Activity diversification and performance of Islamic banks in Malaysia

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Activity diversification and performance of Islamic banks in Malaysia

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Abstract

Several studies analyzed the relationship between performance (and the risks) and diversification (or concentration) generally in American banks. However, few studies were interested in explaining this phenomenon with regard to a new player in the global finance: the Islamic banks. Their rapid development despite the crisis, make them an interesting topic of analysis.

The current paper analyzes the performance and the choice of portfolio in Islamic banks. We consider a sample of 8 Malaysian Islamic banks between 2004 and 2008. The analysis has been made using the fact that the Islamic banks are operating as universal banks since a long time. We use the Herfindahl-Hirschman Index (HHI) as an indicator of the degree of diversification. The performance of the banks is measured by the return on asset ratio (ROA) and the Risk Adjusted Return On Capital ratio (RAROC). Finally, to determine the efficient frontier and the optimal portfolio, we use the Modern Portfolio Theory (MPT) of Markowitz.

The results show that the corporate and investment activity increases significantly returns on assets. However, retail and commercial activity improves the results and performance of these banks. We find evidence that the level of diversification is not too high and recommend that they are be better of, if they become concentrated on just one type of these activities. Finally, the MPT find strongly support the view that Islamic banks are not efficient.

Keywords: Diversification, performance, Islamic banks, HHI, MPT.

JEL classifications: C, F and G.

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1. INTRODUCTION

It is hard to pinpoint the start of Islamic banking. The financial transactions have existed until the 14th century, however no institutions exclusively devoted to banking. The growth of Islamic banking has been increasing ever since, not only in terms of number of countries it is operating in but also in terms of areas of finance it has ventured in.

The so-called Golden Age of the Islamic world took place between the 7th and 10th centuries in the Middle East countries and between the 11^{ht} and 14th centuries in North Africa. Although banks did not exist, innovative financial instruments were a part of commercial life. A frequently used expression is that they were "*bankers without banks*". The Golden age was followed by a period of stagnation and decline between the 15th and the 20th centuries. One among the reasons of this decline is the double break of the Islamic world not only with its past but also with the West. Moreover, during the 16th and 17th centuries, the colonization delayed the development of the Islamic financial models. Simultaneously, the first European banks were established in Turkey, Egypt and Iran at the end of the 17th century. By the end of the 19th century, most of the banks in the Islamic world were conventional/European banks.

The Islamic finance was introduced by Ahmed Al Najjar[4] on experimental basis in a small town of Egypt in 1963. Since then, many Islamic Banks were established in the Middle Eastern and Asian regions. Among Asian countries Malaysia has constructed a detailed plan to domestically develop Islamic finance into a full-fledged dual banking system by 2020. Since the enactment of the Islamic Banking Act of 1983, that enabled the founding of the first Islamic Bank in Malaysia, several Islamic banks have been created. In 2008, Malaysia counted 17 Islamic banks, and represent along with Iran and Saudi Arabia, one of the key players in Islamic finance. As a matter of fact, total Islamic banking assets in Malaysia are estimated at US$68 billion (or 17.5% of total Malaysian banking assets) as of June 2009, and have been experiencing an average annual growth rate of 18-20% since 2007.

Malaysia is thus being erected as a centre of important Islamic finance through cooperation with the Islamic financial centres of Bahrain and Dubai to jointly develop the global Islamic finance market. Besides, Malaysia's largest lender, Maybank, recently acquired Indonesia's sixth largest banking institution, Bank international Indonesia. Some conventional banks in Malaysia have Islamic banking windows and there are subsidiaries that function solely to facilitate Islamic financial transactions. The regulatory environment is completed by the Malaysian Islamic Banking Act of 1983. It was established to govern Malaysia's Islamic financial practices. It is enforced by separate *Shari'ah* boards in both the Bank Negara Malaysia (the Central Bank) and the Securities Commission through centralized oversight. An effort is made to adopt Basel II capital requirements and international accounting standards are being applied to domestic Islamic financial transactions. Despite all those efforts on the regulatory framework, some financial entities like Standard and Poor's think that financial disclosure practices of Islamic financial institutions often do not meet the standards of global best practices. Other analysts maintain that incomplete disclosure could hinder the growth of Islamic finance in the future. In 2008, the Islamic Financial Services Board (IFSB) which is the global standard-setting body for Islamic finance, capital markets and insurance has spearheaded global initiatives to standardize Islamic financial transactions. Standardization remains a significant challenge

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[4] He started this experience in Egypt based on the German saving bank model because he had become familiar with during his studies in Germany and the Germans supported him. Despite the religious position in Egypt at that time, he used family contacts to get the official approval from the government. However, he never made any reference to Islam.

for practitioners, regulators and depositors, since there are a number of variations in regulations across markets and countries. As conventional banks, some Islamic banks are universal and offer many service like for example corporate banking, investment banking, retail or consumer banking, commercial banking and treasury. However, the specificity of Islamic banks is, compliance with the Sharia. This brings them to operate in a narrow segment of investment market. This means greater vulnerability to shocks as sectoral diversification is not always possible. This weakness in diversification was demonstrated by the losses incurred by the Islamic banks in real estate during the subprime crisis, even if those losses are limited. Therefore, product diversification will be a key element in the expansion of Islamic finance across the globe. Hence, the question raised in the paper is: How should Islamic banks diversify their activities?

To answer this question, we estimated the risk-adjusted performance of Islamic Malaysia banks using data of their actual banking financial statements over the period 2004-2008. Then we take into account the gains of diversification and the preferences in terms of risks and we deduce the efficient frontier and the optimal portfolio.

The main findings of our study are: first, the corporate and investment activity is the activity which gives the better return on assets. However, it is the retail and commercial activity which contributes the better to the results and to the performance of the banks of our sample. Second, we found that these Islamic banks are moderately diversified, and that there are gains to concentrate their assets into one type of activity (varies depending on banks). Third, according to the modern portfolio theory, we found that the Islamic banks are not efficient.

Our paper is structured as follows. Section 2 presents the literature review on diversification and performance; section 3 presents our hypothesis and the model. The estimation and the results are discussed in Section 4. Section 5 concludes the paper.

2. LITERATURE REVIEW

2.1) diversification and performance

The problem of bank diversification was discussed in many papers and the relationship between the diversification and the performance was studied. Most of these studies highlight the positive effect of diversification on the performance and on the decrease of the risks. Saunders and Walter (1994), for example, conduct a simulation analysis of large mergers among the largest financial intermediaries in the US. Their results show that if these companies offer different financial services, their level of risk would be lower than the specialized bank. Besides, Templeton and William (1992) provide evidence on the impact of increasing the level of diversification on decreasing risk, if the nonbanking activities are uncorrelated with the banking activities. Their results are consistent with the portfolio theory. The Modern portfolio theory (MPT) was pioneered by Harry Markowitz[5]. In his article, Markowitz described how to combine assets into efficiently diversified portfolios. He demonstrated that investors failed to account correctly for the high correlation among security returns. It was his position that a portfolio's risk could be reduced and the expected rate of return increased, when assets with dissimilar price movements were combined. According to him, diversification reduces the volatility since a diversified portfolio is less volatile than the average of the volatilities of its component parts. The MPT allows investors to estimate both the expected risks and returns, as measured statistically, for their investment portfolios. In managing their portfolio, the investors try to maximize the overall portfolio return for a given

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[5] Professor Harry Markowitz of the University of Chicago, in 1952, he published his paper: "Portfolio Selection" at the Journal of Finance.

level of overall risk. Alternatively, the investors can attempt to minimize overall portfolio risk for a given level of overall portfolio return.

