Journal of Islamic Economic Laws
Vol. 4, No. 2, July 2021: 137-176

Shariah Compliant Macaulay's Duration Model Testing: Evidence from Islamic banks in Indonesia

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ABSTRACT

The purpose of this research is to test Shariah compliant duration models on Islamic banks in Indonesia. This will be achieved using data of earning assets and risk bearing liabilities of Indonesian Islamic banks from 2009 to 2019. Using multiple regressions the results suggest that Shariah compliant duration models are robust to calculate duration of earning assets, return bearing liabilities and Islamic banks. This research adds to the previous research of testing Shariah compliant duration model. Ultimately, it will improve profitability, risk efficiency and Shariah efficiency by improved Shariah compliant measures of risk management. This will ultimately improve market capitalization and returns stability in the long run. A major limitation of the study is very short length of data of Islamic banks. Still another limitation is difference in commencement of business of various Islamic banks that makes length of data unequal.

Key words: Islamic Banks, Earning Assets, Return Bearing Liabilities, Duration Model, Maturity Gap Risk Management model testing

INTRODUCTION

The focus of developments in Islamic financial services industry is Islamic banking. Islamic banking shares a common platform with conventional banks in overwhelming majority of the countries making them face similar risks with different impact (Archer and Karim, 2019). This different impact is also evident

in their respective balance sheets (Chattha, 2013; Chattha et al., 2020). The activities of Islamic banks are exposed to a variety of risks such as credit risk, counterparty risk, equity investment risk, market risk, rate of return risk and liquidity risk (IFSB, 2005; Chattha, 2013; Archer and Karim, 2019). A major adverse affect of such risks is reduced market value of equity (Bierwag and Kaufman, 1992; Bierwag et al., 2000; Entrop et al., 2009; Chattha and Alhabshi, 2018).

ROR risk is similar to interest rate risk in Islamic financial institutions (Chattha et al., 2020). It is also sometime referred to as "benchmark rate risk" Chattha and Alhabshi (2018) and has the very much potential to affect the net worth of Islamic financial institution alongwith their off-balance sheet positions, in case not properly managed (Archer and Karim, 2019; Chattha et al., 2020). Islamic Financial Services Board (IFSB) has stressed to guard against the pitfalls of ROR risk in pillar II using duration gap approach.

Duration is the most common measure of risk management introduced by Macaulay (1938) and used for sensitivity against yield curve movements by Hicks (1939). Hicks (1939) work extends the application of duration into estimation of interest rate risk (Radermacher and Recht, 2020). Fisher and Weil (1971) extend the duration for portfolio immunization and Ho (1992) leads duration for non-parallel shifts of yield curve by introducing duration based on some key rates. Bierwag et al. (1978) identifies an important consideration in the development of duration models that the choice of weights in a duration model is arbitrary and is dependent on its use.

It has been established over the period that Islamic bank balance sheets are structurally different from conventional banks (Chattha et al., 2020). This requires them to develop their own risk management models and other measures to tackle their risk exposures (Shah et al., 2021a&b). However, research over the period of time reveals that most of the research in Islamic context is primarily based on applying conventional tools of financial risk modeling and management in Islamic context. Application of the concept of duration in Islamic banks has also received similar

treatment (Chattha and Bacha, 2010; Chattha and Alhabshi, 2017; Chattha and Alhabshi, 2018 and Chattha et al., 2020). Addressing the issue Shah et al. (2020a) proposes a Shariah compliant duration model that requires comprehensive testing.

The purpose of this study is to test the Shariah compliant duration models of Shah et al. (2020a) following the theme of implementing the durations models under the theory of Macaulay's duration Shah et al. (2020b). This study firstly develops a framework of testing a financial model and proceeds by developing a methodology for testing the Shariah compliant duration models. It collects maturity wise data relating to return bearing assets and liabilities of Islamic banks from Pakistan. The model of Shah et al. (2020a) has been tested by developing an alternative duration models excluding the principal amounts from the Shariah compliant duration model. The purpose is to examine the effect of changes in returns on earnings assets and returns paid on return bearing liabilities on the maturity gap risk management of Islamic banks in short run and long run. This research uses multiple regression analysis, Johansen co-integration, error correction model, vector error correction model and threshold vector error correction model.

LITERATURE REVIEW

Literature on Islamic Banks

Discussing the impact of changes in monetary policy on financial institutions it has been found that Islamic banks respond to monetary policy similar to large conventional banks (Zaheer et al., 2012). A study on 128 banks finds that privately owned Islamic banks provide more protection to their shareholders' equity as compared to state owned banks (Daher et al., 2015). In a research about volatility and persistence in Islamic and conventional banks it has been reported that Islamic banks are more resilient towards uncertainties, but their resilience varies according to the model of Islamic financial system a country has adopted (Fakhfekh et al., 2016). The results of Beltrame et al. (2016) suggest highly negative correlation between interest rates and returns of Islamic banks. However, they report that negative effect can be mitigated

with growth in profit sharing investment accounts. This leads us to the finding that Islamic banks also receive affect from variations in interest rates.

Sadiq et al. (2017) find that Islamic banks in Pakistan are less cost efficient due to excess liquidity, inadequate support and competition from conventional banks. Addressing the financial sector of Pakistan using DEA technique in another study it has been found that insurance sector in Pakistan is more technically efficient than banking sector (Shah and Masood, 2017). Also the Islamic financial sector has done better allocation of resources than their conventional counterparts (Shah and Masood, 2017). Hamza and Saadazoui (2018) in their work on Islamic banks report that interest rate changes negatively affect the financing of Islamic banks. Although the results in performance analysis of Islamic and conventional banks are similar but discussing the usage of credit risk transfer techniques it has been discovered that implementation of credit risk management techniques are not similar in both contexts rather there exists Shariah compliance constraints in case of Islamic banks (Saeed and Ayub, 2017).

The impact of credit and liquidity risk has been analyzed by a few researches where they find no relation between the two and recommend different treatment (Trad et al., 2017; Ghenimi et al., 2017). Research over the period of time finds that although size and capital expansion positively affect profitability but negatively affect liquidity. Similar results have also been reported by Shafiullah and Shamsuddin (2018) who while addressing the topic of risk management find that Islamic banks possess higher liquidity risk but lower insolvency and credit risks as compared to conventional banks. In additions, they discuss the issue of operational risk and report that it declines with increase in numbers and qualifications of members of Shariah supervisory board. The relationship between sukuk and conventional bonds has been analyzed in terms of factors that affect correlations between the two. The results suggest that money market liquidity, stock market liquidity and credit information are the factors affecting volatility in emerging and developing markets almost similarly (Bhuiyan, 2017). Nawaz and Farzana (2018) analyze management of

investment risks in Islamic and conventional banks and find that both types of banks use similar risk management practices for management of their investments.

In another study on performance analysis of banking sector it has been found that profitability of banks is affected similarly in case of Islamic and conventional banks in response to changes in interest rates (Ahmed et al, 2018). Chattha and Alhabshi (2018), report that Islamic banks respond similarly to changes in interest rates because they use similar benchmark rates of interest as their conventional counterparts. Therefore, in order to disintegrate themselves they require a separate benchmark for pricing.

