IS THERE ANY RELATIONSHIP AMONG THE RISKS OF BANKS IN MALAYSIA?

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ABSTRACT
Banking sector is the backbone of any country’s economy and involves in the risky business activity. It is also highly regulated industry mainly due its high risky activities. Among the risks faced by the banks, operating risk, liquidity risk, credit risk and market risk are the major risk. The objective of this study is to examine the correlation among these risks in the context of locally owned banks in Malaysia. The data has been collected from five listed banks for 10 years (2002-2011). Malaysian banking sector is chosen due to its unique nature of banking environment which promotes Malaysia to be the hub of Islamic banking and finance and which accommodate the dual banking system. Pearson correlation method is used to find out the relationship among the risk. The findings show that the risk relation varies across the banks and it is difficult to generalize the risk relationship nature in Malaysian banks. We suggest the banks need to manage the risks based on their risk portfolio and risk appetite. These findings contribute to enhance the knowledge on risk behaviours and will be the interest of regulators, investors and industrial players for future making rules, investment decision and plan the risk management.

Keywords: Operating risk, liquidity risk, credit risk, market risk, Malaysia and banks

1. INTRODUCTION
Banking industry has been recognized as one of the industries exposed to very risky business. Many international organizations like BASEL Committee on Bank Supervision and IFSB (Islamic Financial Services Board) and many developed countries and developing countries have implemented risk management guidelines to mold the banking industry. Among the risks faced by the banks, liquidity risk, credit risk, operational risk and market risk are the major risks (Hoseininassab, Yavari, Mehregan, & Khoshsima, 2012; Sbp, 2010). The literature has highlighted that the risks should be managed together, otherwise, the eliminating of one risk might create another new risk. In addition, if the risk management is in collective nature, one chosen technique will mitigate all the related risks at the same time (Wong, Mariscal, Yao, & Howells, 2013).

Malaysia as one of the leading countries in Islamic banking has no exception in risk exposure. The unique nature of Malaysian banking industry is that the Islamic banking products and services are provided. This Islamic banking emerged as an alternative to the conventional banking because the later one involves the interest which is prohibited from the Islamic perspective. Therefore, the Islamic bankers come out with their banking products and services which are comparable and compatible with conventional banking products while adhering the Islamic principles. In order to be compliant with Islamic laws, the Islamic banks are structuring the products based on the contracts such as profit and loss sharing contracts, for instance, Mudarabah and Musharakah and debt based contracts, for instance, Salam, Istisna while the conventional banking is based on the lending and borrowing concept which involves interest. To the extent of our knowledge, there is no research has been conducted to examine the correlation of the risks faced by the banking groups which offer both Islamic and conventional banking products and services. We are interested and motivated what will be the correlation among the risks in the case of banking group which offers both conventional and Islamic
banking products and services. Thus, the objective of this research is to examine the correlation among the liquidity risk, credit risk, operational risk and market risk in the context of Malaysia. This paper is organized in 5 sections. The second section presents the relevant literature. The third section mentions the research methodology. The fourth section explains the findings and the last section concludes the paper.

2. LITERATURE REVIEW
Risk can be defined as any situation either internal or external event which will have either negative or positive impact on the banks. Risk does not bring only the bad impact on the banks and it can bring the opportunity to the banks if it is managed adequately. The risks that we want to examine are discussed in the following paragraphs.

Operational risk refers to the inefficiency and ineffectiveness of banks’ operations due to the internal management failure. It can be caused due to inadequate information technology system and human resource management. This risk can cause the substantial amount of loss to the banks. Due to the poor risk management in operating aspect, the liquidity and credit risks can be incurred. Therefore, it is important for banks to monitor their personnel very closely so that this risk will not arise (Htay & Salman, 2002; Rippel & Teplý, 2011). This risk can be faced by both Islamic and conventional banks.

