CHAPTER III

METHODOLOGY

A. Research Variable and Data Type

Sharia Banking Resilience (SHABAR) Index is arranged based on *trinity of financial system stability* by using 11 indicators classified into 3 major categories namely Islamic Banking Institution Pressure Index, Islamic Banking Institution Intermdiary index, and Islamic Banking Institution Efficiency Index.

Variables reflecting degree of pressure from Islamic banking financial institutions are Non Performing Financing (NPF), Capital Adequacy Ratio (CAR), Return on Assets (ROA), and delta liquidity (ΔL). Variables reflecting Islamic banking intermediation are the Spread Financing margin to DPK margin (SFTD), Gap Financing to Deposi Ratio (Gap FDR), Financing to GDP ratio (F/GDP) and Gap Gross Domestic Product (Gap GDP). Variables reflecting Islamic banking efficiency are Net Operating Margin (NOM), Operational Efficiency Ratio (BOPO), Cost to Income Ratio (CIR), and Overhead Cost to total Operating Revenue (OHC/PO).

Data used in this study is secondary monthly time series data starting from January 2010 until December 2016. The usage of monthly data based on technical statistics consideration related to *degree of freedom* problem and limitation of publication, while the selection time period from 2010 until 2016 based on the period after being issued Act of The Republic Indonesia Number 21 of 2008 concerning Shariah (Islamic) banking. These regulation practice

certainly have undergone evolutionary episodes of juridical legal base not only for the growth and development of sharia banking but also for possibility development islamic window by conventional banks in Indonesia. It was assumed that 1 year is effective period of sosialisation of regulation, where another 1 year is build upcomplete economic situation in Indonesia (normal-recession-crisis) that makes this study applicable for such future situation.

B. Data Collecting Method and Sources

This study uses documentary collecting method Payne and Payne (2004) describe the documentary method as the techniques used to categorise, investigate, interpret and identify the limitations of physical. This method try to analysis documents that contain information about the phenomenon we wish to study (Bailey 1994).

Datas are obtained from various sources published periodically by (i) Bank Indonesia (BI), (ii) Financial Services Authority (OJK) and (ii) Central Bureau of Statistics (BPS) such as *Indonesia Islamic Banking Statistics* (SPSI) and *Indonesia Financial Economic Statistics* (SEKI) report. This study also obtains relevant information from official websites, magazines, journals and articles regarding to the relevant study.

C. Data Analysis Model and Hypothesis Testing

This study uses indexing method with standardization normalization basic year approach to analyze SHABAR index. This method is used to achieve research

objectives and answer the existing problem formulation. This study uses this method because it normalizes the outliers in the data series, making it easy to make adjustments in scale, facilitating the transformation and aggregation of abnormal data. Moreover the main reason for using this method because it is able to illustrate complex and sometimes elusive issues in wide-ranging fields especially banking system.

1. **Steps for Constructing Sharia Banking Resilience (SHABAR) Index (Data Analysis Model & Hyphothesis Test)**

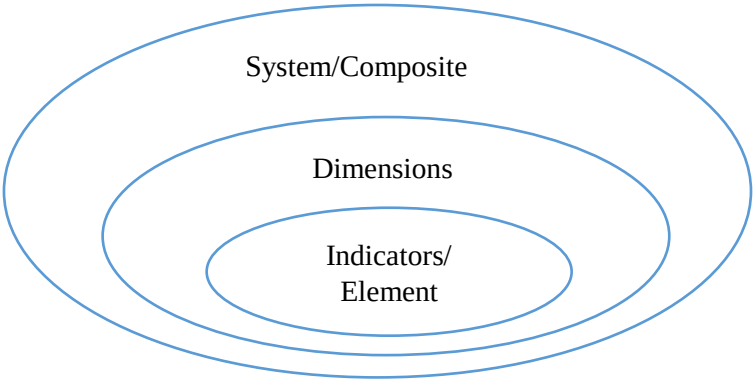
   Step 1: Developing A Theoretical Framework

