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# FTSE BPAM BOND AND SUKUK INDICES

BOND PRICING AGENCY MALAYSIA - METHODOLOGY



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## Introduction

The Malaysian Ringgit (MYR) bond market has seen significant increase of issuance amounts in the primary market and consistent trading volumes in the secondary market over the past few years. Foreign holdings of debt securities outstanding have likewise increased in tandem from year to year. Recent record shows that in 2012, outstanding amount of bonds (including BNM securities) surpassed MYR 1 Trillion mark to close at MYR 1.011 T by year end, registering an increase of 19% from 2011. These developments may be attributed to the continuous strengthening of financial infrastructure, settlement system and regulatory framework to ensure the robustness and vibrancy of local bond market.

In view of the level of Malaysia's bond market growth and Bond Pricing Agency Malaysia's (BPAM) and LSEG's commitment to the market, it was felt that a fixed income index in the public domain would be beneficial to the market. A bond index consists of a series of bonds covering segments of the market which contains broad but homogenous characteristics following the target objectives of the index. It displays choices of daily total return index which represent a normalized level that is converted from the market average return rate. Inclusion of bonds into the index as well as the calculation methods is always rules based.

FTSE BPAM Bond and Sukuk Indices are owned, calculated and administered by BPAM. LSEG is the exclusive licensing and distribution agent.

Among the objectives of a bond index are:

- to represent the market performance on a total-return basis
- to provide relevant benchmarks that are stable, comparable to other markets, easily replicable and clearly measurable in assessing investment opportunities
- to provide objectivity on related risk and return characteristics of potential investment opportunities, and also performance comparison of portfolios

Among the usages of a bond index are:

- benchmark of performance measurement
- basic data for risk management and asset allocation decision
- to act as a general indicator for bond market movement
- to act as an underlying asset for potential derivatives instruments
- to demonstrate added value to intended sponsors for fund managers

The aim of this paper is to provide users of the FTSE BPAM Bond and Sukuk Indices with an understanding of its construction. Covered will be the index rules, the intuition behind the selection of these rules and the calculation methodology of the index. In this way, users may comprehend the limitations and nature of the index and decide on its usages. Construction rules and calculation methodology are based on guidance provided by European Federation of Financial Analysts Societies (EFFAS) Standardized Rules. The adopted methodology conforms to international standards and takes into account the conventions of the local market. The rules and calculation methodology described may be extended in a variety of areas.

## Index Attributes

The index construction process should lead to well defined objective rules which are relevant and applicable to all interested parties in applying the information to their diverse needs. Generally, the rules aim to construct a bond index which is:

- Comprehensive and Accurate
  - An index should reflect the performances of new investments and existing holdings under a realistic representation of market conditions.
  - This also provides a fair representation of available investment opportunities.
- Transparent
  - Index methodology and rules are published and made known to users.
  - Along with index levels, daily index statistics are available to users.
- Replicable
  - Market participants should be able to replicate the indices for performance measurements.
  - The index should allow market participants to derive a realistic baseline strategy.
- Stable
  - Changes of index compositions should occur infrequently unless an index breaches the pre-specified ground rules which are both understandable and predictable.
  - Preferably, changes should not lead to investors executing significant transactions to keep pace with the index levels.
- Contains accessible characteristics and information
  - Price, coupon rate, and risk statistics are all available and accessible for investors.
  - Historical index and price levels are available for time series analysis.
- Investable
  - Bonds are investable and do not contain barriers of entry.
  - For example, an international index should not contain bonds that discourage foreign ownership.

In what follows, the rules and the reasons for selection are discussed for FTSE BPAM All Bond Index Series and FTSE BPAM Liquid Index Series. All bonds included are Malaysian Ringgit denominated, issued locally and registered under the guidelines of the Securities Commission (SC).

## Index Construction Rules

The index construction rules (based on guide by EFFAS' European Bond Commission Standardized Rules on Constructing and Calculating Bond Indices) outline the perimeters to define eligible bonds for inclusion into the index composition and calculation. In addition, local market conventions play a part of the input rules. These rules are with regard to defining bond specifications and structures which are ideal to compose a continuous and stable index performance.

### 1. Index Characteristics

#### Index Type

Generally, bond index types are broadly categorised into:

- All-bond index
- Tracker index
- Liquid/Bellwether index.

All-bond index, as suggested by the name itself, covers all available bonds in the market which fit the basic index and eligible bond rules. A Tracker index is more selective in the sense it outlines more rigid parameters for eligible bonds selection. This is the preferred option when selection of all available bonds is not feasible and a proxy index suffices the purpose of index creation. Furthermore, a more customised index may serve a more specific niche market.

