
HORIZON KINETICS RESEARCH

The Cryptocurrency Compendium Compilation

For February 1, 2021 to March 15, 2021



*Exclusive Marketers of
The Cryptocurrency Compendium*

PCS Research Group LLC
100 Wall Street, 20th Floor
New York, NY 10005
research@pcsresearchservices.com
(212) 233-0100
www.pcsresearchservices.com



Research Team

| Murray Stahl | | Steven Bregman | | |
|---------------------|---------------|-----------------------|--------------------|-------------|
| Rich Begun | Thérèse Byars | Ryan Casey | James Davolos | Peter Doyle |
| Matthew Houk | Utako Kojima | Eric Sites | Fredrik Tjernstrom | Steven Tuen |

Horizon Kinetics LLC ("Horizon Kinetics") is the parent holding company to registered investment adviser Horizon Kinetics Asset Management LLC and is the author of this report. PCS Research Group LLC ("PCS"), an unaffiliated third party, is the exclusive marketer and an authorized distributor of this and other research reports created and authored by Horizon Kinetics. The investment thesis herein is solely that of Horizon Kinetics. This report is based on information available to the public; no representation is made with regard to its accuracy or completeness. This document is neither an offer nor a solicitation to buy or sell securities. All expressions of opinion reflect judgment as of the date published and are subject to change. Horizon Kinetics, PCS, and each of their respective employees, subsidiaries and affiliates may have positions in securities of companies mentioned herein. All views expressed in this research report accurately reflect the research analysts' personal views about any and all of the subject matter, securities, or issuers. No part of the research analysts' compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views expressed by the research analysts in the research report. Reproduction of this report is strictly prohibited. © Horizon Kinetics LLC® 2021.

CRYPTOCURRENCY COMPENDIUM COMPILATION

| | |
|---|----|
| MICROSTRATEGY BITCOIN PURCHASE | 3 |
| <i>European Contrarian Compendium January 2021</i> | |
| The Debt Crisis, Bitcoin, and Law Changes | 4 |
| <i>Spin-Off Compendium February 2021</i> | |
| Bitcoin vs. Gold | 10 |
| <i>Spin-Off Compendium February 2021</i> | |
| Cryptocurrency & Indexation | 12 |
| <i>Spin-Off Compendium February 2021</i> | |
| Bitcoin Value and Volatility vis-a-vis Money Supply and Mining | 19 |
| <i>European Spin-Off & Restructuring Compendium February 2021</i> | |
| Bonds & (Varieties of) Risk | 21 |
| <i>European Spin-Off & Restructuring Compendium February 2021</i> | |
| Corporate Purchases of Bitcoin & Impact on the Market | 26 |
| <i>Fixed Income & Cryptocurrency Compendium March 2021</i> | |
| Bitcoin as an Alternative to Fiat Currency | 27 |
| <i>Fixed Income & Cryptocurrency Compendium March 2021</i> | |
| Counterfeit U.S. Cash Abroad | 29 |
| <i>Fixed Income & Cryptocurrency Compendium March 2021</i> | |
| Fiat Currency, Cryptocurrency, and Counterfeiters | 30 |
| <i>Fixed Income & Cryptocurrency Compendium March 2021</i> | |
| Cryptocurrency, Fiat Currency, and Crime | 32 |
| <i>Fixed Income & Cryptocurrency Compendium March 2021</i> | |
| The Open-Source Movement, Investing, and Varieties of Displacement | 37 |
| <i>Stahl Report Compendium March 2021</i> | |

CRYPTOCURRENCY COMPENDIUM COMPILATION

MICROSTRATEGY BITCOIN PURCHASE

European Contrarian Compendium January 2021

Q: Michael Saylor at MicroStrategy (MSTR) recently issued approximately \$650 million worth of a five-year convertible note with three-year call protection in order to buy more bitcoin. Is that something we should be looking at to purchase for people who cannot buy stock and can only buy bonds?

A: If investors want exposure to bitcoin, MicroStrategy is one way to get it. The company is probably going to make money, because bitcoin is likely to go up, but one should just understand that MicroStrategy is not a bitcoin investment. It is just that it owns over a billion dollars in bitcoin. If one looks at the market capitalization, the bulk of the valuation is not bitcoin. Still, if one wants some exposure to bitcoin, this is a means to accomplish that if one cannot get it through the ordinary means, for example, if one cannot buy GBTC due to custody or oversight issues or a requirement to only purchase bonds.

There are not a lot of equity alternatives for such investors looking for bitcoin exposure. They will probably make money on MicroStrategy, but they should just understand that the bulk of the investment is not in bitcoin. The company now has a heavy bitcoin influence, but it is not a bitcoin stock. Investors should know that and be okay with it before they buy these bonds.

CRYPTOCURRENCY COMPENDIUM COMPILATION

THE DEBT CRISIS, BITCOIN, AND LAW CHANGES

Spin-Off Compendium February 2021

Q: What are your thoughts on tax changes in general for cryptocurrencies in the future? It is hard to predict, but tax law does change. In 1986, we had tax law changes that basically ended the limited partnership industry for a while. Do you see the government trying to raise taxes to pay down debt, or taxing us differently?

A: Well, matters are so far out of hand, debt levels are so high, there is no conceivable tax increase that would raise enough revenue to meaningfully solve the problem. One could always argue that raising taxes high enough has some negative impact on the economy, but I look at it differently.

Let's put some numbers on it for a sense of the magnitude of the problem. The three levels of the U.S. government—federal, state and local—spend a little over \$10 trillion a year. We have a \$21 trillion economy. Government spending is approaching, more or less, 50% of the total economy. I don't know how much more tax revenue you can get out of it.

Let's just say the three levels of government could raise another trillion dollars through various kinds of tax increases. The federal budget deficit by itself right now is \$3.2 trillion. The extra \$1 trillion would not pay down any debt; all it would do is lower the rate of debt increase. The debt would go from \$3.2 trillion to \$2.2 trillion. And that is assuming it is even possible to take in another trillion dollars in tax revenue without having any negative impact on corporate profits, people's income, the rate of employment, and so on and so forth.

We are not going to solve the debt problem by raising taxes. That ship has sailed. If it is the problem many people say it is, something very different has to be done to solve it. We are way beyond changing the tax laws to solve that challenge. The numbers are truly astronomical, and they are getting worse literally by the minute.

For a sense of the magnitude of the national debt, Treasury Direct, a branch of the U.S. Treasury, calculates the U.S. national debt every day, to the penny, and the agency reports we are at slightly less than \$27.8 trillion in debt at this writing. I regard the Treasury Direct website as an authoritative source. We are going to be at \$32 trillion in about 12 months, more or less, no matter what anybody does.

That's the current status. For one sense of how excessive debt becomes so problematic, say that interest rates were to go up by 1%. In that case, the U.S. government would have to pay another \$320 billion in debt service. Now, that increased interest expense, spread across all taxpayers, will reduce their taxable income. So, even if the government manages to levy an extra trillion dollars, assuming it can be done, it's only going to pocket \$680 billion.

CRYPTOCURRENCY COMPENDIUM COMPILATION

Actually, the government would not even pocket the full \$680 billion, because this does not account for other increasing costs. Annual Medicare-Medicaid payments, which are now over \$1.2 trillion a year, are rising at least 10% annually even if Medicare eligibility is not expanded to make it available to more people or to include the uninsured. If we add another \$120 billion or so for increased Medicare costs to the \$320 billion in increased debt service, we are at \$440 billion of increased expense. We have not yet included additional Social Security expenses, or wage increases for the millions of federal employees.

Furthermore, the \$1 trillion calculation is very liberal, because it only includes the U.S. Treasury figures. The total \$10 trillion of government expenditures embraces the states and the municipalities as well, and they have to deal with pension fund payments, health insurance payments, and so forth. They also need to give their employees raises and pay for increases in other operating costs. Even after raising a trillion dollars in new taxes, which is an enormous number, very little will be left for any substantive level of debt reduction.

Let's look at it another way. Say the government wants to raise \$1 trillion more in tax revenue. In the U.S., 124 million people pay taxes. If we divide a trillion dollars by 124 million, basically the government has to get another \$8,000 a year out of every taxpayer. The average taxpayer in the U.S. earns about \$45,000 a year, but to raise another \$1 trillion dollars, the government has to get \$8,000 extra out of that \$45,000 annual salary. That is not very easy to do.

Even that number is a gross overstatement. It is true that the average gross income is \$45,000 a year, but taxpayers do not bring home anything close to \$45,000. They pay income taxes, Social Security, sales taxes, and what have you. Let's just say individuals have \$30,000 in disposable income. If the government wants \$8,000 more, it wants 25% of the average taxpayer's disposable income. The only way people could possibly afford to pay that additional amount in taxes is to drastically reduce their expenditures. They would have no alternative. And if they drastically reduce expenditures, government revenue will drop precipitously anyway.

Q: It does not seem like the government has any other options, which is scary. Where else in the world is the situation any better? What could the government do from here besides raise taxes? What other options are there?

A: There are no options. The government can try to raise taxes, but it is not going to get any more money.

W. Elliot Brownlee, a history Professor Emeritus at the University of California, Santa Barbara, wrote a very interesting book called *Federal Taxation in America*. The history goes back as far as the U. S. had taxation, back to the Whiskey Rebellion of 1791 to 1794. Through a lot of U.S. history, there was no income tax at all. Government had other forms of taxation.

CRYPTOCURRENCY COMPENDIUM COMPILATION

The income tax is a relatively new invention; the first federal income tax was created in 1913.

Let's put it this way. It is very hard for any society, however constituted, no matter what taxing system it has in place, to get a lot more revenue than the U.S. government currently collects. Right now, it is not quite 50% of GDP, but it is close. So, to make it easy for ourselves, let's speak in general terms, even though they're not really accurate.

One approach is to increase taxes, ignore the deficit, and just spend more money. The debt leverage is not a solvable problem from a mathematical standpoint. That ship sailed a long time ago. What is the government to do? I do not have any brilliant ideas about how to solve that problem; I am just telling you that as far as I can determine, from a mathematical standpoint the problem is intractable. As a practical matter, there is nothing anyone can do about it. Maybe there are others who are more astute than I am and perhaps they see a solution; I say go ahead and do it! I personally do not see a solution in a mathematical sense.

There is no kicking the can down the road, either. That ship has sailed, too. We are at the moment of truth. In other words, interest rates are pretty much down to zero. They can possibly be lowered a bit more but that is not going to meaningfully solve any problems. It may save a few dollars here and there, such as some interest expense, but it is not going to change the essential circumstance.

One concern is that now there is no incentive to buy a debt instrumentality, because there is no compensation in it. What is debt? Debt is deferment of current compensation. If one has \$1,000, one can put it into a bond, one can lend the money to somebody, or one can spend the money. Why choose to put \$1,000 into a bond? The goal would be to get enough profit out of it so that in two, four, or ten years, whatever the investor's time horizon may be, one will be able to spend more money, be able to consume more than one could consume today. For some people, it makes sense to defer consumption for a particular period of time if the interest rate is sufficiently high. Today that is not the case. There is no reason on earth to buy the bonds. If the central banks can't sell non-compensatory bonds to the public, to raise the cash to cover the budget deficit, where are they going to get the money to buy the bonds? They have to create it, and when they create more money, the currency is debased. There is no kicking the can down the road anymore. That game is over.

In history, there were governments that were very reluctant to spend a lot of money in a crisis. Why? Let's use the British government of the 19th century as an example. There were crises in the United Kingdom in the 19th century and the government was very reluctant to spend money. It was not that the government was cruel; instead, those in government had the sense that if they were too liberal with the state's finances, they would not be an effective government.

CRYPTOCURRENCY COMPENDIUM COMPILATION

The only power a government really has is the power of the purse, the power to collect money from some people and spend it for other purposes. In other words, incentivizing people to do the things that the government thinks are important, whatever those things happen to be; money is distributed, funding contracts and programs and salaries. Once the government loses control of the nation's finances, it loses control of the ability to get money to incentivize people to assist in those programs. Schools can be built or armies can be built, but governments historically have been loath to take the spending beyond a certain point. The crises were real enough, but they just felt it was too dangerous.

In the 20th century post World War II, no government felt any compunction about raising as much money through debt or taxes as was thought necessary to accomplish its objectives. It has been 75 years since World War II, and every nation is now in the same position, for all intents and purposes: there is no kicking the debt and deficit problem can down the road anymore. This is the moment of truth. And if history is any guide, it does not usually bode well.

What can happen? The answer to that question is what makes cryptocurrency so fascinating. There is a possible solution in cryptocurrency, at least from a government's point of view. Were the aggregate value of cryptocurrency to become equivalent to the fiat values around the world, it would obviously have had to appreciate by hundreds of times. It could be the greatest value increase of an asset in history. Governments could tax that gain, and it is conceivable that the magnitude of that tax revenue could help solve some of the budgetary problem. How much it could solve would depend on how much the crypto value increases and how much trading of crypto occurs, but it is conceivable that taxing crypto capital gains could solve, or largely solve, the problem.

The trouble with this plan is it comes at a cost. It will create a dichotomy of wealth between those people who had the foresight to buy the crypto and those who left their assets in fiat currency. Anyone who had an income stream in the fiat currency would end up impoverished. That includes people who are receiving pensions and perhaps those who left their money in what were considered to be safe government bonds or state municipal bonds. Quite a few people could be impoverished under those circumstances, so the acceptance or ascendance of cryptocurrency to the level of a parallel currency to fiat could come at a horrible price. We need to be cognizant of that.