Chattha and Alhabshi (2018) and Chattha et al. (2020) observe that Islamic banks have longer durations as compared to their conventional parts. These longer durations create a paradox. This is because longer duration means higher risk and higher risk should lead to higher profitability. Contrary to this risk-return principle a comparison of the results suggest that Islamic banks are less profitable as compared to conventional banks (Chattha and Alhabshi, 2018; Chattha et al., 2020). This Islamic-conventional bank risk-return paradox requires investigation. The impact of variations in capital adequacy has also been examined in case of Islamic and conventional banks where it has been found that highly capitalized banks react positively to changes in capital adequacy ratio while the relation reverses in cases of low capitalized banks. The study does not report any difference between Islamic and conventional banks (Narmeen et al., 2018).

Shariah Review of Duration Models:

Shah et al. (2021b) performs review of following duration models and regards them non Shariah compliant.

1. Additive Multiplicative Models:
   These include duration models of Gultekin and Rogalski (1984) examine seven models of duration proposed by Cooper (1977), Bierwag (1977), Bierwag and Kaufman (1978) and Khang (1979).
2. Stochastic Duration Models:
   Duration models of Cox et al. (1979) that are based on

stochastic nature of interest rates.

3. Duration Using Taylor Expansion and Linear Approximation:
   These include duration models of Livingston and Zhou (2005), Tchuindjo (2008) and Dierkes and Ortmann (2015).
4. Effective Duration
   These include duration models of Leland (1994) and Leland and Toft (1996).
5. Duration of Net Income of Banks
   These include duration models of Toevs (1983), Bierwag and Kaufman (1992) and Bierwag and Kaufman (1996).
6. Duration Using logarithmic process:
   This consists of duration model of Pattitoni et al. (2012).
7. Key Rate Duration:
   This consists of duration model of Ho (1992).
8. Principal Component Duration
   These models are based on the works of Willner (1996).
9. Polynomial Time value Duration:
   Such models are based on the works of Osborne (2005), Osborne (2014) and Dierkes and Ortmann (2015).
10. Approximation of duration in non-flat yield curve environment
    This model is an extension of Ho (1992) model of key rate duration.
11. Dedicated Duration
    These models consists of the works of Macaulay (1938), Redington (1952), Fisher and Weil (1971), Zaremba and Rządkowski (2016) and Zaremba (2017).
12. First-Order, Second-Order Durations and Convexities:
    These are present value of cash flow duration models of Alps (2017).
13. Approximating Duration Using Insurance risk Management properties
    These are based on the works of Möhlmann (2017) and Schlütter (2017).
14. Orthogonalising the duration
    Such models consist of the works of Dechow et al. (2004), Chen (2014) Weber (2017) and Chu et al. (2017).

15. Implied Duration: A measure for equity duration
    This mode of duration has been proposed by Dechow et al. (2004).
16. Duration of an organization
    This model has been forwarded by Weber (2018) using the works of Dechow et al. (2004), Campbell and Vuolteenaho (2004), Hansen et al. (2008), Lettau and Wachter (2007) and Santos and Veronesi (2010).
17. Equity Duration & Book Value Duration
    Mohrschladt and Nolte (2018) extend the works of Merton (1973), Sweeney and Warga (1986), Dechow et al. (2004), Lettau and Wachter (2007), van Binsbergen et al. (2012), Schröder and Esterer (2012), Weber (2018) Leibowitz (1986) and Kadiyala and Subrahmanyam (2000) to propose these models.
18. Duration Model of Accounts Receivable
    This model has been proposed by Xu and Ma (2018).
19. Duration of Assets and Liabilities of Insurance Company
    Fernándeza et al. (2018) propose such duration models for assets and liabilities of insurance companies based on expected values of cashflows, time and interest..
20. Duration Measures for Corporate Project Valuation
    These are duration models of Arnold and North (2008) for evaluating corporate projects.
21. Shariah Compliant Duration Model
    Chattha et al. (2020) and Shah et al. (2020b) Shah et al. (2021a&b) recommend and Shah et al. (2020a) propose Shariah compliant models of duration for earning assets and return bearing liabilities of Islamic banks. These models have been tested by Shah et al. (2021b).

Having reviewed the literature on Islamic banks and various duration models developed and tested so far, the objective in this research is to further test the Shariah compliant duration model of Shah et al. (2020)a and tested by Shah et al. (2021b).

METHODS

This research uses the methodology of Shah et al. (2021b) for testing Shariah compliant duration models. Following Shah et al. (2021b) this research uses data relating to financial assets and liabilities of various maturity ladders as reported in various financial statements of Islamic banks in Indonesia Pakistan for the period 2009 to 2019. Maturities are calculated in terms of Stohs and Mauer (1996). According to them maturities of less than 1 year are taken at actual periods. Whereas maturities ranging above 1 to 2 years are taken at 1.5 years, 2 to 3 years are taken at 2.5 years, 3 to 4 years are taken at 3.5 years, 4 to 5 years are taken as 4.5 years. However, for the last category that is primarily over 5 years or 10 years, the maturities are calculated on the assumption that every following year has the same proportion of assets or liabilities as the one immediately preceding until 100% of the values are allocated.

Descriptive statistics of the data consist of Mean, Variance, Skewness and Kurtosis. Skewness has been measured by the third moment from mean divided by second moment to the ½ power. Kurtosis is square root of fourth moment from mean divided by second moment. The descriptive statistic has been used to confirm the observations of Bildersee (1975) Gultekin and Rogalski (1984), Chen (2014), Weber (2017) and Chu et al. (2017) that returns are skewed leptokurtic. The research also calculates t-statistics to ensure the hypotheses that qual zero. This has been achieved by calculating the product of 's to the square root of years in sample period and taking its ratio to the standard deviation of yearly estimates. Lastly, average of R^2 and standard deviation of R^2 has been presented after adjusting for degrees of freedom. These are meant to measure the dependency between risk and return.

