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Analysis of Cryptocurrency Risk

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Introduction

- The market value of all cryptocurrency now exceeds 1% of all traded wealth.
- In recent months there have been massive swings (both up and down) in the values of cryptocurrencies like Bitcoin and Ethereum. During this presentation will be explain a number of key building blocks for understanding how to evaluate the risk of cryptocurrencies and *what magnitude of return expectations would justify those risks for a typical investor.*
- We will show how our basic methodology uses forward-looking information in addition to historical data, as well as several of the statistical nuances of the estimation process. The presentation will conclude with an empirical comparison of our estimates for Bitcoin volatility to the BVI (a thinly traded contract on Bitcoin volatility, similar in concept to VIX).

Institutional Interest

- Some financial institutions such as Goldman Sachs are setting up trading desks to participate in these assets, while other institutions such as HSBC has explicitly stated that they do not support any participation by their clients.
- Irrespective of their intrinsic and extrinsic value, we expect that such items will be turning up in client portfolios from time to time.
- As such, we will be covering the more prominent cryptocurrencies as a currency in future risk model releases.
- Factor loadings for cryptocurrencies will be a combination of certain fiat currencies (e.g. Swiss Franc) and commodities (e.g. gold) in a process similar to our updated analysis of commodities (see Northfield News March 2021 (northinfo.com).

Is Crypto the "Final Frontier"?

- Last March we released enhancements to both coverage and methodology for Northfield coverage of commodities. These changes were discussed in See Northfield News March 2021 (northinfo.com) and 572.pdf (northinfo.com).
- This process is now being repurposed to expand inclusion of "frontier market" currencies which will include *cryptocurrencies.*
  - We create clusters of sovereign currencies based on geographic proximity, trade relations, and cultural similarity.
  - The clustering allows us to build factor exposures for new currencies as combinations of the factor exposures of other members of the cluster while avoiding adding a large number of new factors to the model (which reduces the stability of covariance estimation).
  - Our final step is to adjust for geopolitical risk in Syria based on the sovereign credit rating as assigned by a rating agency (or our Northfield internal model when sovereign debt is unrated).

The Crypto Cluster

- The cluster for cryptocurrencies will include the cryptocurrencies themselves, some fiat currencies (e.g. Swiss Francs) and certain commodities with perceived financial value (e.g. gold).
- To define the cohort set, the analytical process for cryptocurrency must account for several uncommon features. The cluster for cryptocurrencies will include the cryptocurrencies themselves, some fiat currencies (e.g. Swiss Francs) and certain commodities with financial value (e.g. gold).
  - The first is very large departure from our usual IID return assumptions To date cryptocurrencies have exhibited high degrees of skew, kurtosis and serial correlation in their returns.
  - These behaviors may arise from speculative interest from retail investors, the erratic nature of interest from major financial institutions, or fear of cryptocurrencies being severely hampered by regulation (as seen recently in China).

Dealing with Trends (fashion and otherwise)

- With respect to non-IID behavior we are employing four analytical techniques. The first is the use of "root mean square" (RMS) rather than standard deviation as the measure of dispersion of factor returns.
  - We are treating factor return time series as if markets are very efficient so mean returns to a factor should be close to zero, rather than whatever time series mean is observed.
  - A return time series that goes up 10% per month every month for two years (as was roughly observed with Internet stocks in the late 1990s) would have a standard deviation of zero but a significant RMS.
  - Northfield models have captured these effects for many years as described in Getting an Early Jump on Market Anomalies: Lessons from the Internet Stock Phenomenon (northinfo.com), later published in *Journal of Index Investing.*

Open Wide

- The second technique is the idea of "range based" volatility measures, also replacing the usual definition of standard deviation of returns.
  - One way to think about the volatility of an asset is to consider the percentage distance between the highest and lowest prices observed during a particular period (e.g. day, month, year).
  - If the high and low prices are close together, the asset has low volatility. If the high and low prices are far apart, the asset is volatile.
  - Several papers starting with Parkinson (JoB, 1980) have shown that if returns are IID, there is a direct algebraic transformation between traditional return volatility and range-based measures.

- A simplified range based measure of volatility would just be (high-low)/(high + low). For example, if we observe that a currency had a low price of $1000 and a high price of $3000 over the past month, we get a volatility of *50% per month.*

Carry Trades

- The third input to currency risk estimation is the availability of a "carry trade" wherein bank deposits denominated in a particular currency offer higher interest rates than in major currencies.

