# VAR and VECM Models on Factors Influencing Performance of Indonesian Islamic Banks

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### Unique Attributes

The *International Journal of Excellence in Islamic Banking and Finance* strives to enhance excellence in Islamic banking and finance sectors all over the world. It is dedicated to the creation and dissemination of cutting-edge knowledge about the issues of great strategic relevance facing Islamic banking and finance sectors.

The journal is also a forward-looking, interdisciplinary forum for discussing pressing corporate governance and regulatory issues related to these important sectors and will network scholars and practitioners in Islamic banking and finance sectors.

The journal emphasises evaluative, empirical, critical and ethical inquiry into the dynamics of Islamic banking and finance sectors in interaction with clientele of a diverse multicultural society.
The journal encourages communication and the sharing of experience and expertise between academics and practitioners. Articles are a good mix of theoretical frameworks blended with experiences, best practices and case studies, to ensure practical implications based on sound intellectual and theoretical rigour.

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In order to meet the challenges facing Islamic banking and finance industry, it is pertinent that serious consideration be given by theoreticians and practitioners to identify the problems and issues at the outset and then to find solutions for them. Striking the right balance between theory and practice and to attain commanding heights of excellence is the only way forward. The journal is dedicated to generate research output of direct relevance to decision makers, while meeting the highest standards of academic research.

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 Impact of global financial crisis on Islamic banks

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The key editorial objectives of International Journal of Excellence in Islamic Banking and Finance include the following:

 Enhancing excellence in research in the domains of Islamic banking and finance;

 Facilitating the exchange of cutting-edge ideas among academics, policymakers and practitioners;

 Providing a forum for generating problem-solving strategies through scientific research, and

 Disseminating useful knowledge electronically throughout the world.

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 Contributors are advised to maintain a sound balance between theory and practice.

 Contributors are encouraged to identify issues and questions raised by their work and to develop the practical implications for managers and public policymakers.

 Empirical papers and case studies, rather than theoretical articles would be preferred.

 A series of short articles on a linked theme appearing in successive issues is particularly welcome.

 Papers that challenge the paradigms and assumptions of a single discipline or function are encouraged.

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The editor will first review each paper. If a paper is judged suitable for publication, it will be sent to at least two referees/reviewers for electronic double-blind peer review or the Editorial Advisory Board. Based on their recommendations, the editor will decide whether the paper should be accepted as is, revised or rejected. The entire process of submission, reviewing and status update will be conducted online.

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 A series of short articles on a linked theme appearing in successive issues is particularly welcome.

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**The reviewing process**

The Editor will first review each paper. If a paper is judged suitable for publication, it will be then sent to at least two referees for electronic double-blind peer review or the Editorial Board. Based on their recommendations, the Editor will then decide whether the paper should be accepted as is, revised or rejected. The entire process is conducted online.

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 Article needs to be typed out in A4 format and submitted in electronic format as a Microsoft Word Dot.doc or dot.rtf format file.

 Article length should be between 2,000 and 4,000 words.

 Article title should be provided; not exceeding ten words.

 A brief resume should be supplied including full name, affiliation, e-mail address and full international contact details.

 A structured abstract, with a maximum of 250 words, set out under the following sub-headings is to be provided:

- Purpose
- Methodology/Approach
- Findings
- Research limitations/implications, if applicable
- Practical implications, if applicable
- Originality/value of paper.

 Up to six keywords that encapsulate the key topics of the paper

 Paper classification as: research paper, viewpoint, technical paper, conceptual paper, case study, literature review or general review.

 Notes should be used only if absolutely necessary and must be identified in the text by consecutive numbers, enclosed in square brackets and listed at the end of the article.

**Figures**

 Figures should be supplied within the article itself.

 All figures (charts, diagrams and line drawings) and plates (photographic images) should be submitted in electronic form, with clear captions. Figures should be of clear quality, black and white or color and numbered consecutively.

 Acceptable standard image formats are: dot.eps and dot.pdf. If you are unable to supply graphics in these formats then please ensure these are one of dot.tif, dot.jpeg, dot.bmp or dot.gif at a resolution of at least 300dpi and at least 10cm wide. Alternatively, electronic figures can be saved and imported from the original software into a blank Microsoft Word document. Figures created in MS PowerPoint are also acceptable.

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**References**

References to other publications should be complete and in Harvard style. They should contain full bibliographical details and journal titles should not be abbreviated. For multiple citations in the same

year use a, b, c immediately following the year of publication. References should be shown within the text by giving the author's last name followed by a comma and year of publication all in round brackets, e.g. (Zairi, 1994). At the end of the article should be a reference list in alphabetical order. For books, reference the full name, title of the book, publisher and the year of publication. For chapters and articles inside books or journals, reference also the title and the specific pages. For electronic sources, include the URL.

**Contents**

# VAR and VECM Models on Factors Influencing Performance of Indonesian Islamic Banks

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## Abstract

**Purpose:** The main purpose of this research is to analyse factors influencing the growth of Islamic banks' assets in Indonesia.

**Design/methodology/approach:** The research adopts Granger Causality Test under Vector Auto-Regression (VAR) method and then it adopts Vector Error Correction Model (VECM) through Impulse Response Function (IRF) and Forecasted Error Variance Decomposition (FEVD) analyses.

**Findings:** Granger Causality Test concludes that industrial production has a-directional relationship with asset growth that supports better economic growth stimulates investment and

savings. But not the other way, the test does not show that asset growth causes industrial production index in the country. The finding also confirms that market share of Islamic banks' asset of even 3.9% in 2012 is still too small to create impact to production output in the country. The VECM model through its IRF and FEVD explains that inflation and interest rate are major variables that negatively affect the asset growth while industrial production, human capital, and office branch excluding channelling contribute positively.

**Research Limitations:** This research is only limited to the discussion of the asset growth of Islamic banks and may not represent a fair assessment of overall performance of Islamic banks during the period of the research.

**Originality/value:** This paper aims to offer analysis method in examining asset growth of Islamic banks in Indonesia from year 2004 to 2012 that may be useful to be applied in other country where Islamic banks also operate.