Note that diversification is not a recent concept in conventional banks for American banks as well as European banking. For instance, Cubo-Ottone and Nurgia (2000) pinpoint a significant positive relation between abnormal returns and the products of diversification in mergers and acquisitions of banks. Focarelli, Panetta, and Salleo (2002), using Italian balance-sheet data on mergers and acquisitions of banks, find an increase in the return on equity after a merger, and a long-run increase in profitability for acquired banks after an acquisition.

However, some papers find a low or a negative impact of the diversification on banks' performance. Mercieca, Schaeck and Wolfe (2006) provide evidences that there is no direct benefit of diversification within and across business lines and negative relation between non-interest income and bank's performance. Goddard, McKillop and Wilson (2007) found that for both the risk-adjusted and unadjusted returns measures, a positive direct exposure effect is outweighed by a negative indirect exposure effect for all but the largest credit unions. So the diversification strategies are not appropriate similarly for large and small credit unions.

For the case of Islamic banks, some studies addressed the issue of performance. Yudistira (2003) analyzed the impact of financial crises on the efficiency of 18 Islamic banks over 1997-2000. He found that the Islamic banks performed badly after the global crisis in 1998-1999 but they improved their performance after. In addition, small and medium sized banks faced diseconomies of scale and publicly listed banks are less efficient. Sufian (2007) adopted the same approach as Yudistira (2003) to examine the efficiency in domestic and foreign Islamic banks in Malaysia between 2001 and 2004. He provided evidence that these banks improve their efficiency slightly in 2003 and 2004. Moreover, the domestic Islamic banks are found marginally more efficient than foreign Islamic banks.

However, to our knowledge, there is no paper which deals with the issue of the impact of diversification on the performance of Islamic banks.

To feel this gap in the literature, we study the relation between the level of diversification and the performance of these banks and the optimal portfolios. We analyze the risk-adjusted performance used as a criterion for the allocation of assets and management compensation. We adopt the conventional measures of finance such as those of Sharpe, Treynor and Jensen to assess risk-adjusted performance. Before presenting our methodology, we make a brief review of the Malaysian Islamic banking industry.

2.2) Malaysian banking system:

Malaysian banking system is one of the most active in the Islamic field. The first Islamic bank was established in 1983. In 1993, commercial banks, merchant banks and finance companies begun to offer Islamic banking products and services under the Islamic Banking Scheme (IBS banks).

So, over more than 30 years, Malaysia has placed strong emphasis on the four core sectors in Islamic finance - Islamic banking, takaful, the Islamic capital market and the Islamic money

market. This has resulted in the development of a comprehensive Islamic finance environment that is rich in diversity of financial institutions, and vibrant with continuous product innovation and market activity; as well as possessing an ingrained maturity that adds stability and robustness to the overall Islamic finance system[*]. In 2008, Malaysia's Islamic banking assets worth USD55 billion with a growth rate of 17,1 % (Source : CIBAFI).

Furthermore, Malaysia is among the countries where established a large number of Islamic banks: at end-2008, there were 17 Islamic banking institutions and 16 Islamic banking operations conducted through windows by commercial banks, investment banks and DFIs, ("Financial Stability and Payment Systems Report 2008").

Another characteristic of the Malaysian Islamic banks is that they are "universal", i.e. they provide a full range of banking services: corporate banking; investment banking; retail or consumer banking; commercial banking; treasury and others activities. However, we have found that the Malaysian Islamic banks, analyzed in our study, do not apply a unified accounting and disclosure code.

3. METHODOLOGY

3.1) Risk adjusted performance

In conventional finance, financial engineering has created financial instruments to hedge against market, credit and operational risks. Regarding the first risk, the market risk which arises from fluctuations in prices of financial instruments, conventional finance offers futures contracts. However, these hedges often open the field for speculation. On the contrary, Islamic finance is based on a number of principles that led to delete some of those operations non Shariah compliant. So even if Islamic law endorses the principle for economic and financial coverage of operations, financial instruments that allow a party to loose while another one wins do not meet the requirements of the key principle of partnership. Similarly, Islamic banking does not allow the forward sale of goods that we do not have, because a question mark hangs over its actual availability. Thus, futures contracts such as options and futures used in the context of conventional finance are unsuited to Islamic finance through their principles. They are not used in their classic form, but undergo a transformation. In the case of option, for example, it is replaced by the contract of *Bai al-arboon*. This is a kind of purchase with payment of a certain amount that is lost if the purchase doesn't take place and deducted from the total if it runs. The objective is to maintain the balance of transactions and to prevent the weaker party is aggrieved. Thus, Islamic finance uses contractual options (of stipulation and choice) to manage risk. Regarding futures, Islamic financial engineering has invented products to achieve the same objective and consistent with Shariah. In this case, synthetic contracts are used. A synthetic *murabaha* (sale generating debt) includes a real medium with a profit, which is initially set. Therefore, it does not detract from the Islamic view of financial transactions. However, these equivalents do not provide exactly the same type of coverage than in conventional finance and can sometimes be a source of greater risks.

Regarding operational risk, it is the risk of loss from inadequate or failed internal processes, people and systems or external events. It may also be affected by the management principle of Islamic banks and the nature of their financial products. The key principle in Islamic bank

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[*] http://www.mifc.com/index.php

noted above is partnership. Thus, Islamic banks share the fruit of their investments with their depositors and the fruit of financed economic activities with their borrowers. Projects losses are therefore supported by Islamic banks unlike their conventional counterparts. Moreover, as in conventional banking, compliance is a priority but it is more complex in the context of Islamic banks. Islamic banks generally include Shariah Supervisory Board or *fatwa*. They ensure compliance with the rules of Islamic law. They therefore reduce information asymmetry and provide greater efficiency of economy and finance. Another element of the governance of Islamic banks is that, they are directed towards a social objective. They act like an economic and social organism. They are inserted into the local community bearing some responsibility for its prosperity. All these elements can affect the operational risk to which Islamic banks are subject.

Finally, the credit risk is the risk that the borrower may not repay his debt to the deadline. This risk is similar for Islamic and conventional banks, because there are no particular characteristics of Islamic finance as to the appropriate selection of borrowers. However, the good faith lending customers in Islamic banks may be punctuated by their Islamic religious faith.

In the banking literature, there are three measures of the risk-adjusted return: RORAC, RAROC and RARORAC. They are extension of financial index. They are flexible enough to be used as mean of integrating risk management from diverse areas. Providing that Islamic banks display market, credit and operational risks that can be encompassed by these ratios, we think they are the best instruments to gauge risk management of Islamic banks.

a. RORAC (Return on Risk-Adjusted Capital):

The RORAC was initially conceived within Bankers Trust's trading business in the late 1970s. Risk-adjusted capital is capital that has been adjusted after balancing the five main risk metrics—alpha[5], beta[6], r-squared[7], standard deviation[8], and the Sharpe ratio[9]—against each other so that return can be calculated on a level playing field. As defined, it is generally used to evaluate projects or investments that have a high element of risk for the capital involved. Thus, the RORAC is given by:

$$RAROC = \frac{Net\ Income}{Allocated\ Economic\ Capital}$$

It allows comparison of investments that have different levels of risk or different risk profiles. Here, the economic capital is adjusted for the maximum potential loss after calculating probable returns and/or their volatility. It is a very useful method of quantifying and managing acceptable levels of exposure to risk. RORAC is used when the risk may vary according to capital assets used, ie it is the capital itself that is adjusted for those risks, rather than the rate of return. Therefore, it should not be confused with RAROC.

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[5] The difference between the realized return and the average expected return.
[6] The risk that an asset tends to go along with the general market.
[7] It characterizes an asset's movement against a benchmark.
[8] It measures the dispersion of an asset's annual returns.
[9] It is a measure of the excess return (or Risk Premium) per unit of risk in an investment asset or a trading strategy.

b. RAROC (Risk-Adjusted Return on Capital)

RAROC is usually defined as the ratio of risk-adjusted return to the economic capital. Rather than adjust the risk of the capital (as in RORAC), it is the risk of the return itself that is adjusted and measured. It measures risk-based profitability that also enables a consistent comparison of the risky financial returns of a range of projects or investments.