- These accounts do not carry any form of government deposit insurance, so the risk of counterparty failure is substantial.

- At the current time retail "Bitcoin savings accounts" are available with yields over 8% annually, as compared to close to zero for retail accounts in the US.

Crypto Saves the Cost of a Plane Ticket to Panama

- Our final key input is the concept of "convenience yield". The anonymity and ease of global transactions has material economic value to certain market participants (criminals, tax evaders, investors in countries with capital controls).
- While this is hard to quantify directly, there is a long history of low or negative interest rates in countries with tough banking secrecy laws
- In the 1980s, Swiss banks routinely offered negative interest rates on deposit accounts while US banks were offering a rate of around 5% (the maximum allowable under Federal Reserve Regulation Q until 1986).

Implied Risk Aversion

- At the current time the combination of convenience yield and interest premium is probably around 12-13% which implies a volatility equivalent (i.e. inclusive of higher moments) of at least 72%.
  - For a derivation of this relationship see Estimating an Investor's Volatility/Return Tradeoff: The Answer is Always Six (northinfo.com).
- There is also a thinly traded Bitcoin Volatility Index (BVOL) and even less liquid linked "tokens".
  - A useful discussion is presented in Alexander and Imeraj (SSRN, 2019). Recent values have been in the range of 5-6% per day which is consistent with an annualized volatility in excess of 80%.
  - For longer term investors, the high volatility of cryptocurrencies implies considerable "variance drain" (see Messmore, 1995).
  - An 80% gain followed by an 80% loss (or down 80% then up 80%) leaves the investor with only 36% of their original capital, a 64% loss in two years (negative 32% per year variance drain or a negative 40% per year return).

Stablecoins as Modern Banknotes

- A sidelight to the cryptocurrency discussion is the matter of "stable coins" like Tether where a coin issuer functions like an 18th century bank issuing its own currency

- Commercial banks in Hong Kong and Scotland still routinely issue their own "bank notes".

- To stabilize the value of cryptocurrencies at a relatively fixed value in US$ (like a pegged currency) the "custodian" holds financial reserves that purportedly assure that the stable coins have a claim on assets that can be converted to conventional currency.
  - Professor Gary Gorton of Yale recently questioned the validity of the collateral, Yale Economist Gorton Questions the Stability of Stablecoins - Bloomberg.

A Bit More on Stablecoins

- We can treat this issue as we would treat counterparty risk in an OTC derivative if one of three conditions are met:
  - There is the possibility that the collateral is held by a recognized clearing organization (e.g. DTCC) and is transparent in nature.
  - We can also address counterparty risk if the custodian has a recognized credit rating (e.g. S&P or Moody's).
  - Finally, if the issuer is publicly traded, Northfield will create our own internal credit rating as we routinely now do for corporate bond issuers that are not rated.

Cryptocurrency Linked Items

- To the extent that cryptocurrency ETFs become available in various countries, we will be following our normal practice.
  - Once you have the risk representations of underlying cryptocurrencies, we will build the related ETFs "bottom up" based on their constituent portfolios
- Cryptocurrencies with backing from the central bank of a nation will be unsurprisingly tied to the related fiat currency.
  - East Caribbean Currency Union will be the first multinational CBDC
  - El Salvador has recently recognized Bitcoin as legal tender
- Our usual logic will apply to equities related to the cryptocurrency business, such as the Coinbase IPO.
  - Coinbase will be treated as a fixed portfolio consisting of publicly traded equity in financial exchanges (ICE, LSEG) plus some exposure to popular cryptocurrencies such as Bitcoin and Ether.

Ongoing Research

- Unlike conventional securities or currencies, cryptocurrencies involve some aspects which are unfamiliar to many people in the financial community, just as traded derivatives were unfamiliar four decades ago.

- To address this lack of understanding Northfield has been preparing an extensive "white paper" on the technological, structural, and regulatory aspects of cryptocurrencies, as the basis of a formal paper to appear in a "peer review" finance journal.

- If you would like a copy of the white paper when available, please request it from a member of the Northfield sales or tech support staffs.

Conclusions

- We will be adding coverage of fiat currencies from frontier markets in the next couple months.
  - That will be followed by coverage of the major cryptocurrencies.
- The analytical process is similar to what we now do for commodities and currencies.
- With the short to non-existent history of the many new cryptocurrencies functioning as purely speculative assets, the key to good forecasts is to understand what risk level is economically justified by the volatility that investors must likely endure.
- The assessment of volatility and risk is highly dependent on a nuanced understanding of the extent of non-IID returns.