   1) Complex Adaptive System Theory

      Complexity results from the inter-relationship, inter-action and inter-connectivity of indicators within a system and between a system and its environment. Many natural systems (e.g., brains, immune systems, ecologies, societies included politic and economic) and increasingly, many artificial systems (parallel and distributed computing systems, artificial intelligence systems, artificial neural networks, evolutionary programs) are characterized by apparently complex behaviors that emerge as a result of often nonlinear spatio-temporal interactions among a large number of component systems at different levels of organization. These systems have recently become known as Complex Adaptive Systems (CAS).[1]

[1] Ibid

Banking system as part of economy face same characteristic of complex behawviour from nonlinear interactions among a large number of indicator at different level that emerge of the whole system of even economy and a country. Constructing the resilience of sharia banking can be done by feasible monitoring process of every indicator in the banking system itself, so that every movement that can be measured and advanced with a quick and precise decision.



Source: Marchi, 2014 with adjustment

FIGURE 3.1

Illustration of CAS in Constructing Composite Indicators

2) Financial Cycle Phase Theory

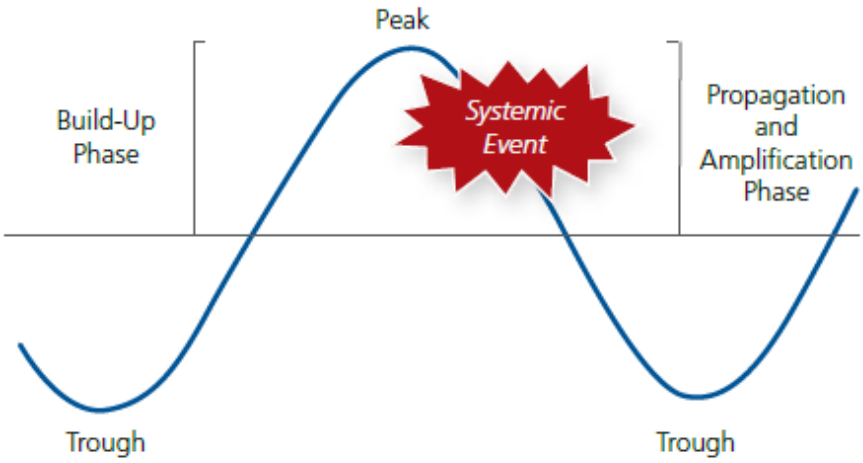
In the financial cycle, the *build up phase* is the stage of source formation interference. In this phase, market participants tend to take advantage of conditions to achieve the greatest profits even though prudential rules have been applied. This phase is illustrated in the upward or upswing cycle segment (Figure 3.1). Under these conditions systemic risk measurement needs to be focused on measurement of financial system imbalance, and measurement against a stress indicator

that can show signs that the financial cycle has been approaching its peak which is interpreted as a risk-taking behavior already excessive

Imbalances detected here are related with the behavior of bank's procyclicality in lending. establishment of financial cycle indicators, as described previously also one of the efforts to detect imbalances in the financial system because of the perception of market participants against economic conditions and behavior take its risks. Furthermore, the source of the materialized disturbance becomes a risk will spread in the propagation phase or *propagation mechanism.* That phase happens after and between the peak of the financial cycle until the cycle reaches basically or trough (Figure 3.1). In this phase the problem occurs in one elements of the banking system tend to be transmitted or propagated on sectors or other elements of the banking system. Therefore, the measurement of risk systemic in this phase generally use cross sectional indicator. Indicator the most needed in this case are indicators that indicate the relationship between physical exposures among financial

system elements, including for every individual element of the financial system is primarily a financial institution and corporation

The last phase is the systemic event phase or also called ss *materialized shock*. The phase is related to the financial crisis. Data in the past shows that the crisis generally occurs around 2 years after the peak of the financial cycle. Thus, systemic event is a very short period in the *propagation phase* due to shock and vulnerability occurs and establishes systemic risk. After systemic event occurs, the downswing segment formed can be U-shaped or V-shaped. If U-shaped, downswing will last deeper and longer in the cycle finance and accompanied by a long recovery period. That condition which has the potential to have structural impacts. If it is V-shaped, downswing will take place in a shorter period and recovery or recovery will also take place quickly. In the financial cycle, systemic events can just does not happen because in