Procedure for testing a financial model has also been explained by Shah et al. (2021b). Their framework for testing the duration model has been given hereunder:

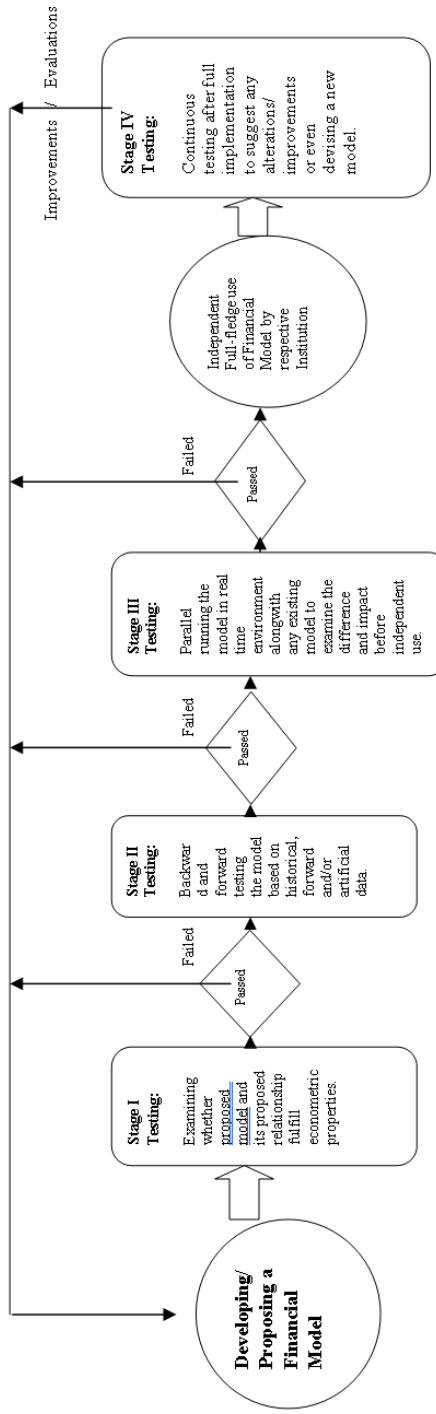

Figure1. Framework for testing a Financial Model

According to them, the relationship of return with duration can be expressed using the following function:

$$R_{i,t} = \alpha + b_1 DUR_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where $R_{i,t}$ is the net return margin b_1 is estimated coefficient and $DUR_{i,t}$ is duration.

Guletkin & Rogalski (1984) provide three hypotheses to be tested on duration models using multiple regression analysis that have been amended for use in Shariah context by Shah et al. (2021b) as under:

> "The relationship between returns volatility and Shariah compliant duration is linear; Shariah compliant duration translates the effect of changes in rates of return, benchmark rates and maturities on returns volatility of Islamic banks; and, the markets for Islamic banks are efficient."

All three hypotheses have been tested using the function as under:

$$\begin{aligned} &\mathrm{R}(n)_{r,o,t} \\ &= \bar{\Upsilon}1(n)_{r,o,t} + \bar{\Upsilon}2(n)_{r,o,t} Dk(n)_{(r-1)(o-1)(t-1)} \\ &+ \bar{\Upsilon}3(n)_{r,o,t} Dk^2_{(r-1)(o-1)(t-1)} + \bar{\Upsilon}4(n)_{r,o,t} \frac{ROR_{A(o-1)(t-1)}}{IBOR_{(r-1)(t-1)}} \\ &+ \bar{\in}(n)_{r,o,t} \end{aligned} \quad (2)$$

In the above functions $R_{r,o,t}$ is the net return margin on earning assets, $\bar{\Upsilon}'s$ are average estimated coefficients, $DK_{(r\text{-}1)(o\text{-}1)(t\text{-}1)}$ is the duration of kth assets calculated using return and benchmak rates of the previous period and $DK^2_{(r\text{-}1)(o\text{-}1)(t\text{-}1)}$ is the square of duration to check linearity and lastly $\frac{ROR_{A(o-1)(t-1)}}{IBOR_{(r-1)(t-1)}}$ is the factor to check whether duration normalizes reversed present values.

The duration of earning assets have testing by regressing the independent variables on returns earned on earning assets.

Similarly the duration of liabilities has been tested using the function:

$$r(n)_{r,o,t} = \Upsilon 1(n)_{r,o,t} + \Upsilon 2(n)_{r,o,t} Dk(n)_{RBL(r-1)(o-1)(t-1)} + \Upsilon 3(n)_{r,o,t,i} Dk^2_{RBL(r-1)(o-1)(t-1)} + \Upsilon 4(n)_{r,o,t} \frac{ROR_{RBL(o-1)(t-1)}}{IBAR_{(r-1)(t-1)}} + \in (n)_{r,o,t} \quad (3)$$

In order to examine the relationship this research examines two models of Shariah compliant duration of Shah et al. (2020a). The model of Shah et al. (2020a) to be tested in this research for earning assets is:

$$D_{EA} = \sum_{i=1}^{n} \frac{\left[\frac{\sum_j^J \sum_i^{N_j} P_{EAij}(1+ror_{EAij})^{t_n}}{(1+IBOR_{ij})^{t_n}}\right] \times t_n}{\sum_j^J \sum_i^{N_j} P_{EAij}\left(1+ror_{EAij}\right)^{t_n}} \quad (4)$$

And for return bearing liabilities is:

$$D_{RBL} = \sum_{i=1}^{n} \frac{\left[\frac{\sum_j^J \sum_i^{N_j} P_{RBLij}(1+ror_{RBLij})^{t_n}}{(1+IBAR_{RBLit})^{t_n}}\right] \times t_n}{\sum_j^J \sum_i^{N_j} P_{RBLij}\left(1+ror_{RBLij}\right)^{t_n}} \quad (5)$$

This methodology complies earlier works of Lanstein and Sharpe (1978) and various subsequent studies such as Lettau and Wachter (2007), Chen (2014), Weber (2018) and Shah et al. (2021b).

For the purpose of this research the changes in returns of Islamic banks have been calculated in terms of Shah et al. (2020) a as hereunder:

$$\Delta NI = \left(D_{EA} \times EA \times \frac{1+\Delta ROR_{EA}}{1+\Delta IBOR} - 1\right) - \left(D_{RBL} \times RBL \times \frac{1+\Delta ROR_{RBL}}{1+\Delta IBAR} - 1\right) \quad (6)$$

Where:

Δ = Change
NI = Net income
D_{EA} = Duration of earning assets
D_{RBL} = Duration of risk bearing liabilities
EA = Earning Assets
RBL = Return Bearing Liabilities
ΔROR_{EA} = Change in rate of return on assets
$\Delta IBOR$ = Change in interbank offered rates
ΔROR_{RBL} = Change in rate of return on liabilities
$\Delta IBAR$ = Change in industry average rates of return on liabilities

However, besides testing the duration of assets and liabilities it also tests the duration gap of Islamic banks. The duration gap has been calculated in terms of Shah et al . (2020) as under:

Duration Gap = Duration of Earning Assets – Duration of Return Bearing liabilities (7)

Regression function to be used for testing duration gap shall take the following form:

$$\Delta NI = \Upsilon 1(n)_{r,o,,t} + \Upsilon 2(n)_{r,o,t} Dk(n)_{IB(r-1)(o-1)(t-1)} + \Upsilon 3(n)_{r,o,t} Dk^2_{IBs(r-1)(o-1)(t-1)} + \Upsilon 4(n)_{r,o,t} \frac{ROR_{EA(o-1)(t-1)}}{IBOR_{(r-1)(t-1)}} - \Upsilon 5(n)_{r,o,t} \frac{ROR_{RBL(o-1)(t-1)}}{IBAR_{(r-1)(t-1)}} + \in (n)_{r,o,t} \quad (8)$$