**Article type**: Research paper

**Keywords**: Islamic bank, asset growth, microeconomic, macroeconomic, VAR, VECM

## Introduction

The Islamic banking development in Indonesia was started with the establishment of Bank Muamalat Indonesia as the first Islamic commercial bank in1992. Since then, the milestones of the development have been well noted along with its rigorous growth. Table 1.1 below explains banking development in Indonesia in term of number of legal entities, number of offices and number of service outlets. From only two commercial banks and 11 Shariah business units and 84 Islamic rural banks existed in 2003, the development is witnessed with the existence of 11 Islamic commercial banks, 24 Shariah business units and 155 Islamic rural banks by March 2012. It also recorded growth of total assets from IDR 7,859 billion or USD 828 million in 2003 to IDR 151,863 billion rupiah or USD 15.9 trillion by March 2012.

**Table 1.1 Number of Islamic Banks in Indonesia**

| Year | ICB | IBU | Offices | OC | IRB |
|---|---|---|---|---|---|
| 2003 | 2 | 11 | 337 | 0 | 84 |
| 2004 | 3 | 15 | 443 | 0 | 88 |
| 2005 | 3 | 19 | 550 | 0 | 92 |
| 2006 | 3 | 20 | 636 | 456 | 105 |
| 2007 | 3 | 26 | 711 | 1,195 | 114 |
| 2008 | 5 | 27 | 953 | 1,470 | 131 |
| 2009 | 6 | 25 | 1,139 | 1,803 | 138 |
| 2010 | 11 | 23 | 1,763 | 1,277 | 150 |
| 2011 | 11 | 24 | 2,101 | 1,277 | 155 |
| 2012* | 11 | 24 | 2,260 | 1,277 | 155 |

*Source: Islamic Banking Statistics, Bank Indonesia*
** Until March 2012*
Note:
*ICB: Islamic Commercial Bank*
*IBU: Islamic Business Unit*
*OC: Office Channelling*
*IRB: Islamic Rural Bank*

The asset market share showed its positive development from 0.6% to 3.9% during the ten-years period (2003-2012) but this has yet attained the expected growth level. According to the Blueprint of Islamic Banking Development 2002 page 22, Bank Indonesia targeted 5% market share of Islamic banks' asset versus national banking in 2011. In addition, Islamic Banking Development Report 2006 page 80 stated that Islamic banks' market share towards the national banking share can be targeted at 5% using acceleration scenario by the end of 2008.

With all target statements as above, all Islamic banks agreed that they should have achieved 5% by the end of 2008 or by the end of 2011. Pohan (2007) suggests that Bank Indonesia must exercise all available options to achieve the 5% targeted market share. In relation to the agenda, Bank Indonesia has released Bank Indonesia Regulation No. 8/3/PBI/2006 concerning *Shariah* service or known as "office channelling", or offering Islamic banking services at conventional offices. Pohan adds that the regulation must be well enforced or to become a compulsory policy for banking head offices to make their outlets as office channels or Islamic banks' services outlets.

However, by the end of 2008 and 2011, Islamic banks failed to achieve its 5% market share target. It was recorded that Islamic banks achieved its total assets of IDR 49 trillions or only 2.1% market share at the end of 2008 and IDR 145 trillions or only 3.8% market share at the end of 2011. This failure has caught attention of many parties because the increase in asset is of paramount importance. Kahf (2004) supports that increase in assets is strongly indicative of the bank's ability to grow and succeed. More importantly, it indicates the bank's ability to generate earnings because growth in asset does not merely raise the amount of money the bank can invest, but it also increases the bank's ability to invest in projects with higher returns.

Using acceleration scenario, Islamic banks failed to achieve its target for 5% market share, however it doesn't mean their asset does not grow. Islamic banks' in Indonesia has failed to achieve 5% market share of the total national banking asset and that was due to its slower growth than the conventional banks. In the year 2008 and 2011, both banks' groups grew but in different speed of growth. As shown on Table 1.5, Appendix 1, the Islamic banks' asset growth was surpassed by the conventional banks' asset growth.

Thus, this research aims to analyse microeconomic and macroeconomic factors that have influenced the slow growth of asset in Islamic banks, which caused the acceleration growth scenario was not achieved. This paper is extended from previous research conducted by Mukhlisin and Muslich (2011) that used data series from March 2004 to March 2010.

Islamic Banking Directorate researchers (LPPS 2006, Bank Indonesia) mentioned three factors such as product and service development, number of office branches and human capital are important determinants of the asset growth under acceleration projection scenario. Mishkin and Eakins (2009:431-432) argue that more loan alternatives (strong product and service development) would contribute better asset management. Also different types of customers (spread in different office branches) and capability of bank's loan officers (human capital) are two other important parameters in banking asset management. Hence these factors are contributing factors to the asset growth.

Likewise, the main macroeconomic variables chosen for this research are interest rate, inflation and GDP. The main variables in macroeconomics such as interest rate, inflation and GDP have become the main consideration in formulating economic and financial policies for investment (Fischer, 1993; Demirguc-Kunt and Detragiache, 1998; Hassan and M. Bashir, 2002). Therefore, financing as the biggest portion in Islamic banks' asset is determined by these variables. In addition, Islamic Banking Directorate (LPPS, 2006) adds that due to different industry characteristic, government support is included as determinant of the asset growth. It is suggested monthly industrial production index as mechanism of GDP measurement can be employed as the focus of this research, as applied by Huang et.al (2008) in their research on causal relationship between energy consumption and GDP growth in 82 countries.

Several microeconomic factors have been identified such as number of office branches and channelling and number of human capital. As for the macroeconomic factors, the variables that may affect the asset growth are interest rate, inflation and industrial production index (as proxy of GDP). Therefore, the problem statement for this research is that the market share of Islamic banks in Indonesia is less than 5% and there is a need to analyse factors that influence Islamic banks' asset growth. The factors identified are number of office branches and channelling, number of human capital, interest rate, inflation, and industrial production index.

This research aims to investigate factors influencing the growth of Islamic banks' assets in Indonesia. The remainder of this paper proceeds as follows. The next section presents literature reviews on performance of Islamic banks and Islamic banks' asset growth. The third section describes research questions and methodology of this research. The fourth section presents results and discussion and the fifth section suggests conclusions, limitation of research and recommendation for further research.

