CHAPTER FOUR
ANALYSIS AND DISCUSSION

4.1 Preface

This chapter elaborates the finding of Granger Causality tests to examine whether there exists bi-directional causality between asset growth and industrial production index. Furthermore, Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) are carried out using Vector Auto Regression (VAR) framework to confirm the causality relationship.

The preparation and pre-estimation testing are conducted such as the following:

a. Data Exploration
b. Data Transformation
c. Unit Root Test
d. VAR Stability Testing Model
e. Lag Optimum Test
f. Co-integration Test

Statistical analysis for pre-estimates testing is required for further analysis that covers Phillips-Peron stationary test, optimum lag determination and stability test. The stationary test and optimum lag determination are pre-requisites before VAR estimation where Granger Causality Test is conducted while stability test is pre-requisite to arrive at Impulse Response Function (IRF) and Factor Error Variance Decomposition (FEVD) analyses (Lindiawatie, 2007).

4.2 Preparation and Pre-estimation Testing

4.2.1 Data Exploration

Data exploration has been started at the beginning of the research. Variables are chosen according to recommendation of theories and previous studies. Each data has been labelled according to its data type such as the following:

a. Asset growth as ASSETG is in percentage
b. Human capital as HRLN is in numeric and transformed into LN

c. Office branch and channelling as OFCLN is in numeric and transformed into LN
d. Interest rate as IR is in percentage
e. Inflation as INFLLN is in index and transformed into LN
f. Industrial production index as IPLN in index and transformed into LN

4.2.2 Data Transformation

All above data are pooled in the spreadsheet file in monthly format from 2004.3 (March 2004) to 2009.12 (December 2009) as shown on Appendix 1 or as sample shown on Table 4.1 below.

Initially, the following data are not under the same type of data therefore the data that are not in percentage format such as number of human capital, number of office branch and channelling, inflation and industrial production index are transformed using logarithm natural (ln) in the spreadsheet. This refers to argument of McGowan Jr and Ibrahim (2009) who assert taking the first differences of the variables may eliminate, or at least reduce the dependence. An alternative for transformation to differencing is to take the natural logarithm of the ratio of the two levels to generate the percentage rate of change.