Source: KSK, 2015

FIGURE 3.2

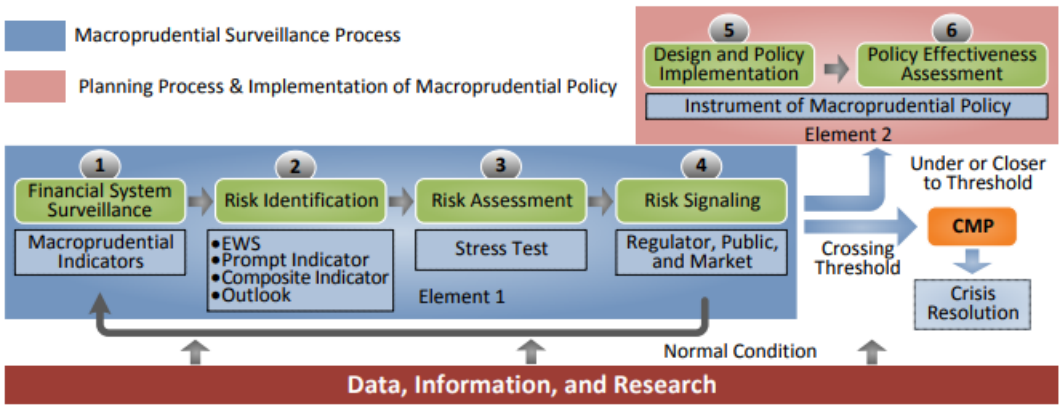
Financial Cycle Phases

the downswing segment market participants are already on automatically adjust its portfolio to reduce potential losses. It depends on the resilience of the elements of the financial system.

3) Defining Resilience and Signal Crisis

4) To determine the level of resilience of sharia banking in Indonesia, the first step is understanding the flows of macroprudential framework in Indonesia in order to identified risk embodied in the financial system which potentially leads to create systemic system. Realizing how to deal with risks spread out, and the precise momentum to release the particular instrument of macroprudential policy so that the potential risks can be prevented and spread accross financial system, macroeconomic, and real sector (Ascarya et al, 2016).

5) This study spesifies to construct such index to monitor the financial system until risk signaling which are the first four steps in conducting macroprudential surveillance process. Macroprudential policy appear in the critical points when crossing below or above the tolerated thresholds. Based on figure 3.3 it happen in fist step of financial system surveillance.



Source: Bank Indonesia

FIGURE 3.3

Conventional Macroprudential Framework in Bank Indonesia

After determining the area of banking resilience, the next step is determine the definition of resilience itself. This definition is done to focus the study on the initial objectives and facilitate the identification of whether the value of the index SHABAR exceeds its threshold or not. If the variable crosses the threshold, a signal is emitted, will determine whether the composite of sharia banking is in a position of resilience or not. The definition of resilience as follow:

The signal is constructed to be a binary variable where $S_{x_t} = (0,1)$. If the variable crosses the threshold, a signal is emitted $S_{x_t} = 1$. Mathematically, it can be described,

$$\{S_{x_t} = 1\} = \{|x_t| > |x_{t*}|\} \quad (4)$$

Meanwhile, If the indicator remains within its threshold boundary, it behaves normally and does not issue a signal, so $S_{x_t} = 0$.

$$\{S_{x_t} = 0\} = \{|x_t| < |x_{t*}|\} \quad (5)$$

Meanwhile, in terms of defining crisis, the research borrows the SHABAR, as follows:

$$\{C_{x_t} = 0\} = \{SHABAR\ Index < Threshold\} \quad (6)$$

$$\{C_{x_t} = 1\} = \{SHABAR\ Index > Threshold\} \quad (7)$$

Where:

S_{x_t} : Signal variable relating indicator x_t in t-period

x_t : Value of indicator x_t in *t*-period

x_* : Threshold of the indicator

$\bar{\partial}_{2\ years}$: Standard deviation of of x_t in 2011

In addition, in taking a conclusive remark, it is important to notice the directional sign [2] may vary depending on whether the indicators (leading indicators) in resilience level equestions above are expressed in absolute terms. After that, it needs to obtain a binary time series of signal or no-signal observations.

