HORIZON KINETICS

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Dear Clients and Friends:

The year 2024 was quite extraordinary, with Bitcoin achieving institutional acceptance as the SEC gave permission to launch a variety of Bitcoin ETFs. There are now at least $110 billion of assets in these funds, led by the iShares Bitcoin ETF. With over $55 billion in AUM, it is the 32nd-largest ETF in the United States. All of this has happened in only 12 months—the speed of acceptance is without historical precedent.

This is also extraordinary because Bitcoin, as well as cryptocurrency more generally, is an entirely new asset class. The last entirely new asset class in the U.S. was options, which began trading in 1973 with the formation of the CBOE (Chicago Board Options Exchange). Options are still largely the domain of specialized trades, although the CBOE estimates daily volume across all options markets at about 57 million contracts daily.[1] The time required to attain this volume has been 51 years.

According to the CBOE, the total notional matched volume of equities, expressed in dollars per day, is now approximately $550 billion.[2] By comparison, the 24-hour dollar-based volume of Bitcoin is now over $28 billion, a figure derived from the blockchain.[3] However, this is only one manner of calculating Bitcoin volume.

Since Bitcoin trading occurs on an intramural basis within a broker from one client to another, without blockchain movement, there is another calculator: the volume reported by brokers. This is more directly analogous to conventional equity trading, and amounts to approximately $83 billion.[4]

But this methodology is also somewhat deficient, because Bitcoin trades every day, whereas equities only trade during business days. Typically, there are 253 trading days in a year, unless there are special-occasion holidays. Consequently, another perhaps-more-interesting way of comparing Bitcoin to an equity would be measuring it against a single stock.

An intriguing stock for this purpose would be Apple (AAPL), the largest position in the S&P 500 Index, with a weight of 6.84%. Daily trading averages 45.9 million shares. Given the current share price, this amounts to a dollar volume of $10.6 billion, obviously much lower than the previously quoted Bitcoin figure of $83 billion. Of course, when comparing these two numbers, it should be realized that Bitcoin will trade 365 days per year, and

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[1] *As of January 24, 2025. Source: https://www.cboe.com/us/options/market_statistics/*

[2] *As of January 27, 2025. Source: https://www.cboe.com/us/equities/market_statistics/*

[3] *As of January 27, 2025. Source: Bitinfocharts.com*

[4] *As of January 27, 2025. Source: coinmarketcap.com. The volume for each market pair is calculated by taking the 24h volume reported directly from the exchange in quote units, and converting it to USD using CoinMarketCap's existing reference prices.*

Apple will trade, on average, for 253 days. So, the volume differential is even greater in favor of Bitcoin.

The next phase in the evolution of cryptocurrency should be the development of a lending market and an associated interest rate, driven by demand for arbitrage transactions. There are 775 cryptocurrency exchanges or trading venues.[5] These are not formally government-licensed exchanges in the traditional sense. Nevertheless, there are still an astonishing number of transactions.

As such, many cryptocurrencies, including Bitcoin, routinely trade at different prices throughout the 24-hour trading day. An arbitrageur will sell a given coin in the most expensive market and simultaneously purchase that coin in the least expensive market. In a cryptocurrency arbitrage, a trader will borrow a coin to sell in the expensive market and repay the loan with the simultaneous purchase of that coin in the least expensive market. The profit will be earned by the trader less the interest that is paid to the lender.

This is particularly important, since such a market will establish a so-called "natural" interest rate that can be very different than for traditional fiat currencies established by central banks. In principle, a Bitcoin ETF can lend bitcoin to this market, and the interest earned would be paid to the ETF holder. A sufficiently high interest rate might increase—or perhaps even vastly increase—the demand for cryptocurrency. If a central bank were effectively compelled to raise interest rates to support a fiat currency value in relation to cryptocurrencies, this could obviously entail implications for that fiat currency.

In a certain sense, interest is already earned on cryptocurrencies in the field known as "proof of stake," or "staking." The practice is the alternative to mining for the validation of cryptocurrency transactions; its advantage is consuming minimal electric power by comparison.

With staking, a validator places a quantity of crypto in a blocked account as collateral for fair and honest behavior in validating transactions. In the case of failure to execute the validation function, a validator can forfeit some or all of the staked cryptocurrency. The staking reward is a form of interest.