Table 4.1 Variables for Asset Growth Model 2004-2009

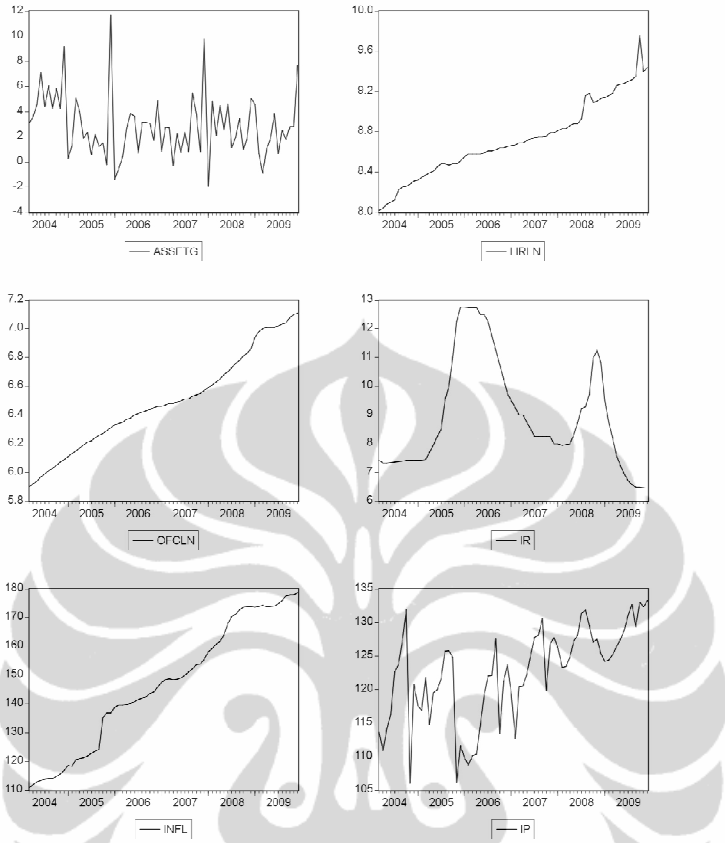
YEAR 2004 SAMPLE

PERIOD	ASSETG	HRLN	OFCLN	IR	INFLLN	IPLN
2004.3	3.05	8.02	5.90	7.42	4.71	4.73
4	3.62	8.04	5.92	7.33	4.72	4.71
5	4.57	8.08	5.94	7.32	4.73	4.74
6	7.09	8.10	5.97	7.34	4.73	4.76
7	4.37	8.12	5.99	7.36	4.74	4.81
8	6.08	8.22	6.01	7.37	4.74	4.82
9	4.22	8.25	6.03	7.39	4.74	4.85
10	5.84	8.26	6.05	7.41	4.74	4.88
11	4.26	8.28	6.07	7.41	4.75	4.66
12	9.19	8.31	6.09	7.43	4.76	4.79

Source: various sources (reorganized data)

For further discussion, Figure 4.1 is presented to give temporary picture on the research variables that are used in the model.

Figure 4. 1 Research Data Trend



Source: Eviews 4.1Graph of Raw Data

From Figure 4.1, it is explained that the asset growth is fluctuating from period to period. In certain periods, it experienced negative growth such as at the 4th quarter of 2005 and 2007 as well as at the 1st quarter of 2009.

As per human capital, it went up steadily over the years except for 3rd quarter of 2009; the period shows the highest number of people recruited. That was due to new opening of Islamic banks i.e. Bank Bukopin Syariah and Bank Panin Syariah. As per office channelling, it increased sharply in 2006 after the release of Bank Indonesia regulation, PBI No. 8/3/PBI/2006 that allows the office channelling exercise.

On the other side, interest rate that is represented by Bank Indonesia Certificate that shows fluctuating trend between 2005 to 2007, but decreased sharply after 2008. This was in response to stimulate the market after the monetary crisis occurred at the end of 2008. Inflation, which is in this case

represented by Consumer Price Index (CPI) shows its increasing trend from early period of observation. It tried to be stable during 2008 but it moved upward a little bit in 2009. Industrial production index is depicted to have its lowest growth at 4th quarter of 2004 and 2005 whereby the rest of the years show fluctuating trend.

4.2.3 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 4.2 shows the outputs of unit root test.

Table 4.2 ADF Test Output

Null Hypothesis: ASSETG has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.181131	0.0000
Test critical values:	1% level	-3.528515	
	5% level	-2.904198	
	10% level	-2.589562	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(HRLN) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=10)

Augmented Dickey-Fuller test statistic
1% level
5% level
10% level

*MacKinnon (1996) one-sided p-values.

Table 4.2 ADF Test Output (Contd.)

Null Hypothesis: OFCLN has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=10)

		t-Statistic
Augmented Dickey-Fuller test statistic		-8.294266
Test critical values:	1% level	-3.528515
	5% level	-2.904198
	10% level	-2.589562

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: IR has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.074121	0.0000
Test critical values:	1% level	-3.530030	
	5% level	-2.904848	
	10% level	-2.589907	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: INFLLN has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic based on SIC, MAXLAG=10)

		t-Statistic
Augmented Dickey-Fuller test statistic		-2.915352
Test critical values:	1% level	-3.533204
	5% level	-2.906210
	10% level	-2.590628

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: IPLN has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.781367	0.0048
Test critical values:	1% level	-3.528515	
	5% level	-2.904198	
	10% level	-2.589562	

*MacKinnon (1996) one-sided p-values.