Liquidity risk is a risk when the banks have shortage of liquid money in order to pay back to the depositors and any other relevant parties. The main cause of this problem is due to the inadequate asset liability of the banks. Normally, the liabilities of the banks, for instance, deposits are mostly short-term in nature while the assets of the banks such as loans and Islamic financing are long-term in nature. In addition, the depositors in the general deposit accounts or current accounts can withdraw their deposits any time and consequently, it creates the liquidity risk to the banks. This type of risk can be minimized if the banks strictly monitor and estimate the cash inflows and outflows of assets and liabilities (Akhtar, Ali, & Sadaqat, 2011; Negara, 2012; Zabri & Abduh, 2013). This risk can be faced by both Islamic and conventional banks.

Credit risk usually refers to the defaults or delays in either payment or delivery of goods. In the case of conventional banks, this risk incurs especially when the customers delay or default in payments. For the Islamic banks, this risk can be caused by two main factors, first is due to delay or default in payments by the customers and the second is when the suppliers delay in delivering the goods or do not meet the specification required by the customers in producing the product. Inefficient and inadequate management information system is also another risk driver because if there is any discrepancy between the actual and predetermined times, the system should alert the credit risk manager, otherwise, it is not easy for the person in charge to detect the cases manually (Caouette, Altman, Narayanan, & Nimmo, 2011; Golin & Delhaise, 2013; Varotto, 2011). This risk can be faced by both Islamic and conventional banks.

Market risk is a risk arises due to the fluctuation in the market prices of shares, bonds and sukuk and any other money market instruments. Normally, the banks are holding the portfolio of these assets with the expectation of getting higher and good return. However, holding these assets might cause loss or incur the lower return than what has been expected. Thus, the banks should be very careful in choosing the assets and the investment decision should be done after all the relevant observations and tests have been done (Bessis, 2011; Idris et al., 2011). This risk can be faced by both Islamic and conventional banks.

3. RESEARCH METHODOLOGY
This research relies on the secondary data since the necessary data can be collected from the annual reports of the respective banks. The data comprises of 10 years (2002 – 2011) with 5 banks in Malaysia and hence, the total observation is 50. The four major risks faced by the
banks are operational risk, liquidity risk, credit risk and market risk. The proxies are ratio of operating expenses to total assets (OETA) and ratio of non-performing loans to total loans (RNLTL) to measure operational risk, ratio of total loans to total deposits (TLTD) to measure liquidity risk, z-score to measure credit risk and standard deviation of quarterly stock return (STD) to measure the market risk.

In the case of sample size, we have taken the top 5 banks as a sample out of 8 local commercial banks in Malaysia. The sample banks are chosen based on the asset size and revenue. Pearson correlation method is used to examine the relationship among the four major risks faced by the banks in Malaysia.

4. FINDINGS AND DISCUSSION

Bank A

<table>
<thead>
<tr>
<th>Proxies</th>
<th>TLTD</th>
<th>OETA</th>
<th>RNLTL</th>
<th>Z score</th>
<th>STD</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLTD</td>
<td>1</td>
<td>-.198</td>
<td>.272</td>
<td>.603</td>
<td>-.227</td>
</tr>
<tr>
<td>OETA</td>
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<td>1</td>
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<td>-.337</td>
<td>.097</td>
</tr>
<tr>
<td>RNLTL</td>
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<td>-.329</td>
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<td>-.090</td>
</tr>
<tr>
<td>Z score</td>
<td>.603</td>
<td>-.337</td>
<td>-.255</td>
<td>1</td>
<td>-.484</td>
</tr>
<tr>
<td>STD</td>
<td>-.227</td>
<td>.097</td>
<td>-.090</td>
<td>-.484</td>
<td>1</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

The correlation between operational risk (measured by ratio of operating expenses to total assets) and liquidity risk (ratio of total loans to total deposits) is -0.198. It shows that the negative relationship between two risks. It means that the higher the operational risk, the lower the liquidity risk is. However, when ratio of non-performing loans to total loans is used as operation risk measure, the relationship is positive and correlation coefficient is 0.272 and it means that the higher the operation risk, the higher the liquidity risk is. Since the correlation value is higher when ratio of non-performing loans to total loans is used as a proxy for operational risk, it can be generally concluded that the higher the operational risk, the higher the liquidity risk is.