Interpreting Crisis and Signal Framework Once the crisis and signal are defined, the evaluation criteria can be conducted by using matrix framework. Kaminsky, et. al (1998) developed matrix crisis-signal framework by using 12 months as signal window horizon, as follows:

TABLE 3.1

The Performance of Individual Indicator by Matrix Crisis-Signal Framework

Table of Statistical Error	Actual	
	Crisis (C=1)	No Crisis (C=0)
Signal Issued (S=1)	Correct Signal (A)	No Stress Event (B)
No Signal Issued (S=0)	Type I Error (C)	Correct Signal (D)

[2] Loc.cit

Source: Ito, et al., 2014 in WP/7/2015 BI

In this matrix, A is the number of months in which the indicator issued a good signal, B is the number of months in which the indicator issued a bad signal or "noise", C is the number of months in which the indicator failed to issue a signal (which would have been a good signal), and D is the number of months in which the indicator refrained from issuing a signal (which would have been a bad signal). It would issue a signal in every month that is to be followed by a crisis (within the next n months, example 12 months), so that A > 0 and C = 0, and it would refrain from issuing a signal in every month that is not to be followed by a crisis (within the next n months, example 12 months), so that B = 0 and D > 0. For sure, none of the indicators fit the profile of a perfect indicator, but the matrix will be a useful reference to assess how close or how far is each indicator from that profile.

6) Determining Evaluation Criteria

This study employs six evaluation criteria in order to assess the performance of indicators which was identified through crisis-signal framework, as follows:

(1) The proportion of observations correctly called $= \frac{A+D}{(B+D)+(A+C)}$, defined as the proportion that all observations correctly bring information about crisis and not crisis. This implies that the higher proportion occurred will lead to best evaluation criteria.

(2) The noise-to-Signal-Ratio $= \frac{\frac{B}{B+D}}{\frac{A}{A+C}}$, it measures the false signals as a ratio of the good signals issued. The selection rule is to pick the variable or model that minimizes the noise to signal ratio (NTS).

(3) The proportion of crises correctly called $= \frac{A}{A+C}$, defined as the proportion of crisis happened once the signal was issued. Thus, the higher of its proportion would be fitting of a perfect indicator in signaling the crisis.

(4) The proportion of false alarm of total alarms issued $= \frac{B}{A+B}$, given that an individual indicator exposes a frequent false signal. Thus, the lower of its proportion would be good to minimize the panic behavior in the markets.

(5) The proportion of crisis given an alarm issued $= \frac{A}{A+B}$, given that an individual indicator generates different signals. This criterion is to select indicators that can maximize the probability of a crisis, given a signal was issued as alarm.

(6) The proportion of probability of crisis given no alarm issued $= \frac{C}{C+D}$, given the signal is important, an occurence of crisis without signals was extremely reduced or minimized.

7) Determining Signalling Horizon

The Study involves various signaling horizons to be chosen as the fit horizon that can predic the crisis. This signaling horizons are range of period that has ability for anticipating a crisis. Kaminsky (1997) uses 24 month signaling horizon. He argued that the longer signaling horizon would enable policy makers to anticipate a crisis. Meanwhile, Bussiere and Fratzscher (2002) set 12 and 18 month as signal horizon. They argues that various time horizons would provide the best achievable trade-off between missing crises and wrong signal. In addition, this paper adds another 3 and 6 month as signaling horizons considering that a crisis is difficult to be predicted. Providing short horizon enables policy makers to react immediately as crisis starts to buildup.

8) Determining Thresholds

Describing conditions on the indices that have been established thresholds required one (thresold) making it easier to determine the conditions and steps to be taken. Beginning the formulation by the reference of Bank Indonesia threshold namely 2 standard deviation (SD), 1,7 SD, and 1,3 SD to construct SHABAR index threshold. Later, the all mentioned thresholds are used to determine the ―level of resilience in Islamic Bank.