Q: If we are at the point where there is no looking back besides this solution using bitcoin, what other options are there? What has happened in the past? Is this the time when we lose world currency dominance?

A: The U.S. is not going to lose world currency dominance, because, give or take a few dollars, every nation has followed the same course. The U.S. would have had that kind of problem had our country been the great debtor while other nations maintained a more

CRYPTOCURRENCY COMPENDIUM COMPILATION

prudent fiscal posture. However, the other countries did basically the same thing the U.S. has done, and quite a few of them went further and fared worse.

It is not as if the mantle of the world's reserve currency is going to pass from the U.S. to some other country's currency. That is not going to happen. What will happen is that the major economies collectively—the U.S., Russia, China, the European Union, Great Britain, etc.—effectively will lose control of monetary policy if bitcoin or some fixed-issuance currency becomes the world-accepted standard. The governments could still conduct monetary policy to some degree, but they will be severely constrained. Monetary policy will not be a tool available to any of them.

It would be very much like the 19th century gold standard. A government theoretically could have inflated a nation's currency, but all that would have done is debase that currency with respect to gold. If a nation that did that had to buy something from abroad, like an essential textile or staple food, it became very expensive for the populace. There was an almost immediate impact lowering the standard of living. A central bank probably does not want to do that.

Most countries in the 19th century did not do it. The inflationary period from, say, the French Revolution through the end of the Napoleonic Wars was so traumatic in a monetary sense that for almost a century, from 1850 to 1914, no country wanted to engage in an inflationary policy.

Then came the First World War. In the First World War, nations felt they had no alternative but to fight the war, and to do that, it had to be financed. There was an enormous amount of debt creation and there was quite serious inflation in a lot of countries. The consequences remained with the countries involved for the next quarter century. We do not have to go into all the horrible events that occurred between 1914 and 1945, but we see what happened to the world, including hyperinflations and deflations, including the Great Depression, through World War II. Nobody wants to experience that again, so history is unlikely to repeat itself.

The one positive outcome of those policies is that a lot of countries could start over because their national finances, their currencies, were wiped out. In the early part of that period, there were modest deficits, then there were yet greater, though still modest, deficits, and it continued to get worse with the passing decades. Do not forget, until the level of debt and deficits approach a crisis level or, at the least, start having visible deleterious impacts, any deficits a government runs just serve to increase GDP—the government is a major consumer and employer, so its increased spending is stimulative. There is an incentive for the government to keep spending until it cannot spend anymore.

We are at that point globally. Governments cannot go very much further than the way it is right now. They are constrained, and there is very little they can do. There might be

CRYPTOCURRENCY COMPENDIUM COMPILATION

approaches they want to take, but they cannot do that. It is a tragedy, but that is where we are.

CRYPTOCURRENCY COMPENDIUM COMPILATION

BITCOIN VS. GOLD

Spin-Off Compendium February 2021

Q: There is something like \$9.7 trillion of gold in the world; maybe the assumptions behind that are wrong, but it's one figure I've come across. Bitcoin, at its eventual 21 million units, and putting aside the allowance for lost private keys, should have a value of around \$450,000 per coin, roughly, if it eventually has the same total market value as gold.

Does that mean—if one's thinking about bitcoin replacing or replacing a part of people's gold allocation—that the current bitcoin price is discounted at less than 10% of the gold that would be replaced by bitcoin, so there's a lot more room to grow. Is that a reasonable way of looking at this or is that just number juggling?

A: Gold is a completely different asset class than bitcoin. They accomplish different aims and they are not really comparable.

To begin with, bitcoin is fixed issuance; gold is unlimited issuance. If the gold price were 25% higher, supply—from a variety of sources—would go up a lot. What is, exactly, the gold supply? There are not that many industrial uses for gold, even though there are some, but there is demand for gold for jewelry, for artwork, and for monetary gold—that is, for the various central banks that have gold reserves. It is not an investment in the way we normally understand investments.

What is the float of gold, that is, what is the value of gold that in equity terms we would call the float? One can debate this. It is similar to the fact that it does not make sense in modern terminology to say the market capitalization of a given stock is X and that it is therefore given an index weighting exactly proportional to its market cap, because about 15 years ago the indexes shifted to a float-adjusted market value that excludes the shares held by insiders. The same approach should apply to gold. That is why I do not even numerically look at gold that way.

Furthermore, gold is not such a great hedge against inflation. It worked well in the '70s, but that was because oil is necessary to provide the heat to smelt gold. So, when oil prices went up considerably in that period, of course the price of gold went up, too. If it did not, no one would have produced gold, because the cost of production would have exceeded the selling price. As a comparison, during the inflation of the '80s and '90s, the price of gold went down.

For me, the primary reason to own gold is to protect monetary assets against political unrest. One can take gold across borders and it will be accepted everywhere. Everyone recognizes the value of gold. Bitcoin, on the other hand, can only function if the worldwide

CRYPTOCURRENCY COMPENDIUM COMPILATION

communication system on the internet is functioning. If it is not functioning, it would not be impossible but it would be a lot more difficult to operate bitcoin.

If one thinks inflation is likely to occur, one is probably better off in bitcoin. If one thinks political unrest will occur—and sometimes inflation comes in the wake of political unrest—I would not spend too much time worrying about bitcoin; I would put the money in gold. They are very different phenomena and they have to be measured accordingly.

We are not on a worldwide gold standard because it is too cumbersome to deal with gold. Theoretically, it is possible to digitize gold, but for a lot of people that defeats the whole purpose of owning it. That is precisely why there is demand for physical gold; in a crisis, one can access one's gold and take it across a border if necessary. If the gold is digitized, then that is not necessarily possible.

For those reasons I do not focus much on the gold market with reference to any crypto, particularly bitcoin.

CRYPTOCURRENCY COMPENDIUM COMPILATION

CRYPTOCURRENCY & INDEXATION

Spin-Off Compendium February 2021

Exogenous Displacement Threat to the Index

One of the more powerful arguments in favor of indexation is that it was conceived as a holistic investment solution that captures the entirety of a market. Although it would capture the least successful firms, including those that are failing or ultimately would fail, it would also capture the most successful companies. Moreover, losses from the failing firms are limited to 100% of the capital the index deployed to those investments, while the profits derived from the most successful firms are theoretically unbounded. There are examples of returns equal to hundreds of times the capital originally deployed, Apple, Inc. (AAPL) being one such example.

However, it is possible that soon a type of company or technology *not* in the index could compete with and even disintermediate the largest information technology companies in the index. The basis for this, at least in principle, is that cryptocurrency can be not only a currency or asset, as is commonly understood, but it can also, through the blockchain that supports it, be an application in the form of a smart contract.

A smart contract is a self-executing computer program stored on a cryptocurrency blockchain. It has pre-established instructions or programming that describe a specified type of transaction that might take place between two or more parties with respect to an asset that is controlled by the contract. Once certain conditions of the contract are met, such as a payment, the smart contract automatically executes its instructions, such as transferring ownership of the payment and the asset between the parties. Among such applications that are already in use, there are a number of blockchain smart contracts for music. Payment for a given piece of music can immediately be paid, even at the one-penny level, according to the smart contract, to the artist, band members, manager, etc., according to pre-established terms.

Among the innumerable applications of this technology, one can easily imagine a circumstance in which, for anyone doing an internet search, a search engine stores the results on an associated blockchain. The data would be owned by each of the various people doing searches. Just like a cryptocurrency coin, the data would belong to each of them alone and would be secure, in that no one else could access it without each person's private key. That means that the search data would not be available to the typical large data collectors such as Google or Facebook.

If such commercial data collectors wanted to make use of that data, presumably these individuals would demand payment for the use of it. Or perhaps advertisers, like large consumer products companies, would offer payment directly to the consumer, bypassing the

CRYPTOCURRENCY COMPENDIUM COMPILATION

commercial data collectors. The payment would be directed to the individual owners of the data. This would up-end the current situation in which the giant technology firms collect the data for themselves, own it, and then monetize it by selling it to other commercial entities. In other words, the data would shift from a centralized ownership structure among a very few large entities to a decentralized ownership structure on the blockchain. This would be, in effect, the demonetization of the large data collectors such as Google or Facebook.

This approach would transform the index into a mere portfolio, since it would no longer be a holistic solution to the investment challenge of ensuring exposure to the whole breadth of significant possibilities and developments in the economy. In this example, a blockchain, or perhaps several different blockchains, could displace index members. But blockchains are not equities, so they cannot be included in the index. In fact, even if the blockchains *were* included in the index, the holistic solution would still not be recreated, because the revenue and profit would accrue to the users of the blockchain, not to the blockchain itself. This is the danger to the index from the existence of blockchain technology.

The same phenomenon applies to video content creators. In the current system, content creators sell a license for content to a company such as Netflix Inc. (NFLX), which then monetizes the content in the form of subscription revenue. However, it is at least theoretically possible for the content creators to place that content directly on the blockchain and charge a fee for access, thereby replacing an intermediary such as Netflix.

In the same spirit, if interest rates are zero or nearly zero, then the price of money is zero or nearly zero. If cryptocurrencies become accepted as a legitimate form of money, it is more secure from theft, if held in cold storage (that is, when the private key or password is not held in an internet-connected app or in a ‘wallet’ on an internet-connected device) than it is in a conventional bank. Ergo, there is no reason to deposit money in a bank, not for interest income, nor for security. A bank—perhaps even all banks—could, in theory, be demonetized.

Table 1 lists large positions in the S&P 500 that are just some examples of companies that could, in principle, be threatened by the disruptive impact of blockchain technology.

Table 1: Examples, Large S&P 500 Companies That Could Be Threatened by Potential Blockchain Smart Contracts

| | | <u>S&P 500 Position</u> |
|--------------|-----------------------|-----------------------------|
| FB | Facebook Inc. | 2.01% |
| GOOG | | |
| GOOGL | Alphabet Inc. | 3.28% |
| V | Visa Inc. | 1.13% |
| DIS | Walt Disney Co. | 1.00% |
| MA | MasterCard Inc. | 0.96% |
| PYPL | PayPal Holding Inc. | 0.86% |
| JPM | JPMorgan Chase & Co. | 1.29% |
| BAC | Bank of America Corp. | 0.78% |
| NFLX | Netflix, Inc. | <u>0.70%</u> |
| <i>Total</i> | | 12.01% |

CRYPTOCURRENCY COMPENDIUM COMPILATION

Implications for Central Bank Interest Rate Policy Control and Equity Valuations

In a larger sense, the risk is not from mere displacement of some index members, however large their index weight. In a cryptocurrency-active world, it will be difficult for central banks to set the interest rate on a national basis. One challenge is that a cryptocurrency such as bitcoin is a global currency. Let's say that bitcoin were to achieve widespread adoption and one day have a market value of a comparable magnitude to the money supply of major nations. A central bank that wished to control the bitcoin interest rate, therefore, would need to operate globally, which means it would need to have authority across national boundaries. The only institution that could play this role might be the Bank for International Settlements. Governance would be an issue, since all of the international constituencies might not agree on an interest rate policy.

Leaving aside the issue of governance, central bank mechanics are still a challenge in a cryptocurrency world. In that future world, a central bank can create money in a fiat currency, but bitcoin has a fixed-issuance monetary policy; there will only ever be 21 million units. Hence, if the central bank wishes to add to global liquidity, the only way this theoretically might be accomplished would be for the central bank to sell its supply of bitcoin. This raises the question of how the central bank would obtain a supply of bitcoin in the first place.

It is always possible for a central bank to purchase bitcoin in exchange for fiat currency. The mere act of issuing fiat currency in exchange for bitcoin, however, raises the value of bitcoin and lowers the value of the fiat currency in question by increasing the fiat supply. This is simply the way exchange rates between any two currencies works, or the way the historical price relationship between a given nation's currency and that nation's demand for gold has worked. At the same time, a decrease in bitcoin supply with the objective of storing this cryptocurrency to be used in some future crisis would make bitcoin more scarce and, at least in principle, raise the bitcoin interest rate for anyone who might wish to borrow in bitcoin. Thus, the mere act of the central bank accumulating bitcoin would serve to lower the value of fiat currency and reduce the ability of the central bank to conduct monetary policy.

If the central bank does not intervene in the cryptocurrency market and there is widespread cryptocurrency adoption, then, as a practical matter, the market and not the central bank will determine the global rate of interest. That rate of interest is not likely to be zero or negative. If the rate of interest is higher than it is now, this will impact indexation by lowering price-to-earnings ratios applied to corporate profits.

The sequence of events would be as follows: Widespread adoption of cryptocurrency would lead to the cryptocurrency market essentially setting a higher rate of interest—a greater proportion of total global money supply would be of the fixed-supply variety, a tight-money policy—and that would result in stocks generally trading at lower valuations.

CRYPTOCURRENCY COMPENDIUM COMPILATION

Some might be inclined to argue that governments can enact laws giving the central bank control over the bitcoin protocol, with a view to increasing issuance. This is possible, but in that circumstance bitcoin would become de facto—perhaps even de jure—another fiat currency.