## Literature Reviews

### *Patronage Studies*

**Table 2.1**

**Patronage Studies on Performance of Islamic Banks Literature**

| | A | B | C | D | E |
|---|---|---|---|---|---|
| Demirguc-Kunt and Detragiache (1998) | + | + | + | + | n/a |
| Archer et.al (1998) | n/a | n/a | n/a | n/a | + |
| Hassan and M. Bashir (2002) | + | + | n/a | n/a | n/a |
| Pramono (2004) | ± | n/a | - | n/a | n/a |
| Indriani (2006) | n/a | n/a | + | n/a | n/a |
| Lindiawatie (2007) | + | n/a | n/a | + | n/a |
| Bank Indonesia | n/a | n/a | + | n/a | n/a |
| Sufian et.al (2008) | n/a | + | n/a | n/a | n/a |
| Adiyanto (2009) | n/a | n/a | + | n/a | n/a |

*Notes: + indicates a positive result, ± indicates an equivocal result, - indicates negative or no significant result and n/a indicates that the variable is not investigated/examined in the study*

A: Profitability

B: Efficiency

C: Asset Growth

D: Soundness

E: Governance

The above studies show the gap that becomes the main concern in this research that is to explore the issues on performance of Islamic banks. As presented, none of the studies shows a

comprehensive analysis on asset growth both from microeconomic and macroeconomic factors and particularly on Indonesian Islamic banks. However, indicators or determinants of Islamic banking performance are discussed in different ways (see Hassan and M. Bashir; 2002). According to their finding, controlling for macroeconomic environment, financial market structure, and taxation, the results indicate that high capital and loan-to-asset ratios lead to higher profitability of Islamic banks. On the other hand, Indirani (2006) finds that number of office branch as micro variable influences Islamic banks' asset growth in Indonesia.

***Performance of Banks and Islamic Banks***

Permono (2004) presents his hypotheses that lower interest rate will increase economic growth through investments. There is a negative relationship between interest and investment demands in one hand, a positive relationship between investment and economic growth on the other hand. It means that lower interest rate will increase the demand of inflation due to the fact that interest rate is a factor of investment cost. The multiple increases in investment will increase banks' asset growth hence boost economic growth. The process will be just on opposite; higher interest rate means decrease in investment demand that will lead decrease in banks' asset growth and followed by economic growth. Indirani (2006) finds that number of office branch as micro variable influencing Islamic banks' asset growth. The purpose of the research is to identify what are the factors that give impact to total asset of Islamic banks in Indonesia and to measure the size of the impact. The finding shows that total of assets in Islamic banking industry are influenced by factors such as GDP, real interest rate in conventional banking, and inflation. The study that investigates whether there is an impact from macroeconomic and microeconomic factors in Islamic banks towards their non-performing financing conducted by Lindiawatie (2007). She tests whether previous period factor also exists and which factor gives the most significant impact. Macroeconomic and microeconomic factors identified in her model are GDP, interest rate, inflation, equity, FDR and financing. Using Vector Auto Regression (VAR) with the focus on Impulse Response Function and Variance Decomposition analysis, the finding shows macroeconomic factors such as GDP, interest rate and inflation contribute little impact and direct or positive relationship towards non-performing financing in Islamic banks. Meanwhile, microeconomic factor such as changes in equity has closed relationship with non-performing financing or negative relationship.

Bank Indonesia (LPPS 2007:62-65), also published a research finding on macroeconomic indicators influencing asset growth of Islamic banks. Variables used in the research are asset growth, financing growth, third party fund growth, consumption, GDP, inflation, interest rate. The research reveals several findings such as the following: a. GDP has positive relationship with that of asset growth of Islamic banks during period of observation between 2006-2007; b. Interest rate has negative correlation with that of asset growth of Islamic banks during period of observation between 2003-2007; c. Inflation has negative correlation with that of asset growth of Islamic banks. Inflation rate that slowly decreased from average of 19% to average of 6% during period of observation from 2006 to 2007 has affected the growth of Islamic banks positively. Sufian et.al (2008) investigate the efficiency of the Islamic banking sectors in 16 MENA and Asian countries during the period of 2001-2006. Using Data Envelopment Analysis (DEA) method, the results suggest that the MENA Islamic banks have exhibited higher mean technical efficiency relative to their Asian Islamic bank counterparts. The empirical findings also indicate that banks from the MENA region were the most efficient banks by dominating the top part of efficiency frontier over the period. Factors identified by Adiyanto (2009) in his marketing research are product characteristics, market characteristics, level of competitiveness, targeting and positioning, consumer behaviour, and human capital. He examines strategic analysis on promoting housing credit (KPR) in PT. Bank X. The research concludes that human capital i.e. Consumer Sales Manager as the most influential factor in KPR promotion that leads to increase in sales then banks' asset.

***Determinants of Economic Growth***

Fischer (1993) confirms macroeconomic policy to growth such as inflation reduces growth by reducing investment and productivity growth; budget deficits also reduce both capital accumulation and productivity growth. Examination of exceptional cases shows that while low inflation and small deficits are not necessary for high growth even over long periods, high inflation is not consistent with sustained growth. Macroeconomic factors are also discussed by Demirguc-Kunt and Detragiache (1998) as determinants of banking crisis in the world. When macroeconomic environment is weak particularly during low growth, high inflation and high

interest rates, the crisis tend to erupt. It becomes worst in the country with explicit deposit insurance scheme at risk and weak law enforcement. Derina and Dasril (2006) show a relationship between market structure and economic development changes in the period before and after the financial crisis in 1997. Before the crisis, the market structure negatively affects the economic growth. After the crisis, market structure of the banking industry promotes the growth in the economy. The study also found that credit channelling from banks to domestic manufacturing industry is not adequate enough to support the economic growth to the level prior the crisis. From other macro perspective, Inggrid (2006) attempts to investigate whether financial development leads to growth in developing country like Indonesia. It is found that there is stable long-run equilibrium relationship between the development of financial sector and the real output. Granger Causality test suggests the bi-directional causality for real output and credit volume and one-way causality from spread to real output. VECM results seem to give strong support to the hypothesis that financial system can be an engine of growth in this country.

**Research Questions and Methodology**

The hypothesis of this research is to test whether all microeconomic and macroeconomic factors such as number of office branch and channelling, number of human capital, interest rate, inflation, and industrial production index give impact to the assets growth of Islamic banks for the period of 96 months from March 2004 to February 2012. Therefore the hypotheses are as stated below.

First of all, null hypothesis and alternative hypothesis state whether bi-directional causality exist between asset growth and industrial production index. This is to test macroeconomic factor that exists outside Islamic banks whether it has reciprocal relationship. As argued by Derina and Dasril (2006) that there is no relationship between market demand for investment with supply of funds from banks during the crisis. As this research adopts data from 2004 to 2012, whereby there were two times of the economic crisis occurred in Indonesia i.e. in 1997 and 2007, should be appropriate to test the relationship.