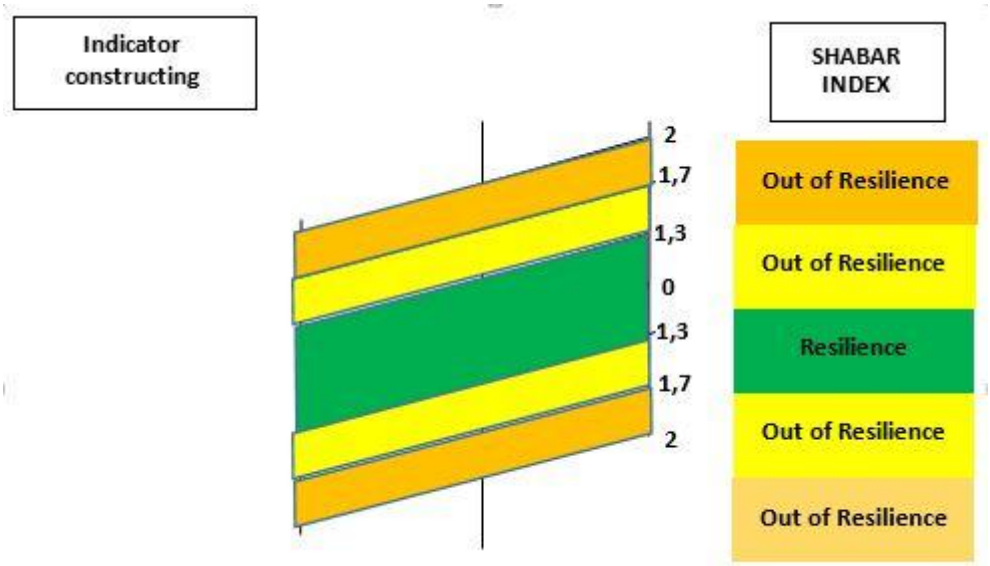


FIGURE 3.5

SHABAR Index's Threshold

Threshold is then translated into the 4 conditions, the resilience condition, alert condition out of resilience, warning condition out of resilience, and crisis conditions.

Step 2: Selecting Varibles (Research Variable and Operational Definition)

This study uses variables derive from all data of IIFS listed in Bank Indonesia. Operational definitions of each variable used in this study are as follow:

TABLE 3.1

Research Variable and Operasional Definition

Varibles representing pressure level of Islamic banking				
No	**Variables**	**Description**	**Measurement**	**Scales**
1	Δ LB y-o-y	Δ Liquidity of bank is Comparison between liquid assets that has been reduced by the primary reserve requirement to total assets. Liquidity assets consisted of cash, demand deposits at Bank, SBI, placements with other BI, HTM SUN, SUN Trading and AFS SUN.*	$\Delta LB = \left(\frac{Liquid\ Assets}{ATMR/TA}\right)$ Compiled data from monthly report of entire Islamic Bank in Indonesia stated in billion rupiah (IDR)	Ratio
2	NPF	Comparison between financing classified as loans substandard, credit doubtful and bad credit with total financing. Financing in this respect is the financing granted to third parties does not include financing other banks.*	$\text{NPF} = \left(\frac{Equity\ Capital}{Risk\ weight\ total\ assets}\right)$ Report at the end of month expressed by percentage	Ratio
3	ROA	Return on assets is Comparison between companies' earning and total assets. ROA is an indicator of how profitable	$ROA = \left(\frac{Net\ income\ before\ tax}{Total\ Assets}\right)$	Ratio

		company is relative to its total assets.*	Report at the end of month expressed by percentage	

Table 3.2 Continuation

4	CAR	CAR as measure of bank's capital, namely the minimum capital adequacy ratio. Comparison between Capital and Risk Weighted credit exposures.*	$CAR = \left(\frac{Capital}{Risk\ Weighted\ Assets}\right)$ Report at the end of month expressed by percentage	Ratio
Varibles represent *idiosyncratic* aspect of Islamic Banking				
5	Spread sb kredit dg sb DPK (SFTD)			
6	Gap GWM-FDR	The difference between FDR with disincentives limit conditions of statutory Reserve (GWM)-Financing to depository ratio (FDR) stipulated by BI. PBI No. 15/16/PBI/2013 about statutory reserve.	FDR > 90% = FDR – 90% 90% < FDR< 78% = 0% FDR < 78% = FDR – 78% Compiled data from monthly report by bank in billion rupiah.	%
7	Gap Credit to long term trend of GDP (Gap GDP)		Compiled data from monthly report by bank in billion rupiah.	

