dxFeed Blockchain Value Index Family Methodology

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1. Description

dxFeed Blockchain Value (BV) Index Family Methodology attempts to estimate a cryptocurrency blockchain's (e.g. Ethereum) value. To do this, it composes a portfolio of representative tokens based on that blockchain and computes its market price in real time. Two weighting schemes are available: based on market cap and volume-turnover ratio (the latter taking token trading activity into account).

2. Index Model

- Fix a cryptocurrency blockchain. Let C be a set of "relevant" tokens from that blockchain, e.g. $C = \{\text{ETH}, \text{SHIB}, \text{CRO}, \dots\}$. See section 3 for a description of the component selection procedure. Depending on the particular configuration, C may or may not include the native blockchain token, e.g. ETH for Ethereum.

- Denote the amount of component c as Share_c and the set of all amounts for the corresponding components in C as Share_C.

- Let Symbol_C be a set of symbols for obtaining market data for index components. The index parameters are then $\Theta = \{\text{Share}_C, \text{Symbol}_C\}$.

- Suppose $\text{Price}(t, \text{Symbol}_c)$ is a function for obtaining a price of a component c using its symbol Symbol_c at time t.

The index value at time t would then be the corresponding portfolio's price:

$$\text{Index}(t \mid \Theta) = \sum_{c \in C} \text{Price}(t, \text{Symbol}_c) \cdot \text{Share}_c.$$

3. Component Selection and Parameter Derivation

3.1. Baseline Index

Let $\mathcal{U}$ be the set of all tokens on the blockchain, tradable on at least one centralized exchange $e \in \mathcal{E} = \{e_1, \ldots, e_M\}$ against a "USD-like" quote currency q from a predefined list of such currencies $\mathcal{Q} = \{q_1, \ldots, q_K\}$, e.g. $\mathcal{Q} = \{\text{USD}, \text{USDT}, \text{DAI}, \ldots\}$.

Consider a parameter estimation period given by a sequence of days $\mathcal{T} = \{t_1, \ldots, t_T\}$. The daily close price and daily trade volume of token c against q on date t on venue e would then be given by, correspondingly $\text{Close}^e_{c/q}(t)$, $\text{Volume}^e_{c/q}(t)$. Additionally, $\text{MCap}_c(t)$ is the market cap of token c on date t.

Components

- Form $\mathcal{C}$ by filtering $\mathcal{U}$:
  - Exclude all stablecoins and wrapped tokens
  - Exclude all tokens if their market cap isn't available for more than $\alpha \cdot 100\%$ days (say, 10%)
- Filter $\mathcal{Q}$:
  - Exclude quote currencies if volume and/or price data aren't available for some dates on any exchange $e \in \mathcal{E}$

Weights

The following procedure derives a set of weights:

1. Let
$$\text{Turnover}_c(t) = \sum_{e \in \mathcal{E}} \sum_{q \in \mathcal{Q}} \text{Volume}^e_{c/q}(t) \cdot \text{VWAP}_c(t)$$
be component c's turnover at day t expressed in USD (price differences between the elements of $\mathcal{Q}$ are neglected). Here,
$$\text{VWAP}_c(t) = \sum_{e \in \mathcal{E}} \sum_{q \in \mathcal{Q}} v^e_{c/q}(t) \cdot \text{Close}^e_{c/q}(t), \quad v^e_{c/q}(t) = \frac{\text{Volume}^e_{c/q}(t)}{\sum_{q' \in \mathcal{Q}} \text{Volume}^e_{c/q'}(t)}$$
is the volume-weighted token c's close price on day t across all available exchanges and quote currencies (if a pair c/q is not traded on e, it is skipped for the purpose of the calculation).

2. Calculate the average daily Volume Turnover Ratio (VTR) for each token:
$$\text{VTR}_c(t) = \frac{\text{Turnover}_c(t)}{\text{MCap}_c(t)}.$$
VTR shows what proportion of the total token's "mass" was actually traded during the day.