Returning to the present, the problem faced by the modern central bank is that interest rates are so low that no incentive to purchase fixed income securities exists. However, fixed income—which is the mechanism of and enables borrowing—is important to the continued operation of governments as well as business. It must be purchased. Therefore, central banks must purchase the debt and issue currency to fund the purchases. Yet, issuing currency serves to further debase the fiat currency. That, in turn, stimulates the demand for fixed-issuance cryptocurrency like bitcoin by people who recognize that the increased fiat-currency issuance debases their fiat-currency purchasing power.

Looking forward, again, to a cryptocurrency-adoption world, and on the basis of this reasoning, if one presumes that the central banks will continue to play a role in monetary policy, this can only be possible if they own a sizeable amount of cryptocurrency. This is no different than the circumstance in the age of the gold standard. Central banks wishing to promulgate a monetary policy of any kind needed to own substantial amounts of gold. It should be anticipated that sooner or later, and most probably sooner, central banks will purchase significant amounts of cryptocurrency.

Central bank purchases of bitcoin, should they occur, would greatly increase its value, if bitcoin becomes the standard cryptocurrency. The effective supply of bitcoin will thereby be reduced. A shortage may even result. In such eventuality, perhaps the various bitcoin forks or spin-offs, or possibly Litecoin, which follow the bitcoin monetary policy, would also play a role in a future global monetary system.

One might be tempted to wonder if it might not be possible to create an unlimited amount of fixed issuance cryptocurrency, which would de facto become a negation of the limited- or fixed-issuance concept. This the question has been answered, in a historical sense, by the metals markets.

The worldwide reserves of silver are 11x greater than those of gold, but silver does not trade at one eleventh the price of gold, although some people believe that would be a reasonable ratio. The recent ratio is one-sixty eighth. This is because once gold was established as a store of value, the holders of gold have been loath to undertake any action that might negatively influence its value. Consequently, gold investors will only accept silver at a large discount to that of gold.

Similarly, worldwide reserves of palladium are lower than worldwide reserves of gold. Palladium does trade at a 29% premium to gold, but this is not related to its investment value.

CRYPTOCURRENCY COMPENDIUM COMPILATION

It is not generally considered an investment metal. Palladium has industrial uses, the most important of which is in catalytic converters. We can presume that if the electric vehicle were to replace the internal combustion engine, the demand for palladium would decline and, consequently, so would the price.

Further Implications and Use Cases of Cryptocurrency Adoption: Taxation

It is readily conceivable that various cryptocurrencies might develop use cases apart from mere store of value, in the same way that various metals have use cases apart from investment value.

One obvious use case is the authentication of content ownership, as noted above. It might be that digitized intellectual property, such as a single piece of music, might be attached to a unit of a certain cryptocurrency for authentication purposes. It might be a natural development that crypto-based authentication could also serve as a convenient payment mechanism, so that all blockchain records for a given service or product are kept in a single cryptocurrency. Thus, there might be separate cryptocurrencies, each specialized for the particular use case, for patent transactions, music, movies, theatre, speeches, lectures and so forth. Even in the world of stock trading, every share could be marked with a unit of cryptocurrency and that particular coin or even tiny fraction of a coin could be the unit of account for the payment of fees.

One interesting possibility for bitcoin would be a consequence of the continual debasement of fiat currencies by governments. If it is the government practice to debase its own currency, then it logically follows that the government would not wish to take tax payments in a depreciating asset like fiat, but rather would prefer to take tax payments in an appreciating asset, such as bitcoin.

Taking this observation further, what if governments were to accept or encourage tax payment in bitcoin? If this seems improbable, there is a new item in the U.S. Individual Income Tax Return Form 1040 for the tax year 2020. It is on the very first page, line 7. It reads: “At any time during 2020, did you receive, sell, send, exchange, or otherwise acquire any financial interest in any virtual currency?” If the government has already seen fit to make this change, and if it may be thought of as preparatory, then following this train of thought to its logical conclusion, accepting tax payments in bitcoin does not seem to be such an outlandish idea. This would greatly increase bitcoin’s value. The resultant trading in bitcoin would create enormous profits for traders. In turn, these traders would be liable for gains taxes on those profits, and the government therefore would generate enormous tax revenue.

In summary, any government has an enormous incentive to collaborate in achieving the greatest possible increase in the value of cryptocurrency because that could offer a partial and perhaps complete solution to the universal budget deficit problem. The popular idea or fear that cryptocurrencies will be banned is actually against governments’ interest because

CRYPTOCURRENCY COMPENDIUM COMPILATION

that policy would generate no revenue, while accepting crypto has the potential to increase government revenue. In fact, an attempt to ban cryptocurrency would actually generate an expense for the purposes of monitoring compliance with the laws. It seems more logical and therefore more likely for governments to undertake to increase the value of cryptocurrency by encouraging its adoption, as opposed to discouraging its adoption.

In fact, in a cryptocurrency-normalized world, the government could take the position that the repayment of fiat debt in fiat currency is a profit for a corporation, if the value of the debt is measured in the appreciating bitcoin. That is, on an exchange-rate basis relative to bitcoin, the fiat-currency denominated bond will have decreased in value over time, so its repurchase would result in a gain. In that case, repayment of that debt could be a significant revenue source for the government. It would effectively be a tax increase on corporations, even at the same tax rate, by reinterpreting the law on how to calculate the exchange-rate-based price of a bond. The companies that comprise the popular stock indexes would end up paying higher tax rates without any increase in the statutory rate of taxation.

A world in which cryptocurrency is an accepted medium of exchange is very different world than the one in which indexation has hitherto operated. It might be a higher interest rate world. It might be a challenge to large capitalization, centralized business models. More importantly, the pace of change will be more rapid than ever before in the history of civilization.

To further clarify the hypothetical example above regarding paying taxes in cryptocurrency: taxpayers would not *choose* whether to use bitcoin to pay a \$5,000 tax bill instead of using whatever is left of their depreciating fiat. In this hypothetical example the government needs a cryptocurrency position as a monetary policy tool, so the government would *require* payment in crypto. The government could pass a law saying that for every \$1,000 of tax owed, some portion, 10%, 20%, or 100% must be paid in crypto (even as it continued to issue fiat currency that is debasing).

Let us take the extreme example: the government says that from now on, it will not accept payment of taxes in fiat currency; it will only accept it in a certain cryptocurrency or maybe any of several. In that case, everybody would have to buy that cryptocurrency. For those who have an unrealized gain in the cryptocurrency, the mere fact of turning it over to the government is the same thing as selling it. A tax would be due on any realized gain, so the government would charge another tax on top of the initial taxes that resulted in everyone buying cryptocurrency to pay what they owe the government.

One can see a circumstance in which a government could greatly improve its financial posture by requiring partial or perhaps even an entire payment in crypto. A small enough government could balance its budget.

CRYPTOCURRENCY COMPENDIUM COMPILATION

In a rather aggressive but nonetheless plausible scenario, it is conceivable that the U.S. government might either wholly or largely eliminate its budget deficit by requiring payment in crypto. Even leaving the tax rate unchanged, the government actually could greatly increase its revenues. That would be intriguing from the point of view of the U.S. Treasury, because Congress would not have to agree to change the tax rates.

All that would be needed to require tax payments be made in a certain way, such as in cryptocurrency, is a directive from the Internal Revenue Service. For example, the U.S. Treasury does not ordinarily allow taxpayers to mail cash in an envelope in payment for taxes. A check, a wire, or some similar non-cash method must be used. That decision is within the purview of the Internal Revenue Service (IRS). If money is legal tender, one ostensibly should be able to pay \$100,000 one owes in taxes by packing cash up in a box or a briefcase and sending it to the IRS, but the Treasury generally does not want payment that way, although they might accept it in certain circumstances.

One can see how a government could use cryptocurrency to revolutionize its financial position. That is what I believe will happen one day.

CRYPTOCURRENCY COMPENDIUM COMPILATION

BITCOIN VALUE AND VOLATILITY VIS-A-VIS MONEY SUPPLY AND MINING

European Spin-Off & Restructuring Compendium February 2021

Q: Regarding the earlier discussion about the 27% growth in M2 from January 2020 to January 2021, would you explain the connection between this increase and the rise in bitcoin's price from about \$9,500 in January 2020 to \$32,000 or \$33,000? Mathematically, is there a way to bring that together?

As a follow-up question, mining drives the price of bitcoin, but how does mining tie into that relationship?

A: Let us just disaggregate some of the points here.

To begin with, bitcoin did not appreciate. What people call the appreciation of bitcoin is only partially due to the issuance of dollars. It is also a function of the issuance of many other fiat currencies.

If the United States was the only country engaged in excess money creation, there would be no need for bitcoin. One would just move one's investments into an alternative currency, a stronger one with a non-inflationary or less-inflationary monetary policy. However, more or less all the central banks are engaged in an extremely similar practice. The investor cannot achieve maintenance of value by moving into another currency. The central banks are all essentially engaged in the same monetary policy, so another currency entirely has to be created.

Back to the earlier point, talking about the volatility of bitcoin is looking at it the wrong way. It is not that bitcoin is volatile. People think that the bitcoin is volatile and the dollar is not volatile; after all, the dollar is just worth a dollar. However, that is only because the people who say that choose to ignore the purchasing power of the dollar in relation to bitcoin.

The dollar is as volatile as bitcoin in terms of currency depreciation. No more, no less. The right metric is how many bitcoin a dollar buys. A dollar will obviously buy a lot fewer than it did a year ago, so the dollar is as volatile as bitcoin.

To balance the equation of the gain in bitcoin purchasing power in relation to the dollar, one has to have the exact same volatility in the dollar in relation to bitcoin. It is ridiculous to say the rise in the price of bitcoin points to a bubble because one can see how volatile it is. All one is really observing is how many dollars one bitcoin buys—it's an exchange rate.

To make this more familiar, when one looks the dollar in relation to other currencies, say, to the Swiss franc, sterling, or dollar yen, one always looks at both sides; their price changes relative to one another have to be identical. One can say that the £/USD price is 1.38 or that

CRYPTOCURRENCY COMPENDIUM COMPILATION

the USD/£ price is 0.72. Similarly, if bitcoin is volatile in terms of its ability to purchase U.S. dollars, then the U.S. dollar is volatile in terms of its ability to purchase bitcoin. They are precisely equivalent volatility. The only reason no one notices this fact is that it is not described the right way.

Now let us move on to mining. Mining is an important vector in cryptocurrency, but not the only one. The cost of making a bitcoin is one of the factors that drives the value of cryptocurrency. If the aggregate computational power of the system—the hash rate—is greater, many more machines compete for a fixed block reward. You are going to earn less bitcoin if that happens, but the costs are the same. If you earn less bitcoin, the return might not be adequate unless bitcoin appreciates, so bitcoin appreciates.

Bitcoin appreciates because the alternative is no mining. Instead, some of the miners elect to drop out of the mining market in favor of buying bitcoin—those miners find it cheaper to buy a bitcoin than to mine it. They enter the buying market and, in doing so, force up the value of bitcoin. Another consequence of those miners dropping out of mining is that fewer machines are available to compete for the 10-minute block reward and, therefore, the new equilibrium is established; profitability increases for the remaining miners. That is basically how it works.

If the price of machines were to fall and the hash rate were to stay the same, it just means it would be less expensive to manufacture bitcoin, and chances are that probably most or all of that cost would be passed on to the bitcoin consumer. The price would fall in much the same way that the purchasing power of currency on a gold standard would fall if it suddenly became cheaper to mine gold and a lot more gold were produced.

That actually happened in history, with gold. An enormous quantity of gold entered Spain with the inception of the Spanish conquest of Central and South America. Spain was on the gold standard, not the precise gold standard of the 19th century point of view, but nevertheless gold was considered to be money. As more gold entered Spain, a vicious inflation took hold. Many historians of Spain argue the inflation of the 16th century was so severe that, to this very day, Spain has yet to recover from that influx of gold.

CRYPTOCURRENCY COMPENDIUM COMPILATION

BONDS & (VARIETIES OF) RISK

European Spin-Off & Restructuring Compendium February 2021

Bonds are ordinarily considered to be a low-risk asset class. In reality, as will be discussed here, the risk of an asset class is far more a function of circumstance than it is a property of the asset class itself. The issuance of any security is the result of a market-based negotiation between a buyer and a seller, at least in the way we are taught that it occurs in a functioning market. As the need for funds increases, the bargaining power passes from the seller to the buyer; a bond buyer can demand a higher interest rate when the seller (the borrower) is more needful.

The United States now owes \$27.82 trillion in the U.S. bond market. Based on what we know today, in January 2021, this debt figure will surpass \$32 trillion in January of 2022. In a properly functioning market, borrowing requirements of this magnitude would empower bond buyers to demand and receive higher rates of interest. This has not been happening, though, since the Federal Reserve routinely intervenes in the bond market and purchases as many bonds as are necessary so that interest rates remain very low. In other words, the bond buyers do not really have the opportunity to exercise market power—the clearing-price function of the market has been circumvented.

Such market intervention by the central bank requires the creation of money, contributing to what is known in academic jargon as M2.¹ M2 outstanding equaled \$15.371 trillion on January 13, 2020, according to the St. Louis Federal Reserve. One year later, on January 11, 2021, the M2 outstanding increased to \$19.548 trillion. That is a 27.2% increase.

