AN INVESTABLE CRYPTO-CURRENCY INDEX

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ABSTRACT. We describe the design of the CCI30 cryptocurrency index.

1. INTRODUCTION

In early 2017 we decided to design an index for the burgeoning cryptocurrency market. The purpose of this index would be twofold:

A) It would be a kind of a barometer for the cryptocurrency market.
B) It would be an investment vehicle which would allow a passive investor to participate in the growth potential of the cryptocurrency space.

These goals meant that the index needed to be:

A) Diversified.
B) Have deep coverage of the cryptocurrency space.
C) Have as good a risk-adjusted performance profile as possible (given the points A), B) above.

Our task was complicated by a number of idiosyncrasies of the cryptocurrency market.

1 The cryptocurrency space is extremely volatile (see [Riv18a] for a more in-depth look).
2 New “coins” appear almost daily.
3 The lion’s share of the entire cryptocurrency market capitalization\(^1\) is in Bit-coin (ticker BTC) and Ethereum (ticker ETH). This would mean that a market cap weighted index (along the lines of the Standard and Poor 500 equity index) would not work very well.

2. SOLUTION

2.1. computing the index. Between reweightings and rebalancing, the index is computed using as follows: Suppose that there are \(N\) cryptocurrencies in the index. Then, if the weights of the cryptocurrencies at (reweighting) time \(T_0\) are \(w_1, \ldots, w_N\), the value of the index at time \(t\) is given by:

\[
I(t) = \sum_{i=1}^{N} w_i \frac{P(t)}{P(T_0)},
\]

where \(P(t)\) is the price of coin \(i\) at time \(t\).

\(^1\)at the time of this writing, the total market capitalization of the crypto-currency market is $302BN, of which Bitcoin and Ethereum together are worth $180BN.
2.2. Number of cryptocurrencies. We decided to use top 30 cryptocurrencies by market capitalization - the currencies below this cutoff are not very liquid (and so their inclusion would impair the performance of the index as an investment vehicle), and the top 30 capture 90% of the total cryptocurrency market capitalization.

2.3. Weighting scheme. The constituents of the index are weighted proportionally to the square root of their market capitalizations. The square root function was chosen as a kind of a compromise - as discussed above, a market capitalization weighted index would be dominated by the top couple of cryptocurrencies, while a more slowly decaying weighting (the extreme version of which would be equal weighting) would give too much weight to the tiny (and not very liquid) crypto-currencies at the bottom of the range.

2.4. Market capitalization computation. Market capitalization is NOT computed as some instantaneous number - the volatility in the cryptocurrency market is such that this would destabilize the index composition too much. Instead we use an exponentially weighted moving average of the market capitalization. In other words:

$$M^*(T) = \frac{\sum_{i=0}^{\infty} M(T - i) \exp(-\alpha i)}{\sum_{i=0}^{\infty} \exp(-\alpha i)},$$

where $M(t)$ is the actual market cap at time $t$, $M^*$ is our adjusted market cap, and $\alpha$ is a reasonable decay parameter. Notice that the sum goes from 0 to $\infty$ for notational convenience - any reasonable value of $\alpha$ will make the contribution corresponding to large values of $i$ infinitesimally small.

2.5. Rebalancing frequency. The index is completely rebalanced every quarter (on quarter boundaries), and reweighed every month. This is necessitated by the rapid evolution of the cryptocurrency market.

3. Performance

The performance of the CCI30 index we have designed can be seen at http://cci30.com. From the beginning of 2015, the index is up by around 7000%, with Sharpe ratio of 0.88 (note that we compute the Sharpe Ratio using the correct formula, as explained in [Riv18b]. In the same period, Bitcoin, by contrast, is up some 2500% with a Sharpe ratio of 0.81 (using the same formula).

4. Other instruments

Similar ideas can be used for the design of indices in other domains. The equities market does not pose the same challenges, but the (much larger) debt market is in many ways more dynamic, and our ideas may prove fertile there.

References

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