For Solana, the current staking reward is about 6.24%. To pay the interest, new coins are created, and this constitutes inflation rate for the coin. Solana's rate of inflation was initially 8%. It is scheduled by the Solana protocol to decline gradually by 15% per annum to a long-term fixed rate of 1.5%.

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[5] *Ibid.*

Ethereum has an inflation rate of 0.35%, with a staking rate of 3.08%[6] which is controlled by so-called "burning." This is merely the imposition of transaction fees totaling about 2.7%. These payments are then withdrawn from circulation, thus controlling the supply of coins.

The Solana approach does not require high transaction costs—the current fee is 0.00027%. This has recently increased the value of Solana in relation to Ethereum. Solana can also support a far greater rate of transactions than Ethereum. Presently, Ethereum's transaction rate is approximately 15 per second. Solana's is roughly 2,600 per second.

With this new asset class being created, the nature of investing is changing in ways unseen since the creation of common stock. It appears the first genuine common stock, in the modern sense, was issued by the Dutch East India Company in 1602. The creation of new asset classes is rather rare in the historical sense.

In fact, the fiat money that seems so natural in the contemporary world was only first created in China in the 10th Century. Historically, money was backed by a physical asset, such as gold or silver. Governments did seek to debase the money by changing the statutory gold or silver value. This was certainly the case with the Roman denarius, first issued in 211 B.C. during the time of the Second Punic War.

At the time of the Emperor Tiberius, subsequent to the death of Jesus Christ, historians seem to agree that the denarius still contained about 98% of its silver content from the time of first issuance over two centuries previously.[7] Subsequent to the death of Tiberius, Roman coinage began a long period of debasement that seems to have contributed in no small degree to the ultimate collapse of the Roman Empire.

In an investment sense, the current moment is unique. And the same holds true—perhaps with even higher stakes—in an economic sense. This is because of the development and evolution of what is now called artificial intelligence. The name itself is rather misleading, as it creates the impression of thinking machines or devices. In actuality, the devices engage in extremely high-order computation. An example might be the use of a large language model such as ChatGPT.

Essentially, and obviously, a computer can store very large amounts of previously written material. For instance, it could store the contents of every book, article, essay, or speech about the work of Pablo Picasso. One could ask the computer to generate a summary of this work. In fact, one could ask for an essay on the Picasso Rose Period. The computer

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[6] *https://www.compassft.com/indice/styeth/*

[7] *See Kenneth Hall, "Coinage in the Roman Economy, 300 B.C. to 700 A.D."*

would construct this based upon the probability of certain words occurring in the stored text—subject to rules of English grammar, or the rules of any language chosen.

The reason the essay would appear to be written by a human relates to a subject called "temperature." In computer science terms, temperature is a deviation from the calculated rank order probabilistic preferences in all the stored text. The ranking could be frequency of the appearance of various words, or frequency of citation by scholars. If the device merely followed the probabilistic rank order preference, the same words would be used repeatedly. The created text would not be very engaging.

Consequently, the device regularly deviates from the rank order preference of words in probabilistic order by using less-frequently cited words. The resulting text is far more engaging or warm. It is in this sense that temperature is applied to computer-generated text. This obviously requires a great deal of computation.

This level of processing requires significant amounts of electric power. A ChatGPT query uses far more energy than a simple Google search. Interestingly, there is a great deal of divergence among the estimates of ChatGPT energy use, as one might readily verify by simply posing a ChatGPT query, or even a Google search, on this subject. The reason for the divergence among energy usage estimates is that the amount of data being collectively stored by OpenAI (the company that owns ChatGPT) is always increasing.

For example, UNESCO (United Nations Educational, Scientific, and Cultural Organization) estimates that globally about 2.2 million books are published each year. This obviously does not include scholarly articles, magazine articles, newspaper articles, and blogs, among other forms of communication. As more data is accumulated, the energy cost of processing that data will surely increase.

Large language models are only a small part of the vastly increasing computer processing needs of modern civilization. One must also consider the incredibly more extensive digital processing requirements of large quantitative models that are just in the initial stages.

Modern scientific development creates hitherto unprecedented processing and computational requirements. An example from pharmaceutical research will make this point quite clear. Most pharmaceutical projects fail to obtain government approval. This is because even with very extensive testing, it is not generally possible to derive a predictable outcome for the average human being.