RESULTS AND DISCUSSION

Table 1. List of Islamic commercial banks in Indonesia and data period

Sr #	Name of Bank	Data Period
1	PT. Bank Aceh Syariah	2016-2019
2	PT BPD Nusa Tenggara Barat Syariah	2018-2019
3	PT. Bank Muamalat Indonesia	2009-2019
4	PT. Bank Victoria Syariah	2010-2019
5	PT. Bank BRI Syariah	2009-2019
6	PT. Bank Jabar Banten Syariah	2009-2019
7	PT. Bank BNI Syariah	2009-2019
8	PT. Bank Syariah Mandiri	2009-2019
9	PT. Bank Mega Syariah	2009-2019
10	PT. Bank Panin Dubai Syariah	2010-2019
11	PT. Bank Syariah Bukopin	2010-2019
12	PT. BCA Syariah	2010-2019
13	PT. Bank Tabungan Pensiunan Nasional Syariah	2015-2019
14	PT. Maybank Syariah Indonesia	2010-2019

Data Source: Statistik Perbankan Syariah 2009-2019

Table 2. Summary Descriptive of Durations of Earning Assets

Maturities M=Months Y=Years	Variance	Skewness	Kurtosis
Upto 3M	44.27%	0.4718	3.91
3M> to 6M `	31.35%	0.3712	2.79
6M> to 12M	29.38%	0.3785	3.25
1Y> to 2Y	31.32%	0.5965	4.97
2Y> to 3Y	35.22%	0.4645	4.67
3Y> to 5Y	32.34%	0.3234	5.71
5Y>	49.77%	0.3436	5.78

Table 3. Summary Descriptive of Benchmark rates Earning Assets

Maturities M=Months Y=Years	Variance	Skewness	Kurtosis
1 Months	12.27%	0.4675	3.45
3 Months `	13.35%	0.4894	3.56
6 Months	13.43%	0.6821	2.17
1 Year and Above	12.31%	0.6794	3.97

Table 4. Summary Descriptive of Rate of Return rates on Earning Assets

Maturities M=Months Y=Years	Variance	Skewness	Kurtosis
Upto 3M	34.21%	0.4785	3.31
3M> to 6M `	31.47%	0.4123	3.45
6M> to 12M	33.37%	0.4589	3.76
1Y> to 2Y	38.32%	0.4428	2.97
2Y> to 3Y	31.37%	0.4765	5.78
3Y> to 5Y	32.13%	0.4178	6.72
5Y>	30.34%	0.5176	5.22

Table 5. Summary Descriptive of Returns earned on earning assets

Maturities M=Months Y=Years	Variance	Skewness	Kurtosis
Upto 3M	12.32%	0.7425	5.37
3M> to 6M `	19.73%	-0.6145	4.91
6M> to 12M	13.78%	-0.5432	4.53
1Y> to 2Y	37.43%	-0.3245	3.23
2Y> to 3Y	39.32%	0.5463	3.77
3Y> to 5Y	41.32%	0.4981	3.21
5Y>	51.44%	0.4237	5.79

Table 6. Summary Descriptive of Return Bearing Liabilities

Maturities M=Months Y=Years	Variance	Skewness	Kurtosis
Upto 3M	37.32%	0.4231	4.23
3M> to 6M `	32.24%	0.7124	6.56
6M> to 12M	27.85%	0.2378	7.47
1Y> to 2Y	45.43%	0.6756	4.12
2Y> to 3Y	45.88%	-0.4235	3.56
3Y> to 5Y	41.32%	-0.8675	5.35
5Y>	42.57%	-0.6234	5.12

Table 7. Summary Descriptive of Returns paid on Return Bearing Liabilities

Maturities M=Months Y=Years	Variance	Skewness	Kurtosis
Upto 3M	18.76%	0.6215	3.21
3M> to 6M `	21.23%	0.7237	4.23
6M> to 12M	22.24%	0.6745	4.39
1Y> to 2Y	27.83%	0.4391	6.21
2Y> to 3Y	34.88%	-0.2734	5.01
3Y> to 5Y	31.32%	-0.3691	5.43
5Y>	32.57%	-0.2141	5.69

The results descriptive statistic in tables 2 to 7 conform Bildersee (1975), Gultekin and Rogalski (1984), Chen (2014), Weber (2017) and Chu et al. (2017) about confirmation of skewed and leptokurtic distribution. Besides, Various tests have been performed for implications of duration measures. The tests have been performed using maturity-wise data of Islamic banks relating to their return bearing assets and liabilities. The results of testing the duration models on earning assets, return bearing liabilities and duration of Islamic banks have been reported hereunder. The results have been presented in 4 different versions of return-duration regression equations that have been incorporated at the top of each respective table. Tables 11, 15 and 19 are based on regression equations incorporating all the respective variables. However, in rest of the tables from tables 8 to 19 excluding tables 11,15 and 19 one or more of the variables have been omitted.

For each of the holding period using model expressed at the top of tables 8 to 19 there are coefficients for each of the maturity bracket as regression coefficient estimate and respective first order autocorrelation. The table also shows p-values calculated on the basis of t-statistics of This testing procedure corresponds to testing mechanism of Fama and MacBeth (1973). have been calculated across return on earning assets and duration of earning assets relationships of entire Indonesian Islamic banking sector that has helped in obtaining period by period estimated alongwith the confidence intervals of significance tests. In the final columns of tables 8 to 19 R^2 and S (R^2) have been presented, which are coefficient of determination and its standard deviation.

Table 8: Regression Results D_{EA} Equation 1

$$r(n)_{r,o,t,i} = Y1(n)_{r,o,t,i} + Y2(n)_{r,o,t,i} Dk(n)_{EA(r-1)(o-1)(t-1)i+} \bar{e}\,(n)_{r,o,t,i}$$

Period	*Y*1	*Y*2	*Y*3	*Y*4	ρ̇(*Y*1)	ρ̇(*Y*2)	ρ̇(*Y*3)	ρ̇(*Y*4)	p(*Y*1)	p(*Y*2)	p(*Y*3)	p(*Y*4)	R^2	$S(R^2)$
Upto 3M	30.73	-0.45			0.43	0.05			0.077	0.071			0.25	0.19
3M> to 6M`	31.25	-0.31			-0.36	0.02			0.077	0.127			0.22	0.17
6M> to 12M	29.77	0.33			0.34	-0.32			0.052	0.172			0.20	0.12
1Y> to 2Y	38.71	-0.35			-0.41	0.02			0.017*	0.132			0.50	0.32
2Y> to 3Y	34.25	-0.27			-0.32	0.02			0.031*	0.114			0.40	0.35
3Y> to 5Y	35.27	-0.31			0.21	0.03			0.004*	0.117			0.31	0.21
5Y>	37.45	-0.51			0.13	0.01			0.055	0.323			0.28	0.19

***at 5% level of significance**

Explanation: indicates the level of rates of return is not significantly between maturity brackets. in the second column is negative and insignificant conforming to the observation of Chattha et al. (2020) that Islamic banks have higher duration and lower profitability. Non zero serial correlation of indicate interrelationship between the rates of returns. Serial correlation close to zero values of indicate durations are not interrelated. The significant p-values of and show reliability of results.