3. Calculate two possible sets of weights for all $c \in \mathcal{C}$ based on:
   - Daily market cap
   $$\text{Weight}^{\text{MC}}_c = \frac{\text{median}_{t \in \mathcal{T}} \text{MCap}_c(t)}{\sum_{c' \in \mathcal{C}} \text{median}_{t \in \mathcal{T}} \text{MCap}_{c'}(t)}.$$
   - Daily VTR
   $$\text{Weight}^{\text{VTR}}_c = \frac{\text{median}_{t \in \mathcal{T}} \text{VTR}_c(t)}{\sum_{c' \in \mathcal{C}} \text{median}_{t \in \mathcal{T}} \text{VTR}_{c'}(t)}.$$

Symbols

For each token $c \in C$, pick the quote currency q^* and the exchange e^* that delivers the highest daily average trading volume:

$$(e_c^*, q_c^*) = \arg\max_{\substack{q\in\mathcal{Q}\\ e\in\mathcal{E}}} \operatorname*{median}_{t\in\mathcal{T}} \mathrm{Volume}^e_{c/q}(t), \quad c \in C. \tag{1}$$

The set of symbols Symbol_C correspond to c/q_c^* on e_c^*.

Shares

Since

$$\mathrm{Weight}_c(t) = \frac{\mathrm{Price}_c(t \mid \mathrm{Symbol}_C) \cdot \mathrm{Share}_c}{\sum_{c'\in C} \mathrm{Price}(t, \mathrm{Symbol}_{c'}) \cdot \mathrm{Share}_{c'}} = \frac{\mathrm{Price}_c(t \mid \mathrm{Symbol}_C) \cdot \mathrm{Share}_c}{\mathrm{Index}(t \mid \Theta)}, \tag{2}$$

Share_c can be expressed as

$$\mathrm{Share}_c(t) = \frac{\mathrm{Weight}_c}{\mathrm{Price}_c(t \mid \mathrm{Symbol}_C)} \cdot \mathrm{Index}(t \mid \Theta), \quad c \in C. \tag{3}$$

If no index value $\mathrm{Index}(t \mid \Theta)$ is known at t, an arbitrary number can be provided. This is also the case if it's desired to start the index from a certain value.

3.2. Reduced Index

To achieve better interpretability, and to ease the index's replicability at the cost of some precision, the following procedure is utilized to reduce the (possibly quite large) number or index component set C:

1. At iteration i, remove c with the smallest Weight_c
2. Re-normalize the weights and obtain a new set of parameters $\Theta^{(i)}$
3. Backtest the index on $\mathcal{T}$
4. Calculate the mean percentage error as

$$E(\Theta^{(i)}) = \frac{1}{T}\sum_{t=1}^{T} \frac{\mathrm{Index}(t \mid \Theta) - \mathrm{Index}(t \mid \Theta^{(i)})}{\mathrm{Index}(t \mid \Theta)}$$

5. If the $E(\Theta^{(i)}) \geq \epsilon$ (e.g. $\epsilon = 5\%$), then $\Theta^{(i-1)}$ becomes the final set of index parameters. Otherwise, the procedure is repeated.

4. Lifecycle & Maintenance

4.1. Rebalancing

The index's composition is reviewed periodically. See the accompanying factsheet for details. This review may cause rebalancing.

Suppose the parameter estimation procedure yields a new set of weights and symbols—$\mathrm{Weight}'_{C'}$ and $\mathrm{Symbol}'_{C'}$ respectively—corresponding to a new component set C', effective at day $t^* = t_T + 1$, where t_T is the last day of the parameter estimation period $\mathcal{T}$. The new set of shares $\mathrm{Share}'_{C'}$ is then computed using (3) on $t = t_T$.

4.2. Trading Pair Removal

If a trading pair c/q, corresponding to the component c, is delisted from the corresponding exchange e, then a new pair (and/or exchange) is selected so that (e', q') is the second-best combination that maximizes median trading volume (1).

During the reconfiguration period, the last known component price is used to compute the index value ("last observation carried forward").

In case no combination can be found, the component is completely removed from the index as follows:

1. Set $C' = C \setminus \{c\}$
2. Recompute the de-facto weights $\text{Weight}_{C'}$ using (2).
3. Rebalance the index as in section 4.1 using $\text{Weight}_{C'}$, $\text{Symbol}_{C'}$

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