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## **Guide to the Calculation of the FTSE DAR Digital Asset Prices and FTSE DAR Reference Prices In Association with Digital Asset Research v1.2**

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## Section 1

# Introduction

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### 1.0 Introduction

1.1 This document sets out the methodology for the calculation of the FTSE DAR Digital Asset Prices and the FTSE DAR Reference Prices. This document should be read in conjunction with the Guide to the Vetting of Digital Assets and Digital Asset Exchanges document which is available at [www.ftserussell.com](http://www.ftserussell.com).

1.1.1 A digital asset is a Cryptographically Secured Digital Instrument for which the issuance, transfer and ownership is recorded on a data structure commonly referred to as a Blockchain.

### 1.2 FTSE Russell

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1.3 FTSE Russell does not make any representation or warranty, express or implied, as to the accuracy, completeness or correctness of the FTSE DAR Digital Asset Prices or the FTSE DAR Reference Prices.

1.4 No liability whether as a result of negligence or otherwise is accepted by FTSE Russell (or any person concerned with the preparation or publication of this Guide to Calculation) for any losses, damages, claims and expenses suffered by any person as a result of:

- any reliance on this Guide to Calculation, and/or
- any errors or inaccuracies in this Guide to Calculation, and/or
- any non-application or misapplication of the policies or procedures described in this Guide to Calculation.



## Section 2

# Management Responsibilities

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## 2.0 Management Responsibilities

### 2.1 FTSE International Limited (FTSE)<sup>1</sup>

2.1.1 FTSE is responsible for the calculation, production and operation of the FTSE DAR Reference Prices.

2.1.2 FTSE is the administrator of the FTSE DAR Reference Prices – Benchmark Assets.

2.1.3 FTSE will:

- maintain records of the prices of all digital assets for which FTSE DAR Digital Asset Prices and FTSE DAR Reference Prices are calculated;
- make changes to the digital assets for which FTSE DAR Digital Asset Prices and FTSE DAR Reference Prices are calculated in accordance with the Guide to the Vetting of Digital Assets and Digital Asset Exchanges;
- publish changes to the digital assets for which FTSE DAR Digital Asset Prices and FTSE DAR Reference Prices are calculated resulting from their ongoing maintenance and in accordance to the Guide to the Vetting of Digital Asset and Digital Asset Exchanges;
- disseminate the prices.

### 2.2 Digital Asset Research

2.2.1 Digital Asset Research (DAR) is the calculation agent for the FTSE DAR Digital Asset Prices. DAR assesses the quality of pricing data, qualifies pricing sources, and supplies FTSE Russell with price feeds.

2.2.2 DAR is an independent, privately-owned research firm and data provider which partners with FTSE Russell in research into and providing data on digital assets.

2.2.3 DAR is responsible for the ongoing vetting of digital assets and of the Exchanges of digital assets as set out in the Guide to the Vetting of Digital Assets and Digital Asset Exchanges. DAR collects and validates the data it obtains as Principal to ensure both digital assets and Exchanges of digital assets pass a strict set of rules.

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<sup>1</sup> The term administrator is used in this document in the same sense as it is defined in [Regulation \(EU\) 2016/1011 of the European Parliament and of the Council of 8 June 2016 on indices used as benchmarks in financial instruments and financial contracts or to measure the performance of investment funds](#) (the European Benchmark Regulation).

## 2.3 **Amendments to this Guide to Calculation**

- 2.3.1 This Guide to Calculation shall be subject to regular review by FTSE Russell to ensure that it continues to best reflect the aims of the FTSE DAR Digital Asset Prices and FTSE DAR Reference Prices. The feedback from these reviews will be considered by the FTSE Russell Index Governance Board before approval is granted for any change to the methodology.



## Section 3

# FTSE DAR Digital Asset Prices

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### 3.0 FTSE DAR Digital Asset Prices

#### 3.1 Overview

- 3.1.1 The FTSE DAR Digital Asset Prices are calculated by DAR for FTSE Russell and are used in the calculation of the FTSE DAR Reference Prices. The FTSE DAR Digital Asset Prices are calculated in US Dollars.
- 3.1.2 Digital assets are quoted in terms of a trading pair, similar to foreign exchange currency quotes. Transactions can be made from a fiat currency to digital asset or from digital asset to digital asset including stablecoins.
- 3.1.3 As part of the FTSE DAR Digital Asset Price calculation, each digital asset price is converted into US Dollars using one or more of the following conversions, as necessary, in order of operations:
- The digital asset to US Dollars (USD) transaction if it is available;
  - The digital asset to Eligible Fiat currency transaction pairs which are defined as Great British Pound (GBP), Euro (EUR) or Japanese Yen (JPY) if it is available, then the Fiat currency to USD;
  - The digital asset to Eligible Stablecoin transaction pairs which are defined as Tether (USDT) or USD Coin (USDC) if it is available, then the Stablecoin to US Dollars;
  - The digital asset to Eligible Digital Asset transaction pairs which are defined as Bitcoin (BTC) or Ethereum (ETH) if it is available, then the Digital Asset to USD.
- 3.1.4 Only executed transactions from Eligible Exchanges, as set out in the Guide to the Vetting of Digital Asset and Digital Asset Exchanges, are used in the calculation of the FTSE DAR Digital Asset Prices.
- 3.1.5 Prices are calculated net of any transaction costs.