Such actions ordinarily carry the risk of inflation. Many investors might be inclined to avoid such risk by switching assets into another currency, but other currencies exhibit a similar phenomenon. The European Central Bank is one example. It publishes money supply figures with a larger lag than the Federal Reserve, due to the complexity of compiling data from different countries. The November monthly data released on January 9, 2021 shows money supply figures for the euro increasing by 6.63% vis-à-vis April 2020. This is a 13.7% annual rate, if it continues, and one should not be surprised to see an increase in the months ahead. One cannot escape monetary debasement by exiting an individual fiat currency, because the other currencies exhibit similar characteristics.

One might escape fiat debasement by transferring funds into one of the fixed-issuance cryptocurrencies, such as bitcoin or Litecoin. However, such actions still appear exotic or bizarre to the typical investor. One reason for that is the perceived vast appreciation of some cryptocurrencies, such as bitcoin, which easily gives the impression that cryptocurrencies are in the process of experiencing bubble-like appreciation.

¹The M2 measure of money supply includes cash, checking deposits, and easily convertible near money.

CRYPTOCURRENCY COMPENDIUM COMPILATION

The mode of calculation, however, is misleading. When one looks at a price chart of bitcoin, for instance, it is, more precisely, a record of bitcoin's price denominated in dollars; it represents the changing exchange rate between the two. If one were to invert the exchange rate, showing how many dollars (or any other currency, like the Euro or Yen) are required to buy a bitcoin, it would show a sharply declining value of the dollar relative to bitcoin. That is the more informative view.

Every stated deficiency of cryptocurrency actually is a deficiency of fiat currency. For instance, one obvious deficiency of cryptocurrency, from the perspective of the majority of investors, is the volatility relative to fiat currency. But what this means, from the perspective of the small minority of investors who have purchased cryptocurrency, is that they are so concerned with the debasement of fiat currency that they are willing to tolerate extreme volatility in order to escape the certainty of debasement.

The purpose of owning bonds denominated in a fiat currency is that the deferral of consumption in the present, by purchasing a bond, will make yet more consumption possible at a future date, since (ordinarily), the bond provides a meaningful income stream that can be accumulated. It is readily conceivable, for example, that people would invest in the U.S. bond market with a view to saving enough money to purchase a home. During the past four decades, such savers also had the advantage of declining interest rates and the associated price appreciation to enhance the coupon-based return of their bond holdings. Lower interest rates also have a tendency to inflate housing prices. The price of the average home increased by 4.70% annually between 2010 and 2019 according to the Case-Shiller U.S. National Home Price Index (the 2020 data have yet to be compiled). The year-by-year index values are as follows:

Table 1: Year-by-Year Case-Shiller U.S.
National Home Price Index Values

| | |
|------|--------|
| 2010 | 140.64 |
| 2011 | 135.16 |
| 2012 | 143.88 |
| 2013 | 159.30 |
| 2014 | 166.50 |
| 2015 | 175.17 |
| 2016 | 184.51 |
| 2017 | 195.99 |
| 2018 | 204.90 |
| 2019 | 212.59 |

Source: Statista

CRYPTOCURRENCY COMPENDIUM COMPILATION

The iShares Core U.S. Aggregate Bond ETF (AGG) is arguably a good choice to use as a measure of the U.S. Bond market. The total annualized rate of return for this index for the period 2010 to 2019 was 3.36%.

One might justifiably wonder if this is any longer a reasonable guide or indicator, at least on a forward-looking basis. An important component of the return of the Aggregate Bond ETF is the appreciation due to the decline in interest rates. It does not appear that the interest rate decline of the past nine years can be repeated, considering the very low interest rate levels right now. Therefore, the capital appreciation component of the AGG return cannot be repeated. In contrast, the appreciation of the average U.S. home *could* be repeated if there were adequate inflation.

Based upon the entirely reasonable best-case supposition that interest rates will not increase, the return of the Core U.S. Aggregate Bond ETF can best be estimated by the current average yield to maturity: 1.10%. This figure is below even the best-case (lowest) estimate of future inflation. An optimist, assuming that a best-case estimate of future inflation is 2.1% per year, despite the continual much higher rate of money issuance, might estimate a loss of purchasing power of 1% per year.

A pessimist might conclude that money issuance on the current scale will eventually create inflation of a similar magnitude to the money creation rate. The St. Louis Federal Reserve M2 figures would indicate the possibility of an annual inflation rate of 20%. This risk, like any risk, is still only a possibility, but standard bond risk statistics do not measure this possibility at all.

This is because a primary risk measurement tool of publicly traded securities is the three-year standard deviation statistic, which is backward looking. In the case of the iShares U.S. Aggregate Bond ETF, this measure of its price volatility is 3.41%. By way of comparison, the three-year standard deviation of the S&P 500 is 18.80%. Weighted average maturity and duration are also common indicators of risk for the bond funds. The Core U.S. Aggregate Bond ETF has a weighted average maturity of 7.84 years and a duration of 5.96 years.

Another risk statistic, but one that is not generally quoted, is the real rate of return, after deducting inflation. The concept of real rate of return must be used judiciously. If the negative real rate of return constitutes a risk relative to the stated or nominal return, it does not logically follow that positive real rates of return constitute the absence of risk. To illustrate, take the following hypothetical scenario:

The inflation rate is 2%, the weighted average yield to maturity is 4%, and the economy grows at 1%.

CRYPTOCURRENCY COMPENDIUM COMPILATION

The real rate of return in this circumstance is 2%, and the ability of the nation to service debt grows by the sum of the inflation rate and the economic growth rate, which is 3% in this case.

Can one conclude that this is a salubrious environment from the point of view of the bond investor? Not necessarily. One must consider credit risk in the sense of the ability of a nation to service interest expense and maintain the creditworthiness to finance the debt.

An important statistic towards this end is the rate of growth of debt. U.S. government debt at the federal level is expanding by about 11.5% per annum according to the National Debt Clock. This is obviously well above the growth rate of the economy. According to the same source, total debt in the U.S. is growing at an even more rapid rate.

According to the National Debt Clock, the U.S. federal debt-to-GDP ratio was 130.68% on the day the research for this *Compendium* was conducted. Within days it was 130.69%, as it ticks up every other day. These figures are easily the highest in U.S. history. In 1946, subsequent to the conclusion of World War II, the U.S. debt-to-GDP ratio was 118%. The source for these figures is thebalance.com, but a lot of websites report this data.

A debt-to-GDP ratio of 130.68% does not mean that the U.S. is unable to service its debt. As an abstract figure, debt-to-GDP ratio is not really the determining measure, since the key variable is the amount of interest that must be paid to service that debt. In the case of the U.S., the National Debt Clock reports the annual interest burden, due to the near-zero interest rates, is only \$393.03 billion, or only 1.85% of GDP.

Another issue with this type of statistical approach is that the proceeds of large borrowings are spent, and such expenditures contribute to growth in GDP. If borrowing were to be reduced, this would have a negative impact upon GDP. If the borrowing reduction were to be sufficiently large, it could cause the GDP to shrink, which would greatly lessen the ability of the nation to carry its large debt.

Interestingly, this did not occur at the end of the Second World War. The U.S. debt-to-GDP ratio was 118% in 1946, as noted above, and total federal debt was \$269 billion. By 1960, the U.S. debt-to-GDP ratio was 53%, according to thebalance.com. The U.S. hardly added to the national debt after 1946. The debt was not repaid; it was simply refinanced. In the year 1960, federal debt was \$286 billion. This is only \$17 billion or 6.54% more than in 1946. The average annual rate of growth of the debt was 45 basis points per annum.

In subsequent years, debt did increase, but the GDP grew at an even more rapid rate. Debt was only 35% of GDP by 1970, with a \$371 billion nominal value. The next ten years were

CRYPTOCURRENCY COMPENDIUM COMPILATION

the worst ten years in the history of the U.S. bond market. Federal debt increased from \$371 billion in 1970 to \$908 billion in 1980. Yet, the debt-to-GDP ratio was only 32% in 1980.

From 1980 to 2020, debt at the federal level expanded by 30.61x. This is a compound annual expansion rate of 8.93%. Most observers in 1980 would have found such a policy irresponsible if it were possible to know then that this would happen over the course of the next four decades. Nevertheless, those four decades represent the best bond market in U.S. history.

The inception of those four decades of the best bond market in U.S. history commences with the highest coupons in U.S. bond market history. Investors at that time reaped decades of meaningful benefit from those coupons. Conversely, the 1970 start of the worst bond market in U.S. history exhibited historically low coupons.

Bond coupons are now the lowest in U.S. history. As long as interest rates are declining, a responsive form of asset management that consists of upward security valuation adjustment can be practiced. However, the various market participants will become convinced at some point that no further interest declines are likely, so no further upward valuation adjustments are likely. At that point, bonds become instrumentalities with all the attendant risks—of a rise in interest rates, in inflation, in credit risk—but devoid of any possibility of commensurate reward. That position may now have been reached.

CRYPTOCURRENCY COMPENDIUM COMPILATION

CORPORATE PURCHASES OF BITCOIN & IMPACT ON THE MARKET

Fixed Income & Cryptocurrency Compendium March 2021

Q: This is a follow-up on bitcoin as it relates to the overall market. Elon Musk put a billion and a half dollars into bitcoin, and Square has put some cash into it as well. What does that do to the valuation of these companies and to the S&P 500 or to the overall market? Will that have a major impact on their share prices regardless of profits of the underlying businesses and the margins, etc.?

Q: No, that will not happen. Most of the corporations, especially the top ten, are huge, like Tesla, which has something like an \$850 billion market capitalization. Owning a billion dollars of bitcoin by itself is irrelevant to the market capitalization unless bitcoin goes up a thousand times. If bitcoin goes up a thousand times, as I believe it will, that will mean that Tesla will more or less double. Why will it only double if a billion dollars becomes a trillion dollars? The company will not keep the trillion dollars; it will have to pay taxes on it, so the tax liability must be subtracted from that trillion. If the company does not pay too high a rate, maybe Tesla could double that way over a number of years. Maybe.

Of course, if every corporation all over the world spends that kind of money on bitcoin, bitcoin would have a very high price. Another scenario could unfold, and which is beginning to happen in very small measure, but it might happen on a grander scale: There might be a business that lends dollars to buy crypto and lets the borrower use the crypto as collateral. There are businesses like that. One might have corporations that use their borrowing power. They do not even have to use any of their cash; they can use their borrowing power to buy bitcoin.

Let's say a company has \$100 billion of cash on the balance sheet, and it borrows a billion dollars in fiat currency. If worse comes to worst and the bitcoin is worthless, the company still has a \$100 billion of cash on the balance sheet, so obviously it is still a good credit. On the other hand, if bitcoin actually does what I think it will do and goes up as much as I think it will go up, that dramatically impacts the valuation of the company. The mere fact that a variety of prominent corporations all decided to do this in a relatively short period of time has the elements of initiating a self-fulfilling prophecy. That might happen actually.

CRYPTOCURRENCY COMPENDIUM COMPILATION

BITCOIN AS AN ALTERNATIVE TO FIAT CURRENCY

Fixed Income & Cryptocurrency Compendium March 2021

Q: Do you consider bitcoin as the best alternative to fiat currency as a hedge against inflation?

A: As an alternative to fiat currency, is bitcoin the best cryptocurrency you could ever devise? Obviously not. There are some that probably have more intriguing technical features. In terms of monetary policy, though, bitcoin is great because it has a fixed-issuance policy and the issuance is already disclosed. Everyone knows what the total ‘money supply’ will be, the ultimate number of coins, and this is reflected—discounted—in the price of the coin. Because it has the first mover advantage, it has the network effect advantage.

Some would say there are better technologies than bitcoin. True. However, this is not the risk that many people think it is. In order to avoid centralization, all cryptocurrency is open-source code. Any uniquely desirable feature of a different cryptocurrency, in principle, can be given to bitcoin by the community of bitcoin users via reprogramming or reengineering the bitcoin code. There is no technological disadvantage to bitcoin, because open source code allows any blockchain to adopt advantageous technical improvements if that’s what the users want, even though there are better cryptocurrencies in the technological sense. There is a first mover advantage. That is what makes bitcoin so important.

In terms of valuation, bitcoin’s total market value, at present, is a fraction of the valuation of any reasonable definition of money. Various economists have presented the notion that federal government bonds are instantaneously convertible into money. To the degree that people think of them in terms of cash or near cash, they do not distinguish cash in the bank account from a T-bill or even a 2-year Treasury. They are basically instantaneously convertible to money.

It was much more cumbersome to sell a treasury bill or note in years past, when the monetary aggregate definitions were created. The transactional friction difference between M2 and the large institutional certificates of deposit and other such instruments that differentiated M3 from M2 has vastly diminished. So, one can convert those into money, too, and then add some proportion—and it is a totally subjective figure—of all of the government securities that are convertible into money and get a much bigger M4 number.

If one uses the M4 number worldwide in relation to crypto, and let’s say bitcoin is your crypto of choice, and one makes some allowance for the amount of additional debt that will be issued by various governments in the next four or five years, one would probably have appreciation potential in the thousands of times. As outlandish as that figure appears to be, even that may well be very conservative. Why conservative? Well, for one, because it’s not entirely clear that all the bitcoin that exists is actually eligible bitcoin, meaning, it could have

CRYPTOCURRENCY COMPENDIUM COMPILATION

suffered from bit rot and people might have lost their private keys, so it is not and never will be part of the float; it can never be accessed or used.