Test on these unit roots is conducted on level to first difference. It is found that after conducting the tests, all data are stationary at “level” with probability of less than 5% except number of human capital that is stationary at “first difference”. This concludes that logarithm natural (ln) is to stationer variety of data and differencing is to stationer average of data.

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 the variables such as number of human capital, number of office and channelling, interest rate, inflation and industrial production index.

4.2.4 VAR Stability Testing Model

Table 4.3 VAR Stability Test Output

Roots of Characteristic Polynomial
Endogenous variables: ASSETG HRLN OFCLN IR INFLLN IPLN
Exogenous variables: C
Lag specification: 1 1
Date: 06/25/10 Time: 21:09

Root	Modulus
0.981404	0.981404
0.542842 - 0.306725i	0.623504
0.542842 + 0.306725i	0.623504
0.379650	0.379650
-0.262978	0.262978
-0.021496	0.021496

No root lies outside the unit circle.
VAR satisfies the stability condition.

At Lag 1, VAR is found to be stable as the modulus is stated less than 1 (one) as shown on the above table. This means that VAR analysis shall be continued to Optimum Lag Test.

4.2.5 Optimum Lag Test

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 Schwarz Information Criterion (SC) and Hannan-Quinn Information Criterion (HQ), see Table 4.4.

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.

Table 4.4 Optimum Lag Test Output

VAR Lag Order Selection Criteria
Endogenous variables: ASSETG HRLN OFCLN IR INFLLN IPLN
Exogenous variables: C
Date: 06/25/10 Time: 12:52
Sample: 2004:03 2009:12
Included observations: 64

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1254.568	NA	5.17E+09	39.39275	39.59515	39.47249
1	-1106.746	263.3078*	1.58E+08*	35.89832*	37.31508*	36.45645*
2	-1084.936	34.76052	2.53E+08	36.34174	38.97288	37.37828
3	-1059.797	35.35120	3.83E+08	36.68116	40.52667	38.19610
4	-1039.093	25.23320	7.20E+08	37.15915	42.21903	39.15249
5	-1012.420	27.50620	1.26E+09	37.45063	43.72488	39.92237
6	-964.9576	40.04653	1.38E+09	37.09242	44.58105	40.04257

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

4.2.6 Co-Integration Test

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 number of human capital 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 on Table 4.5 below shows one variable that is considered in co-integrated equation on critical value of 5%.

Table 4.5 Co-Integration Rank Test Output

Date: 06/25/10 Time: 12:54
Sample(adjusted): 2004:05 2009:12
Included observations: 68 after adjusting endpoints
Trend assumption: Linear deterministic trend
Series: ASSETG HRLN OFCLN IR INFLLN IPLN
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.488855	140.8713	94.15	103.18
At most 1 **	0.417649	95.23633	68.52	76.07
At most 2 **	0.379525	58.46994	47.21	54.46
At most 3	0.198966	26.01556	29.68	35.65
At most 4	0.146126	10.92967	15.41	20.04
At most 5	0.002755	0.187616	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 3 cointegrating equation(s) at both 5% and 1% levels

Co-integrated processes are processes that are random in the short-term but tend to move together in the long-term. Wooldridge (2003) in McGowan Jr and Ibrahim (2009) shows six month Treasury bill rates and three month Treasury bill rates are both unit root processes that are independent in the short-term but do not float too far apart in the long-term. If either rate moves too far from equilibrium, too high (too low), investors move money from the low (high) rate alternative to the high (low) rate alternative. This process will raise (lower) the rate in the low (high) rate market.

4.2.7 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 4.4 above.

The output of the Granger Causality Test is presented on Table 4.6 below. It is seen that null hypothesis of the following bi-directional and a-directional causality are rejected at 5% significant level;

a. Number of Human Capital does not Granger Cause Asset Growth;
b. Number of Human Capital does not Granger Cause Industrial Production Index, and
c. Inflation does not have bi-directional causality with Interest Rate

None of the findings shows there exist bi-directional causality between Industrial Production Index (IP) and ASSETG. This does not support the finding of Inggrid (2006) and other references of 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.