The correlation coefficient value between operational risk (measured by ratio of operating expenses to total assets) and credit risk (z score) is examined, it shows the negative relationship with the coefficient value of -0.337. This negative relationship remains the same when ratio of non-performing loans to total loans as a proxy for operational risk since the correlation coefficient value is -0.225.

The correlation between operational risk (measured by ratio of operating expenses to total assets) and market risk (standard deviation of quarterly stock return) is 0.097. It shows that the positive relationship between two risks. It means that the higher the operational risk, the higher the market risk is. However, when ratio of non-performing loans to total loans is used as operation risk measure, the relationship is negative and correlation coefficient is -0.090 and it means that the higher the operation risk, the lower the market risk is. Since the correlation value is higher when ratio of operating expenses to total assets is used as a proxy for operational risk, it can be generally concluded that the higher the operational risk, the higher the market risk is.
Surprisingly, the correlation between two proxies of operational risk is negative. Since the correlation coefficient value is -0.329.

The credit risk measured by z score and liquidity risk proxied by ratio of total loans to total deposits shows the correlation value of 0.603. Hence, the higher the credit risk, the higher the liquidity risk will be.

In addition, liquidity risk (ratio of total loans to total deposits) and market risk (standard deviation of quarterly stock return) show -0.227 and it means the higher the liquidity risk, the lower the market risk will be.

The correlation value between credit risk (Z score) and market risk (standard deviation of quarterly stock return) is -0.484. The relationship between these two risks is negative and hence, the higher the credit risk, the lower the market risk will be.

The above interpretation is based on the sign, positive or negative and it cannot be concluded with any confidence level since the values are not significant.

### Bank B

<table>
<thead>
<tr>
<th>Proxies</th>
<th>TLTD</th>
<th>OETA</th>
<th>RNLTL</th>
<th>Z score</th>
<th>STD</th>
</tr>
</thead>
<tbody>
<tr>
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<td>.375</td>
<td>.469</td>
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<tr>
<td>OETA</td>
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<td>1</td>
<td>-.301</td>
<td>-.652*</td>
<td>.315</td>
</tr>
<tr>
<td>RNLTL</td>
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<td>.296</td>
<td>.095</td>
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<tr>
<td>Z score</td>
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<td>-.652*</td>
<td>.296</td>
<td>1</td>
<td>.298</td>
</tr>
<tr>
<td>STD</td>
<td>.469</td>
<td>.315</td>
<td>.095</td>
<td>-.298</td>
<td>1</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (2-tailed).**

*Correlation is significant at the 0.05 level (2-tailed).*

The correlation between operational risk (measured by ratio of operating expenses to total assets) and liquidity risk (ratio of total loans to total deposits) is -0.074. It shows that the negative relationship between two risks. It means that the higher the operational risk, the lower the liquidity risk is. However, when ratio of non-performing loans to total loans is used as operation risk measure, the relationship is positive and correlation coefficient is 0.437 and it means that the higher the operation risk, the higher the liquidity risk is. Since the correlation value is higher when ratio of non-performing loans to total loans is used as a proxy for operational risk, it can be generally concluded that the higher the operational risk, the higher the liquidity risk is.

The correlation coefficient value between operational risk (measured by ratio of operating expenses to total assets) and credit risk (z score) is examined, it shows the negative relationship with the coefficient value of -0.652 (Sig. at 5%). However, when ratio of nonperforming loans to total loans as a proxy for operational risk, their relationship becomes positive, i.e. 0.296. Since the first proxy shows the significant level at 5%, it can be concluded that there is a positive relationship between operational risk and credit risk, i.e. the higher the operational risk, the higher the credit risk will be.

The correlation between operational risk (measured by ratio of operating expenses to total assets) and market risk (standard deviation of quarterly stock return) is 0.315. It shows that the positive relationship between two risks. This positive relationship remains when ratio of non-performing loans to total loans is used as operation risk measure since the correlation
The correlation coefficient is 0.095. Thus, it can be concluded that the higher the operational risk, the higher the market risk is.

Surprisingly, the correlation between two proxies of operational risk is negative. Since the correlation coefficient value is -0.301.

The credit risk measured by z score and liquidity risk proxied by ratio of total loans to total deposits shows the correlation value of 0.375. Hence, the higher the credit risk, the higher the liquidity risk will be.