Table 9: Regression Results D_{EA} Equation 2

$$r(n)_{r,o,t,i} = Y1(n)_{r,o,t,i} + Y2(n)_{r,o,t,i} Dk(n)_{EA(r-1)(o-1)(t-1)i} + Y3(n)_{r,o,t,i} Dk^2_{EA(r-1)(o-1)(t-1)i} + \bar{e}\,(n)_{r,o,t,i}$$

Period	*Y*1	*Y*2	*Y*3	*Y*4	$\dot{\rho}(Y1)$	$\dot{\rho}(Y2)$	$\dot{\rho}(Y3)$	$\dot{\rho}(Y4)$	p(*Y*1)	p(*Y*2)	p(*Y*3)	p(*Y*4)	R^2	$S(R^2)$
Upto 3M	24.7	0.48	-1.37		0.38	0.041	0.021		0.162	0.152	0.021*		0.33	0.27
3M> to 6M`	25.3	0.41	-1.22		0.02	0.031	-0.031		0.037*	0.045	0.017*		0.34	0.29
6M> to 12M	35.7	0.34	-0.93		0.57	-0.071	-0.031		0.042*	0.171	0.027*		0.47	0.38
1Y> to 2Y	34.2	0.33	-0.44		-0.32	-0.037	-0.025		0.031*	0.137	0.022*		0.49	0.41
2Y> to 3Y	28.1	0.26	-0.97		-0.21	-0.031	0.035		0.041*	0.141	0.037*		0.41	0.39
3Y> to 5Y	25.2	0.22	0.83		-0.37	0.034	0.027		0.021*	0.117	0.041*		0.45	0.36
5Y>	21.7	0.47	-0.85		0.09	0.003	0.033		0.174	0.215	0.070		0.45	0.32

*at 5% level of significance

Explanation: has largely remained between 20 and 30 indicating no big difference in rates of return between maturity brackets. Values of and indicate no significant linear relationship between returns on assets and duration. exhibits negative signs to show negative and significant showing non linear relationship of duration with returns over 1 year maturity brackets. Serial correlation values of indicate interrelationship between the rates of returns. However, serial correlation of and that durations are not interrelated.

Table 10: Regression Results D_{EA} Equation 3

$$r(n)_{r,o,t,i} = Y1(n)_{r,o,t,i} + Y2(n)_{r,o,t,i} Dk(n)_{EA(r-1)(o-1)(t-1)i} + Y4(n)_{r,o,t,i} \frac{ROR_{A(o-1)(t-1)i}}{IBOR_{(r-1)(t-1)i}} + \bar{\varepsilon}(n)_{r,o,t,i}$$

Period	*Y*1	*Y*2	*Y*3	*Y*4	$\dot{\rho}(Y1)$	$\dot{\rho}(Y2)$	$\dot{\rho}(Y3)$	$\dot{\rho}(Y4)$	p(*Y*1)	p(*Y*2)	p(*Y*3)	p(*Y*4)	R^2	$S(R^2)$
Upto 3M	31.44	0.51		1.39	0.78	0.03		0.01	0.009*	0.172		0.031*	0.67	0.51
3M> to 6M`	25.23	-0.39		1.53	-0.54	-0.05		0.01	0.012*	0.213		0.017*	0.34	0.29
6M> to 12M	22.25	-0.25		1.78	0.34	-0.04		-0.03	0.018*	0.192		0.049*	0.45	0.36
1Y> to 2Y	34.25	0.35		0.62	-0.51	-0.04		-0.05	0.039*	0.129		0.032*	0.43	0.25
2Y> to 3Y	19.23	-0.29		1.22	-0.41	0.04		0.03	0.042*	0.328		0.045*	0.32	0.23
3Y> to 5Y	31.22	-0.35		0.22	0.31	0.01		0.02	0.031*	0.413		0.012*	0.23	0.26
5Y>	19.25	-0.52		0.29	0.67	0.02		0.01	0.029*	0.173		0.045*	0.41	0.37

*at 5% level of significance

Explanation: indicates no big difference of rates of return between over 1 year maturity brackets. exhibit positive signs to show positive relationship with returns showing rates of return and benchmark rates significantly affect long term relationship of return with duration.

Table 11: Regression Results D_{EA} Equation 4

$$r(n)_{r,o,t,i} = Y1(n)_{r,o,t,i} + Y2(n)_{r,o,t,i} Dk(n)_{EA(r-1)(o-1)(t-1)i} + Y3(n)_{r,o,t,i} Dk^2_{EA(r-1)(o-1)(t-1)i} + Y4(n)_{r,o,t,i} \frac{ROR_{A(o-1)(t-1)i}}{IBOR_{(r-1)(t-1)i}} + \bar{\varepsilon}\,(n)_{r,o,t,i}$$

Period	*Y*1	*Y*2	*Y*3	*Y*4	$\dot{\rho}(Y1)$	$\dot{\rho}(Y2)$	$\dot{\rho}(Y3)$	$\dot{\rho}(Y4)$	p(*Y*1)	p(*Y*2)	p(*Y*3)	p(*Y*4)	R^2	$S(R^2)$
Upto 3M	31.24	0.41	-1.31	-0.32	-0.42	0.02	0.02	0.02	0.031*	0.067	0.031*	0.017*	0.62	0.51
3M> to 6M`	33.19	0.78	-1.34	-0.74	0.35	-0.04	0.02	0.02	0.041*	0.157	0.021*	0.037*	0.67	0.42
6M> to 12M	37.78	0.75	-1.61	0.23	-0.56	0.02	0.01	0.01	0.024*	0.145	0.037*	0.024*	0.44	0.35
1Y> to 2Y	25.23	0.74	-1.39	-0.45	0.14	-0.04	-0.04	-0.05	0.012*	0.111	0.017*	0.037*	0.63	0.51
2Y> to 3Y	28.24	0.67	-1.21	-1.34	0.12	0.03	-0.06	0.03	0.037*	0.137	0.022*	0.020*	0.27	0.21
3Y> to 5Y	25.25	0.25	-1.23	-0.78	-0.24	0.02	0.04	0.02	0.017*	0.016*	0.015*	0.054	0.42	0.35
5Y>	25.27	0.27	-0.57	-0.69	0.23	0.09	0.03	0.01	0.015*	0.145	0.025*	0.042*	0.27	0.19

*at 5% level of significance

Explanation: indicates no big difference of rates of return between maturity brackets particularly over 1 year. shows that the relationship between return and duration is not linear. shows that rates of return and benchmark rates significantly affect long term relationship of return with duration. Serial correlation values of , and are close to zero, which shows that durations are not interrelated.