It is given by:

$$RAROC = \frac{Expected\ Return}{Economic\ capital}$$

c. RARORAC (Risk-Adjusted Return on Risk-Adjusted Capital):

The RARORAC is a combination of the RAROC and RORAC ratios which specific treatments in the return stream and capital charge to capture all the levels of risk in different lines of business. It is increasingly used as a measure to assess both the risk-adjusted economic capital and the risk-adjusted return on an investment. It becomes widely known when the Basel Committee on Banking Supervision began requiring banks to apply risk adjustments to the way they calculated their capital stock. It therefore uses the capital adequacy guidelines as defined by Basel II.

The RARORAC is calculated by dividing the risk-weighted return by the economic capital after including the diversification benefits. The risk-weighted return is given by the sum of the net profit before results on divestments, provisions for credit risks after replacing (replaced) by estimated values, cycle-neutral expected losses on loans and investment securities.

The RARORAC equation is[2]:

$$RARORAC = \frac{Risk\ Adjusted\ Return}{Capital\ At\ Risk}$$

or

$$RARORAC = \frac{Anticipated\ Net\ Revenue - Expected\ loss}{CaRMarkt + CaRCrt + CaROps + CaRReg + CaRPol + ect\ \ldots}$$

Where CaR: Capital At Risk, Mrkt: Marketing, Crt: Credit…

It is straightforward to see that a double risk adjustment is made, in both the numerator and the denominator.

These ratios present advantages and disadvantages. They cannot cover systemic risks. However, allow for the incorporation of market risk, credit risk and operational risk within a single comprehensive framework. Therefore, they reveal the interrelationships between different sorts of risk and scenarios where there might be a too-high concentration of risks.

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[2] KPMG, "Financial risk management: Protecting capital through Risk Adjusted Performance measures", p3, 2005. http://www.kpmginsiders.com/pdf/CapitalManagement.pdf

d. calculations

In this section, we derive the RAROC indexes (hereafter, we use the accepted term RAROC even though we are actually estimating RORAC as well as RAROC indices).

For this study, we use the Internal Systematic Risk approach, in which the "systematic risk of a unit is measured in reference to the bank's portfolio (covariance between the bank's activity and the bank's total portfolio of activities).

Here, we examine both return and the current positions in all the activities the Islamic bank is investing on. This is why, we focus on earning parameters and not on rates of return.

Three indices were used to measure the banks' performance in different activities:

First, extension of the Sharpe ratio, a RAROC index was derived for activity *i* where this activity is considered to "stand alone". Thus the risk is expressed in terms of standard deviation, i.e., consistent with the definition of VaR (Value at Risk)[10]. As Shimko (1997) has shown, the return on risk adjusted capital (RAROC) can be interpreted as a linear transformation of the Sharpe ratio where capital is measured using VaR.

The equation of the RAROC measure is:

$$(1)\ RAROCSi = \frac{\Pi i - \Pi fi}{\sigma \pi i}$$

Where
$$\Pi i - \Pi fi = \frac{1}{T} \sum_t^T (\Pi it - \Pi fit)$$

$$\Pi fit = Rft\ Kit$$

Where: Π_{fi} is the average of earnings in the risk free share of the activity i ; K_{it} is the average (beginning-end of year) investment in activity *i* in year t; and Π_i, $\sigma_{\Pi i}$ are respectively the average profits (net operating profit or net profit from ordinary items) and standard deviation of the profit of activity *i* during the whole period T.

In the portfolio approach, which considers the correlations between the different activities, two other indexes are used. The first one is an extension of the Treynor measure in which risk is measured by covariance, i.e., as component value at risk (CoVaR).

$$(2)\ RAROCTi = \frac{\Pi i - \Pi fi}{B\pi i}$$

The risk index or the CoVaR in the activity i is given by:

$$(3)\ B\pi i = \frac{\sigma \pi iB}{\sigma \pi B}$$

[10] It's a measure of the risk of loss on a specific portfolio of financial assets. For a given portfolio, probability and time horizon, VaR is defined as a threshold value such that the probability that the mark-to-market loss on the portfolio over the given time horizon exceeds this value (assuming normal markets and no trading in the portfolio) is the given probability level

Where: $\sigma_{\Pi iB}$ and $\sigma_{\Pi B}$ are respectively the covariance between bank earnings and activity i earnings, and the standard deviation of bank earnings. The covariance $\sigma_{\Pi iB}$ is the systematic risk of activity i. It is the sum of the covariance of asset i written:

$$(3)\ \sigma\pi iB = \sum_{j} \sigma\pi ij \quad \text{and} \quad \sigma\pi iB = \sqrt{\sum_{i}\sum_{j} \sigma\pi ij}$$

The bank's total risk is given by the sum of all the variance and covariance of the earnings terms of all the activities.

$\sigma_{\Pi iB}$ is the systematic risk of activity i, it is the sum of the covariance terms of asset i with all other assets in the portfolio.

$B_{\Pi i}$ is the standardized measure of the systematic risk of activity i.

Accordingly, the total risk of the bank is given by:

$$(4)\ \sigma\pi B = \sum_{i} B\pi i$$

Note that the assets are negatively correlated with the bank's portfolio and have a negative risk measure ("hedge").

Finally, the measure of the performance of the activity i, in earnings terms, is an application of the Jensen Index:

$$(5)\ Ai = \Pi i - (\Pi fi + (\Pi Bi - \Pi fi) * \beta \Pi i)$$

Where:

$$\Pi Bi = \frac{1}{T}\sum_{t}\frac{\Pi Bt}{KBt}\ Kit = \frac{1}{T}\sum_{t} RBt\ Kit$$

Π_{Bi} : are the attributed earnings of the "benchmark" portfolio (the earnings of activity i assuming a rate of return equal to that of the bank)..

The risk is defined as the "internal beta" of activity i in earnings terms:

$$B\pi i = \frac{\sigma\pi iB}{\sigma^2\pi B}$$

The index A_i can be considered to be a measure of the *Economic Value Added* (EVA) of the activity; it has many uses in banking, among them in capital budgeting, see Uyemura, Kantor, and Pettit (1996).

To take account of the difference in size of the banks and activities, the index is standardized by dividing it by the average investment in activity i (K_i):

$$(6) \ RAROCJi = \frac{Ai}{Ki}$$

To examine performance of a specific activity, we compared performance of the activity in the different banks and in the system as a whole. We also compared performance in various activities at the bank, including the performance of the entire bank.

e. Data

The measures of the performance are estimated for eight Malaysian Islamic banks, using financial statements data. Our sample is restricted to the period 2004-2008, because of data availability. There are few databases offering information about Islamic banks. Famous databases, such as Datastream or Bankscope, provide certainly some data about these institutions, but the information needed in our study are not available. We therefore collected this information from Malaysian Islamic banks annual reports. For each institution, we have downloaded its available reports from its website. However, many limitations, in regard to financial statements of Islamic banks, are present since they do not yet apply a unified accounting and disclosure code and therefore may vary greatly in their presentations and intended meanings.

In order to maximize the number of banks and to construct a representative sample, we consider that the activities of the corporate banking and the investment banking are one simple activity. Similarly, we grouped the retail banking and the commercial banking: they constitute together only one activity. We made this choice because, in some banks of the sample, they have already grouped the retail and the commercial activities together, and in others, they put the corporate and the investment banking together. Thus, in our empirical study, the total activity of the banking group will be divided into four components: corporate and investment banking; retail and commercial banking; treasury and others activities. Note that the data of the net operating profits (ordinary net income), the segmental results and the investments (segmental assets) in the different activities, are provided by the note on "Segment Information" that we have found in the annual financial statements of these banks.