$H_0$ = Industrial production index does not Granger cause asset growth of

Islamic banks in Indonesia

$H_1$ = Industrial production index does Granger cause asset growth of Islamic banks in Indonesia

After that, null hypothesis and alternative hypothesis state all microeconomic factors i.e. number of office branch and channelling and number of human capital.

$H_2$ = Number of office branch and channelling gives impact to asset growth of Islamic banks in Indonesia

$H_3$ = Number of human capital gives impact to asset growth of Islamic banks in Indonesia

Furthermore, the macroeconomic factors are investigated i.e. interest rate, inflation, and industrial production index. Below is the null hypothesis and alternative hypothesis for the following research questions:

$H_4$ = Interest rate gives impact to asset growth of Islamic banks in Indonesia

$H_5$ = Inflation gives impact to asset growth of Islamic banks in Indonesia

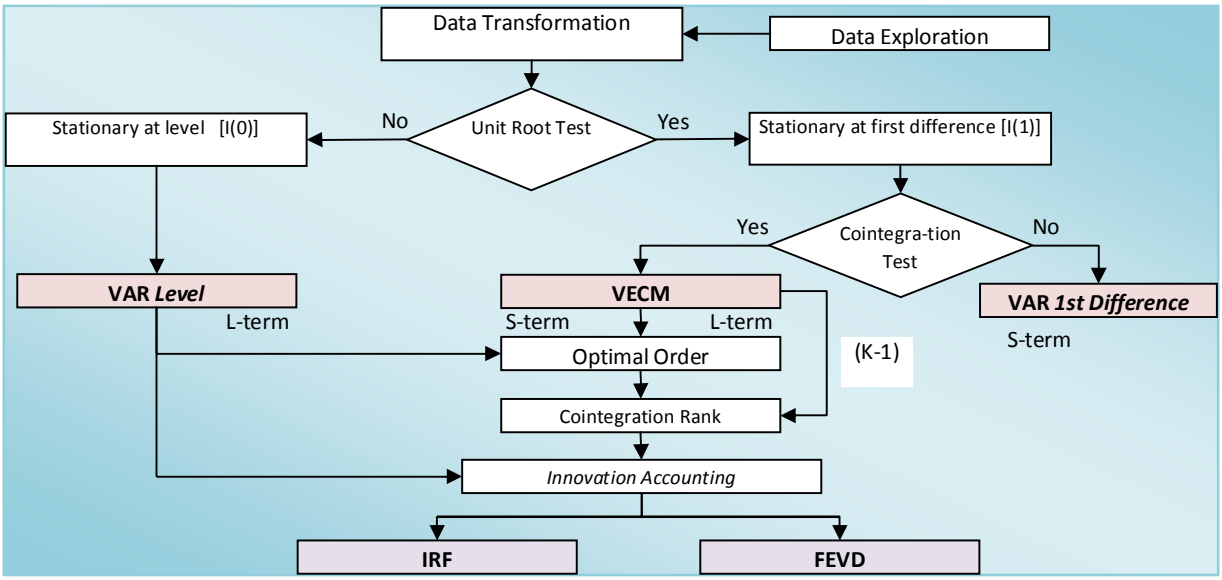
$H_6$ = Industrial Production Index does not give impact to asset growth of Islamic banks in Indonesia

The methodology of this research is quantitative descriptive statistical model, employing Vector Auto Regression (VAR) and Vector Error Correction Model (VECM). VAR simply illustrates the inter-variable causative relation in the system by adding intercept. This method developed by Sims in 1980 (Ascarya, 2008) that considers all variables in the system is endogenous (defined in system) so this method is known as a-theoretically model (theory-free base). If data employed is stationary at first difference and not at level, VAR model will be combined with correction on fault model and turns to VECM. Impulse response function analysis is illustrated to see the response of endogenous variable on other variable shocks in the model. Variance decomposition analysis is also presented to find relative contribution of variable in explaining variability of endogenous variable.

First, Granger Causality test is conducted to examine whether bi-directional causality exists

between variables. After that Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) analysis are conducted to confirm the finding from Granger causality test. The following Flowchart 3.1 explains the steps to conduct both VAR and VECM test processes.

**Flowchart 3.1 VAR and VECM Flowchart Process**




*Source: Ascarya et.al (2008)*

For the purpose of this research, operational variables are used in the test as elaborated in the following Table. 3.1.

**Table 3.1 Operational Variables**

| No. | Information | Source & Period of Data | Type of Data |
|---|---|---|---|
| 1 | Asset Growth | Islamic Banking Statistics, Bank Indonesia, 96 months starting from March 2004 up to February 2012 | Originally numeric but transformed into percentage of growth |
| 2 | Number of Human Capital (human resources employed by Islamic banks) | Islamic Banking Statistics, Bank Indonesia, 96 months starting from March 2004 up to February 2012 | Originally numeric but transformed into Natural Logarithm (NL) |
| 3 | Number of | Islamic Banking Statistics, Bank | Originally numeric but |

| | | | |
|---|---|---|---|
| | Office Branch and Channelling | Indonesia, 96 months starting from March 2004 up to February 2012 | transformed into Natural Logarithm (NL) |
| 4 | Interest rate | Indonesian Statistic on Economics and Finance of Bank Indonesia, 96 months starting from March 2004 up to February 2012 | Percentage |
| 5 | Inflation rate (Consumer Price Index) | Indonesian Statistic on Economics and Finance of Bank Indonesia, 96 months starting from March 2004 up to February 2012 | Index and transformed into Natural Logarithm (NL) |
| 6 | Industrial Production Index | Industrial Production Index is cited from http://www.bps.go.id, 96 months starting from March 2004 up to February 2012 | Index and transformed into Natural Logarithm (NL) |

For this research, the factors identified are microeconomic factors (number of human capital and number of office branch and channelling) and macroeconomic factors (interest rate, inflation and industrial production index) that will be further developed and tested whether they give impact on the asset growth of Islamic banks.

The focus of this research is to find out the impact of number of office branch and channelling and number of human capital as microeconomic factors towards asset growth of Islamic banks. On the other side, the macroeconomic factors to be investigated are interest rate, inflation and industrial production index on their impact to asset growth of Islamic bank.