In addition, liquidity risk (ratio of total loans to total deposits) and market risk (standard deviation of quarterly stock return) show 0.469 and it means the higher the liquidity risk, the higher the market risk will be.

The correlation value between credit risk (z score) and market risk (standard deviation of quarterly stock return) is -0.298. The relationship between these two risks is negative and hence, the higher the credit risk, the lower the market risk will be.

The interpretation above is based on the positive or negative sign and none of the relationships except the relationship between the operational risk (measured by ratio of operating expenses to total assets) and credit risk (z score).

### Bank C

<table>
<thead>
<tr>
<th>Table 3: Correlation for Bank C</th>
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</thead>
<tbody>
<tr>
<td>Proxies</td>
</tr>
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<td>-----</td>
</tr>
<tr>
<td>TLTD</td>
</tr>
<tr>
<td>OETA</td>
</tr>
<tr>
<td>RNLTL</td>
</tr>
<tr>
<td>Z score</td>
</tr>
<tr>
<td>STD</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The correlation between operational risk (measured by ratio of operating expenses to total assets) and liquidity risk (ratio of total loans to total deposits) is -0.356. It shows that the negative relationship between two risks. It means that the higher the operational risk, the lower the liquidity risk is. However, when ratio of non-performing loans to total loans is used as operation risk measure, the relationship becomes positive and correlation coefficient is 0.514 and it means that the higher the operation risk, the higher the liquidity risk is. Since the correlation value is higher when ratio of non-performing loans to total loans is used as a proxy for operational risk, it can be generally concluded that the higher the operational risk, the higher the liquidity risk is.

The correlation coefficient value between operational risk (measured by ratio of operating expenses to total assets) and credit risk (z score) is examined, it shows the negative relationship with the coefficient value of -0.442. However, when ratio of nonperforming loans to total loans as a proxy for operational risk since the correlation coefficient value is 0.656 (Sig. at 5%). Hence, it can be generally concluded that the higher the operational risk, the higher the credit risk will be.

The correlation between operational risk (measured by ratio of operating expenses to total assets) and market risk (standard deviation of quarterly stock return) is 0.659 (Sig. at 5%). It shows that the positive relationship between two risks. It means that the higher the operational risk
risk, the higher the market risk is. However, when ratio of non-performing loans to total loans is used as operation risk measure, the relationship is negative and correlation coefficient is -0.671 (Sig. at 5%) and it means that the higher the operation risk, the lower the market risk is. Since the correlation value is higher when ratio of non-performing loans to total loans is used as a proxy for operational risk, it can be generally concluded that the higher the operational risk, the lower the market risk is.

Surprisingly, the correlation between two proxies of operational risk is negative. Since the correlation coefficient value is -0.266.

The credit risk measured by z score and liquidity risk proxied by ratio of total loans to total deposits shows the correlation value of 0.016. Hence, the higher the credit risk, the higher the liquidity risk will be.

In addition, liquidity risk (ratio of total loans to total deposits) and market risk (standard deviation of quarterly stock return) show -0.440 and it means the higher the liquidity risk, the lower the market risk will be.

The correlation value between credit risk (z score) and market risk (standard deviation of quarterly stock return) is -0.220. The relationship between these two risks is negative and hence, the higher the credit risk, the lower the market risk will be.

The above interpretation is based on the sign, positive or negative and the findings can be concluded at 5% significant level, the higher the operational risk, the lower the market risk is and the higher the credit risk will be.

**BANK D**

<table>
<thead>
<tr>
<th></th>
<th>TLTD</th>
<th>OETA</th>
<th>RNLT</th>
<th>Z score</th>
<th>STD</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLTD</td>
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<td>.994*</td>
<td>.103</td>
<td>-.735*</td>
<td>.742*</td>
</tr>
<tr>
<td>OETA</td>
<td></td>
<td>1</td>
<td>.105</td>
<td>-.737*</td>
<td>.746*</td>
</tr>
<tr>
<td>RNLT</td>
<td>.103</td>
<td>.105</td>
<td>1</td>
<td>-.359</td>
<td>.597</td>
</tr>
<tr>
<td>Z score</td>
<td>-.735*</td>
<td>-.737*</td>
<td>-.359</td>
<td>1</td>
<td>-.750*</td>
</tr>
<tr>
<td>STD</td>
<td>.742*</td>
<td>.746*</td>
<td>.597</td>
<td>-.750*</td>
<td>1</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).**

* Correlation is significant at the 0.05 level (2-tailed).