The investment by the bank in activity i at time t is denoted variable K_{it}. The sum of the investments (amount of segmental assets) in each of the activities is equal to the total assets of the bank. Finally, as noted in equation (1), we must use in our calculations of the RAROC a well-defined variable, the risk-free rate (R_{ft}). However, for the Islamic banks, we haven't such rate since the interest is prohibited. That's why, we took as the risk-free rate for the Malaysian Islamic banks the rate of the sovereign Sukuk of Bank Negara Malaysia (Central bank of Malaysia), as experts usually do. In addition, to our knowledge, in contrast with many other Islamic countries, Malaysia is the only Islamic one where there is a yearly issuance of sovereign Sukuk between 2004 and 2008. The Malaysian authorities have been very transparent and clear on this point since you can find this type of information on their website[3].

Our sample is composed from eight Islamic banks:

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[3] http://www.bnm.gov.my/index.php?ch=12&pg=623&eId=box1 // http://www.bnm.gov.my/index.php

Bank' Name	Total Assets (2008) Millions USD	Market Share (%) Total 2008 = 55,228
Affin Islamic Bank Berhad	1741	3,15 %
Al Rajhi Banking & Investment Corporation Berhad	1376	2,49 %
Bank Islam Malaysia Berhad BIMB	6775	12,26 %
CIMB Islamic Bank Berhad	5349	9,68 %
EONCAP Islamic Bank Berhad	2035	3,68 %
Hong Leong Islamic Bank	2329	4,12 %
Kuwait Finance House (KFH) Malaysia Berhad	2764	5 %
RHB Islamic bank Berhad	2687	4,86 %
TOTAL	**25056**	**45,36 %**

f. Results

Table 1 and 2

Table 1 presents the average rates of ROA and the average of profits in each of the four banking activities (business units) for the eight banks of our sample. ROA (Return on assets) indicates the profitability on the assets of the firm once expenses and taxes are paid and gives an idea about the management performance (Van Horne 2005, Ross et al. 2005). It measures net earnings per unit of assets for a given asset. And it is a common figure used for comparing the performance of the financial institutions, such as banks, because the majority of their assets will have a carrying value that is close to their actual market value. Therefore, a high ROA implies that the use of assets is efficient and shows better managerial performance, in contrast with low ratio. It is increasing through the increase of margins of profits or turnover asset. Our statistics show that the Affin Islamic bank has the highest ROA (1.61%), which implies its good performance.

EONCAP Islamic Bank Berhad has a negative ROA (-0.52%), since the corporate and investments activities have a negative impact on the bank's performance and despite the fact that the other activities, i.e. the retail and commercial and the treasury have a positive effect (respectively 2.51% and 0.58%).

We notice also that BIMB (Bank Islam Malaysia Berhad) is the only bank of the sample which hasn't a treasury activity; in contrast with the other banks. All the others practice this activity.

Table 2, which presents the average profits, shows that the retail and commercial banking are the first activities that contribute significantly to the whole bank's profit (about 65% percent

of the total profits of our sample). They are followed by treasury activity (28%) and the corporate and investment banking with only 9% of the total sample profit (it is straightforward to see that BIMB and EONCAP had affected largely the results of the corporate and investment activity because these two banks have registered respectively - 46% and - 158%).

The banks in the sample show high standard deviation in all the activities (large dispersion in results for the different banks and for the different activities). Each bank has different proportions of average profits compared to the other banks in almost all the activities.

Table 3

The main findings in Tables 3 are the following:

The performance measures (Sharpe and Treynor) show that BIMB had the best overall performance (1.17), followed by EONCAP Islamic Bank Berhad, Affin Islamic Bank and Kuwait Finance House Malaysia Berhad, while Al Rajhi, CIMB Islamic, RHB Islamic bank and Hong Leong Islamic bank have a negative value of the ratio. For the banks which have a negative value, the measure means that they generate an average rate of return (ROA in our example) smaller than the risk-free rate (rate of the sukuk here). Note also that the risk-adjusted ratios provide different results from those of ROA analysis. For instance, according to RAROCS and RAROCT, the BIMB is now ranked while it was ranked seventh in the classification of ROA. One explanation is that BIMB' performance is closely related to services it is investing.

We now turn to analyzing the contribution of each activity on the total performance of the bank. According to all the measures, the retail and commercial banking have the highest effects on the bank's performance: RAROCS = 0,56, RAROCT = 0,79 and RAROCJ = 0,0174. However, the Treasury activity had registered the worst performance value, having even a negative rate for all the measures: RAROCS = - 2,69, RAROCT = - 0,55 and RAROCJ = - 0,018, except KFH Malaysia Berhad which recorded for the Treasury activity positive values for the three ratios, RAROCS = 0,24, RAROCT = 0,32 and RAROCJ = 0,0113. This result can be explained by the fact that this bank invests all its assets in the treasury activity. In fact, in 2008, the bank had a put all his assets (100%) in the treasury activity.

Finally, the performance of each activity of the different banks is analyzed here. The performance is measured as a "stand alone" activity and as component of a portfolio. The main findings are:

Affin Islamic Bank has registered a good performance due to the activities of retail and commercial, followed by the corporate and investment banking. One surprising result is that treasury activity has a negative impact on the performance despite the fact that Affin Islamic bank invests 66% of its assets in this activity. In fact, the annual report (2008) of Affin Islamic Bank reports that "…Treasury and Islamic money market operations are involved in proprietary trading in fixed income and foreign exchange, Islamic derivatives trading and structuring, managing customer-based foreign exchange and Islamic money market transactions, funding and investment in ringgit and foreign currencies". We conclude that treasury activity is a long-term investment and return on investment is realized on the long term. The latter result explains the liquidity problem in banking.

The good performance of BIMB comes mainly from the high performance of retail and commercial activities: RAROCS = 2.33, RAROCT = 2.98 and RAROCJ = 0,041. This may explain why BIMB have allocated 1/3 of its assets to these activities (the bank has invested nearly 31% in 2008 and 35% in 2004, see Table 5). However, the performance of the corporate and investment banking was relatively poor: all the indexes have a negative value, RAROCS = - 0,18, RAROCT = - 0,24 and RAROCJ = - 0,0021.

At CIMB Islamic, the retail and commercial banking performed well (despite the fact that only 14% of investments in 2008 are allocated to commercial services) while all the other activities performed poorly (negative values). That is why the performance of the bank entirely is negative.

At EONCAP Islamic bank Berhad, the good performance was derived mainly from the performance of its large retail and commercial banking (50% of the total investment in 2008 and 70% in 2006) but also from the corporate and investment banking (15% of the total investment in 2008) which have an interesting value of the RAROCS and RAROCJ index (respectively 1,04 and 3,24).

Moreover, correlations between the earnings of the retail, commercial, corporate and investment banking and the bank earnings are very high in the 8 banks: an average of 96% for the retail and commercial activity and 72% for the corporate and investment banking).

Only EONCAP Islamic Bank Berhad and Hong Leong Islamic Bank show slight different results: correlation between earnings of corporate and investment banking and total earnings are not too strong (respectively 48% and 47%).

In RHB Islamic Bank, correlation between the earnings of the corporate and investment banking and the total earnings of the bank is almost nonexistent (6%). On the other hand, the correlation of treasury is relatively high (68%). This measure is very high in all the banks of our sample (approximately 90%) except for the Hong Leong Islamic Bank where we find a negative value (-0.74).

Finally, correlations between the activities do not vary significantly between banks, thus one may compare the performance of various activities across banks.

3.2. Optimal portfolio and efficient frontier:

   a. Modern Portfolio theory

After having estimated and analyzed the performance of the eight Malaysian Islamic banks on a risk-adjusted basis, we now estimate the optimal structure of their asset portfolios and compare them to the actual portfolios of the banks in 2008 and 2004, (see Table 5 = Composition of the actual portfolio).