Lastly, Liquid index introduces further restriction where only liquid bonds are considered for index inclusion. The metrics to measure liquidity may come from the likes of activeness of trades, price spreads or availability of quotes. Such index is formed to measure the performance of non-captive bonds which are actively traded in the market and which reflect the true performance of the bond market.

BPAM's Index Series offering include an All-bond index and a Liquid index, named FTSE BPAM All Bond Index Series and FTSE BPAM Liquid Index Series respectively.

#### Portfolio Emulation

In any index calculation, the nature of a bond portfolio consisting of a number of bonds with different sizes by values should be emulated. That is to say, assuming a portfolio manager is able to hold the exact same percentage of bonds contained within an index, both the manager and index must perform identically. To reflect a portfolio, the index uses arithmetic calculations on its bond constituents to derive its values. Example, assuming there is no cash flow, if the total value of the various underlying bonds in the index rises by 50%, then the index as a whole, should also rise by 50%.

To maintain continuity from the previous day, the arithmetic calculations are chain-linked. This means to say that an index value for a particular day is defined from the previous day's index value multiplied by the aggregated one day percentage value change in the current constituents. Chain-link method allows constituents to change their relative sizes by placing weights on both current and previous prices. Section 4 on the index calculation formulae provides a mathematical derivation of this method.

#### Weighting Scheme

Each bond within the index's constituents is weighted via market capitalisation, similar to the equity index concept. Therefore, the index will give larger issues greater role in influencing the total return of the index. Large market capitalisation implies greater liquidity, thus would reflect the market environment more accurately.

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**FTSE BPAM BOND AND SUKUK INDEX METHODOLOGY**
**2. Index Data Source and Conventions**Pricing

BPAM's daily evaluated prices are used to derive the index values. BPAM's evaluated prices are adjusted on a daily basis for all rated bonds. The methodology has been tested and approved by the SC.

Settlement Date

Follows convention of BPAM's evaluated prices, the settlement date is T + 1.

Index Base Date

The first date an index is calculated. The significance of this date is the index returns and levels start accruing on this date. Base dates for FTSE BPAM All Bond Index Series and FTSE BPAM Liquid Index Series are 3 January 2007 and 31 January 2007 respectively.

**3. Eligible Bond Specifications**Bond Outstanding Amount

Bonds with outstanding amount below MYR50 million are excluded. This is because a single transaction for bonds with small outstanding amounts may have considerable price effects and fluctuations. Furthermore, bonds with small outstanding amounts are often held to maturity.

Rating Criteria

Eligible bonds include sovereign, quasi-government and all investment grade bonds as rated by rating agencies registered under the SC. This means bonds rated below BBB3 or BBB- will not be included. Non-investment grade bonds are excluded as they are not reflective of market environment and do not form the majority.

Bond Type

The principle behind bond type inclusion for an All-bond index is to obtain constituents which are similar-like in features and have quantifiable future cash flows which include bond types as follows:

- Zero Coupon Bonds
- Bullet Bonds
- Fixed Coupon Bonds
- Bonds With Secondary Notes

According to EFFAS, option embedded bonds should be excluded unless they represent a significant proportion of the market sector. Securitised assets such as asset-backed securities (ABS) and mortgage-backed securities (MBS) which have payment methods listed above are also excluded. This is because the redemption schedule can be volatile due to prepayment actions which in turn may cause doubt in the future cash flows.

FTSE BPAM All Bond Index Series utilises the bond selection principles outlined above. On the other hand, FTSE BPAM Liquid Index Series does not introduce restriction on bond type as the primary objective of a bellwether index is to capture liquidity in the market.

#### 4. Index Reviewing and Rebalancing

##### Generation Frequency

Following BPAM's evaluated prices, index is generated and calculated daily at the end of the day. This is performed on every business day. During holidays, the index is assumed to be the same as that on the previous business day, although interests continue to accrue.

##### Rebalancing Frequency

Index rebalancing refers to re-allocation, inclusion and exclusion of constituents in an index. Both new and existing issuances which fulfil or fall short of the criteria outlined in index construction rules are included or excluded from the index accordingly. Also, re-allocations of index constituents to other index segments may be prompted by factors such as rating or tenure changes.

Rebalancing frequency may differ from one index to another. For FTSE BPAM All Bond Index Series, bonds which are eligible for inclusion, exclusion and re-allocation as at 5 pm every business day will be adjusted accordingly. Index constituents may change daily.