#### 3.2 Time Windows

- 3.2.1 The calculation of the FTSE DAR Digital Asset Price consists of several steps and the use of four separate time windows of digital asset price and volume data from each Eligible Exchange.
- One Hour Price Window – this is the most recent price and volume data on Eligible Exchanges over the last hour and is used if there are no previous VWAP price aggregations available for a digital asset. A set of data as described in 3.3 is obtained for each currency a digital asset price is quoted against (both Fiat and other digital assets). This window forms the

basis of the initialization VWAP for new digital assets and is the source of data for shorter time windows.

2. Fifteen Minute Price Window – consists of the most recent 15 minutes of price and volume extracted from Eligible Exchanges. This window forms the basis of price and volume data used in the conversion rates for eligible Digital Assets and Stablecoins.
3. Ten Minute Price Window – is the most recent 10 minutes of data from Eligible Exchanges. This window forms the basis of the data set for which the outlier tests are applied.
4. Fifteen Second Price Window – is the most recent 15 seconds of data from Eligible Exchanges. This window forms the basis of the FTSE DAR Digital Asset Price.

### 3.3 Conversion VWAPs

3.3.1 As an initial step in the FTSE DAR Digital Asset Price, all transactions with non-USD quote currencies are converted to USD.

1. Fiat currency conversion: if the transaction pair includes an Eligible Fiat currency, then foreign exchange rates from Alpha Vantage or Polygon.io are used for the conversion. Foreign exchange rates are updated each minute and trades are converted to USD using the most recent foreign exchange rate that is prior to the time of the transaction.
2. Stablecoin conversion: if the transaction pair includes an Eligible Stablecoin, then the transaction is converted as follows:
  - a. The previous 15 minutes of transactions for each USD – Stablecoin pair are aggregated.
  - b. A VWAP for the Stablecoin is calculated for each eligible exchange on which the Stablecoin trades; this is referred to as the Local Conversion Rate.
  - c. A VWAP for the Stablecoin is calculated for all eligible exchanges on which the Stablecoin trades; this is referred to as the Global Conversion Rate.
  - d. A USD price is calculated for each trade with an eligible Stablecoin pair.
    - i. If the exchange on which the trade was made has a Local Conversion Rate, then this rate is used in the calculation.
    - ii. If the exchange on which the trade was made does not have a Local Conversion Rate, then the Global Conversion Rate is used in the calculation.
3. Digital Asset conversion: if the transaction pair is an Eligible Digital Asset, then the transaction is converted as follows:
  - a. The previous 15 minutes of transactions for each Digital Asset – Eligible Fiat pair are aggregated.
  - b. A VWAP for the Digital Asset is calculated for each Eligible Exchange on which the Digital Asset trades; this is referred to as the Local Conversion Rate.
  - c. A VWAP for the Digital Asset is calculated for all Eligible Exchanges on which the Digital Asset trades; this is referred to as the Global Conversion Rate.
  - d. A USD price is calculated for each trade with an Eligible Digital Asset pair.
    - i. If the exchange on which the trade was made has a Local Conversion Rate, then this rate is used in the calculation.
    - ii. If the exchange on which the trade was made does not have a Local Conversion Rate, the Global Conversion Rate is used in the calculation.

### 3.4 Initialization VWAPs for new Digital Assets

3.4.1 An initialization VWAP is determined for each new digital asset across Eligible Exchanges as follows:

1. Retrieve raw trade data for the One Hour Price Window.
2. Calculate a one-hour VWAP for each new digital asset-pair per the rules 3.1.3 and 3.3.1, on each Eligible Exchange; this is a one-hour Initialization VWAP for the digital asset – currency.
3. Calculate a one-hour Initialization VWAP in US Dollars for each digital asset across all Eligible Exchanges. This Initialization VWAP is used in the absence of any previously calculated FTSE DAR Digital Asset Price.

### 3.5 Trade Outlier Filtration

3.5.1 After the conversion to USD and prior to calculation the FTSE DAR Digital Asset Price, trades are filtered at the exchange level and trade level to identify and remove outliers.

1. Exchange-Level Outlier Filtering
  - a. All trades for a given digital asset from the most recent Ten Minute Window are aggregated.
  - b. Using the aggregated trade data, a VWAP for the digital asset is calculated for each exchange on which the digital asset trades.
  - c. Using the set of exchange VWAP values for the digital asset, a mean VWAP value and standard deviation values are calculated.
  - d. Trades from any exchange with a VWAP value for the digital asset that is not within 1.5 standard deviations of the mean are excluded from the FTSE DAR Digital Asset Price calculation.
2. Trade-Level Outlier Filtering
  - a. All trades for a given digital asset from the most recent Ten Minute Window are aggregated.
  - b. Using the aggregated trade data, a mean price and standard deviations value is calculated for each digital asset.
  - c. Any trade with a price that is not within 2.5 standard deviations of the mean is excluded from the FTSE DAR Digital Asset Price calculation.
  - d. The remaining trades are known as Eligible Trades.

