficiency dimensions and dynamic panel regression technique.

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