The correlation between operational risk (measured by ratio of operating expenses to total assets) and liquidity risk (ratio of total loans to total deposits) is .994 (Sig. at 1%). It shows that the positive relationship between two risks. It means that the higher the operational risk, the higher the liquidity risk is. Similarly, even for the ratio of non-performing loans to total loans which has also been used as operation risk measure, the relationship becomes positive and correlation coefficient is 0.105 and it means that the higher the operation risk, the higher the liquidity risk is. However, the correlation value is not of much significance as it has only 10.5% of correlation as against 99.4% (Operating Expense to Total Asset). Therefore, it can be infer that when ratio of non-performing loans to total loans is used as a proxy for operational risk, it can be generally concluded that if the operational risk higher, the liquidity risk will also be higher, but not as high as operational risk, that is, the correlation between these two categories of risk will be relatively less, in spite of it being positive. In contrast, when operating expense to total asset is used as proxy for operational risk, the correlation between operational
and liquidity risk can be said to have perfect relationship. The higher the operational risk is, the higher would be the liquidity. The correlation coefficient value between operational risk (measured by ratio of operating expenses to total assets) and credit risk (z score) is examined, it shows the negative relationship with the coefficient value of -0.737 (Sig. at 5%). When ratio of non-performing loans to total loans is used as a proxy for operational risk, the correlation coefficient value is -0.359. Hence, it can be generally concluded that the higher the operational risk, the lower the credit risk will be. Hence it has inverse relationship.

The correlation between operational risk (measured by ratio of operating expenses to total assets) and market risk (standard deviation of quarterly stock return) is 0.746 (Sig. at 5%). It shows that the positive relationship between two risks. It means that the higher the operational risk, the higher the market risk is. The same relationship established when ratio of non-performing loans to total loans is used as operation risk measure, the relationship is positive and correlation coefficient is 0.597(Sig.at 5%). Since the correlation value is higher when ratio of non-performing loans to total loans is used as a proxy for operational risk, it can be generally concluded that the higher the operational risk, the lower the market risk is.

Subsequently, the correlation between two proxies of operational risk is positive. Since the correlation coefficient value is .105.

The credit risk measured by z score and liquidity risk proxied by ratio of total loans to total deposits shows the correlation value of -735 (Sig. at 5%). Hence, the higher the credit risk, the lower the liquidity risk will be and vice-versa. In addition, liquidity risk (ratio of total loans to total deposits) and market risk (standard deviation of quarterly stock return) show 0.742 and it means the higher the liquidity risk, the higher the market risk will be.

The correlation value between credit risk (z score) and market risk (standard deviation of quarterly stock return) is -0.750 (Sig. at 5%). The relationship between these two risks is negative and hence, the higher the credit risk, the lower the market risk will be.

The above interpretation is based on the sign, positive or negative and the findings can be concluded at 5% significant level, the higher the credit risk, the lower will be the liquidity, operational (operating expense to total asset) and market risk.

### BANK E

**Table 5: Correlation for Bank E**

<table>
<thead>
<tr>
<th>Proxies</th>
<th>TLTD</th>
<th>OETA</th>
<th>RNLTL</th>
<th>Z score</th>
<th>STD</th>
</tr>
</thead>
<tbody>
<tr>
<td>TLTD</td>
<td>1</td>
<td>.359</td>
<td>.117</td>
<td>.449</td>
<td>-.028</td>
</tr>
<tr>
<td>OETA</td>
<td>.359</td>
<td>1</td>
<td>.925**</td>
<td>.972**</td>
<td>.342</td>
</tr>
<tr>
<td>RNLTL</td>
<td>.117</td>
<td>.925**</td>
<td>1</td>
<td>.862**</td>
<td>.301</td>
</tr>
<tr>
<td>Z score</td>
<td>.449</td>
<td>.972**</td>
<td>.862**</td>
<td>1</td>
<td>.260</td>
</tr>
<tr>
<td>STD</td>
<td>-.028</td>
<td>.342</td>
<td>.301</td>
<td>.260</td>
<td>1</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).**

* Correlation is significant at the 0.05 level (2-tailed).