One of the major concepts that most investors should be aware of is the relationship between the risk and the return of a financial asset. It is a common knowledge that there is a positive relationship between the risk and the expected return of a financial asset. In other words,

when the risk of an asset increases, so does its expected return[4]. Thus, we will use the concept of Modern Portfolio Theory to derive the relationship between the risk and return of a portfolio of financial assets.

Hereafter, we will derive the relationship between the risk and return of a portfolio by looking at a series of four portfolios of our banks.

According to Brown (2009), to calculate the optimal portfolio and the efficient frontier, the MPT assumes that the portfolio return is a linear function of the weights (proportions) of the different assets in the portfolio.

Mathematically, the expected return for the asset portfolio $E(R_p)$ is given by:

$$E(Rp) = \sum_{i=1}^{m} wi\, E(Ri)$$

Where $E(R_i)$ is the expected return of asset class i, w_i is the relative amount of money invested in asset (weight associated with asset class i) and m is the number of asset classes. In a macroeconomic level, the equation can be written as

$$E(Rp) = w'[E(R)]$$

E(R) is the matrix of expected returns for the portfolio assets and w' is the transpose of the matrix of assets weights.

The portfolio risk entails systematic risk and unsystematic risk. The first one (systematic or non-diversifiable or market risk) is caused by factors that affect overall market risk, such as macroeconomic conditions, currency fluctuations… This risk cannot be reduced through portfolio diversification (Devinney et al., 1985). On the other hand, the specific risk depends on many factors (management, the quality of labor…) which are closely related to the characteristics of each asset.

The MPT deals with the specific risk and suppose that the portfolio's standard deviation, , is the appropriate measure of risk. The MPT assumes that the level of risk of a portfolio is lower than the sum of weighted risk of the assets

This risk is written:

$$\sigma p = \sqrt{\sigma^2 p} = \sum_{i=1}^{m} w^2 i\ \sigma^2 i + 2 \sum_{i=1}^{m} \sum_{j=1}^{m} wi\, wj\, \sigma ij$$

Where is the portfolio standard deviation, ^{2} is the portfolio variance, w_i is the weight associated with asset class i, $_i$ is the standard deviation of returns from asset class i and $_{ij}$ is the covariance of returns from asset classes i and j.

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[4] Dr. Siaw-Peng Wan, Article: "Modern Portfolio theory", 2000, Source: Business 442: Investments Chapter 5-5

In matrix terms, overall portfolio risk is given by:

$$\sigma p = w'C\,w$$

Where W is the matrix of asset weights and C is the covariance matrix of asset returns.
The efficient frontier and the optimal portfolio are solution of the following optimization problem:

Minimize	$\sigma p = w'C\,w$
Subject to	$w'\mu = \mu p$
And	$w'e = 1$

For the mathematical development and the calculating of the efficiency frontier and the optimal portfolio, more details are available in the appendix A.

b. Results for optimal portfolio Analysis

The results of the optimal portfolio analysis, concerning the performance of the banks in the various activities in terms of the direction of change between the existing allocation of investments and the optimal portfolio, were mostly consistent with our analysis in the previous section (RAROC indexes).

Table 6

The table 6 enables us to give the following recommendations:

First, Al Rajhi banking and Investment Corporation Malaysia Berhad should invest higher share of assets in treasury activity. But simultaneously, it should decrease their investment in retail and commercial activities and reduce the activity of corporate and investment. Our result is inconsistent with the actual decline of the share of the treasury activity in the portfolio of the bank in the recent years (from 89% in 2005 to 31% in 2008) and the enhance of the share of the retail and commercial banking (from 11% in 2005 to 18% in 2008) and the corporate and investment banking activity (from 0% in 2005 to 51% in 2008) in the portfolio of the bank. Our results are also in contradictory with our findings in the first part of the study. Indeed, despite that the treasury activity have a positive value of the ROA (0,8%), all the RAROC indexes were negative and even the worst of the activities of the bank.

Second, BIMB should increase substantially the corporate and investment banking and give a small boost to the other activities. However, a significant contraction of the retail and commercial banking must be done. These results are consistent with the movement of changes made in the bank, since the retail and commercial banking has decreased from 35% in 2004 to 31% in 2008, the commercial and investment activity has augmented from 65% to 69% and the other activities increased to 0.01% in 2008.However, these results are not consistent with

the previous findings about the RAROC indexes. According to these indexes, the retail and commercial activity is the better activity of the bank. It, even, gives the best performance of these indexes regarding our sample in whole.

Third, EONCAP Islamic Bank Berhad should make a real cutback of its treasury activity which captured at about 34 % of the bank's assets in 2008. On the other side, the retail and commercial activity should be the main activity of this bank. At the same time, the bank should invest more money in the corporate and investment activity. These results confirm our findings in the first part of this study since we found that the retail and commercial activity is the most profitable activity of the bank. Indeed, the RAROCS, RAROCT and RAROCJ were positive and have the higher values compared to the values of the other activities. Also, the ROA of this activity is the higher of the bank, 1,49%. However, these results are not consistent with the EONCAP's strategies in the sense that the retail and commercial activity (Tables 1 or 2) cut down from 70% in 2006 to 50% in 2008, while the optimal value of this activity according to the MPT, should be around 68%. Similarly, the corporate and investment activity has decreased from 20% in 2006 to 15% in 2008, while the optimal investment in this activity should be around 21%. Finally, the treasury activity should be diminished by 18 % in 2008 (decrease from 34% in 2008 to 16% (optimal investment)).

Finally, according to the optimization problem, Hong Leong Islamic Bank should cut back its corporate and investment banking. On contrary, this bank should focus basically on the retail and commercial activity (77%). As shown in the first section, the retail and commercial banking are the most profitable (RAROCS, RAROCT and RAROCJ are positive for this activity and negative for the other activities) for the bank. Besides, the changes of the weighting of activities in the portfolio of the bank between 2006 and 2008 are consistent with the actual increase of the retail and commercial activity and the decrease of the corporate and investment banking.

Table 7 (a and b)

Table 7 shows that the 8 banks choose diversification and invest almost in all the lines of business. Besides, the optimal portfolios of these banks show that they have non-zero investments in all the activities. However, according to the Herfindahl-Hirschman Indexes*, some banks should diversify the allocation of their assets while others should be concentrated.

For Al Rajhi banking and Investment Corporation Malaysia Berhad, the optimal HHI is equal to 0,4087. The value of this index is close to 0,333 (1/n with n is the number of business lines, 3 in our example) which corresponds to a situation where there is a perfect diversification, i.e. the same amount of assets is invested in each activity. Thus, if the bank follow the recommendations of the MPT, it should diversify more its activity between the different activities because the real HHI is equal to 0,604 (the bank is currently fairly diversified) and in order that this index reaches the optimal value of 0,4087, the bank should diversify more its assets allocation.

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* The Herfindahl index, also known as Herfindahl-Hirschman Index or HHI, is a commonly accepted measure of the market concentration. Named after economists Orris C. Herfindahl and Albert O. Hirschman, this index is calculated by squaring the market share of each firm competing in a market, and then summing the resulting numbers.

However, always according to the Herfindahl-Hirschman Indexes, the other banks should concentrate their assets. The optimal HHI in BIMB is (equal to 0,8837 which is a high value, very) too close to 1 (the actual HHI = 0,5281). So, if the bank follows the recommendations of the MPT, it should concentrate its activity, particularly in the Corporate & Investment activity.

For EONCAP Islamic Bank Berhad, we found that the optimal HHI is equal to 0,5321 while the actual current value of the HHI is 0,4334. According to the MPT, it should invest basically on the retail and commercial activity.