Table 12: Regression Results D_{RBL} Equation 1

$$r(n)_{r,o,t,i} = Y1(n)_{r,o,t,i} + Y2(n)_{r,o,t,i} Dk(n)_{RBL(r-1)(o-1)(t-1)i+} \bar{e}\,(n)_{r,o,t,i}$$

Period	*Y*1	*Y*2	*Y*3	*Y*4	$\dot{\rho}(Y1)$	$\dot{\rho}(Y2)$	$\dot{\rho}(Y3)$	$\dot{\rho}(Y4)$	p(*Y*1)	p(*Y*2)	p(*Y*3)	p(*Y*4)	R^2	$S(R^2)$
Upto 3M	55.23	0.42			0.42	0.07			0.037*	0.141			0.75	0.67
3M> to 6M`	52.47	0.34			0.37	0.02			0.024*	0.138			0.67	0.54
6M> to 12M	34.23	0.42			-0.23	0.06			0.041*	0.121			0.58	0.41
1Y> to 2Y	33.67	0.37			-0.22	0.02			0.007*	0.065			0.53	0.57
2Y> to 3Y	47.28	0.31			0.11	-0.07			0.069	0.071			0.20	0.47
3Y> to 5Y	43.28	0.34			0.33	-0.01			0.124	0.081			0.23	0.24
5Y>	44.25	0.42			0.15	0.08			0.097	0.076			0.09	0.26

*at 5% level of significance

Explanation: indicates that level of rates of return is heterogeneous between various liabilities brackets. Values of and in the second column indicate no significant linear relationship between return bearing liabilities and duration. Non zero serial correlation values of indicate interrelationship between the rates of returns. Close to zero serial correlation values of show that durations are not interrelated.

Table 13: Regression Results D_{RBL} Equation 2

$$r(n)_{r,a,t,i} = Y1(n)_{r,a,t,i} + Y2(n)_{r,a,t,i} Dk(n)_{RBL(r-1)(a-1)(t-1)_1} + Y3(n)_{r,a,t,i} Dk^1_{RBL(r-1)(a-1)(t-1)_1} + \bar{\varepsilon}\ (n)_{r,a,t,i}$$

Period	*Y1*	*Y2*	*Y3*	*Y4*	$\dot{\rho}(Y1)$	$\dot{\rho}(Y2)$	$\dot{\rho}(Y3)$	$\dot{\rho}(Y4)$	p(*Y1*)	p(*Y2*)	p(*Y3*)	p(*Y4*)	R^2	$S(R^2)$
Upto 3M	34.47	0.67	-1.65		0.54	0.04	0.06		0.015*	0.121	0.065		0.74	0.41
3M> to 6M`	37.52	0.43	-1.61		0.31	0.08	0.07		0.024*	0.131	0.041*		0.62	0.44
6M> to 12M	44.47	0.51	-1.55		0.73	-0.09	-0.03		0.041*	0.106	0.025*		0.52	0.47
1Y> to 2Y	45.76	0.39	-1.43		-0.67	-0.03	-0.01		0.017*	0.114	0.037*		0.56	0.49
2Y> to 3Y	32.52	0.54	-1.23		-0.81	0.06	0.03		0.095	0.137	0.037*		0.33	0.21
3Y> to 5Y	24.67	0.19	-1.19		-0.78	0.04	0.07		0.123	0.071	0.121		0.37	0.27
5Y>	29.62	0.15	-1.21		0.13	0.01	0.06		0.135	0.087	0.124		0.38	0.23

*at 5% level of significance

Explanation: values are significant from 6 months to 3 years. This shows that the relationship of return duration is not linear. Serial correlation values of are non zero that indicate interrelationship between the rates of returns. However, serial correlation values of and are close to zero, which shows that durations are not interrelated.

Table 14: Regression Results D_{RBL} Equation 3

$$r(n)_{r,o,t,i} = Y1(n)_{r,o,t,i} + Y2(n)_{r,o,t,i} Dk(n)_{RBL(r-1)(o-1)(t-1)i} + Y4(n)_{r,o,t,i} \frac{ROR_{RBL(o-1)(t-1)i}}{IBAR_{(r-1)(t-1)i}} + \bar{\varepsilon}(n)_{r,o,t}$$

Period	*Y*1	*Y*2	*Y*3	*Y*4	$\dot{\rho}(Y1)$	$\dot{\rho}(Y2)$	$\dot{\rho}(Y3)$	$\dot{\rho}(Y4)$	p(*Y*1)	p(*Y*2)	p(*Y*3)	p(*Y*4)	R^2	$S(R^2)$
Upto 3M	29.25	-0.21		1.41	0.62	0.06		0.05	0.012*	0.141		0.031*	0.61	0.47
3M> to 6M`	32.67	-0.27		1.57	0.51	-0.04		0.01	0.031*	0.116		0.024*	0.65	0.58
6M> to 12M	35.25	-0.14		1.32	0.51	-0.02		0.02	0.009*	0.137		0.031*	0.65	0.54
1Y> to 2Y	34.13	-0.13		1.45	-0.51	0.03		-0.09	0.035*	0.317		0.037*	0.69	0.62
2Y> to 3Y	45.14	-0.27		1.43	-0.31	0.17		-0.12	0.051	0.222		0.041*	0.45	0.39
3Y> to 5Y	47.12	-0.29		1.11	-0.30	0.25		0.14	0.042*	0.147		0.021*	0.42	0.37
5Y>	46.44	-0.23		1.09	0.41	0.08		0.74	0.021*	0.124		0.041*	0.29	0.25

*at 5% level of significance

Explanation: exhibit positive signs, this shows that rates of return and benchmark rates significantly affect long term relationship of return with duration. Serial correlation values of are non zero that indicate interrelationship between the rates of returns. However, serial correlation values of and are close to zero, which shows that durations are not interrelated.

Table 15: Regression Results D_{RBL} Equation 4

$$r(n)_{r,o,t,i} = Y1(n)_{r,o,t,i} + Y2(n)_{r,o,t,i} Dk(n)_{RBL(r-1)(o-1)(t-1)i} + Y3(n)_{r,o,t,i} Dk^2_{RBL(r-1)(o-1)(t-1)i} + Y4(n)_{r,o,t,i} \frac{ROR_{RBL(o-1)(t-1)i}}{IBAR_{(r-1)(t-1)i}} + \bar{\varepsilon}\,(n)_{r,o,t,i}$$

Period	*Y*1	*Y*2	*Y*3	*Y*4	$\dot{\rho}(Y1)$	$\dot{\rho}(Y2)$	$\dot{\rho}(Y3)$	$\dot{\rho}(Y4)$	p(*Y*1)	p(*Y*2)	p(*Y*3)	p(*Y*4)	R^2	$S(R^2)$
Upto 3M	13.24	0.45	-1.23	-0.31	0.63	0.01	0.25	0.76	0.012*	0.146	0.031*	0.047*	0.57	0.43
3M> to 6M`	13.65	0.67	-1.37	-1.37	-0.54	0.35	-0.45	0.81	0.041*	0.107	0.026*	0.022*	0.45	0.37
6M> to 12M	21.27	0.55	-0.54	-1.54	-0.55	0.32	-0.34	0.24	0.032*	0.122	0.035*	0.026*	0.73	0.65
1Y> to 2Y	24.55	0.52	-0.78	1.45	0.35	-0.26	0.34	-0.25	0.041*	0.134	0.025*	0.023*	0.55	0.45
2Y> to 3Y	34.76	0.61	-0.57	-0.47	0.54	-0.14	0.37	-0.62	0.019*	0.094	0.032*	0.042*	0.79	0.61
3Y> to 5Y	33.69	0.24	-0.56	-0.56	-0.18	0.12	0.76	-0.77	0.023*	0.141	0.037*	0.036*	0.24	0.21
5Y>	33.54	0.23	-0.97	-0.51	0.24	0.25	0.81	0.25	0.041*	0.145	0.046*	0.025*	0.21	0.21

*at 5% level of significance

Explanation: shows that the relationship between return and duration is not linear. exhibits positive signs this shows that rates of return and benchmark rates significantly affect long term relationship of return with duration. Serial correlation values of are non zero that indicate interrelationship between the rates of returns. However, serial correlation values of , and are close to zero, which shows that durations are not interrelated.