The correlation between operational risk (measured by ratio of operating expenses to total assets) and liquidity risk (ratio of total loans to total deposits) is 0.359. It shows that the positive relationship between two risks. It means that the higher the operational risk, the higher the liquidity risk is. Similarly, even for the ratio of non-performing loans to total loans
(RNLTL) which has also been used as operation risk measure, the relationship becomes positive and correlation coefficient is 0.117. It means that the higher the operation risk, the higher the liquidity risk is. The correlation value for RNLTL yet not of much significance as it has only 11.7% of correlation as against 35.9% (Operating Expense to Total Asset). Therefore, it can be infer that when ratio of non-performing loans to total loans is used as a proxy for operational risk, when the operational risk is higher, the liquidity risk will also be higher, but not as high as operational risk, that is, the correlation between these two categories of risk will be relatively less, in spite of it being positive. In contrast, when Operating expense to total asset is used as proxy for operational risk, the correlation between operational and liquidity is slightly greater than the RNLTL, therefore the same rule is applicable here as well as discussed above. The higher the operational risk is, the higher would be the liquidity but relatively with at small scale.

The correlation coefficient value between operational risk (measured by ratio of operating expenses to total assets) and credit risk (z score) is examined, it shows the negative relationship with the coefficient value of 0.972 (Sig. at 1%). When ratio of non-performing loans to total loans is used as a proxy for operational risk, the correlation coefficient value is 0.862. Hence, it can be generally concluded that the higher the operational risk, the higher the credit risk will be. Hence it has direct relationship.

The correlation between operational risk (measured by ratio of operating expenses to total assets) and market risk (standard deviation of quarterly stock return) is 0.342. It shows the positive relationship between two risks. It means that the higher the operational risk, the higher the market risk would be. The same relationship established when ratio of non-performing loans to total loans is used as operation risk measure, the relationship is positive and correlation coefficient is 0.301. Since the correlation values for ratio of non-performing loans to total loans and operating expenses to total asset when used as a proxy for operational risk the general conclusion is that the higher the operational risk, the higher the market risk would be.

Subsequently, the correlation between two proxies of operational risk is also positive. Since the correlation coefficient values are .925.

The credit risk measured by z score and liquidity risk proxied by ratio of total loans to total deposits shows the correlation value of 0.449. Hence, the higher the credit risk, the higher the liquidity risk will be and vice-versa.

In addition, liquidity risk (ratio of total loans to total deposits) and market risk (standard deviation of quarterly stock return) show -0.028, that is, negative correlation. It means the higher the liquidity risk, the lower the market risk will be.

The correlation value between credit risk (z score) and market risk (standard deviation of quarterly stock return) is 0.260. As the relationship between these two risks is positive and hence, the higher the credit risk, the higher will be the market risk.

The above interpretation is based on the sign, positive or negative and the findings can be concluded at 1% significant level. The relationship between all the risks except market risk and liquidity has positive correlation.

This chart illustrates the overall coefficient correlation among all listed banks in Malaysia. The correlation between aggregate operational risk (measured by ratio of operating expenses to total assets) and aggregate liquidity risk (ratio of total loans to total deposits) is -0.068. It shows the negative relationship between two risks. It means that the higher the operational risk exposure; the lower will be the liquidity risk exposure. In contrary, the ratio of non-performing loans to total loans (RNLTL) which has also been used as operation risk measure, the relationship becomes positive and correlation coefficient is 0.325 (Sig. at 1%). It means that the higher the operation risk, the higher the liquidity risk is. The correlation value for RNLTL yet not of much significance as it has only 32.5%. Therefore, it can be infer that when ratio of non-performing loans to total loans is used as a proxy for operational risk, as the operational
risk increases, the liquidity risk will also increase, but not as high as operational risk, that is, the correlation between these two categories of risk will be relatively less, in spite of it being positive. In contrast, when Operating expense to total asset is used as a proxy for operational risk, the correlation between operational and liquidity risk have an inverse relationship, therefore, as the exposure to operational risk increases, exposure to liquidity risk will decrease but relatively with at small scale.