Finally, for the Hong Leong Islamic Bank, the optimal HHI is equal to 0,8622 while the actual value of this index is 0,4346. So, the bank should concentrate more its activity, mostly in the retail and commercial activity.

   c.   <u>Results for the efficient frontier analysis</u>

Finally, we delineated the efficient frontier (in terms of ROA and standard deviation) of three banks of our sample and compared them to the actual positions of the banking groups in the period.

This provides us with another way of measuring performance: we compare the actual portfolios and the efficient ones across banks and also over time.

Figure 1: Efficient Frontier and actual Portfolio

Efficient frontier and actual portfolio Al Rajhi banking and Investment Corporation Malaysia Berhad

Efficient frontier and actual portfolio: BIMB

Efficient frontier and actual portfolio EONCAP
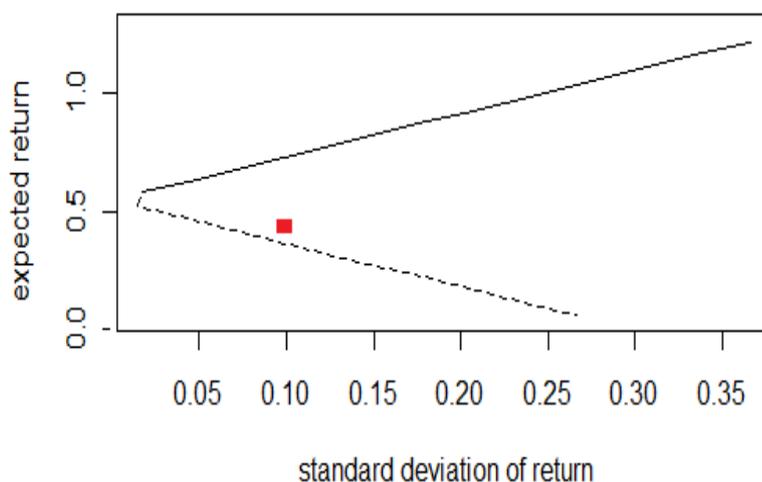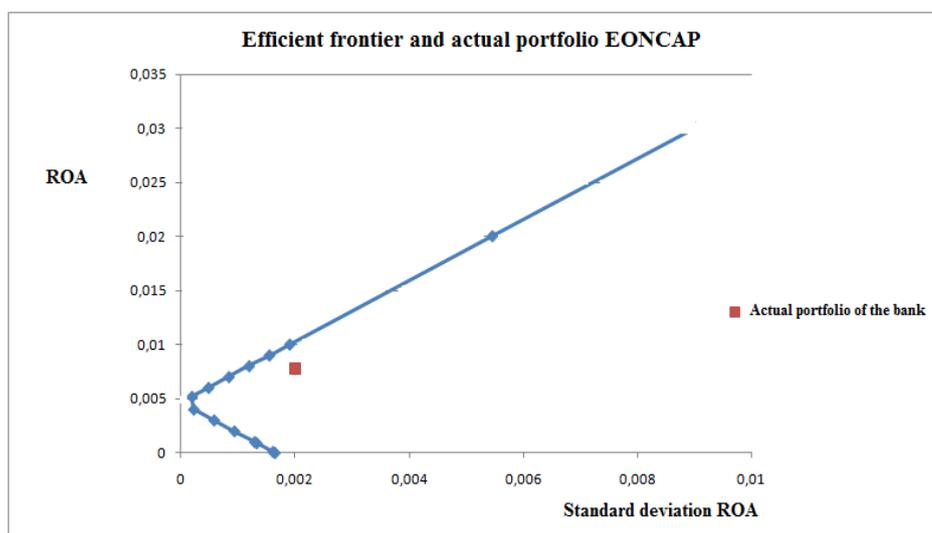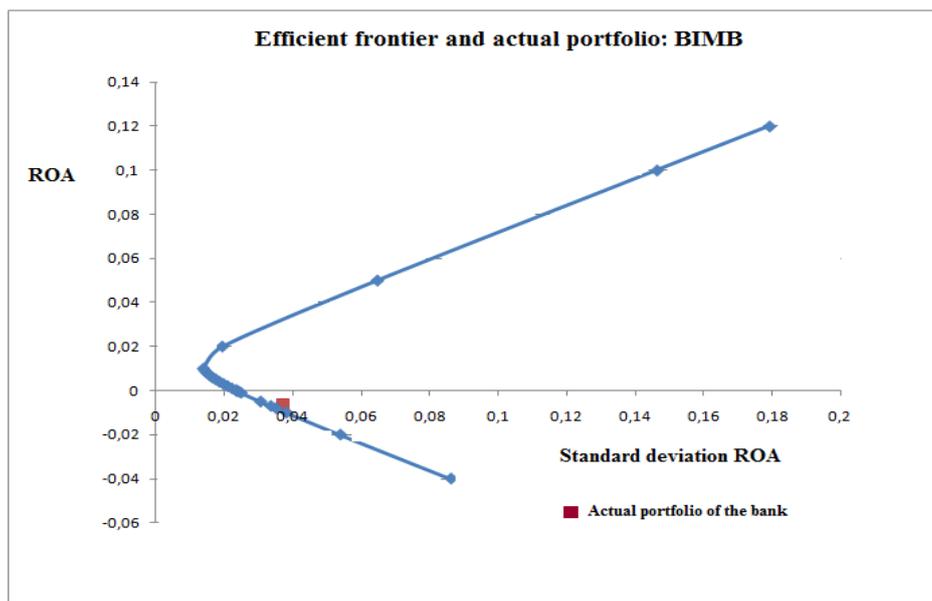
In Figure 1, we present graphically the efficient frontier of BIMB and EONCAP Islamic Bank Berhad and their current positions.

We found that the current BIMB's portfolio is not efficient: it is above the efficiency frontier in the negative side. This implies that BIMB' return is negative. So, we found that the actual portfolio of the Bank Islam Malaysia Berhad (BIMB) has a negative return what is understandable because the actual return of this bank is negative.

The EONCAP Islamic Bank Berhad and Al Rajhi banking and investment Corporation Malaysia Berhad are also non efficient. However, the portfolios of these two banks are below the efficiency frontier. Indeed, we are dealing with the normal representation. So, for a certain level of risk (σ_{ROA}), these banks have reached a rate of return (ROA) that is below the optimal value, thus these banks are not efficient and they can improve their performance.

4. SUMMARY OF THE MAIN RESULTS AND CONCLUDING REMARKS

This paper investigates two current important related topics in banking: the effects of diversification across financial products (business units) in terms of the efficient frontier and the optimal portfolio of the banking group and the related issue of risk adjusted performance of banks. Despite the limited data, we tried to derive interesting analysis of the diversification of Islamic banks. Sometimes the analysis couldn't be carried for al the eight banks of the sample. However whenever possible, our results were quite interesting and enriching.

Using the ROA and the RAROC indices we were able to analyse the risk adjusted performance of 8 Malaysian Islamic banks. We found that the retail and commercial banking are the first activities that contribute significantly to the whole bank's profit (about 65% percent of the total profits of our sample). As a matter of fact those activities have the highest effects on the bank's performance. Besides, banks in the sample show high standard deviation in all the activities (large dispersion in results for the different banks and for the different activities). Another interesting result is the average high correlation between commercial and retail activities on the one hand and corporate and investments activities for all banks of the sample apart form EONCAP Islamic bank Berhad, Hong Leong Islamic bank and RHB Islamic bank, on the other hand.