After referring to previous studies and related theories, therefore the model can be formulated as follows:

$$\text{Asset Growth: } \alpha + \beta 1ofc + \beta 2hr + \beta 3ir + \beta 4Infl + \beta 5ip + e$$

*Where;*

$\alpha$ : constant

$\beta i$ : coefficient, I = 1,2…..5

ofc : Office coefficient; number of office branch and channelling - in Natural Logarithm (NL)

hr : Human Capital - in Natural Logarithm (NL)

infl : Inflation is Customer Price Index – in Natural Logarithm (NL)

ip : Industrial Production Index – in Natural Logarithm (NL)

**Results and Discussion**

***Unit Root Test***

For stationary data test, this research adopts Augmented Dickey Fuller (ADF) and Phillips-Perron test at 5% real level. If t-ADF and t-PP are bigger than critical value of McKinnon or if the probability less than 5% (0.05), it can be concluded that data is stationary (does not have unit root). The following Table 4.1 shows the outputs of unit root test.

**Table 4.1 ADF Test Output**

| Variabel | Nilai ADF | | Nilai Kritis McKinnon 5% | |
|---|---|---|---|---|
| | Level | 1st Difference | Level | 1st Difference |
| **ASSETG** | -10.52237 | -8.519105 | -2.892200 | -2.893956 |
| HR | 0.340434 | -10.01909 | -2.892200 | -2.893956 |
| OFC | 1.307838 | -7.610205 | -2.892200 | -2.893956 |
| IR | -2.606502 | -3.834687 | -2.892200 | -2.893956 |
| INFL | -1.756639 | -9.482761 | -2.892200 | -2.893956 |
| IP | -1.545330 | -15.02071 | -2.892200 | -2.893956 |

*Note: Bold sign shows that data is stationary at McKinnon critical points of 5%.*

Test on unit root is conducted on level to first difference. On ADF test, one variable achieves stationary level i.e. Asset Growth while the rest are converted to stationary on real level of 5% after first difference test. The same result is shown from Phillips-Perron test. It means, all data is integrated on ordo one or in short I (1).

This is important to stationer the time series data above because the study on each variable is not constrained to only a particular episode (Gujarati, 2009). Thus, it is now possible to generalize it to other time periods. It will then serve the purpose of forecasting as to whether the asset growth is influenced by all variables such as number of human capital, number of office and channelling, interest rate, inflation and industrial production index.

***Optimum Lag Test***

**Table 4.2 Optimum Lag Test Output**

| Lag | LogL | LR | FPE | AIC | SC | HQ |
|---|---|---|---|---|---|---|
| 0 | 476.2021 | NA | 8.14E-13 | -10.80924 | -10.63918 | -10.74076 |
| 1 | 586.8142 | 203.4246 | 1.47E-13* | **-12.52446*** | **-11.33403*** | **-12.04511*** |
| 2 | 621.8341 | 59.57404* | 1.52E-13 | -12.50193 | -10.29112 | -11.61171 |
| 3 | 650.3044 | 44.50525 | 1.86E-13 | -12.32884 | -9.097646 | -11.02774 |
| 4 | 664.4128 | 20.10856 | 3.26E-13 | -11.82558 | -7.574016 | -10.11361 |
| 5 | 698.5933 | 44.00247 | 3.74E-13 | -11.78375 | -6.511812 | -9.660905 |
| 6 | 713.7066 | 17.37160 | 7.02E-13 | -11.30360 | -5.011282 | -8.769877 |
| 7 | 738.7574 | 25.33874 | 1.13E-12 | -11.05189 | -3.739200 | -8.107298 |
| 8 | 775.4455 | 32.04943 | 1.53E-12 | -11.06771 | -2.734645 | -7.712244 |

The test on optimum lag is very useful to abolish autocorrelation problems in VAR method. This problem will not exist when Optimum Lag Test is adopted. The standard of optimum lag used in this research based on the shortest value in the table. The results show that equilibrium model reaches optimum lag at Lag1, according to Akaike Info Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn Information Criterion (HQ). Determining appropriate lag is very important in adopting VAR method. If the lag chosen is too short, it would create biasness, if the lag chosen is too long, it would cause longer parameters that will reduce degree of freedom and requires bigger sample size. As shown below, optimum lag is reached at Lag 1, hence, Lag 1 will be used for the rest of the tests conducted for this research.

***Results of VAR Stability Test***

VAR stability is required to be tested before conducting further analysis because if it indicates un-stability combined with fault correction model, Impulse Response Function and Variance Decomposition is no longer valid. To test the stability, we can check on stability VAR condition

in form of roots of characteristic polynomial. VAR system considered stable when all of its roots have smaller modulus than one (Gujarati, 2003). Based on VAR system test, we can say that VAR estimation for IRF and VD analysing is stable. After being tested, we conclude that formed VAR model is stable on its lag optimum.

***Co-Integration Test***

**Table 4.3 Co-Integration Test Output**

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| **None **** | **0.437259** | **126.4128** | **94.15** | **103.18** |
| **At most 1 *** | **0.283926** | **72.94381** | **68.52** | **76.07** |
| At most 2 | 0.203360 | 41.88444 | 47.21 | 54.46 |
| At most 3 | 0.150144 | 20.74069 | 29.68 | 35.65 |
| At most 4 | 0.057773 | 5.610683 | 15.41 | 20.04 |
| At most 5 | 0.000820 | 0.076313 | 3.76 | 6.65 |

This test is run in order to get long term inter-variables analysis that are qualified during the integration process, in which all variables except asset growth are stationer at level. First of all, the long-term information is achieved by defining co-integrated rank to find out how many equilibrium of the whole system can explain the relationship.

Co-integrated test results based on trace statistics shows there is one co-integrated rank in real level of 5% in this model. Co-integrated processes are processes that are random in the short-term but tend to move together in the long-term.

***Granger Causality Test***

The purpose of this test is to show bi-directional causality between Asset Growth (ASSETG) and Industrial Production Index (IP). The Granger Causality Test is conducted using Lag 1 after considering optimum lag test on Table 4.2 above.