These studies reach the same conclusion that credit volume has bi-directional causality with real output. The finding further explains when it becomes a government policy in Indonesia; credit will be expanded by all banks and other financial sectors and stimulates production output in the country. Likewise, growth of economic activity requires more capital (both fixed and liquid) that is supplied by financial institution, which then promotes more variety of product and services.

Table 4.6 Granger Causality Test Output

Pairwise Granger Causality Tests
Date: 06/25/10 Time: 12:53
Sample: 2004:03 2009:12
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
HRLN does not Granger Cause ASSETG	**69**	**3.16791**	**0.07970**
ASSETG does not Granger Cause HRLN		0.26787	0.60649
OFCLN does not Granger Cause ASSETG	69	0.94616	0.33425
ASSETG does not Granger Cause OFCLN		0.84835	0.36037
IR does not Granger Cause ASSETG	69	2.07630	0.15433
ASSETG does not Granger Cause IR		1.43288	0.23558
INFLLN does not Granger Cause ASSETG	69	0.97565	0.32688
ASSETG does not Granger Cause INFLLN		7.8E-08	0.99978
IPLN does not Granger Cause ASSETG	69	1.09950	0.29820
ASSETG does not Granger Cause IPLN		0.68130	0.41211
OFCLN does not Granger Cause HRLN	69	0.87144	0.35396
HRLN does not Granger Cause OFCLN		1.62815	0.20643
IR does not Granger Cause HRLN	69	0.02285	0.88031
HRLN does not Granger Cause IR		0.00133	0.97101
INFLLN does not Granger Cause HRLN	69	0.00827	0.92780
HRLN does not Granger Cause INFLLN		0.00562	0.94047
IPLN does not Granger Cause HRLN	69	0.24378	0.62313
HRLN does not Granger Cause IPLN		**8.87735**	**0.00404**
IR does not Granger Cause OFCLN	69	0.06136	0.80513
OFCLN does not Granger Cause IR		0.02317	0.87947
INFLLN does not Granger Cause OFCLN	69	0.04441	0.83374
OFCLN does not Granger Cause INFLLN		0.00916	0.92405
IPLN does not Granger Cause OFCLN	69	0.08057	0.77742
OFCLN does not Granger Cause IPLN		0.36001	0.55055
INFLLN does not Granger Cause IR	**69**	**3.08439**	**0.08369**
IR does not Granger Cause INFLLN		**31.5021**	**4.3E-07**
IPLN does not Granger Cause IR	69	0.26705	0.60705
IR does not Granger Cause IPLN		0.01716	0.89617
IPLN does not Granger Cause INFLLN	69	0.20388	0.65309
INFLLN does not Granger Cause IPLN		0.58540	0.44693

This phenomenal finding that states no bi-directional causality between IP and ASSETG is perhaps explained by the fact that market share of Islamic banks' asset of 2.5% is too small to give impact to production output in the country. Likewise, the production output does not really give impact to asset growth of Islamic banks because Islamic bank is still considered as a new alternative compared to the conventional one to finance economic activities 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. To confirm the results, the following analysis on Impulse Response Function (IRF) and Forecast Error Variance Decomposition (FEVD) are conducted.

4.2.8 Impulse Response Function Analysis

The analysis on the short-term and long-term relationship of the whole variables is continued to impulse test as appeared in the following Figure 4.2 that shows shock response of asset growth towards the rest of the variables at present and in the future.