It may be that even though when you look at bitcoin formalistically, and see that there are somewhat over 18.5 million units outstanding, that is true in the blockchain accounting sense, but it might not be true in a private key transference sense. The number might be a lot lower. Therefore, we might even have a much bigger appreciation from what the float-adjusted current market capitalization of bitcoin is. We just do not know what level of bitcoin rot has taken place. There is no way of measuring it, but some degree of it probably happens every day. No bitcoin that was part of rot and was recovered. Once the private keys are lost, they are lost forever. They are still in the blockchain, but they are unusable.

There is a tremendous amount of potential. Even though an enormous amount of money has been made in the last 5 ½ years, I do not think we have even started to see the appreciation.

CRYPTOCURRENCY COMPENDIUM COMPILATION

COUNTERFEIT U.S. CASH ABROAD

Fixed Income & Cryptocurrency Compendium March 2021

According to the Federal Reserve, the entire money supply includes a total of \$2.04 trillion of cash in circulation. That is 10.25% of the M2 money supply. The Federal Reserve Board also reports that 39% of that cash is held outside the U.S. As a consequence, many worn bills never pass through the Federal Reserve at all, so if they are counterfeit, they cannot be identified as such.

The counterfeit bills probably circulate among relatively poor people who are living in highly inflationary societies and who do not trust the local currency to hold its purchasing power. They have no way of determining whether or not their dollars are bona fide. It is even conceivable that some unscrupulous governments and businesses circulate counterfeit bills among the local population.

Modern counterfeiting requires technological sophistication, and the majority of people who are victims of counterfeiting lack the skill and resources for such activity.

CRYPTOCURRENCY COMPENDIUM COMPILATION

FIAT CURRENCY, CRYPTOCURRENCY, AND COUNTERFEITERS

Fixed Income & Cryptocurrency Compendium March 2021

Counterfeiters present another problem for fiat currency. The U.S. Currency Education Program is designed to help users of U.S. dollars identify counterfeit currency. Unfortunately, any detection technology available to the U.S. government to spot counterfeit bills is also available to any hostile foreign government, and hostile foreign governments have been known to share this technology with nongovernmental organizations.

There aren't a great many anti-counterfeiting techniques. One such process is intaglio printing. In intaglio printing, an image is cut into the surface of the paper, creating a sunken line. This sunken line holds the ink and gives the U.S. currency its characteristic rough feel, as opposed to Canadian currency, which does not feel rough to the touch. Intaglio printing was invented in the 15th century, so the technique is well known.

There are six other anti-counterfeiting techniques practiced by the U.S. Bureau of Engraving and Printing. All of them are fully explained at uscurrency.gov, and summarized here.

1. *Color shifting ink.* The color of a U.S. currency note will shift when the perspective of the person holding the note changes. This is the result of using what is known as optically variable ink, and it is noticeable even with very slight movements of the bill in question. It was invented when color copiers that can replicate currency were introduced. Copiers can only copy at a single angle, so they cannot capture the change of color. Criminals are very creative, though. Counterfeiters now use "interference colorants." The color shifting is simulated by layers of metal oxide onto mica, titanium particles, or even iron oxide. Such colorants are used by artists working in oil and are readily available for purchase.
2. *Three-dimensional security ribbon.* Since the ribbon, which is woven into the paper, rather than being printed onto it, is designed to appear to be three-dimensional, it will appear to move if the bill is moved. This might be far more effective were it not for the fact that three-dimensional security ribbons with thermal transfer properties are readily available on Alibaba. The cost is \$1.26 each for a minimum 50-piece order, which is a good price if one wishes to counterfeit U.S. \$100 bills. The 3D security ribbon is used on the \$100 bill.
3. *Security thread.* A security thread is embedded in all U.S. bills in denominations of \$5 or greater. It changes color when it is held under ultraviolet light. A security thread is also woven into the U.S. Passport. That is why it is held under ultraviolet light to determine if it is bona fide. Alibaba sells security thread paper at \$4,000 a ton, with a minimum one-ton order. We can surmise that the counterfeiters make use of the

CRYPTOCURRENCY COMPENDIUM COMPILATION

\$500-per-ton discount on orders over one ton. Obviously, a ton of security paper can be used to make a great deal of U.S. currency.

4. *Watermark.* All U.S. currency of \$5 denominations and higher are watermarked. A watermark is an image or a pattern on paper that is not printed. It is created by varying the thickness or the density of the paper at various points. In the late 13th century in Italy, when watermarks were invented, it was considered to be cutting edge technology. It is fair to say that subsequent to the 13th century, the technique has been mastered by many people.
5. *Microprinting.* If one looks closely at U.S. currency denominations of \$5 or above, one will notice words in very small print such as *United States of America* or *E Pluribus Unum* (one from many or many from one). Microprinting is a patented technique. Many valid microprinting patents exist, but a counterfeiter willing to break federal law is unlikely to shy from violating a patent. A Canon MicroPrinter 90 can be purchased online for \$2,800 at microfilmworld.com.
6. *Red and blue fibers.* The paper on which U.S. currency is printed has red and blue fibers embedded through each bill. Such paper is 75% cotton and 25% linen. A box of 30 sheets, 216 millimeter x 279 millimeter, is advertised at wish.com for \$22. As of this writing, supplies are sold out for reasons that are quite understandable. The website has 33 reviews of this product, and many are five-star ratings. One three-star rating complained about slow delivery.

Obviously, the counterfeiters are well able to counterfeit fiat currency.

CRYPTOCURRENCY COMPENDIUM COMPILATION

CRYPTOCURRENCY, FIAT CURRENCY, AND CRIME

Fixed Income & Cryptocurrency Compendium March 2021

The role of criminals in the exchange of cryptocurrency is a topic of lively conversation. It has been asserted that the criminal element prefers cryptocurrency as a means of payment due to the anonymous nature of cryptocurrency exchange. No statistics have ever been collected regarding the role of criminals in cryptocurrency.

The issue might be less controversially expressed: What regulations might be needed to prevent criminals from using any cryptocurrency? From this perspective, it seems inevitable that the Know Your Customer (or Know Your Client) rules should be applied to cryptocurrency. The Know Your Customer rule requires that every financial institution use reasonable efforts to know and maintain records on the identities of each client, including those individuals who assert the right to act on behalf of a given client in a fiduciary capacity.

Applied to cryptocurrencies, the rule means a client who obtains bitcoin and wishes to either trade it or custody it would be asked to identify the entity from which the bitcoin was obtained. It could only be transferred when both buyer and seller have been identified as bona fide entities by the authorities.

It is probably true that there are entities that wish to remain anonymous. If this were to be the case for bitcoin with Know Your Customer rules in place, it would not be possible to make the bitcoin transfer via a regulated financial institution within a country that has a Know Your Customer rule. If the various nations eventually were to reach agreement on Know Your Customer rules, transfer among nations would become as difficult as transfer within nations.

Two bitcoin systems would evolve if this were to happen. The first would be the bitcoin identified and tracked by regulatory authorities and owned by bona fide entities. The second system would be the bitcoin owned by those wishing to remain anonymous, perhaps facilitated by financial institutions in nations that reject the rules of conduct of the international financial community. Regulated bitcoin would trade at a big premium to the unregulated bitcoin, since the regulated bitcoin would be freely transferrable. Alternatively expressed, the unregulated bitcoin would trade at a big discount to regulated bitcoin, since it would not be accepted by most of the international financial community. It would probably be a criminal offense to accept bitcoin from an unregulated and unidentified source.

In actuality, if one wishes to reintroduce some liveliness to this debate, it is far easier to regulate payment with cryptocurrency recorded on the blockchain than payment with cash or electronic money. There does not exist, for cash or electronic money, an aggregate financial ledger that is visible to all participants and that is reliably accurate. In other words, it is much easier to launder fiat money than to launder bitcoin or other cryptocurrency.

CRYPTOCURRENCY COMPENDIUM COMPILATION

It is helpful to understand how fiat currency is laundered in order to see why it would be easier to launder fiat currency than currency recorded on the blockchain.

The most common money laundering method is known as smurfing. A criminal divides illicit cash into small amounts. These small amounts are used to purchase bearer instruments such as money orders that could theoretically be sent anywhere in the world and would be accepted as a means of payment. Alternatively, the money orders could be used to purchase products from legitimate businesses.

The only way authorities can stop smurfing is to make cash conversion into money orders illegal. However, for the less affluent, who are frequently paid in cash, the money order is the means by which they access the banking system and the international money transfer system.

According to the U.S. Census Bureau, there are about 40 million people in the U.S. who live in poverty, and these people are unlikely to have enough money to maintain the minimum balance requirements of a typical bank. It would be prohibitive for them to maintain a bank account and, even if they could do so, the typical bank clearly does not wish to service such people. Money orders are more affordable. A money order can be purchased for a fee of \$1.30 for amounts between a penny and \$500. In the case of a \$100 money order, the fee is 1.3%. In the case of money orders between \$500.01 and \$1,000, the fee is \$1.75. In the case of a \$600 money order, the fee is only 29 basis points. Money orders are only available up to the sum of \$1,000. These are the US Postal Service prices; a money order from Walmart is slightly less expensive.

As an aside, the U.S. government long ago recognized the difficulty that the impoverished have in obtaining banking service. Under the Taft administration in 1911, the government established the Postal Savings System, which accepted deposits in small amounts, with no exorbitant fees and no minimum balance requirements. Over two dozen other countries continue to maintain postal savings systems. Unfortunately, the U.S. Postal Savings System was abolished in 1967 in a bill signed by President Lyndon Johnson. This left no access to banking services for those who have to make ends meet on low wages, a situation that continues to this very day. Ironically, this created the large-scale money order system, which facilitates money laundering by the smurfing method.

The re-creation of the postal banking system would create transactional records by clients and hence, it would make money laundering far more difficult. Less affluent people would purchase the money orders from money that is in their postal system savings accounts, so a transactional ledger would be kept with the identities of the people sending and buying small money orders. Anyone who would make a habit of buying excessive amounts of small money orders would stand out as someone who is probably smurfing.

CRYPTOCURRENCY COMPENDIUM COMPILATION

Another popular method of money laundering is the offshore bank. It may seem bizarre but an “offshore bank” can actually exist *within* the U.S. In principle, banks in Nevada accept foreign deposits. Interestingly, Nevada law protects bank deposits from creditors. Foreigners can open bank accounts in the U.S. as offshore entities and use bank facilities to pay Americans. A payment to a U.S. citizen is not necessarily income unless the foreign payer discloses it to the U.S. tax authorities as such. There are many offshore banking jurisdictions from which money can be disbursed to Americans with little or no scrutiny, such as Luxemburg, Guernsey, Hong Kong, Cyprus, Belize, Isle of Man, Jersey, Grenada, Marshall Islands, Panama, Seychelles, Malta, Gibraltar, Lichtenstein and Monaco. This is only a partial list. Forty-six foreign jurisdictions are outside of the U.S. reporting requirements, according to the International Monetary Fund.

Many of these jurisdictions are also used by multinational corporations to avoid paying the U.S. statutory tax rate. The technique is known as base erosion and profit shifting (BEPS). In the case of income derived from intellectual property, it is possible to argue that the intellectual property belongs to a subsidiary domiciled in a tax haven and should be subject to the low tax rate of that domicile unless repatriated to the home country, which is the U.S. in the case of many corporations.

In some instances, the tax haven subsidiary lends cash to domestic institutions at extremely high rates of interest. The profits are effectively redirected to a low-tax area. This technique is known as earnings stripping. Variants of earnings stripping can be used for money laundering purposes as well.

Sometimes several money laundering techniques are used simultaneously. One technique involves smuggling bulk cash out of a country. This is relatively easy, since most trade in merchandise is done via sealed containers. The money is ultimately deposited in a controlled foreign corporation in an offshore tax haven with minimal reporting requirements. This method is known as round-tripping. The name derives from the fact that the malefactors who remain in the U.S. can then borrow the money and use it without consequence, since these funds are proceeds of borrowings or debt and are therefore not subject to any income taxation.

Yet another technique is known as trade-based laundering. An example is the proceeds that can come from the sale of art at a deliberately undervalued, small sum. The art can then be resold at an enormous profit. Since each item of art is unique, it is very difficult to prove that the artwork was deliberately undervalued when it could be that the seller was just misinformed. Conversely, a criminal might claim to be the artist creating the work in question and receive payment for criminal activity in the form of an exorbitant price for the sale of such art to a buyer. Auction houses are also notoriously secretive about the identities of buyers and sellers.

CRYPTOCURRENCY COMPENDIUM COMPILATION

The same trade-based laundering can take place with collectibles, memorabilia, books, jewelry, and even gambling proceeds. The problem from the perspective of the regulatory authorities is that there is no holistic compilation of the wealth of the world, particularly, but not exclusively, monetary or cash assets.

If a cryptocurrency such as bitcoin is used, the totality of the currency is on the blockchain for all to see. Any unusual transaction activity is instantaneously visible, although the identity of the individual consummating the transaction may be hidden, because he or she is known only by their public alpha-numeric key. However, that individual can only remain secret if that individual does not transact with any other public key known to the authorities. In other words, if person A is unknown to the authorities, but B is known, the authorities can always determine the identity of A if B follows the applicable Know Your Customer rules and relays data to the authorities upon request. If B fails to ascertain the identity of A, which is possible, B will most probably be compelled to pay some form of penalty.