Concerning our findings for the optimal portfolio, the results are mitigated. Indeed, for the two banks of the four banks we analyzed (they are namely Al Rajhi banking and Investment Corporation Malaysia Berhad and Bank Islam Malaysia Berhad (BIMB)), we found an overinvestment in the retail and commercial activities. Those banks should therefore reduce their investment despite the relative good performance of this activity, especially for the BIMB. However, our results suggest a substantial increase in retail and commercial activity for the other two banks (EONCAP Islamic bank Berhad and Hong Leong Islamic bank). Regarding the treasury activity, we found that all banks should increase their investment, except EONCAP Islamic Bank Berhad. Our recommendations are validated by the actual changes in the composition of the portfolios for Bank Islam Malaysia Berhad (BIMB) and Hong Leong Islamic bank, but not for the other banks.

Finally, the efficiency frontier analysis for the portfolio of three banks (BIMB, EONCAP Islamic Bank Berhad and Al Rajhi banking and investment Corporation Malaysia Berhad) reveals that they are not efficient. For the latter two, however the analysis shows that they can improve their efficiency.

This study shows the importance of diversification of Islamic banks activities. Indeed, our results suggest that despite the weight of retail and commercial activities in the banks 'portfolio, they are not efficient as shown by the analysis of efficiency frontier. Our recommendation is that banks studied in our sample should decrease their investment in retail and commercial activities and increase them in corporate and investment activities. However, the proportion of increase or decrease depends on the specificities of each bank.

Table 1: Average Return On Assets (ROA) by activities of eight Malaysian Islamic banks for the period 2004-2008

Activities Bank	Retail and commercial banking	Corporate & Investment banking	Treasury	Others	Total bank
Affin Islamic Bank	2,64	1,73	0,45	1,72	1,61 (1)
Al Rajhi banking and Investment Corporation Malysia Berhad	-1,62	0,81	0,8	0	0,00 (6)
Bank Islam Malysia Berhad (BIMB)	-0,22	-0,9	0	93,14	-0,37 (7)
CIMB Islamic	1,02	0,96	1,05	-33,51	1,01 (5)
EONCAP Islamic Bank Berhad	2,51	-4,65	0,58	0	-0,52 (8)
Hong Leong Islamic Bank	2,19	1,77	-0,34	0	1,21 (3)
Kuwait Finance House (KFH) Malaysia Berhad	0,68	2,13	0,92	-5,58	1,24 (2)
RHB islamic bank	1,14	1,61	0,54	1,57	1,10 (4)

Where: the average rate of assets of activity i is: $ROA_i = 1/T \sum_{t=1}^{T} \Pi_{it} / A_{it} = \sum_{t=1}^{T} ROA_{it}$

Where T is the length of the sample period in years

And ROA_{it} = net profit of activity i in year t divided by average assets of activity i during the year.

Table 2: Average profits by activities of eight Malaysian Islamic banks for the period 2004-2008

(The amounts of profit are expressed in 000$)
(Numbers in parentheses are percent of the total profit of the bank)

Activities Bank	Retail and commercial banking	Corporate & Investment banking	Treasury	Others	Total bank
Affin Islamic Bank	4788 *(33%)*	3097 *(21%)*	4375 *(30%)*	2302 *(16%)*	14562
Al Rajhi banking and Investment Corporation Malaysia Berhad	-2307 *(-68%)*	5862 *(173%)*	-165 *(-5%)*	0	3390
Bank Islam Malaysia Berhad (BIMB)	-6727 *(-45%)*	-6849 *(-46%)*	0	-1448 *(-9%)*	-15024
CIMB Islamic	1927 *(15%)*	3191 *(25%)*	16396 *(127%)*	-8603 *(-67%)*	12911
EONCAP Islamic Bank Berhad	25530 *(262%)*	-15383 *(-158%)*	-413 *(-4%)*	0	9734
Hong Leong Islamic Bank	21681 *(96%)*	2763 *(12%)*	-1923 *(-8%)*	0	22521
Kuwait Finance House (KFH) Malaysia Berhad	4392 *(28%)*	9690 *(61%)*	4190 *(26%)*	-2400 *(-15%)*	15872
RHB islamic bank	7374 *(22%)*	8537 *(26%)*	6440 *(20%)*	10426 *(32%)*	32777
Average per Activity	**7964** **(65%)**	**1116** **(9%)**	**3504** **(28%)**	**-289** **(-2%)**	**12295**

Table 3a:

RAROCS ("Sharpe" Index) by activities of eight Malaysian Islamic Banks

Activities Bank	Retail and commercial banking	Corporate & Investment banking	Treasury	Others	Total bank
Affin Islamic Bank	1.39	0.79	-0.62	0.52	0.38 (3)
Al Rajhi banking and Investment Corporation Malaysia Berhad	-0.61	-0.51	-1.58	Na	-0.28 (5)
Bank Islam Malaysia Berhad (BIMB)	2.33	-0.18	Na	0.97	1.17 (1)
CIMB Islamic	0.34	-1.91	-2.57	-3.91	-1.12 (6)
EONCAP Islamic Bank Berhad	1.49	1.04	-0.72	Na	0.59 (2)
Hong Leong Islamic Bank	0.01	-1.82	-7.14	Na	-15.69 (8)
Kuwait Finance House (KFH) Malaysia Berhad	0.23	0.48	0.24	0.55	0.23 (4)
RHB islamic bank	-0.65	-1.84	-6.48	-0.93	-4.97 (7)
Average per activity	0.56	-0.49	-2.69	-0.56	

$RAROCSi = (\Pi_i - \Pi_{fi}) / \sigma_{\Pi i}$

Where: $\Pi_i - \Pi_{fi} = 1/T \sum_{t}^{T} (\Pi_{it} - \Pi_{fit})$

And $\Pi_{fit} = R_{ft} K_{it}$

Table 3b:

RAROCT ("Treynor" Index) by activities of eight Malaysian Islamic Banks

Activities Bank	Retail and commercial banking	Corporate & Investment banking	Treasury	Others	Total bank
Affin Islamic Bank	2.16	1.18	-0.16	0.81	0.38 (3)
Al Rajhi banking and Investment Corporation Malysia Berhad	-0.91	-0.77	-2.61	na	-0.28 (5)
Bank Islam Malysia Berhad (BIMB)	2.98	-0.24	na	1.39	1.17 (1)
CIMB Islamic	0.46	-2.83	-3.58	-5.24	-1.12 (6)
EONCAP Islamic Bank Berhad	2.26	3.24	-1.18	na	0.59 (2)
Hong Leong Islamic Bank	0.01	-5.79	14.45	na	-15.69 (8)
Kuwait Finance House (KFH) Malaysia Berhad	0.31	0.64	0.32	0.74	0.23 (4)
RHB islamic bank	-0.92	-39.44	-11.15	-1.34	-4.97 (7)
Average per activity	0.79	-5.50	-0.55	-0.72	

$RAROCT_i = (\Pi_i - \Pi_{fi}) / B_{\Pi i}$

Table 3b:

RAROCJ ("Jensen" Index) by activities of eight Malaysian Islamic Banks

Activities Bank	Retail and commercial banking	Corporate & Investment banking	Treasury	Others	Total bank
Affin Islamic Bank	0.023	0.013	-0.008	0.015	0.0003
Al Rajhi banking and Investment Corporation Malaysia Berhad	0.018	-0.017	-0.013	na	-0.011
Bank Islam Malaysia Berhad (BIMB)	0.041	-0.0021	na	0.78	0.015
CIMB Islamic	0.0290	-0.0290	-0.0292	-0.0343	-0.0225
EONCAP Islamic Bank Berhad	0.0164	0.0083	-0.016	na	0.007
Hong Leong Islamic Bank	0.00008	-0.0069	-0.040	na	-0.0171
Kuwait Finance House (KFH) Malaysia Berhad	0.0177	0.0376	0.0113	0.0477	0.0120
RHB islamic bank	-0.0054	-0.0206	-0.0334	-0.0139	-0.0247
Average per activity	0.0174	-0.002	-0.018	0.15	