**Table 4.4 Granger Causality Test Output**

Pairwise Granger Causality Tests
Date: 09/01/12 Time: 20:20
Sample: 2004:03 2012:02
Lags: 2

| Null Hypothesis: | Obs | F-Statistic | Probability |
|---|---|---|---|
| HR does not Granger Cause ASSETG | 94 | 0.81926 | 0.44405 |
| ASSETG does not Granger Cause HR | | 0.14094 | 0.86873 |
| OFC does not Granger Cause ASSETG | 94 | 1.90899 | 0.15425 |
| ASSETG does not Granger Cause OFC | | 6.92824 | 0.00160* |
| IR does not Granger Cause ASSETG | 94 | 0.20441 | 0.81551 |
| ASSETG does not Granger Cause IR | | 1.37089 | 0.25919 |
| INFL does not Granger Cause ASSETG | 94 | 1.30741 | 0.27566 |
| ASSETG does not Granger Cause INFL | | 0.21019 | 0.81083 |
| IP does not Granger Cause ASSETG | 94 | 4.21761 | 0.01778* |
| ASSETG does not Granger Cause IP | | 0.59842 | 0.55187 |
| OFC does not Granger Cause HR | 94 | 8.38670 | 0.00046* |
| HR does not Granger Cause OFC | | 1.09079 | 0.34040 |
| IR does not Granger Cause HR | 94 | 0.19220 | 0.82548 |
| HR does not Granger Cause IR | | 1.11921 | 0.33109 |
| INFL does not Granger Cause HR | 94 | 0.67673 | 0.51087 |
| HR does not Granger Cause INFL | | 0.23945 | 0.78757 |
| IP does not Granger Cause HR | 94 | 0.40071 | 0.67104 |
| HR does not Granger Cause IP | | 6.11385 | 0.00325* |
| IR does not Granger Cause OFC | 94 | 0.98953 | 0.37581 |
| OFC does not Granger Cause IR | | 0.88504 | 0.41630 |
| INFL does not Granger Cause OFC | 94 | 0.42515 | 0.65499 |
| OFC does not Granger Cause INFL | | 0.18106 | 0.83469 |
| IP does not Granger Cause OFC | 94 | 0.89229 | 0.41335 |
| OFC does not Granger Cause IP | | 6.27050 | 0.00283* |
| INFL does not Granger Cause IR | 94 | 1.74431 | 0.18069 |
| IR does not Granger Cause INFL | | 0.93422 | 0.39671 |
| IP does not Granger Cause IR | 94 | 1.11108 | 0.33373 |
| IR does not Granger Cause IP | | 0.87024 | 0.42238 |
| IP does not Granger Cause INFL | 94 | 1.95380 | 0.14777 |
| INFL does not Granger Cause IP | | 14.1616 | 4.6E-06* |

The output of the Granger Causality Test is presented on the above table. It is seen that null hypothesis of Industrial production index and asset growth of Islamic banks in Indonesia whether they have bi-directional or a-directional causality is rejected at 5% significant level. It means

alternative hypothesis that states Industrial production index does Granger cause asset growth of Islamic banks in Indonesia is accepted. Better economic growth stimulates investment that involves Islamic banks either in a way of financing the existing projects or savings generated from better income of the people. This is consistent to Inggrid (2006) and other references in Inggrid such as Demetriades and Hussein (1996), Arestis and Demetriades (1996), Kul and Khan (1999) (in Boulila, Ghazi and Trabelsi, Mohamed (2002), Chuah and Thai (2004) in their research in Gulf developing countries. However, the two crises that occurred in 1997 and 2007 are not seen to create different analysis as argued by Derina and Dasril (2006) that the market demand for investment in the particular period of economic crisis does not meet equilibrium with the supply from the banks' funding. This can be explained that the aggregate data from 2004 to 2012 is not able to trace particular movement of the economic crisis or Islamic banks are not sensitive to the crisis.

As for the finding that states no a-directional causality between asset growth and industrial production index is explained by the fact that market share of Islamic banks' asset 3.9% is too small to give impact to production output in the country. Unlike the finding of Inggrid et.al, that uses aggregate total of financial sector contribution in the country (mixed Islamic and conventional financial sectors) which influences industrial production output, this study confines to Islamic banks only. To confirm the results, the following analysis on Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) are conducted and analysed in the following sub section.

***Impulse Response Function Analysis***

After all pre-estimation test series (roots of unit test, standardization of lag optimum, VAR stability test and co-integrated test) have been conducted and during co-integrated test, it is found that there is one co-integrated rank in real level of 5% in this model. This, further test such as VECM is required. VECM estimation is conducted to find out short and long term analysis. The output of impulse response function analysis for variables that give impact to Islamic banks' asset growth in Indonesia is shown on Figure 4.1 below.