Table 3.2 Continuation

Varibles represent efficiency of IIFS				
8	*Net Income Margin* (NIM)	Net Shows how optimum of a bank in a net profit of major operational activities (lending). Hanafi and Halim (2005)	$NPM = \frac{Margin\ income - margin\ expenses}{Total\ Productive\ assets}$ Compiled data from monthly report by bank in billion rupiah.	Ratio
9	*Biaya Operasional terhadap Pendapatan Operasional* (BOPO)	Operating Cost against Operating, indicates income operational efficiency ratio shows affectivity of bank to push down their cost during running business. (Riyadi, 2004)	$OER = \frac{Total\ operating\ expenses}{Total\ operating\ revenunue} \times 100$ Report at the end of month expressed by percentage	Ratio
10	CIR (Cost to Income Ratio)	This ratio equal total overhead cost of a bank divided by the income generated before accounting for any provisions. The lower the ratio, the more efficient a bank is.	$CIR = \frac{Overhead\ Cost}{Operating\ Income}$ Compiled data from monthly report by bank in billion rupiah	Ratio
11	Cost Efficiency Ratio (OHC/PO)	OHC/PO Indicates how efficiently the bank in managing overhead costs to earn net profit sharing income and non-profit	$OHC/PO = \frac{Overhead\ cost}{total\ operating\ revenue}$	Ratio

*Sources from Nomor PBI 3/30/DPNP and *UU No 21 Tahun 2008*

		sahring income. Riyadi (2004	Compiled data from monthly report by bank in billion rupiah.	

Step 3: Imputation of Missing Data

The data used in this research is secondary data from Bank Indonesia categorized as monthly time series data from January 2010 to Desember 2016. The study period is chosen as a benchmark for sharia banking and financial system of Indonesia on the period experienced a complete regulation after enactment Act No. Number 21 of 2008 Concerning *Sharia (Islamic) Banking* which brought adequate regulation for expansion and operation of Islamic Bank in proper way. This step can be skipped by the availability of adequate data.

Step 4: Normalisation of Data

Sharia Banking Resilience (SHABAR) Index formed using the *statistical normalization* approach base year 2011, when banking performance is in the most stable level compare to the other years.[3]

Statistical Normalization approach Sharia Banking Resilience (SHABAR) Index base year 2011 is used as forming the single index, dimension index, and the main index (SHABAR Index) sequentially. Methodology of calculation using the statistical approach normalization base year 2011, was formed through the following calculation:

[3] ibid

$$Q_t = \sum_{j=1}^{n} \omega_j \frac{x_t^j - \bar{x}_{(based\ year)}}{\bar{\sigma}_{(based\ year)}} \quad (8)$$

Where:

Q_t : Composite Index (Single, dimension, main)

ω_t : Weight value of each variable

x_t^j : Value of variable x_t in t-period

$\bar{x}_{based\ year}$: Average variables of x_t in 2011

$\bar{\partial}_{2\ years}$: Standard deviation of of x_t in 2011

The period of 2011 base year as a benchmark for sharia banking and financial system of Indonesia on the period experienced a complete regulation after enactment Act No. Number 21 of 2008 Concerning *Sharia (Islamic) Banking* which brought adequate regulation for expansion and operation of Islamic Bank in proper way.

Step 5: Weighting and Aggregation for Every Indicators

The result of normalization of each indicator (single index) of Islamic Bank will be merged into an index with a certain weight (dimension index). Weighting will be determined through variance of the standard deviation of the sample mean to put into strengths in the interpretation of SHABAR Index. The approach is expected to perform the synchronization between the perceptions of security conditions Islamic banking financial institutions with the movement of the Index.

The calculation of the weighting method by using variance of the standard deviation can be described in the following formula:

$$Var_{(mean)} = \frac{1}{N} Var(x), where\ \partial_{mean} = \frac{\partial}{\sqrt{N}} \quad (9)$$

Where:

$Var_{(mean)}$: Mean of the Variance (Weight index)

N : Number of observations in the sample used

∂_{mean} : Annually standard deviation of the mean of x_t

∂ : Standard deviation of x_t

The use of positive and negative sign indicates the direction vector of each indicator against which SHABAR index was formed, the positive influence showed that the higher the pressure on the index and vice versa. Especially for the Index Banking Intermediation, a positive sign indicates an increase in intermediation and the negative sign indicates a decrease in intermediation.