Table 16: Regression Results D_{IBs} Equation 1

$$\Delta NI_i = Y1(n)_{r,o,t,i} + Y2(n)_{r,o,t,i} Dk(n)_{IBs(r-1)(o-1)(t-1)i+} \bar{e}\,(n)_{r,o,t,i}$$

Period	*Y1*	*Y2*	*Y3*	*Y4*	*Y5*	$\dot{\rho}(Y1)$	$\dot{\rho}(Y2)$	$\dot{\rho}(Y3)$	$\dot{\rho}(Y4)$	$\dot{\rho}(Y5)$	p(*Y1*)	p(*Y2*)	p(*Y3*)	p(*Y4*)	p(*Y5*)	R^2	S(R^2)
Upto 3M	27.34	-0.39				0.36	0.07				0.076	0.058				0.13	0.11
3M> to 6M`	28.74	-0.27				-0.33	0.18				0.082	0.097				0.15	0.10
6M> to 12M	25.23	-0.29				-0.34	-0.22				0.047*	0.083				0.23	0.19
1Y> to 2Y	28.27	-0.27				-0.37	0.04				0.011*	0.228				0.52	0.43
2Y> to 3Y	31.39	-0.25				-0.28	0.07				0.037*	0.129				0.43	0.35
3Y> to 5Y	32.41	-0.29				0.19	0.06				0.019*	0.141				0.44	0.33
5Y>	35.37	-0.43				0.10	0.02				0.055	0.214				0.32	0.22

*at 5% level of significance

Explanation: indicates above 1 year rates of returns are very close between maturity brackets. conforms to the observation of Chattha et al. (2020) that Islamic banks have higher duration and lower profitability. Non zero serial correlation of indicates interrelationship between rates of returns. Serial correlation values of is close to zero, which shows that durations are not interrelated.

Table 17: Regression Results D_{IB} Equation 2

$$\Delta NI_i = Y1(n)_{r,o,t,i} + Y2(n)_{r,o,t,i} Dk(n)_{IB(r-1)(o-1)(t-1)i} + Y3(n)_{r,o,t,i} Dk^2_{IB(r-1)(o-1)(t-1)i} + \equiv (n)_{r,o,t,i}$$

Period	*Y*1	*Y*2	*Y*3	*Y*4	$\dot{\rho}$(*Y*1)	$\dot{\rho}$(*Y*2)	$\dot{\rho}$(*Y*3)	$\dot{\rho}$(*Y*4)	p(*Y*1)	p(*Y*2)	p(*Y*3)	p(*Y*4)	R^2	$S(R^2)$
Upto 3M	23.33	0.51	-1.52		0.41	0.11	0.04		0.093	0.076	0.043*		0.45	0.39
3M> to 6M	22.19	0.48	-1.42		0.57	0.04	-0.07		0.048*	0.088	0.025*		0.51	0.45
6M> to 12M	28.27	0.53	-0.85		0.32	-0.08	-0.05		0.036*	0.145	0.000*		0.39	0.28
1Y> to 2Y	31.29	0.45	-0.57		-0.55	-0.05	-0.06		0.029*	0.129	0.000*		0.34	0.27
2Y> to 3Y	29.22	0.47	-0.92		-0.91	-0.04	0.04		0.037*	0.166	0.037*		0.55	0.49
3Y> to 5Y	30.97	0.46	0.67		-0.23	0.05	0.03		0.044*	0.065	0.004*		0.56	0.51
5Y>	28.25	0.55	-0.42		0.41	0.06	0.04		0.159	0.191	0.045*		0.29	0.25

Explanation: Values of and negate linear relationship and show negative long run non linear relationship of duration with returns. Close to zero serial correlation values of and show that durations are not interrelated.

Table 18: Regression Results D_{EA} Equation 3

$$\Delta NI_i = Y1(n)_{r,o,t,i} + Y2(n)_{r,o,t,i} Dk(n)_{IB(r-1)(o-1)(t-1)i} + Y4(n)_{r,o,t,i} \frac{ROR_{A(o-1)(t-1)i}}{IBOR_{(r-1)(t-1)i}} - Y5(n)_{r,o,t,i} \frac{ROR_{RBL(o-1)(t-1)i}}{IBAR_{(r-1)(t-1)i}} + \equiv (n)_{r,o,t,i}$$

Period	*Y*1	*Y*2	*Y*3	*Y*4	*Y*5	$\dot{\rho}$(*Y*1)	$\dot{\rho}$(*Y*2)	$\dot{\rho}$(*Y*3)	$\dot{\rho}$(*Y*4)	$\dot{\rho}$(*Y*5)	p(*Y*1)	p(*Y*2)	p(*Y*3)	p(*Y*4)	p(*Y*5)	R^2	S(R^2)
Upto 3M	25.75	-0.59		1.43	1.31	0.78	0.03		0.01	0.07	0.000*	0.081		0.000*	0.000*	0.71	0.65
3M> to 6M	27.93	-0.65		1.64	1.47	-0.54	-0.05		0.01	0.12	0.003*	0.174		0.001*	0.000*	0.53	0.48
6M> to 12M	31.44	-0.48		1.41	1.32	1.64	-0.04		-0.03	0.01	0.000*	0.125		0.004*	0.017*	0.41	0.31
1Y> to 2Y	33.22	-0.56		1.42	1.59	-0.51	-0.04		-0.05	0.13	0.008*	0.167		0.012*	0.043*	0.39	0.32
2Y> to 3Y	35.26	-0.47		1.67	1.36	-0.41	0.04		0.03	0.14	0.000*	0.047*		0.007*	0.031*	0.46	0.39
3Y> to 5Y	36.47	-0.49		1.23	1.48	0.31	0.01		0.02	0.15	0.009*	0.005*		0.019*	0.029*	0.32	0.25
5Y>	33.39	-0.42		1.42	1.54	0.67	0.02		0.01	0.12	0.001*	0.123		0.034*	0.000*	0.49	0.44

*at 5% level of significance

Explanation: show that rates of return and benchmark rates significantly affect long term relationship of return with duration. Serial correlation values of are non zero that indicate interrelationship between the rates of returns. However, serial correlation values of , are close to zero, which shows that durations are not interrelated.