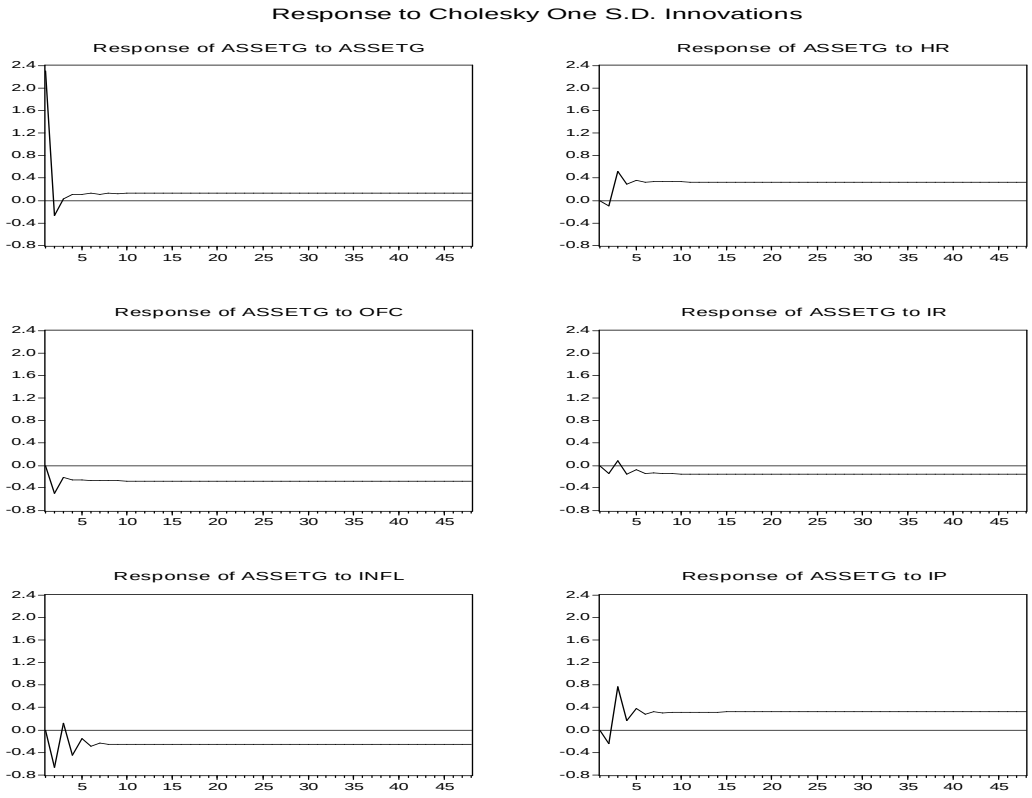



**Figure 4.1 Response of Asset Growth to Its Microeconomic and Macroeconomic Variables**

Figure 4.1 above depicts response of asset growth to human capital (HR), office branch and channelling (OFC), interest rate (IR), inflation (INFL) and industrial production index (IP). Shock response of HR towards ASSETG is negative then positive and the impact is disappeared after Period of 5. It then reaches its stable equilibrium after that period permanently. This shows that number of human capital both in the short term and long-term promise positive response to asset growth. The finding is consistent with Adiyanto (2009) that states that human capital is one determinant to ensure marketing of Islamic banks hence increase its growth. Shock response of OFC towards ASSETG is negative and stays permanently throughout the period. This shows that number of office branch and channelling has permanent negative response to the asset growth both in the short term and in the long term. Thus, it is not consistent with the purpose of Bank Indonesia Regulation No. 8/3/PBI/2006 that stimulates openings of more office channelings in order to stimulate funding growth thus increase asset growth of Islamic banks. The movement of total funding in Islamic banks as shown on Table 1.3, Appendix 1, explains insignificant growth.

It climbed only from 1.9% in 2006 to 3.7% in 2010. However, it rose after the opening of new banks and increase more office branches in 2010 and 2011. Indirani (2006) confirms this relationship that states if number of office is increased for 1 unit therefore the growth of Islamic banks' asset will increase for 94.1318 percent. In sum, opening of office channelings and office branches create different outputs. Office channelings with its purpose only for saving and withdrawal has less sensitivity as compared to office branches that can serve customers with many more banking services.

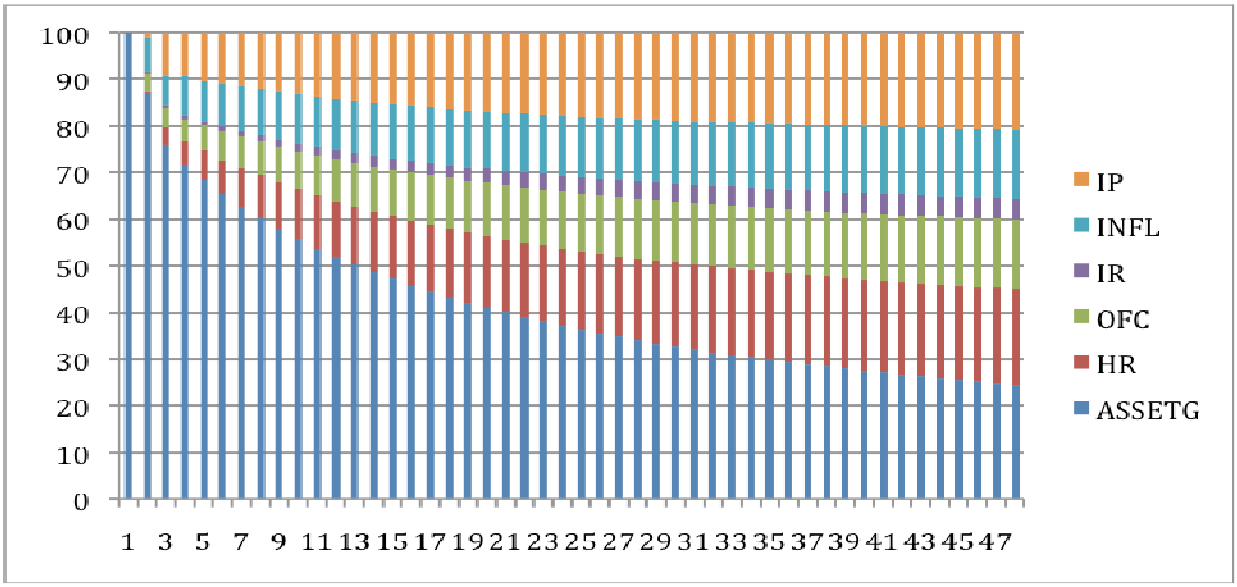
Shock response of IR towards ASSETG is negative and the impact is disappeared after Period 12 and reaches its stable equilibrium after that period. This shows that interest rate as a benchmark of margin and profit sharing determination[1] contributes negative impact to the asset growth in the long term. It is consistent with Permono (2004) that presents his hypotheses that lower interest rate will increase economic growth through investments. Data from April 2004 shows consistent double-digit interest rate up to February 2012. Shock response of INFL is negative towards ASSETG and the impact is disappeared after Period 8 and then reaches its stable equilibrium. Inflation that shows its increasing trend over the years may result a negative feedback from customers hence hamper asset growth. This is consistent with Bank Indonesia study (LPPS 2007:62-65) on inflation rate that slowly decreased from average of 19% to average of 6% from 2006 to 2007 that has affected the growth of Islamic banks positively. It stimulated the real sector to grow and respond the banks' offers. However, this research observes from March 2004 to February 2012 that experienced increasing trend of inflation on average. As a result, higher inflation rate is affecting growth of Islamic banks' asset in the long term permanently. As suggested by Fischer (1993) high inflation is not consistent with sustained growth. Shock response of IP is positive towards ASSETG and the impact is disappeared after Period 8 an then reaches its stable equilibrium after that period. It supports the finding of Inggrid (2006) that there is stable long-run equilibrium relationship between the development of financial sector and the real output.

[1] The interest rate from conventional market that has become a reference for Islamic banks has been an issue as to whether it is fairly applicable. In this case, Bank Indonesia has put initiative towards the setting of Islamic banks' reference rate (Bank Indonesia, 2010)

***Forecast Error Variance Decomposition Analysis***

After making analysis on dynamic behaviour through impulse response, the model can be further analysed through variance decomposition. Graph 4.1 shows fluctuating expression of variables responding to asset growth.