### Consolidated Correlation of All Sample Banks

<table>
<thead>
<tr>
<th>Proxies</th>
<th>TLTD</th>
<th>OETA</th>
<th>RNLTL</th>
<th>Z score</th>
<th>STD</th>
</tr>
</thead>
<tbody>
<tr>
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<td>.325*</td>
<td>.079</td>
<td>.026</td>
</tr>
<tr>
<td>OETA</td>
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<td>1</td>
<td>-.008</td>
<td>-.775**</td>
<td>-.095</td>
</tr>
<tr>
<td>RNLTL</td>
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<td>Z score</td>
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<td>-.775**</td>
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<tr>
<td>STD</td>
<td>.026</td>
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<td>-.013</td>
<td>.099</td>
<td>1</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

The correlation coefficient value between operational risk (measured by ratio of operating expenses to total assets) and credit risk (z score) is examined, it shows the negative relationship with the coefficient value of -0.775 (Sig. at 1%). When ratio of non-performing loans to total loans is used as a proxy for operational risk, the correlation coefficient value is -0.057. Hence, it can be concluded that the higher the exposure to operational risk is, the lower will be the credit risk exposure. Hence it has an inverse relationship. The correlation between operational risk (measured by ratio of operating expenses to total assets) and market risk (standard deviation of quarterly stock return) is -0.095. It shows the negative relationship between two risks. It means that the higher the operational risk, the lower will be the market risk. The same relationship established when ratio of non-performing loans to total loans is used as operation risk measure, the relationship is negative and correlation coefficient is -0.013. Since the correlation values for ratio of non-performing loans to total loans and operating expenses to total asset when used as a proxy for operational risk the general conclusion is that the higher the operational risk, the lower the market risk would be.

Subsequently, the correlation between two proxies of operational risk is also negative. Since the correlation coefficient values are -0.008. The credit risk measured by z score and liquidity risk proxied by ratio of total loans to total deposits shows the correlation value of 0.079. Hence, the higher the credit risk, the higher will be the liquidity risk and vice-versa. In addition, liquidity risk (ratio of total loans to total deposits) and market risk (standard deviation of quarterly stock return) show 0.026, that is, positive correlation. It means the higher the liquidity risk, the higher the market risk will be. The correlation value between credit risk (z score) and market risk (standard deviation of quarterly stock return) is 0.099. As the relationship between these two risks is positive and hence, the higher the credit risk, the higher will be the market risk.

### 5. Conclusion

The correlation results from Bank A do not show any significant relationship among four risks. Bank B shows there is a negative relation between the operational risk and liquidity risk at 5%
significant level. In the case of Bank C, operational risk has negative relationship with credit risk and market risk at 5% significant level. Bank D shows that there is a positive relationship between operational risk and liquidity risk (at 5% sig. level), negative relation of credit risk with liquidity risk (at 5% sig. level) and operational risk (at 5% sig. level). In addition, there is a positive relationship of market risk with liquidity risk (at 5% sig. level) and operational risk (at 5% sig. level). In the case of the correlation between market risk and credit risk is negative at 5% significant level. The correlation results from Bank E show that there is a positive relation of credit and operational risk at 1% significant level. The correlation results from the consolidated data show that operating risk is positively related with liquidity risk at 5% significant level and negatively related with credit risk at 1% significant level.

In sum, it is difficult to conclude the exact relationship among these four major risks since it varies from one bank to another. Thus, it is suggested that the banks need to manage and monitor the risks based on their own specific portfolio since there is no standardized method or technique to generalize the risk correlation across the banks. This study examines the relationship among four major risks and it does not cover the simultaneous effects among them. Thus, future research should look into it. We expect that the findings of this research will be useful to the investors, industrial players and regulators for their future decision making for investment, business and laws and regulations.

6. References