### 3.6 Calculation

3.6.1 The calculation of the FTSE DAR Digital Asset Price consists of the previous steps to derive the Eligible Trades of each digital asset's price and volume data from each Eligible Exchange.

1. Calculate a 15 second VWAP in US Dollars for each digital asset across all Eligible Exchanges. This is the FTSE DAR Digital Asset Price.
2. If no trades have been made in the most recent 15 seconds, the previous FTSE DAR Digital Asset Price is used. If there is no previously available FTSE DAR Digital Asset Price the Initialization VWAP is used.
3. The process is repeated every 15 seconds.

3.6.2 The FTSE DAR Digital Asset Price is the volume weighted average US Dollar price of a digital asset from all Eligible Exchanges:



$$FTSE\ DAR\ Digital\ Asset\ Price_i = \frac{\sum_x (Volume_{x,i} \cdot Price\ in\ USD_{x,i})}{\sum_x Volume_{x,i}}$$

where  $Volume_{x,i}$  is the volume of the digital asset i traded on exchange x in units of the digital asset and  $Price\ in\ USD_{x,i}$  is the price in US Dollars digital asset i traded on exchange x



## Section 4

# FTSE DAR Reference Prices

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### 4.0 FTSE DAR Reference Prices

4.1 The FTSE DAR Reference Prices are an hourly fixing of all digital assets for which a FTSE DAR Digital Asset Price is calculated.

4.1.1 The prices are separated into two files:

(1) The FTSE DAR Reference Prices – Benchmark Assets are calculated from prices sourced entirely from vetted exchanges as outlined in the Guide to the Vetting of Digital Assets and Digital Asset Exchanges. The FTSE DAR Reference Prices - Benchmark Assets can be used in the European Union (as “use” is set out in article 3(1)(7) of the EU Benchmark Regulation and the Council of 8 June 2016 on indices used as benchmarks in financial instruments and financial contracts or to measure the performance of investment funds in the European Union) (the “EU BMR”).

(2) The FTSE DAR Reference Prices – Non-Benchmark Assets are calculated from prices not sourced entirely from vetted exchanges as set out in the Guide to the Vetting of Digital Assets and Digital Asset Exchanges. The FTSE DAR Reference Prices - Non-Benchmark Assets are not EU BMR compliant and are not to be used in the European Union (as “use” is set out in article 3(1)(7) of the EU Benchmark Regulation and the Council of 8 June 2016 on indices used as benchmarks in financial instruments and financial contracts or to measure the performance of investment funds in the European Union) (the “EU BMR”) and accordingly, the EU BMR does not apply to the FTSE DAR Reference Prices – Non-Benchmark Assets. Consequently, supervised entities (as “supervised entities” is set out in article 3(1)(17) of the EU BMR) within the European Union are not permitted to use the FTSE DAR Reference Prices – Non-Benchmark Assets as benchmarks as set out in article 3(1)(7) of the EU BMR.

4.1.2 The FTSE-DAR Reference Price is determined as the volume time weighted average of the FTSE DAR Digital Asset Price over the 15-minute period before the fixing time. For example, the fix at 4.00pm would take all prices published every 15 seconds in the observation window from 3.45pm to 4.00pm inclusive (61 observations):

$$FTSE\ DAR\ Reference\ Price = \frac{\sum_{t=1}^{61} w_t \times FTSE\ DAR\ Digital\ Asset\ Price_t \times Volume_t}{\sum_{t=1}^{61} w_t \times Volume_t}$$

Where *FTSE DAR Digital Asset Price<sub>t</sub>* is the price of the digital asset at time, *t* and *Volume<sub>t</sub>* is the volume traded in the digital asset in the 15 second period over which the

**FTSE DAR Digital Asset Price<sub>t</sub>** is determined. The integer **t** corresponds to the observation, counting down from **t = 61** at the start of the observation period to **t = 1** at the fixing time.

- 4.1.3 The weights,  $w_t = \frac{w'_t}{\sum w'_t}$ , where the un-normalized weights  $w'_t = \left\{ \frac{1}{61}, \frac{1}{60}, \dots, \frac{1}{2}, \mathbf{1} \right\}$  are inversely proportional to the time **t**.



## Appendix A: Further Information

A Glossary of Terms used in FTSE Russell's Ground Rule documents can be found using the following link:

[Glossary - Digital Assets.pdf \(ftserussell.com\)](#)

Further information on the FTSE DAR Digital Asset Prices and the FTSE DAR Reference Prices is available from FTSE Russell.

For contact details please visit the FTSE Russell website or contact FTSE Russell client services at [info@ftserussell.com](mailto:info@ftserussell.com).

Website: [www.ftserussell.com](http://www.ftserussell.com)

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