All that is really needed to properly regulate bitcoin is a robust set of enforced Know Your Customer rules. If there is robust enforcement, it should be assumed that malefactors will move to a cryptocurrency with much more anonymity built into the coins, such as Zcash or possibly Monero. The Know Your Customer rules would still apply to Zcash and Monero, but the holders of those could either choose to comply or fail to comply. If the Zcash and Monero holders comply, then the identity of the holders will be known to the authorities and regulation will take place. If the Zcash and Monero holders do not comply, the authorities will at least know the proportion of holders that did not comply, because the Zcash and Monero blockchains would still be visible.

In the situation described above, the holders of Zcash and Monero will find that the network of people to whom undisclosed Zcash and Monero can be transferred is much smaller than the network of people to whom disclosed cryptocurrencies can be transferred. It is likely that a bifurcated market would develop for both cryptos in this circumstance. First, there would be a freely transferrable Zcash and Monero with proper owner disclosures made to intermediaries. Second, there would also be less-freely transferrable coins that are transferrable only to those entities that evade the Know Your Customer Rules. The latter network would be far smaller than the former network. By the established principles of network effect—Metcalfe’s Law—the value of the latter would be less than the value of the former.² Effectively, there would be a self-imposed valuation discount on those who elect to evade the Know Your Customer regulations.

²Metcalfe’s Law “states that the value of a network grows exponentially with each new node that joins the network.” Kyle Roberts, “Metcalfe’s Law for CPAs, Accounting Today, December 29, 2020 <https://www.accountingtoday.com/opinion/metcalfes-law-for-cpas>

CRYPTOCURRENCY COMPENDIUM COMPILATION

In the fiat currency market, this does not happen, because once money has been properly laundered, it is fungible and it is all legal tender. Laundering money is only possible because exceptions exist to facilitate smurfing and other techniques. It is impossible to form a holistic picture of, or index, the monetary wealth of the world and monitor its movement as long as there are dozens of jurisdictions hosting hundreds of banks and tens of thousands of foreign-controlled corporations.

In contrast, cryptocurrency has the blockchain, which is a comprehensive accounting of the entire currency. No currency movement, however small, will fail to be posted on the blockchain. Therefore, only two types of currency movements can exist: those transactions in which the identity of the holder is known and those in which the identity of the holder is unknown. This latter category of coins can be specifically identified and, if regulations are sufficiently robust, those particular coins should never be able to enter the regulated system. The longer the custodial chain of unidentified holders—that is, from one such transaction in a specific coin to another—the lower the value of those coins, because they will be presumed to be illegitimate transactions. The lost value at market will pass to the universe of identifiable coins so that there is an incentive for compliance.

In summary, if it is possible to know the totality of the transactions of a coinage system, it is possible to regulate the system by making unidentifiable transactions illegitimate. The blockchain makes such regulation possible, and value changes between ‘regulated’ and ‘unregulated’ coins incentivize compliance.

In the fiat system, there can be no blockchain or comprehensive accounting without the cooperation of all jurisdictions and all financial institutions. Since many jurisdictions and financial institutions maintain secrecy, *it is fiat currency*, not cryptocurrency, that is the problem for regulators of illicit activity.

CRYPTOCURRENCY COMPENDIUM COMPILATION

THE OPEN-SOURCE MOVEMENT, INVESTING, AND VARIETIES OF DISPLACEMENT

Stahl Report Compendium March 2021

The open-source movement should really be called the open collaboration movement. This is the system of product or service evolution that relies upon voluntarily-connected individuals to create economic value. The term open-source is frequently used instead of open collaboration, since the examples most familiar to individuals are instances of open-source software.

Bitcoin, or cryptocurrency more generally, is an example of open-source software. Wikipedia is, too. TEDx, or TED (Technology, Entertainment and Design), is an example of open collaboration. Creative Commons is also an example of open collaboration. It is a nonprofit 501(c)(3) organization that makes educational and creative works freely available by use of a Creative Commons license.

A Creative Commons license is simply a public copyright that essentially gives anyone the right to use or distribute the material in question. The Open Knowledge Foundation is a parallel organization that does not merely limit itself to creative work. It provides access to scientific research via its open science network. This includes the practice of open-notebook science, which shares observations before any discovery is actually produced. The Open Knowledge Foundation also promotes open data and makes data freely available.

This is obviously a problem vis-à-vis the world of investing, since there are many publicly traded companies that collect and sell data as a business. The open collaboration movement runs counter to the basic corporate interest in proprietary research and development. A well-funded corporation might employ 1,000 brilliant scientists to study a problem. At the same time, the open knowledge movement might engage a million scientists working on, or thinking about, the same problem.

Software is an obvious area to which the concept of collaboration can be applied. Free licenses known as GNU General Public Licenses, is an example of such, which permits users the freedom to modify software. In fact, the Free Software Foundation was founded 35 years ago to promote such ideas. It is a 501(c)(3) organization.

None of this would be possible without the internet, which obviously connects people. Much of this was predicted in a 2006 book entitled *The Wealth of Networks: How Social Production Transforms Markets and Freedom* by Professor Yochai Benkler. In the book, the open collaboration movement is referred to as “commons-based peer production.” One of the more intriguing aspects of commons-based peer production is that participants are not motivated by individualist prospects of gain, although individualism may take other forms, such as a desire for societal recognition.

CRYPTOCURRENCY COMPENDIUM COMPILATION

An example of the limitations of the open-source movement thus far is Linux. This is an operating system that was devised in 1991 that functions much like Unix. However, corporations have used the free Linux software as a system upon which to base proprietary software. Almost all cloud computing services use Linux. The vast majority of smartphones in the world make use of Linux.

It should be evident from the aforementioned example that the open-source or open collaboration movement is not about to replace the many proprietary products and services. However, it is making an impression on the global economy. The obvious example is bitcoin. If one accepts the notion of Gresham's law³, one should accept the notion that a fixed issuance currency such as bitcoin is superior to an unlimited issuance fiat currency. If bitcoin gains generalized acceptance, it might—in the current era of near-zero interest rates—even replace the bond asset class. The typical bond produces a very low yield. In the case of a 10-year U.S. Treasury, the yield, at this writing, is 1.09%, which is obviously lower than the rate of inflation, so that the real rate of interest on this bond is negative.

Since bitcoin has the property of fixed issuance, the supply cannot be increased. Thus, if one were to borrow a bitcoin, the rate of interest would need to be sufficiently high to induce someone to accept the credit risk of a lender. In a partially bitcoin-denominated world, if the money supply cannot be altered, the notion of central banking must be altered. A central bank, as a lender of last resort, is still conceivable. It is simply that the central bank would require a large store of bitcoin in order to be able to discharge the lender-of-last-resort function in a crisis. As a consequence, the actual unit volume of bitcoin in circulation would be necessarily small, even in relation to the amount of bitcoin in existence, and its price or exchange value against fiat currency would quite necessarily be large.

A bank wishing to attract bitcoin deposits would probably pay a substantial rate of interest to the depositors. It would be expensive and, therefore, dangerous for a bank to leverage its balance sheet, as is the current practice, since it could never repay its depositors in inflated fiat money.

If this proposition is correct, a bank with some portion of its capital in cryptocurrency might earn a much higher return on equity than a bank with 100% equity in fiat currency. Viewed from an investment perspective, the large banks, at current bitcoin prices, could probably never purchase enough bitcoin to materially improve their current ROEs. Only a small bank would be able to reorient its balance sheet in this manner. However, small banks with no

³ After Sir Thomas Gresham (1519 – 1579), popularly known as ‘Bad money drives out good.’ The observation was that among coins in circulation, people continued to transact in those that were debased below the official value of the precious metal they purportedly contained (by alloying them with a cheaper base metal), while they retained, for their higher value, the ‘good’ coins, which were thereby withdrawn from circulation.

CRYPTOCURRENCY COMPENDIUM COMPILATION

presence in the S&P 500 Index might enormously outperform the large banks, given the constraints of size.

Open collaboration can, at least theoretically, disrupt any business that can be recreated as a consequence of peer production. One such possibility is the cryptocurrency known as Filecoin. This is a blockchain-based cooperative digital storage system. Essentially, owners of disk storage space lease their excess unused hard drive space in exchange for rent in the form of Filecoin. Since digital storage has economic value, as it competes with cloud storage, the coins are exchangeable for fiat currency in the exact manner as more well-established cryptocurrencies. Unlike bitcoin, for which the primary system task is to validate transactions via a proof-of-work method, Filecoin uses the proof-of-spacetime approach. The objective is not merely to locate excess hard-drive space, but to make that space available for prolonged periods of time. In the proof-of-spacetime approach, one must prove that disk space is being consumed for fixed periods of time to earn or mine a block.

Proof-of-space has an unintended positive security consequence inasmuch as a user is occupying a fixed amount of storage space. Ergo, the intrusion of malware would need to occupy more space, however small, and would be instantaneously detected as an intrusion or hacking attempt. The Chia Network, which is another cryptocurrency, also uses the proof-of-spacetime approach.

Filecoin is relatively small in relation to the giant cloud companies such as Amazon Web Services, Microsoft and Google. However, it is growing fairly rapidly. Since it is decentralized, censorship of content is extremely difficult. In the event of any censorship attempt, a user would simply locate alternative storage space. It is also the case that the owners of the excess disk space are generally uninterested in censorship and very interested in improving the return on capital of purchased storage devices with dormant or unused capacity.

In principle, if there were sufficient unused storage capacity and if information about Filecoin becomes more widely disseminated, this would pose potential competition for the giant cloud storage firms. Even if the cloud companies retain their preeminent positions, the mere existence of sufficient excess capacity on Filecoin could serve to dramatically lower cloud computing prices and, hence, lower returns for the cloud computing companies.

The salient point is that, in principle, the cloud companies might compete with unstructured networks of people with excess disk space. These people have little overhead expense in that it is intrinsic to their use of their own preexisting equipment. The investment in storage that is in excess of needs is simply a sunk cost that can be leased for relatively small sums of money.

CRYPTOCURRENCY COMPENDIUM COMPILATION

It may seem farfetched that enormous technology firms can be disrupted by mere open collaboration by private citizens. However, the internet itself started as a collaborative effort among scientists to establish a network for the exchange of scientific information.

Approximately 20 to 25 years ago, it seemed absurd to believe that the newspaper business, which at the time was considered the ultimate wide-moat franchise, might be disrupted by the internet. Yet, in the fullness of time, not only newspapers, but entertainment in general and especially conventional television was disrupted. This includes movies, radio, theatres and publishing.

In the realm of economics, the direction of thought is towards the so-called tragedy of the commons. The basic idea is that open access to a shared resource by self-interested individuals results in resource depletion. Only coordinated action as a consequence of regulation is presumed to be able to avoid this outcome. In the investment world, it is believed that the most predictable outcome for an industry is discipline through dominance by one or, at most, several industry participants. This outcome has been seen in banking, technology and, to a large extent, in the field of healthcare. There are many such examples from the origin of the limited liability company in the late 19th century until the current time.

Viewed within the context of history, this is a short period of time. Such a view has been challenged by Elinor Ostrom, the recipient of the 2009 Nobel Prize in Economics. In her seminal work entitled *Governing the Commons: The Evolution of Institutions for Collective Action*, she cites a plethora of examples from ancient to modern times of shared resources being successfully managed in a collaborative manner without the intercession of bureaucratic regulatory structures. The examples range from the fisheries of Nova Scotia, to irrigation systems in Spain, to Swiss grazing pastures and Japanese forestland.

Thus, one can think of common intellectual property in the form of wikis, open-source software, open-source licenses and Creative Commons licenses. The field of cryptocurrency might simply be a step in the return of civilization to open collaborative structures and a source of competition for the large-capitalization equity class.