Table 19: Regression Results D_{IB} Equation 4

$$\Delta NI_t = Y1(n)_{r,a,t,i} + Y2(n)_{r,a,t,i} Dk(n)_{IB(r-1)(a-1)(t-1)i} + Y3(n)_{r,a,t,i} Dk^{1}_{IBs(r-1)(a-1)(t-1)i} + Y4(n)_{r,a,t,i} \frac{ROR_{EA(a-1)(t-1)i}}{IBOR_{(r-1)(t-1)i}} - Y5(n)_{r,a,t,i} \frac{ROR_{RBL(a-1)(t-1)i}}{IBAR_{(r-1)(t-1)i}} + \bar{\varepsilon}\ (n)_{r,a,t,i}$$

Period	*Y*1	*Y*2	*Y*3	*Y*4	*Y*5	$\dot{\rho}$(*Y*1)	$\dot{\rho}$(*Y*2)	$\dot{\rho}$(*Y*3)	$\dot{\rho}$(*Y*4)	$\dot{\rho}$(*Y*5)	p(*Y*1)	p(*Y*2)	p(*Y*3)	p(*Y*4)	p(*Y*5)	R^2	S(R^2)
Upto 3M	33.41	0.73	-1.43	-0.54	-0.51	-0.48	0.13	0.04	0.03	0.09	0.021*	0.132	0.000*	0.017*	0.004*	0.57	0.48
3M> to 6M`	32.57	0.65	-1.54	-0.48	-0.52	0.65	-0.04	0.06	0.05	0.13	0.000*	0.171	0.002*	0.037*	0.043*	0.55	0.40
6M> to 12M	34.32	0.61	-1.56	0.36	-0.47	-0.51	0.15	0.07	0.02	0.11	0.003*	0.031	0.018*	0.024*	0.002*	0.41	0.30
1Y> to 2Y	37.31	0.69	-1.61	-0.45	-0.49	0.23	0.04	0.12	0.08	0.06	0.000*	0.134	0.032*	0.037*	0.021*	0.43	0.31
2Y> to 3Y	36.21	0.68	-1.64	-0.45	-0.44	0.29	0.07	-0.09	0.12	0.08	0.014*	0.024*	0.000*	0.020*	0.034*	0.39	0.29
3Y> to 5Y	34.34	0.55	-1.58	-0.69	-0.42	-0.43	0.06	0.15	0.03	0.15	0.011*	0.076	0.041*	0.054	0.021*	0.49	0.38
5Y>	37.22	0.51	-1.53	-0.67	-0.41	0.41	0.03	0.12	0.07	0.17	0.025*	0.122	0.001*	0.042*	0.000*	0.54	0.41

*at 5% level of significance

Explanation: and negate linear relationship and shows that the relationship between return and duration is not linear. and indicate rates of return and relevant benchmarks affect relationship between net income and duration of Islamic banks. Serial correlation values of , , and are close to zero which shows that durations are not interrelated.

Descriptive statistics tables 2 to 7 of duration of assets and liabilities show that the data has skewed and leptokurtic distributions. The results of the duration functions after incorporating into multiple regression function have been reported in tables 8 to 19. Tables 7 to 11 relate to duration of earning assets, tables 12 to 15 relate to duration of return bearing liabilities and tables 16 to 19 relate to duration of Islamic banks in Indonesia, which is calculated as duration gap.

For testing the hypotheses multiple regression has been used for duration for assets and liabilities in four different combinations that have been reproduced at the top of each of the table, however, table 8 and 12 are based on full equations. The tables produce regression coefficients in columns 1 to 4, autocorrelations in columns 6 to 10, p-values in columns 11 to 14 and the last two columns report means and standard deviations of coefficient of determination.

The results in tables 8, 12 and 16 do not let us accept linearity hypothesis both for duration of earning assets and return bearing liabilities. Tables 7, 13 and 17 lead us to the finding that long term relationship of duration on returns is quadratic i.e., upwards sloping. Tables 8,14 and 18 lead us to the findings that rates of return, interbank offered rates, principal sum and maturities are complete determinants of relationship between duration and returns thereby accepting our second hypothesis. Table 9,15 and 19 lead us to the finding that factor of reversed present values do have relationship with duration in original state. This can be confirmed from making a combined analysis of tables 9&10, 14&15 and 18&19 that by including reversed present value factor into regression function neither the linear relationship is effected nor non-linear relationship. These results conform to Bildersee (1975), Gultekin and Rogalski (1984), Chen (2014), Weber (2017) and Chu et al. (2017).

CONCLUSION

This research uses duration models testing procedures of Guletkin & Rogalski (1984) as amended by Shah et al. (2021b) using multiple regressions to test Shariah compliant duration

models. However, the results of this research although do not conform to all of the previous results of Guletkin & Rogalski (1984) but conform to the results of Shah et al. (2021b). The results of first hypothesis conform to Guletkin & Rogalski (1984) & Shah et al. (2021b) that duration of assets and liabilities do not have linear relationship. In case of second and third hypotheses the results although conform to Shah et a. (2021b) but do not conform to Guletkin & Rogalski (1984). This is because rate of return earned on earning assets and interbank offered rates are significant factors for determining duration of earning assets whereas rate of return return paid on return bearing liabilities and interbank average rates of deposit are significant factors in case of duration on return bearing liabilities. This research confirms the works of Shah et al. (2020a&b) and subsequently of Shah et al. (2021b). This research further confirms the nature and behavior of earning assets and return bearing liabilities of two distinct Islamic countries due to existence of a common feature of Shariah compliance. Furthermore, it answers the observation of Chattha and Alhabshi (2018) and Chattha et al. (2020) that Islamic banks have longer durations with low profitability. This is because Islamic banks have earning assets of longer maturity at similar rates of returns; and on the liabilities they have to offer higher rates of return for liabilities of similar maturities when compared to conventional banks. This makes them bear more risk due to longer duration gap at lower profitability.

Limitations & Future Research Directions

The study mainly focuses duration of earning assets and return bearing liabilities and their relationship with earnings of Islamic banks. Furthermore, as the study is only conducted on Islamic banks of Indonesia, therefore a larger sample and testing in various other banks operating in non-Muslim countries is also recommended to validate the model.

Lastly, The study only deals with assets and liabilities that have maturities alongwith return characteristics. As Islamic banks have various assets and liabilities that do not have returns and maturities therefore a study encompassing such assets and

liabilities will yield more comprehensive results regarding duration of a Islamic banking organization. The study also severely suffers from availability of data. As most of the Islamic banks do not have long histories, alongwith difference in year of commencement of business therefore the length of data is not enough and is unbalanced. The models proposed in this study therefore require continuous testing over the period to better analyze the respective models. This research has been conducted only on such full-fledged Islamic banks that have been involved in business similar to conventional banks. Therefore a study on all Islamic financial institutions that deal with earning assets and return bearing liabilities such as takaful companies, Islamic mutual funds and Islamic microfinance institutions may further be used to validate the model.

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