$RAROCJ_i = A_i / K_i$

$A_i = \Pi_i - (\Pi_{fi} + (\Pi_{Bi} - \Pi_{fi})*\beta_{\Pi i})$,

Where: $\Pi_{Bi} = 1/T \sum_t (\Pi_{Bt} / K_{Bt})*K_{it} = 1/T \sum_t R_{Bt} K_{it}$

Table 4:

Correlation coefficients of profits between banking activities with total Profit of banking groups and the system 2004-2008

Activities Bank	Retail and commercial banking	Corporate & Investment banking	Treasury	Others	Total bank
Affin Islamic Bank	0.96	0.99	0.98	0.95	1
Al Rajhi banking and Investment Corporation Malaysia Berhad	0.99	0.98	0.90	0	1
Bank Islam Malaysia Berhad (BIMB)	0.99	0.96	0	0.80	1
CIMB Islamic	0.99	0.90	0.95	0.99	1
EONCAP Islamic Bank Berhad	0.99	0.48	0.92	0	1
Hong Leong Islamic Bank	0.90	0.47	-0.74	0	1
Kuwait Finance House (KFH) Malaysia Berhad	0.97	0.99	0.98	0.99	1
RHB islamic bank	0.94	0.06	0.77	0.92	1
Average per activity	0.96	0.72	0.68	0.93	

Table 5:

Composition of the actual Malaysian Islamic banks Portfolio December 31 2008

(Numbers in parentheses are the percent of the activity in the beginning)

Activities / Bank	Retail and commercial banking	Corporate & Investment banking	Treasury	Others	Total bank assets (2008) US 000$
Affin Islamic Bank	13% (13%)	15% (12%)	66% (68%)	0	100% 1723366
Al Rajhi banking and Investment Corporation Malaysia Berhad	18% (11%)	51% (0%)	31% (89%)	0	100% 1289795
Bank Islam Malaysia Berhad (BIMB)	31% (35%)	69% (65%)	0	0.01% (0)	100% 6769093
CIMB Islamic	14% (0)	20% (0)	60% (95%)	7% (5%)	100% 5190630
EONCAP Islamic Bank Berhad	50% (70%)	15% (20%)	34% (10%)	0	100% 2009291
Hong Leong Islamic Bank	47% (54%)	6% (9%)	47% (37%)	0	100% 2284224
Kuwait Finance House (KFH) Malaysia Berhad	35% (0%)	29% (0%)	33% (100%)	3% (0%)	100% 2678667
RHB islamic bank	25% (24%)	22% (22%)	50% (57%)	1% (-3%)	100% 2390197
Average per activity	29% (26%)	29% (16%)	40% (57%)	2% (1%)	

Mathematical development for the calculating of efficiency frontier and optimal portfolio

To determine the efficient frontier and the optimal portfolio, we must resolve the following system:

$$
\begin{cases}
\text{Minimize} & = w'Cw \\
\text{Subject to} & w'\mu = \mu_p \\
\text{And} & w'e = 1
\end{cases}
$$

Where w is the weight vector of assets weights, μ the vector of assets returns, C the covariance matrix of asset returns and $e = [1\ 1\ 1\ \ldots\ 1]$

To solve this system, we determine the following Lagrangian:

$$L = w'Cw + \lambda_1\,(\mu_p - w'\mu) + \lambda_2\,(1 - w'e)$$

With λ_1 and λ_2 are the multipliers of Lagrange. The optimality condition of the first order is written

$$\partial L/\partial w = 2Cw - \lambda_1\,\mu - \lambda_2\,e = 0 \iff \boxed{w = \lambda_1/2\ C^{-1}\mu + \lambda_2/2\ C^{-1}e \qquad\qquad (1)}$$

With C^{-1} is the inverse of the matrix.

In combination with the 2 constraints, we have:

$$
\begin{cases} w'\mu = \mu_p \\ w'e = 1 \end{cases}
\iff
\begin{cases} \mu'w = \mu_p \\ e'w = 1 \end{cases}
\iff
\begin{cases} \lambda_1\,\mu'C^{-1}\mu + \lambda_2\,\mu'C^{-1}e = 2\mu_p \\ \lambda_1\,e'C^{-1}\mu + \lambda_2\,e'C^{-1}e = 2 \end{cases}
$$

We pose the following constants:

$$A = e'C^{-1}\mu = \mu'C^{-1}e;\ B = \mu'C^{-1}\mu \text{ and } \mathbf{C} = e'C^{-1}e$$

The system to solve becomes:

$$
\begin{cases} \lambda_1\,B + \lambda_2\,A = 2\mu_p \\ \lambda_1\,A + \lambda_2\,C = 2 \end{cases}
\iff
\begin{cases} \lambda_1 = 2\,(C\mu_p - A)\,/\,D \\ \lambda_2 = 2\,(B - A\mu_p)\,/\,D \end{cases}
$$

With $D = BC - A^2$

Finally, we substitute λ_1 and λ_2 in equation (1), we obtain the weight of assets on the optimal portfolio:

$$w_p = g + h\mu_p$$

With $g = 1/D\ [B(C^{-1}e) - A(C^{-1}\mu)]$ and
$h = 1/D\ [\mathbf{C}(C^{-1}\mu) - A(C^{-1}e)]$

Then, we can represent the efficient frontier (all the efficient portfolios) in the plane (μ_p, w_p) with

$$= \sqrt{(w'_p C w_p)} = \sqrt{1/D\ (C\mu^2_p - 2A\mu_p + B)}$$

Table 6a:

Optimal composition of the Malaysian Islamic banks Portfolio, Directions of change
(Percent)

Activities Bank	Retail and commercial banking	Corporate & Investment banking	Treasury	Others	Total bank assets (2008) US 000$
Al Rajhi banking and Investment Corporation Malysia Berhad	⇩	⇩⇩	⇧	-	100%
Bank Islam Malysia Berhad (BIMB)	⇩⇩	⇧⇧	⇧	-	100%
EONCAP Islamic Bank Berhad	⇧⇧	⇧	⇩⇩	-	100%
Hong Leong Islamic Bank	⇧⇧	⇩⇩	⇧	-	100%

⇧⇧/ ⇩⇩ Significant increase or decrease, respectively.

⇧/⇩ increase or decrease, respectively.

Table 6b:

Optimal composition of the Malaysian Islamic banks Portfolio
(Percent)

Activities Bank	Retail and commercial banking	Corporate & Investment banking	Treasury	Others	Total bank assets (2008) US 000$
Al Rajhi banking and Investment Corporation Malaysia Berhad	12.3%	37.89%	50%	0	100%
Bank Islam Malaysia Berhad (BIMB)	5.93%	93.82%	0	0.2%	100%
EONCAP Islamic Bank Berhad	68%	21%	16%	0	100%
Hong Leong Islamic Bank	77%	-22%	47%	0	100%

Table 7a:
Actual HHI (Percent)

Activities Bank	Retail and commercial banking	Corporate & Investment banking	Treasury	HHI Assets
Al Rajhi banking and Investment Corporation Malysia Berhad	0,0162	0,3696	0,2182	0,604
Bank Islam Malysia Berhad (BIMB)	0,1681	0, 36	0,0000	0,5281
EONCAP Islamic Bank Berhad	0,3481	0,0324	0,0529	0,4334
Hong Leong Islamic Bank	0,2601	0,0064	0,1681	0,4346

Table 7b:
Optimal HHI (Percent)

Activities Bank	Retail and commercial banking	Corporate & Investment banking	Treasury	HHI Assets
Al Rajhi banking and Investment Corporation Malysia Berhad	0,0151	0,1436	0,2500	0,4087
Bank Islam Malysia Berhad (BIMB)	0,0035	0,8802	0,0000	0,8837
EONCAP Islamic Bank Berhad	0,4624	0,0441	0,0256	0,5321
Hong Leong Islamic Bank	0,5929	0,0484	0,2209	0,8622

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