Rebalancing of FTSE BPAM Liquid Index Series occurs on monthly basis every month end based on constituents' liquidities for the month. 20% of constituents in the portfolio with the lowest liquidity and constituents with zero liquidity for the month is/are replaced with bonds that have liquidity in ascending order. Upon rebalancing, index constituents are fixed for the following month until the next rebalancing occurs.

##### Reinvestment Assumption

On occasions, the constituents of index experience intermediate cash flows in the form of coupon payments and redemptions. One may choose to either reinvest or remove the proceeds from the index. Following EFFAS recommendation, BPAM reinvests the intermediate cash flows into the index in proportion to the size of the holdings. Transaction costs are ignored. The formulae for total and coupon return index in Section 4 reflect this reinvestment assumption whereby the redemption and coupon payments are included in the calculation. Cash flows which fall on holidays are reinvested on the next business day.

#### 5. Index Segmentation

Index segmentation refers to how a main index is segmented into other sub-indices to show the index performances of different classifications. The segmentation rules depend on how the market is classified into different issuance or trade categories in terms of issuance principle, credit rating, classes or types of securities, industries, maturities or region. As such, a meaningful segmentation approach is indispensable in producing a meaningful index for the use of market practitioners.

Index segmentation rules are closely related to investment mandates held by fund managers or to trading requirements imposed on traders. An irrelevant index segment may mean the produced index would not be applicable or too rigid for performance benchmarking purpose. For this reason, a comprehensive and flexible set of classifications needs to be adopted from the start to cover major areas of the market.

Generally, the index segmentation rules defined by BPAM are as follows:

- Principle (Conventional, Islamic)
- Class (Govt., Quasi-Govt., BNM, Financial, Corporate-Guaranteed, Corporate)
- Tenure Bucket (3M-1YR, 1YR-3YR, 3YR-7YR, 7YR+)
- Aggregate Segment\* (Govt-Related, All-Corporates)
- Credit Rating\* (AAA, AA, A, BBB)

\* These segment additions are made available in April 2013

FTSE BPAM All Bond Index Series has all the segmentation rules listed. FTSE BPAM Liquid Index Series has both principle and combined segment rules.

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FTSE BPAM BOND AND SUKUK INDEX METHODOLOGYTenure Bucket Sub Groups

To divide the index into maturity sub groups, considerations are given to market expectations, conventions and the various market players who participate in certain tenure buckets. For example, insurance funds would often have a long-term horizon, thus they would choose to invest in longer tenure bonds where selections are relatively illiquid than medium tenure bonds.

In the Malaysian bond market, we have observed that market segmentation occurs for bonds with remaining tenure of approximately 1 year and below as opposed to those above 1 year. Hence, it is common to find large difference in yield between, say for instance a 0.75 year bond to a 1.25 year bond of the same class or even of the same issuer.

Common tenure points are often referenced by market participants. For example, in term structure modelling, tenures of 3, 5, 7, 10 and 15 years are commonly quoted. This is seen in the Bank Negara weekly indicative quotes for class curves, submitted by a panel of selected financial institutions. Therefore, it was concluded that the standard maturity sub groups would be divided as follows:

- Bonds with residual maturity of 0.25 to 1 year - short term and market segmentation
- Bonds with residual maturity of 1 to 3 years - short term
- Bonds with residual maturity of 3 to 7 years - medium term
- Bonds with residual maturity of above 7 years - long term

Aggregate Segment and Credit Rating Sub Groups

The rationale of having these segments is to segregate the market into relative riskiness by nature of issuers' credit profiles. Govt-Related combined segment comprises securities from Govt., Quasi-Govt., and BNM segments while All-Corporates comprise securities from Financial, Corporate-Guaranteed and Corporate segments.

Moving on, All-Corporates issues with credit ratings are further segmented into classes of rating grades, categorised into AAA, AA, A and BBB grades, as assigned by credit rating agencies. These issues are grouped by credit rating. In this case, further segments are available where Financial, Corporate-Guaranteed and Corporate segments are subdivided into rating grades from AAA grade down to BBB grade.



## Index Calculation Formulae

At the close of each business day, index returns and levels are calculated to reflect the performance of the previous business day's portfolio. Hence the returns are calculated based on the previous business day's index composition, before rebalancing is performed.