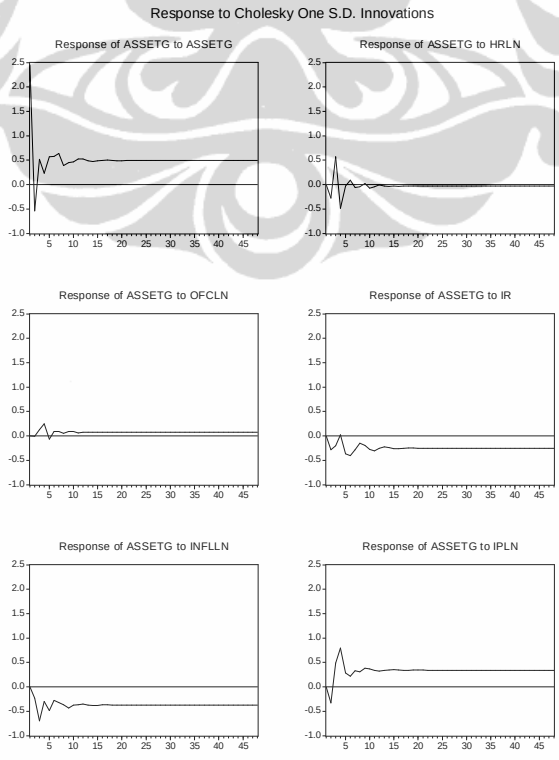


Figure 4.2 Response of Asset Growth To Its Internal and External Variables

Figure 4.2 above depicts response of asset growth to human capital (HRLN), office branch and channelling (OFCLN), interest rate (IR), inflation (INFLLN) and industrial production index (IPLN):

a. Response of HRLN towards ASSETG is negative then positive and the impact is disappeared after Period of 13. It then reaches its stable equilibrium after that period. This shows that number of human capital both in the short term and long-term promise positive response to asset growth. This supports the above Granger Test analyses that conclude number of human capital affects asset growth.
b. Response of OFCLN towards ASSETG is negative then positive and the impact is disappeared after Period 10. It then reaches its stable equilibrium after that period. OFCLN appears to be the variable that reaches its stability in a very short period of time compared to other variables. This shows that number of office branch and channelling has stable positive response to the asset growth both in the short term and in the long term. The Granger Test does not show the relationship, this is perhaps other variables give stronger impact than of number of office branch and channelling.
c. Response of IR towards ASSETG is negative and the impact is disappeared after Period 20. It then reaches its stable equilibrium after that period. IR appears to be the variable that is not stable in the longest period compared to other variables when interacts with asset growth. This shows that interest rate as a benchmark of margin and profit sharing determination contributes negative impact to the asset growth for longest period of period compared to other variables. However, the above Granger Test does not show any relationship between interest rate and asset growth of Islamic bank. This indicates fluctuation of interest rate in the market does not really influence asset growth of Islamic banks. This is answered with its instability when influencing its asset growth.

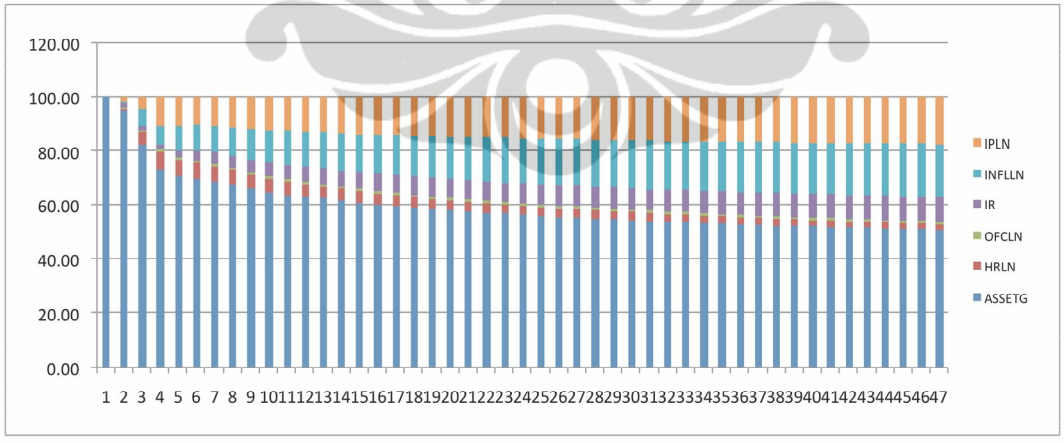
d. Response of INFLLN is negative towards ASSETG and the impact is disappeared after Period 15. It then reaches its stable equilibrium after that period. Inflation that shows its increasing trend over the years may result a negative feedback from customers hence hamper asset growth. From the Granger Test, it shows no relationship between inflation and asset growth that indicates increasing trend of inflation does not contribute positively to the asset growth.