Step 6: Accuracy Test

To measure the accuracy of forecasting calibration probability of resilient use Quadratic Probability Score (QPS). QPS has a range from 0 to 2, when score = 0 reflects very accurately with the following formula:

$$QPS = \frac{1}{T} \sum_{t=1} 2(P_t - R_t)^2 \quad (10)$$

Where:

P = Forecasting

R = Realisation

T = Period

Meanwhile, the calibration of probability forecasting relates to the accuracy of probability forecasting and the observed relative frequency. Calibration compares the average probability forecast to the average of its realization. Global Square Bias (GSB) values have ranges from 0 to 2 with score value = 0 reflecting perfect calibration. The formula is as follows:

$$GSB = 2(\bar{P} - \bar{R})^2, \quad (11)$$

where $\bar{P} = \frac{1}{T}\sum_{t=1}^{T} P_t \; P$ and

$$\bar{P} = \frac{1}{T}\sum_{t=1}^{T} P_t \quad (12)$$

Step 7: Back to The Details

One of the weaknesses in the Indexation of the indicators is difficult, to do trace back to see the source of the pressure on the Index. Heat map is one of the best visualization tools for dense point data. They are also useful for doing cluster analysis or hotspot analysis. I this study, Heat map or chart indicators with color indication as manual vulnerability level of the indicator. Heat map of SHABAR Index show the entire Index results in terms of pressure, intermediation and banking efficiency.

For each composite Index will be composed of the composite Index constituent, presence Heat Map make easy see the source of vulnerability. The use of variation color in the Heat Map refers to the threshold

(treshold). Overall there are three colors on the Heat Map SHABAR index, green depicts resilience condition, with color indicator stands at a better value than the first treshold. Yellow color (two degradation depict below and upper threshold) depict alert condition out of resilience threshold, the indicator value in these conditions is between treshold first and second treshold. The orange color, warning fase before crisis in resiliency of Islamic Bank. If it is more than upper threshold or below the lower threshold depict crisis in Banking.

TABLE 3.2

Hypothesis of SHABAR Index

	Indicator		**The Influence of The Index**
Sharia Banking Resilience (SHABAR) Index	Pressure index	(+)	The pressure index increases, the Sharia banking resilience will decrease, and vice versa.
	Intermediary index	(+)	The intermediary index increases, the Sharia banking resilience will decrease, and vice versa.
	Efficiency index	(-)	The efficiency index increases, the Sharia banking resilience will increase, and vice versa.

Table 3.3 Continuation

Sharia Banking Pressure Index	NPF	(+)	The NPF indicator increases, sharia banking pressure will increase, and vice versa.
	ROA	(-)	The ROA indicator increases, sharia banking pressure will decrease, and vice versa.
	CAR	(-)	The CAR indicator increases, sharia banking pressure will decrease, and vice versa
	ΔL yoy	(-)	The ΔL yoy indiator increases, sharia banking pressure will increase, and vice versa.
Sharia Banking Intermediary Index	Spread financing to deposit (SFTD) ratio	(-)	The SFTD indicator increases, sharia banking intermediary will decrease, and vice versa.
	Gap FDR	(+)	The Gap FDR indicator increases, sharia banking intermediary will increase, and vice versa.
	Financing to GDP (F/GDP) ratio	(+)	The F/GDP indicator increases, sharia banking intermediary will increase, and vice versa.
	Gap GDP	(+)	The Gap GDP indicator increases, sharia banking intermediary will increase, and vice versa.
Sharia Banking Efficiency Index	NIM	(-)	The NIM indicator increases, sharia banking intermediary will decrease, and vice versa.

	BOPO	(-)	The BOPO indicator increases, sharia banking intermediary will decrease, and vice versa.
	CIR	(-)	The CIR indicator increases, sharia banking intermediary will decrease, and vice versa.
	OHC/PO	(-)	The OHC/PO indicator increases, sharia banking intermediary will decrease, and vice versa.