### 1. Notation

Notation	Descriptions
$P_{i,t}$	clean price of the $i$ -th bond at time $t$
$P'_{i,t}$	dirty price of the $i$ -th bond at time $t$
AI	accrued interest
I	coupon payments
PRIN	regularly scheduled principle payments
N	nominal outstanding amount
Y	yield to maturity (YTM)
T	time to maturity
MD	modified duration
C	convexity
CR	coupon rate

### 2. Calculation of Index Returns and Levels

Daily returns are calculated for all index constituents on a close-to-close basis. The formulae for daily returns are as follows:

$$\text{Total Return (TR}_{i,t}) = \frac{(P_{i,t} + \text{PRIN}_{i,t} + \text{AI}_{i,t} + I_{i,t}) - (P_{i,t-1} + \text{AI}_{i,t-1})}{P_{i,t-1} + \text{AI}_{i,t-1}}$$

The total return is in fact the summation of the price return and the coupon return:

$$\text{Total Return (TR}_{i,t}) = \text{Price Return (PR}_{i,t}) + \text{Coupon Return (CR}_{i,t})$$

$$\text{where Price Return (PR}_{i,t}) = \frac{P_{i,t} + \text{PRIN}_{i,t} - P_{i,t-1}}{P_{i,t-1} + \text{AI}_{i,t-1}} \text{ and Coupon Return (CR}_{i,t}) = \frac{(\text{AI}_{i,t} + I_{i,t}) - (\text{AI}_{i,t-1})}{P_{i,t-1} + \text{AI}_{i,t-1}}$$

### 3. Daily Index Returns

The daily total return, price return and coupon return for the index or sub-indices, on a given day are equal to the weighted average of the returns of index constituents that forms the index or sub-indices. The formulae for the daily Index Returns are as follows:

$$\text{Index Total Return (ITR}_{i,t}) = \sum_{i=1}^n w_i \times \text{TR}_{i,t}$$

$$\text{Index Price Return (IPR}_{i,t}) = \sum_{i=1}^n w_i \times \text{PR}_{i,t}$$

$$\text{Index Coupon Return (ICR}_{i,t}) = \sum_{i=1}^n w_i \times \text{CR}_{i,t}$$

The weight of each index bond being equal to the market capitalisation of the index bond expressed as a percentage of the total market capitalisation of the index or sub-indices as of previous business day, as follows:

$$W_i = \frac{(P_{i,t-1} + AI_{i,t-1}) \times N_{i,t-1}}{\sum_{j=1}^n ((P_{j,t-1} + AI_{j,t-1}) \times N_{j,t-1})}$$

### 4. Index Levels

Daily Index values are derived at the close of each business day by multiplying the preceding business day's Index Value by current business day's Index Return, as follows:

$$\text{Total Return Index (TRI}_{i,t}) = (1 + \text{ITR}_t) \times \text{TRI}_{t-1}, \text{TRI}_0 = 100$$

$$\text{Price Return Index (PRI}_{i,t}) = (1 + \text{IPR}_t) \times \text{PRI}_{t-1}, \text{PRI}_0 = 100$$

$$\text{Coupon Return Index (CRI}_{i,t}) = (1 + \text{ICR}_t) \times \text{CRI}_{t-1}, \text{CRI}_0 = 100$$

## Index Statistics Calculation Formulae

In contrast to Index Returns and Levels, Index Statistics are calculated to reflect the risk profile of the Index, after rebalancing has occurred. These statistics are designed to be forward looking. They are therefore calculated based on the index as it is constituted after any necessary changes to the index have been made by the close on the day of calculation. Hence, the statistics reflect the portfolio of index bonds which will generate returns for the succeeding day. The following statistics are calculated:

- Average Clean Price
- Average Coupon
- Average YTM
- Average Maturity
- Average Duration
- Average Convexity

The average statistics for the index or a sub-index is simply a market-weighted average of the values of that statistic for the individual index bonds which make up the index or sub-index, where the market weight is expressed as a percentage of the total market capitalisation of the index or sub-index after rebalancing has occurred, as follows:

$$w'_i = \frac{(P_{i,t} + AI_{i,t-1}) \times N_{i,t}}{\sum_{j=1}^n ((P_{j,t} + AI_{j,t-1}) \times N_{j,t})}$$

The averaging formulae are as follows:

$$\text{Average Clean Price (AP}_t\text{)} = \sum_{i=1}^n w'_i \times AP_{i,t}$$

$$\text{Average Coupon (ACR}_t\text{)} = \sum_{i=1}^n w'_i \times CR_{i,t}$$

$$\text{Average YTM (AY}_t\text{)} = \sum_{i=1}^n w'_i \times Y_{i,t}$$

$$\text{Average Maturity (AT}_t\text{)} = \sum_{i=1}^n w'_i \times T_{i,t}$$

$$\text{Average Duration (AMD}_t\text{)} = \sum_{i=1}^n w'_i \times MD_{i,t}$$

$$\text{Average Convexity (AC}_t\text{)} = \sum_{i=1}^n w'_i \times C_{i,t}$$

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