CRYPTOCURRENCY COMPENDIUM COMPILATION

WEALTH INDEX (Ticker: RCH Index)

As of June 30, 2020

| <u>Annualized Total Return</u> | <u>1 Year</u> | <u>3 Years</u> | <u>5 Years</u> | <u>7 Years</u> | <u>10 Years</u> | <u>15 Years</u> | <u>20 Years</u> | <u>Since Incep. 1991 - Jun '20</u> |
|------------------------------------|---------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|--|
| Wealth Index | -7.25% | 1.49% | 3.28% | 6.82% | 11.04% | 9.24% | 7.31% | 11.56% |
| S&P 500 | 7.51% | 10.73% | 10.73% | 12.13% | 13.99% | 8.83% | 5.91% | 10.14% |
| S&P 500 Eq. Wgt. | -3.25% | 5.43% | 7.14% | 9.67% | 12.64% | 8.79% | 8.67% | 11.43% |
| Russell 3000 | 6.53% | 10.04% | 10.03% | 11.68% | 13.72% | 8.78% | 6.15% | 10.27% |
| Russell 2000 | -6.63% | 2.01% | 4.29% | 7.17% | 10.50% | 7.01% | 6.69% | 9.95% |
| Excess Return vs. S&P 500 | -14.76% | -9.24% | -7.44% | -5.31% | -2.95% | 0.41% | 1.40% | 1.42% |
| Excess Return vs. S&P 500 Eq. Wgt. | -4.01% | -3.95% | -3.66% | -2.85% | -1.60% | 0.45% | -1.35% | 0.13% |
| Excess Return vs. Russell 3000 | -13.78% | -8.56% | -6.75% | -4.86% | -2.68% | 0.47% | 1.16% | 1.29% |
| Excess Return vs. Russell 2000 | -0.63% | -0.52% | -1.00% | -0.35% | 0.54% | 2.23% | 0.63% | 1.61% |

*Note: Calculated Using Total Returns

| <u>Risk Adjusted Return</u> | <u>1 Year</u> | <u>3 Years</u> | <u>5 Years</u> | <u>7 Years</u> | <u>10 Years</u> | <u>15 Years</u> | <u>20 Years</u> | <u>Since Incep. 1991 - Jun '20</u> |
|-----------------------------|---------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|--|
| Wealth Index | (0.21) | 0.06 | 0.16 | 0.36 | 0.60 | 0.45 | 0.33 | 0.56 |
| S&P 500 | 0.34 | 0.63 | 0.73 | 0.90 | 1.04 | 0.60 | 0.40 | 0.70 |
| S&P 500 Eq. Wgt. | (0.12) | 0.28 | 0.43 | 0.64 | 0.83 | 0.51 | 0.50 | 0.71 |
| Russell 3000 | 0.28 | 0.57 | 0.65 | 0.84 | 0.98 | 0.57 | 0.40 | 0.70 |
| Russell 2000 | (0.22) | 0.09 | 0.21 | 0.38 | 0.56 | 0.35 | 0.34 | 0.52 |

*Note: Calculated As Annualized Total Return Divided By Annualized Total Return Volatility (Uses Monthly Total Returns)

| <u>Information Ratio</u> | <u>1 Year</u> | <u>3 Years</u> | <u>5 Years</u> | <u>7 Years</u> | <u>10 Years</u> | <u>15 Years</u> | <u>20 Years</u> | <u>Since Incep. 1991 - Jun '20</u> |
|-----------------------------------|---------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|--|
| Wealth Index vs. S&P 500 | (0.99) | (0.92) | (0.81) | (0.64) | (0.39) | 0.05 | 0.13 | 0.14 |
| Wealth Index vs. S&P 500 Eq. Wgt. | (0.45) | (0.62) | (0.63) | (0.51) | (0.30) | 0.08 | (0.15) | 0.02 |
| Wealth Index vs. Russell 3000 | (1.04) | (0.96) | (0.83) | (0.67) | (0.40) | 0.06 | 0.12 | 0.14 |
| Wealth Index vs. Russell 2000 | (0.10) | (0.10) | (0.19) | (0.06) | 0.09 | 0.33 | 0.07 | 0.16 |

*Note: Calculated As Annualized Excess Total Return Divided By Annualized Excess Total Return Volatility (Uses Monthly Excess Total Returns)

| <u>Wealth Index Batting Average</u> | <u>Roll. 1 Year</u> | <u>Roll. 3 Year</u> | <u>Roll. 5 Year</u> |
|-------------------------------------|---------------------|---------------------|---------------------|
| vs. S&P 500 | 52.48% | 55.80% | 58.31% |
| vs. S&P 500 Eq. Wgt. | 52.48% | 49.84% | 49.49% |
| vs. Russell 3000 | 54.52% | 55.80% | 62.71% |
| vs. Russell 2000 | 56.27% | 59.87% | 66.44% |

*Note: Calculated Using Total Returns

| <u>Annualized Volatility</u> | <u>1 Year</u> | <u>3 Years</u> | <u>5 Years</u> | <u>7 Years</u> | <u>10 Years</u> | <u>15 Years</u> | <u>20 Years</u> | <u>Since Incep. 1991 - Jun '20</u> |
|------------------------------|---------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|--|
| Wealth Index | 35.29% | 24.49% | 21.07% | 18.90% | 18.27% | 20.40% | 22.13% | 20.65% |
| S&P 500 | 21.88% | 16.95% | 14.76% | 13.41% | 13.42% | 14.71% | 14.97% | 14.45% |
| S&P 500 Eq. Wgt. | 27.26% | 19.74% | 16.80% | 15.14% | 15.26% | 17.25% | 17.27% | 16.15% |
| Russell 3000 | 23.25% | 17.69% | 15.36% | 13.91% | 13.96% | 15.27% | 15.47% | 14.76% |
| Russell 2000 | 30.59% | 22.93% | 20.27% | 18.44% | 18.60% | 19.76% | 19.84% | 19.06% |

*Note: Calculated Using Total Returns

| <u>Annualized Tracking Error</u> | <u>1 Year</u> | <u>3 Years</u> | <u>5 Years</u> | <u>7 Years</u> | <u>10 Years</u> | <u>15 Years</u> | <u>20 Years</u> | <u>Since Incep. 1991 - Jun '20</u> |
|----------------------------------|---------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|--|
| vs. S&P 500 | 14.84% | 10.05% | 9.20% | 8.30% | 7.59% | 8.95% | 10.57% | 9.99% |
| vs. S&P 500 Eq. Wgt. | 8.88% | 6.37% | 6.12% | 5.62% | 5.26% | 5.78% | 8.75% | 8.76% |
| vs. Russell 3000 | 13.28% | 8.95% | 8.16% | 7.29% | 6.70% | 8.02% | 9.75% | 9.14% |
| vs. Russell 2000 | 6.28% | 5.43% | 5.33% | 5.62% | 5.92% | 6.81% | 9.21% | 9.79% |

*Note: Calculated Using Total Returns

| <u>Wealth Index Beta</u> | <u>1 Year</u> | <u>3 Years</u> | <u>5 Years</u> | <u>7 Years</u> | <u>10 Years</u> | <u>15 Years</u> | <u>20 Years</u> | <u>Since Incep. 1991 - Jun '20</u> |
|--------------------------|---------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|--|
| vs. S&P 500 | 1.57 | 1.37 | 1.32 | 1.30 | 1.27 | 1.28 | 1.34 | 1.28 |
| vs. S&P 500 Eq. Wgt. | 1.29 | 1.22 | 1.22 | 1.21 | 1.16 | 1.14 | 1.19 | 1.17 |
| vs. Russell 3000 | 1.49 | 1.33 | 1.30 | 1.29 | 1.24 | 1.25 | 1.32 | 1.29 |
| vs. Russell 2000 | 1.14 | 1.04 | 1.01 | 0.97 | 0.93 | 0.97 | 1.01 | 0.96 |

*Note: Calculated Using Total Returns

| <u>Calendar Year Total Returns</u> | <u>Wealth Index</u> | <u>S&P 500</u> | <u>S&P 500 Eq. Wgt.</u> | <u>Russell 3000</u> | <u>Russell 2000</u> | <u>ER v. SP500</u> | <u>ER v. SP500 EW</u> | <u>ER v. R3000</u> | <u>ER v. R2000</u> |
|------------------------------------|---------------------|--------------------|-----------------------------|---------------------|---------------------|--------------------|-----------------------|--------------------|--------------------|
| 1991 | 44.25% | 30.47% | 35.51% | 33.48% | 44.04% | 13.78% | 8.73% | 10.57% | -1.80% |
| 1992 | 20.20% | 7.62% | 15.63% | 9.59% | 18.41% | 12.58% | 4.56% | 10.61% | 1.79% |
| 1993 | 3.38% | 10.08% | 15.12% | 10.88% | 18.88% | -6.70% | -11.75% | -7.50% | -15.50% |
| 1994 | 0.33% | 1.32% | 0.95% | 0.19% | -1.82% | -0.99% | -0.62% | 0.14% | 2.15% |
| 1995 | 31.31% | 37.58% | 32.03% | 36.80% | 28.45% | -6.27% | -0.72% | -5.49% | 2.84% |
| 1996 | 23.09% | 22.94% | 19.02% | 21.82% | 16.49% | 0.13% | 4.06% | 1.27% | 6.59% |
| 1997 | 27.31% | 33.36% | 29.05% | 31.78% | 22.36% | -6.06% | -1.74% | -4.48% | 4.94% |
| 1998 | 24.95% | 28.58% | 12.19% | 24.14% | -2.55% | -3.65% | 12.76% | 0.81% | 27.49% |
| 1999 | 44.68% | 21.04% | 12.03% | 20.90% | 21.26% | 23.64% | 32.66% | 23.78% | 23.43% |
| 2000 | -19.16% | -9.10% | 9.64% | -7.46% | -3.02% | -10.06% | -28.80% | -11.70% | -16.14% |
| 2001 | -10.80% | -11.89% | -0.39% | -11.46% | 2.49% | 1.08% | -10.41% | 0.65% | -13.25% |
| 2002 | -15.49% | -22.10% | -18.18% | -21.54% | -20.48% | 6.61% | 2.69% | 6.05% | 4.99% |
| 2003 | 45.41% | 28.68% | 40.97% | 31.06% | 47.25% | 16.72% | 4.44% | 14.35% | -1.85% |
| 2004 | 17.97% | 10.88% | 16.95% | 11.95% | 18.33% | 7.09% | 1.02% | 6.02% | -0.36% |
| 2005 | 3.30% | 4.91% | 8.06% | 6.12% | 4.55% | -1.61% | -4.76% | -2.82% | -1.25% |
| 2006 | 22.61% | 15.79% | 15.80% | 15.71% | 18.37% | 6.81% | 6.81% | 6.89% | 4.24% |
| 2007 | 1.73% | 5.49% | 1.53% | 5.14% | -1.57% | -3.76% | 0.20% | -3.41% | 3.30% |
| 2008 | -43.67% | -37.00% | -39.72% | -37.31% | -33.79% | -6.88% | -3.95% | -6.37% | -9.89% |
| 2009 | 72.80% | 26.46% | 46.31% | 28.34% | 27.17% | 46.33% | 26.49% | 44.46% | 45.62% |
| 2010 | 31.51% | 15.06% | 21.91% | 16.93% | 26.85% | 16.45% | 9.60% | 14.58% | 4.65% |
| 2011 | 5.11% | 2.11% | -0.11% | 1.03% | -4.18% | 3.00% | 5.22% | 4.09% | 9.29% |
| 2012 | 13.53% | 16.00% | 17.65% | 16.42% | 16.35% | -2.48% | -4.13% | -2.89% | -2.82% |
| 2013 | 41.08% | 32.39% | 36.16% | 33.55% | 38.82% | 8.69% | 4.92% | 7.53% | 2.25% |
| 2014 | 7.06% | 13.69% | 14.49% | 12.56% | 4.89% | -6.63% | -7.43% | -5.50% | 2.17% |
| 2015 | -6.87% | 1.38% | -2.20% | 0.48% | -4.41% | -8.26% | -4.67% | -7.35% | -2.46% |
| 2016 | 16.85% | 11.96% | 14.80% | 12.74% | 21.31% | 4.89% | 2.05% | 4.12% | -4.45% |
| 2017 | 19.44% | 21.83% | 18.90% | 21.13% | 14.65% | -2.39% | 0.54% | -1.69% | 4.80% |
| 2018 | -13.80% | -4.38% | -7.64% | -5.24% | -11.01% | -9.42% | -6.16% | -8.56% | -2.79% |
| 2019 | 26.38% | 31.49% | 29.24% | 31.02% | 25.52% | -5.10% | -2.85% | -4.63% | 0.86% |
| 2020 YTD | -14.35% | -3.08% | -10.77% | -3.48% | -12.98% | -11.27% | -3.58% | -10.87% | -1.37% |

*Note: Calculated Using Total Returns

Source: Horizon Kinetics LLC, International Securities Exchange, Bloomberg

See important disclosures for additional information.