**Graph 4.1 Forecast Error Variance Decomposition Analyses**




| Variable | Size of VD (%) |
|---|---|
| **HR** | 20.4 |
| **OFC** | 14.8 |
| **IR** | 4.6 |
| **INFL** | 14.7 |
| **IP** | 20.7 |
| **SUM** | **75.3** |

FEVD analyses on Graph 3.1 shows the following. Asset growth (ASSETG) shows its own innovations explain almost 90.00% of its error variance from Period 2. It gradually decreases as other factors come in to picture explaining their impact on asset growth (ASSETG). At the end of the period, it explains 24.7%. Among the five variables, human capital/human resource (HR) seems to be the main variable among other microeconomic factors affecting ASSETG starting

from Period 3 and it increases over time up to the end of the period to 20.4% of the error variance of ASSETG. This explains variable as major variable that affects positively towards the asset growth of Islamic bank. Hence, this supports IRF analysis that HR has positive impact towards the asset growth.

Meanwhile, major variable from macroeconomic factors is industrial production index (IP) that affects ASSETG starting from Period 2 and it increases over time up to the end of the period to 20.7% of the error variance of ASSETG. This indicates the same conclusion with IRF analysis above that IP has positive impact towards the asset growth due to the nature of Islamic banks that play their roles in real sectors. As for number of office branch and channelling, it has positive influence to the asset growth to 14.8% at the end of the period. This corrects the IRF analysis that shows negative equilibrium between number of offices and channellings with that of asset growth in the long run. Although the influence is not as high as human capital but it is relatively significant. As for inflation (INFL) and interest rate (IR), it shows its own innovations explain its error variance at 14.7% and 4.6% respectively at the end of the analysis period. Although interest rate has become a benchmark but Islamic banks have their own method to practice its profit sharing mechanism. Hence, fluctuation of interest rate shows only little negative impact to the asset growth.

**Conclusion**

In this research paper, the main determinants of Islamic banks' asset growth have been analysed using Vector Auto Regression (VAR), Vector Error Correction Model (VECM) procedures with analyses of Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD). The IRF and FEVD analysis confirm the finding of Granger Causality Test on bi-directional causality between asset growth and industrial production index, with the following conclusions. From Granger Causality Test, it is found that Industrial production index does Granger cause asset growth of Islamic banks in Indonesia. Better economic growth stimulates investment that involves Islamic banks either in a way of financing the existing projects or savings generated from better income of the people. But not the other way, the test does not show that asset growth causes industrial production index in the country. The finding is

explained by the fact that market share of Islamic banks' asset of 3.9% is too small to give impact to production output in the country. In other test conducted from March 2004 to December 2009, it shows the production output does not give impact to asset growth of Islamic banks. This is to show that as the asset growth of Islamic banks is increasing from December 2009 to February 2012, it begins to take part in the economic growth. From the IRF analyses, it confirms that both human capital and number of office branch and channelling affect asset growth positively both in the short and long term. However, it is significant when number of offices is increasing and it does not apply similarly to number of office channelling.

There is bi-directional causality to answer the hypothesis that states industrial production index has bi-directional causality with asset growth. From Granger Causality Test, it is found that Industrial production index does Granger cause asset growth of Islamic banks in Indonesia. Better economic growth stimulates investment that involves Islamic banks either in a way of financing the existing projects or savings generated from better income of the people. But not the other way, the test does not show that asset growth causes industrial production index in the country. Hence, this finding is explained by the fact that market share of Islamic banks' asset of even 3.9% is still too small to give impact to production output in the country. In the previous test conducted from March 2004 to December 2009 (Mukhlisin and Muslich, 2011), it shows the production output does not give impact to asset growth of Islamic banks. This is to show that as the asset growth of Islamic banks is increasing from December 2009 to February 2012, it begins to take part in the economic growth. VECM confirms that number of office branch and channelling affects asset growth positively with contribution at 14.8% decomposition. Therefore, the Islamic banks should expand their outlets by opening more office branches but not office channelling. VECM confirms that number of human capital affects asset growth positively at 20.4% and appears to be the most stable variable when interacts with asset growth compared to other variables. Thus, to support the growth, preparation for more human capital is required. VECM confirms that inflation contributes major negative impact to asset growth by 14.7%. This certainly explains the impact of increasing trend of inflation that occurred during the period of observation especially after the crisis in 2007-2008. Price distortion affects income distribution and leads uncertainty for investment thus reduces asset growth of Islamic banks. VECM

confirms that interest rate also contributes negative impact to the asset growth by 4.6% at the end of the period of analysis and it is recorded as the variable that is permanently negative when interacts with asset growth in the long run. As inflation serves as factor to interest rate, the finding on interest rate leads to the same conclusion. Although the interest rate has become one benchmark for Islamic banks in determining margin and profit sharing ratio, the bank has its own way to apply margin and profit sharing mechanism in Islamic banking transactions. Thus, with decreasing trend of interest rate in 2009, it was not too sensitive for Islamic banks and customers to respond. VECM confirms that industrial production index contributes positively to asset growth by 20.7%. It supports the finding that industrial production index has relationship with that of asset growth in Granger Test. It explains that Islamic banks interact with real sectors in their banking transaction and promises long-term positive impact.

All identified factors (number of office branch excluding channelling, number of human capital, and industrial production index) are concluded to influence the Islamic banks' asset growth positively. On the other hand, interest rate and inflation are concluded to influence the Islamic banks' asset growth in negative way. Therefore, the conclusion is to reject null hypotheses and accept $H_2$, $H_3$, $H_4$, $H_5$ and $H_6$. From IRF and FEVD analyses, all variables are ranked from the most to the least in their impact to asset growth, such as 1) industrial production index, 2) number of human capital, 3) number of office branch and channelling, 4) inflation, 5) interest rate.

**Recommendations**

The findings of the research suggest some recommendation. Opening more office branch is one strategic plan to accelerate the growth of Islamic banks but not expanding office channelling that is only to serve limited service of Islamic banks. Concurrently, more capable human resources to run Islamic banks are absolutely required. The fact shows that the tools have been provided but lack of human resources to operate Islamic banks may lead to ineffectiveness and hinder the Islamic banks' asset to grow. The initiatives to set up educational institutions that offer special skills in Islamic banks should be welcomed. In addition, standard of curriculum and educational quality management system to ensure eligible and capable graduates are also required. Finally,

Islamic banks should offer more variety of products to attract real sectors as they promise growth for Islamic banks. To date, consumptive financing is more dominant than productive financing, and that does not count yet contribution of Islamic banks to real sectors or national industries at large.

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