e. Response of IPLN is positive towards ASSETG and the impact is disappeared after Period 13. It then reaches its stable equilibrium after that period. At first, the finding of Granger Test states that industrial production index has no relationship with asset growth, due to the size of Islamic banks. However, under this IRF analysis, it shows that IPLN has positive impact to the asset growth.

4.2.9 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 Analysis



FEVD analyses on Graph 4.1 shows the following:

a. Asset growth (ASSETG) shows its own innovations explain around 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 51%.

b. Among the five variables, inflation (INFLLN) seems to be the main variable affecting ASSETG starting from Period 3 by 7% and increases over time up to the end of the period by 20% of the error variance of ASSETG. This explains inflation as major variable that affects negatively towards the asset growth of Islamic bank. Hence, this supports the previous analyses (Granger Test and Impulse Response Function) that during period of this research the increasing trend of inflation have negative impact towards the asset growth.

c. Second major variable is industrial production index (IPLN) that affects ASSETG starting from Period 4 by 10% and increases over time up to the end of the period by 17% of the error variance of ASSETG. This indicates the same conclusion with IRF analysis above that IPLN has positive impact towards the asset growth due to the nature of Islamic banks that play their roles in real sectors.

d. As for interest rate (IR), it shows its own innovations explain around 3% of its error variance from Period 5 and increases to 9% at the end of the analysis period. This support the same analysis as Granger Test and IRF above that interest rate contributes negatively towards the asset growth. 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.

e. As for number of human capital and number of office branch and channelling, both have positive but insignificant contribution to the asset growth; HRLN explains its impact of 2% and OFCLN of less than 1%. This relates to Granger Test and IRF analyses that both HRLN and OFCLN promise positive long-term impact.

4.3 Economic Analysis

As mentioned earlier that there is one bi-directional causality variable found in the Granger Causality Test such as inflation and interest rate but it does not answer the hypothesis that states industrial production index has bi-directional causality with asset growth. This finding is then confirmed by VECM analysis that states only small contribution of industrial production to asset growth, which is by 17%. The finding is perhaps explained by the fact that market share of Islamic banks' asset of 2.5% is too small to give impact to production output in the country. Likewise, the production output does not really give impact to asset growth of Islamic banks because Islamic bank is still considered as a new alternative compared to the conventional one to finance economic activities in the country. Although both industrial production index and asset growth show no relationship in Granger Test but industrial production shows positive impact in IRF and FEVD. It explains that Islamic banks interact with real sectors in their banking transaction and promises long-term positive impact.

From the above analyses, it confirms that number of office branch and channelling affects asset growth positively both in the short and long term. Although its contribution is insignificant (1%) but it promises better long-term impact to the asset growth.

As for number of human capital, it affects asset growth positively. Although it is not significant (2%) but it promises long term impact the same as number of office branch and channelling. Thus, to support the growth, preparation for more human capital is required to match opening of new office branches and channelling units.

Inflation is confirmed to contribute major negative impact to asset growth by 20%. This certainly explains the impact of increasing trend of inflation that occurred during the period of observation especially after the crisis in 2008. Price distortion affects income distribution and leads uncertainty for investment, thus reduce asset growth of Islamic banks.

The IRF and FEVD analyses also state that interest rate contributes negative impact to the asset growth by 9% at the end of the period of analysis. 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.