To systematically solve the problem of pharmaceutical effectiveness, one must collect enormous quantities of data on individual human body chemistry. This is made far more complex by the fact that individual human body chemistry varies with time and by individual. In addition, it is necessary to collect data on given ailments at the molecular level. It is also necessary to understand this level of organic chemistry in relation to proposed pharmaceuticals with hundreds of trillions of possible molecular structures.

This can only be accomplished with extremely high-order computation, consuming vast amounts of electric power that will require hitherto unimaginable amounts of energy. Although quantum computers do not currently exist, these will require cooling at a constant temperature of 15 millikelvin (-273.135 degrees Celsius).

Modern civilization is not yet prepared to produce this level of energy. In fact, the currently prevailing investment view relegates energy to a very small role in a standard portfolio. The S&P 500 has a 3.39% weighting in the sector. Yet, although the societal investment in energy is far below the expanding needs of modern computation, this is not the primary problem regarding power requirements.

A far more important limiting factor is water. The discussion regarding the power requirements of modern computing now largely revolves around choices between nuclear, coal-fired, and gas-fired power generation. These are then compared to emerging alternative power sources such as wind and solar energy.

The common feature of nuclear, coal-fired, and gas-fired generation is that all these modalities are examples of thermal power generation. That is to say that they all essentially heat water to produce steam to drive a turbine. It is the rotational motion of the turbine that is converted to electric power.

To understand the enormity of the water requirement, the Millstone 2 nuclear power plant in Connecticut has a rated power capacity at maximum output of 870 megawatts (or Mwe—megawatt electric). It uses 504,000 gallons of water per minute. Of course, the water is largely used to produce steam, and this steam can be condensed to once again become water in a cooling tower. Nevertheless, it should be realized that in accordance with the laws of thermodynamics, there is no such thing as 100% energy conversion.

In practice, some of the water will inevitably be evaporated into the atmosphere. Those who question the scientific principle involved can always view the Millstone plant in operation and see the steam emitted from the cooling tower. It should be noted that posting a photograph of Millstone 2 is not considered to be advisable, due to security regulations.

In any event, let us assume extremely efficient thermal conversion with evaporation of only 50,000 gallons per minute (still enough to fill two typical backyard swimming pools). There are 42 gallons in a barrel, so this evaporation amounts to 1,190.48 barrels per minute, or 71,428.57 barrels per hour. This is equivalent to 1,714,285.71 barrels per day and 625,714,285 barrels per year—more than 25 times the volume of New York's Central Park Reservoir—for one not-very-large power plant.

Let us assume that the requirement was to power a 1 GW (gigawatts of power production) data center. This would obviously not be sufficient. That is because any thermal power plant can be offline for scheduled or unscheduled maintenance. In round figures, perhaps it might be reasoned that 2 GW could adequately supply a one-gigawatt data center that must be operating continuously. Unfortunately, the calculation of the generation plant requirement must take account of the laws of thermodynamics. This is done through a metric known as power usage effectiveness (PUE).

Again, in accordance with the laws of thermodynamics, there is no such thing as 100% energy conversion. In a data center, the power that enters via the transformer is much greater than the rated power usage of the equipment. A typical PUE metric is expressed as a ratio, such as 1.54. This means that if 154 kilowatt hours are purchased from a power plant, only 100 kilowatt hours are consumed by the equipment. The differential is heat, for the same reason a phone charger plugged into an electric outlet is noticeably warm.

In other words, a data center requires 54% more power than it actually consumes. Therefore, in the aforementioned power usage example of 2 GW in power generation to serve a 1 GW data center, the real requirement would be 3.08 GW. The obvious challenge is to determine the degree to which alternatives can replace conventional thermal plants. This is very important, since in the prior example, a 3.08 GW load in thermal generation requires enormous quantities of water. An advantage of wind and solar is that they are non-thermal—and, as such, do not impose huge water consumption requirements.

Unfortunately, the issue with wind and solar is load variability. Transformers, motors, transmission lines, lighting, and generators are all set to operate at a standard frequency. In the U.S., that frequency is 60 Hz. The utility grid is designed to detect meaningful variation from this frequency, and circuit breakers will automatically power down the system if meaningful deviations from 60 Hz are detected. This is to prevent a power surge that can damage equipment.

Wind is inherently variable due to the obvious continual variation in its velocity. Solar is less variable than wind, but nonetheless variable; cloud cover, dust, and haze levels shift throughout the day. Consequently, wind and solar must be simultaneously supplemented with continually—which is to say immediately—dispatchable power, meaning that such a power plant is constantly running in the background. Accordingly, traditional power generation sources remain in the electricity generation mix, even in the presence of quite substantial wind and solar capacity.

It is for such reasons that the Horizon portfolios have been so heavily weighted towards energy—and, more importantly, water—resources. Ordinarily, the portfolios are explained on an issue-by-issue basis constructed in accordance with value investment principles. This letter is merely another way of viewing the portfolio in terms of grand public policy issues.

As can be plainly observed, water is the critical scarce resource. It is difficult to obtain a water exposure meaningful to modern high-order computation issues through conventional investment products such as indexes. These typically have no meaningful water exposure. However, those same indexes are replete with heavily weighted technology firms. The future growth of those companies is deeply dependent, and arguably critically dependent, upon the availability of water.

Since water is indeed a scarce resource, a conventionally diversified portfolio can be expected to have little or no water exposure. However, this is not a very wise strategy. It seems unreasonable to construct a portfolio devoid of the critical resource that will determine the success or failure of the technology companies that now comprise the largest allocation in conventionally diversified portfolios.

Incidentally, although artificial intelligence seems to emerge as the dominant technology theme, one might take some comfort in the fact that even the fastest modern computers cannot beat a rational human being at a simple game such as tic-tac-toe. This is because tic-tac-toe has a limited number of possible moves, which can all be visualized by humans in a simple decision tree. A game of tic-tac-toe between the fastest, most elaborate computer and a rational human being will ordinarily result in a tie.

Of course, a modern chess-playing program such as AlphaZero can ordinarily beat a human being at chess. This is also true for games such as Shogi (Japanese chess) and Go. The computer can visualize far more elaborate and extensive decision trees than can human beings, although they cannot calculate complete decision trees for all of the possible true strategies in chess. This, according to some computational scientists, might require decision trees that are substantially larger than the currently known universe. Thus, it is theoretically possible for a human to devise a chess-playing strategy that will be superior to all chess playing strategies devised by AlphaZero.

Despite the vast increase in the computational power of the modern computer, nobody has developed a program that can beat human beings at poker. One reason is that the computer programs have been designed to wager in a manner proportional to the hands that are dealt. It will very quickly become apparent to the human players that this is the strategy of the computer, and thus, the program will become predictable and vulnerable.

One might also note that bluffing is an important part of poker. The computer has no rational basis upon which to bluff. Indeed, if such a rational basis were to be devised, it would become readily apparent to the human players, and therefore predictable. The ability to perceive predictable betting is a distinct advantage in poker.

It is to be hoped that this overview of the Horizon portfolio construction—from a strategic perspective, as opposed to the customary individual security perspective—is interesting. We have not made major changes to the portfolio for quite some time. Consequently, some positions have substantially appreciated to the degree that they have become highly concentrated. This level of concentration is meaningfully different from conventional portfolios, and as such, we believe it is actually an important means of diversification away from traditional portfolio construction—particularly indexes.

The choice constraints upon energy and electric power are not yet obvious to the investment community. These are nothing other than consequences of the laws of thermodynamics. Once this is realized, as it eventually must be, investment capital will flow in very different directions than has been the case for the past 10-15 years. If that does happen, we believe the Horizon portfolios will not seem as dramatically different from the typical “diversified” portfolio profile as they do now.

These choice constraints, imposed as they are by the laws of physics, entail resource constraints that should entail inflationary consequences due to shortages of crucial resources. This will make the fiat money policies of the past half-century far more difficult to execute and promote more rapid adoption of cryptocurrency as an important asset class.

This is just a taste of what we are thinking about as we enter the new year. We look forward to discussing these and other related topics at our next roundtable meeting. Until that time, if readers should wish to pose further questions or require more information, we continue to be at your disposal. As always, our personal and corporate capital remain invested in these strategies.

With gratitude, onward into 2025!

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