© Horizon Kinetics LLC © 2020

Cryptocurrency COMPENDIUM

Index Constituent Changes: 1. Nuveen Investments Inc (JNC US) was delisted from the US Security Exchange effective 11/14/2007 and has been removed from the index. 2. Alliance Financial Corp (ALNC US) was delisted from US Security Exchange effective 03/11/2013 and has been removed from the index. The divisor has been adjusted accordingly for each of these changes. 3. Fortress Investment Group (FIG US) was delisted from US Security Exchange effective 12/27/2017 and has been removed from the index. 4. Legg Mason Inc (LM US) was delisted from US Security Exchange effective 08/03/2020 and has been removed from the index

Money Manager Index

From Aug 1983 to Feb 2021

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Yr. End | Annualized return | | |
|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|-------------------|---------------|-------------------|
| | | | | | | | | | | | | | | Index | Yearly return | (since inception) |
| 1983 | | | | | | | | 1.00 | 0.81 | 0.76 | 0.87 | 0.75 | 1983 | 0.75 | (60.5)% | (50.2)% |
| 1984 | 0.75 | 0.71 | 0.70 | 0.66 | 0.67 | 0.67 | 0.61 | 0.83 | 0.79 | 0.76 | 0.67 | 0.65 | 1984 | 0.65 | (13.5)% | (26.5)% |
| 1985 | 0.92 | 0.93 | 0.99 | 0.95 | 1.20 | 1.30 | 1.32 | 1.38 | 1.28 | 1.50 | 1.86 | 2.02 | 1985 | 2.02 | 211.8% | 33.7% |
| 1986 | 2.46 | 2.78 | 2.47 | 2.31 | 2.36 | 2.33 | 2.03 | 2.23 | 1.98 | 2.37 | 2.34 | 2.34 | 1986 | 2.34 | 15.9% | 28.2% |
| 1987 | 3.21 | 3.27 | 3.16 | 2.55 | 2.37 | 2.30 | 2.39 | 2.47 | 2.22 | 1.56 | 1.44 | 1.52 | 1987 | 1.52 | (35.0)% | 9.9% |
| 1988 | 1.80 | 1.87 | 1.78 | 1.79 | 1.69 | 1.94 | 1.92 | 1.96 | 2.01 | 1.97 | 1.95 | 2.07 | 1988 | 2.07 | 36.0% | 14.3% |
| 1989 | 2.42 | 2.37 | 2.54 | 2.63 | 2.64 | 2.64 | 2.93 | 3.12 | 3.07 | 3.05 | 3.23 | 3.26 | 1989 | 3.26 | 57.8% | 20.2% |
| 1990 | 3.12 | 3.15 | 3.53 | 3.06 | 3.47 | 3.45 | 3.30 | 2.70 | 2.68 | 2.40 | 2.52 | 3.02 | 1990 | 3.02 | (7.3)% | 16.1% |
| 1991 | 3.08 | 3.49 | 3.70 | 3.68 | 3.71 | 3.61 | 3.86 | 4.05 | 4.07 | 4.69 | 4.47 | 5.72 | 1991 | 5.72 | 89.4% | 23.0% |
| 1992 | 5.76 | 5.61 | 5.30 | 5.12 | 4.98 | 4.99 | 5.93 | 6.06 | 6.19 | 6.56 | 7.25 | 7.36 | 1992 | 7.36 | 28.6% | 23.6% |
| 1993 | 8.06 | 8.04 | 8.20 | 7.94 | 8.15 | 8.57 | 9.05 | 10.00 | 9.99 | 9.31 | 8.97 | 8.90 | 1993 | 8.90 | 21.0% | 23.4% |
| 1994 | 9.52 | 8.73 | 8.05 | 7.85 | 7.81 | 7.53 | 7.66 | 8.31 | 8.15 | 8.52 | 7.88 | 7.95 | 1994 | 7.95 | (10.6)% | 19.9% |
| 1995 | 7.74 | 8.38 | 8.72 | 8.77 | 9.20 | 9.35 | 9.93 | 10.78 | 11.22 | 10.53 | 10.89 | 10.40 | 1995 | 10.40 | 30.8% | 20.8% |
| 1996 | 11.12 | 11.50 | 11.33 | 11.62 | 11.86 | 12.53 | 11.91 | 12.36 | 13.32 | 14.03 | 14.42 | 15.02 | 1996 | 15.02 | 44.4% | 22.4% |
| 1997 | 16.04 | 16.81 | 15.32 | 17.27 | 18.42 | 20.29 | 22.28 | 21.39 | 25.31 | 24.95 | 24.95 | 25.50 | 1997 | 25.50 | 69.8% | 25.2% |
| 1998 | 25.67 | 29.00 | 29.89 | 30.60 | 28.90 | 30.44 | 27.67 | 21.33 | 21.74 | 25.16 | 27.27 | 25.41 | 1998 | 25.41 | (0.4)% | 23.3% |
| 1999 | 26.00 | 23.71 | 23.92 | 26.77 | 28.94 | 29.74 | 28.78 | 26.74 | 25.89 | 27.73 | 28.54 | 30.55 | 1999 | 30.55 | 20.2% | 23.2% |
| 2000 | 31.07 | 31.19 | 36.01 | 35.60 | 35.20 | 40.32 | 43.58 | 45.75 | 45.62 | 48.69 | 44.05 | 49.84 | 2000 | 49.84 | 63.1% | 25.2% |
| 2001 | 50.23 | 46.41 | 44.27 | 46.96 | 48.90 | 49.98 | 50.67 | 49.70 | 46.47 | 44.81 | 48.04 | 51.91 | 2001 | 51.91 | 4.2% | 23.9% |
| 2002 | 53.62 | 53.74 | 55.11 | 52.52 | 52.83 | 50.48 | 42.58 | 44.92 | 41.54 | 42.66 | 45.78 | 43.17 | 2002 | 43.17 | (16.8)% | 21.4% |
| 2003 | 42.72 | 41.18 | 42.36 | 45.98 | 49.02 | 50.71 | 53.47 | 53.97 | 53.46 | 56.12 | 55.83 | 58.49 | 2003 | 58.49 | 35.5% | 22.1% |
| 2004 | 64.38 | 65.08 | 64.63 | 61.68 | 60.86 | 62.30 | 58.71 | 64.08 | 65.73 | 68.86 | 73.53 | 78.16 | 2004 | 78.16 | 33.6% | 22.6% |
| 2005 | 76.46 | 77.94 | 74.06 | 72.83 | 77.02 | 80.25 | 83.59 | 83.07 | 86.03 | 89.19 | 96.58 | 97.35 | 2005 | 97.35 | 24.6% | 22.7% |
| 2006 | 107.62 | 111.44 | 110.75 | 111.88 | 101.89 | 100.61 | 100.62 | 104.98 | 114.61 | 116.64 | 113.78 | 118.05 | 2006 | 118.05 | 21.3% | 22.6% |
| 2007 | 125.73 | 123.77 | 122.62 | 127.58 | 133.57 | 134.68 | 126.61 | 124.07 | 133.57 | 148.09 | 135.13 | 135.56 | 2007 | 135.56 | 14.8% | 22.3% |
| 2008 | 127.53 | 115.76 | 115.94 | 121.58 | 130.51 | 115.68 | 119.94 | 120.55 | 109.69 | 72.70 | 62.95 | 67.91 | 2008 | 67.91 | (49.9)% | 18.1% |
| 2009 | 57.51 | 51.76 | 65.63 | 79.49 | 85.67 | 90.79 | 99.97 | 101.69 | 107.32 | 107.36 | 110.94 | 115.01 | 2009 | 115.01 | 69.4% | 19.7% |
| 2010 | 106.84 | 110.32 | 118.13 | 114.91 | 100.18 | 88.17 | 97.65 | 89.64 | 103.59 | 108.29 | 108.64 | 119.58 | 2010 | 119.58 | 4.0% | 19.1% |
| 2011 | 122.80 | 128.28 | 127.94 | 127.97 | 126.06 | 121.03 | 115.49 | 104.25 | 91.32 | 102.44 | 103.79 | 103.98 | 2011 | 103.98 | (13.1)% | 17.8% |
| 2012 | 109.46 | 120.12 | 125.37 | 121.64 | 108.44 | 114.12 | 113.56 | 118.33 | 123.18 | 127.91 | 131.76 | 135.00 | 2012 | 135.00 | 29.8% | 18.1% |
| 2013 | 151.20 | 155.13 | 165.52 | 166.55 | 174.89 | 164.20 | 179.01 | 168.47 | 176.12 | 192.14 | 197.16 | 208.44 | 2013 | 208.44 | 54.4% | 19.2% |
| 2014 | 194.17 | 196.87 | 203.88 | 196.24 | 195.40 | 206.41 | 194.00 | 207.06 | 201.07 | 205.28 | 212.28 | 215.25 | 2014 | 215.25 | 3.3% | 18.6% |
| 2015 | 203.96 | 217.70 | 215.97 | 218.17 | 217.01 | 211.12 | 203.85 | 184.77 | 175.53 | 195.50 | 198.54 | 181.68 | 2015 | 181.68 | (15.6)% | 17.4% |
| 2016 | 165.64 | 164.85 | 183.47 | 190.06 | 194.22 | 177.37 | 187.78 | 190.19 | 185.87 | 173.66 | 194.88 | 199.52 | 2016 | 199.52 | 9.8% | 17.2% |
| 2017 | 196.14 | 209.63 | 205.70 | 207.52 | 210.37 | 221.66 | 230.87 | 225.39 | 239.74 | 245.52 | 261.47 | 264.79 | 2017 | 264.79 | 32.7% | 17.6% |
| 2018 | 278.34 | 266.70 | 266.44 | 253.48 | 256.42 | 243.56 | 250.69 | 238.98 | 234.72 | 209.04 | 213.62 | 194.43 | 2018 | 194.43 | (26.6)% | 16.0% |
| 2019 | 203.57 | 219.59 | 213.65 | 234.81 | 206.43 | 229.48 | 229.27 | 210.59 | 223.22 | 225.90 | 239.32 | 240.01 | 2019 | 240.01 | 23.4% | 16.2% |
| 2020 | 248.58 | 219.88 | 192.81 | 222.04 | 227.81 | 240.17 | 250.44 | 254.25 | 241.97 | 264.83 | 306.02 | 326.74 | 2020 | 326.74 | 36.1% | 16.7% |
| 2021 | 325.81 | 336.65 | | | | | | | | | | | 2021 | 336.65 | 3.0% | 16.7% |

| S.No. | Ticker | Name | Amount Invested | Shares Purchased | Date of Investment | Current Index Value |
|-------|----------------|-----------------------------|-----------------|------------------|--------------------|---------------------|
| 1 | AMG US Equity | Affiliated Manager | \$22,947 | 1,377 | 11/30/1997 | \$ 192,725 |
| 2 | BLK US Equity | BlackRock | \$23,205 | 1,658 | 9/30/1999 | \$ 1,151,143 |
| 3 | WDR US Equity | Waddell & Reed | \$27,513 | 1,587 | 3/31/1998 | \$ 39,825 |
| 4 | EV US Equity | Eaton Vance | \$2,641 | 3,998 | 1/31/1986 | \$ 292,163 |
| 5 | TROW US Equity | T. Rowe Price | \$2,423 | 2,014 | 4/30/1986 | \$ 326,525 |
| 6 | BEN US Equity | Franklin resources | \$908 | 1,263 | 4/30/1985 | \$ 99,169 |
| 7 | FHI US Equity | Federated Hermes Inc | \$26,381 | 2,206 | 5/31/1998 | \$ 59,542 |
| 8 | PZN US Equity | Pzena Investment Management | \$122,426 | 6,317 | 10/31/2007 | \$ 59,823 |

Cryptocurrency COMPENDIUM

Index Constituent Changes: 1. New Star Asset Management (NSAM LN) was delisted from the London Security Exchange effective 03/10/2009 and has been removed from the index. 2. Australia Wealth Management (AUW AU) was delisted from Australian Security Exchange effective 05/18/2009 and has been removed from the index. 3. Bluebay Asset Management/UNI (BBAY LN) was delisted from the London Security Exchange effective 12/20/2010 and has been removed from the index. 4. Everest Financial Group Limited (EFG AU) was delisted from the Australian Security Exchange effective 7/19/2011 and has been removed from the index. 5. RAB Capital Plc (RAB LN) was delisted from the London Security Exchange effective 9/2/2011 and has been removed from the index. 6. Invista Real Estate (INRE LN) was delisted effective 8/13/2012 and has been removed from the index. 7. F&C Asset Management Plc (FCAM LN) was delisted effective 5/8/2014 and has been removed from the index. 8. Charleagne Capital Ltd (CCAP LN) was delisted effective 12/14/2016 and has been removed from the index. The divisor has been adjusted accordingly for each of these changes. 9. Henderson Group Plc (HGG LN) was delisted from London Security Exchange effective 5/30/2017 and has been removed from the Index. 10. Aberdeen Asset Management Plc (ADN LN) was delisted from London Stock Exchange effective 8/14/2017 and has been removed from the Index.

International Money Manager Index

From Nov 1986 to Feb 2021

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Yr. End | Index | Yearly return | Annualized return (since inception) |
|------|--------|--------|-------|-------|-------|-------|--------|--------|-------|-------|--------|--------|---------|--------|---------------|-------------------------------------|
| 1986 | | | | | | | | | | | 1.00 | 1.02 | 1986 | 1.02 | 10.0% | 10.0% |
| 1987 | 1.25 | 1.37 | 1.48 | 1.48 | 1.37 | 1.33 | 1.39 | 1.40 | 1.33 | 0.81 | 0.76 | 0.73 | 1987 | 0.73 | (27.7)% | (23.3)% |
| 1988 | 0.75 | 0.92 | 1.02 | 0.95 | 0.80 | 0.89 | 0.88 | 0.82 | 0.86 | 0.88 | 0.89 | 0.93 | 1988 | 0.93 | 26.4% | (3.4)% |
| 1989 | 1.03 | 1.02 | 1.06 | 1.17 | 1.19 | 1.18 | 1.25 | 1.16 | 1.17 | 1.20 | 1.21 | 1.28 | 1989 | 1.28 | 37.8% | 8.1% |
| 1990 | 1.24 | 1.24 | 1.18 | 1.19 | 1.22 | 1.24 | 1.26 | 1.26 | 1.23 | 1.24 | 1.25 | 1.33 | 1990 | 1.33 | 3.7% | 7.0% |
| 1991 | 1.34 | 1.52 | 1.56 | 1.58 | 1.57 | 1.47 | 1.52 | 1.64 | 1.81 | 1.89 | 1.94 | 1.92 | 1991 | 1.92 | 44.8% | 13.5% |
| 1992 | 2.01 | 1.93 | 1.88 | 2.14 | 2.19 | 2.13 | 2.08 | 1.99 | 1.95 | 1.77 | 1.76 | 1.96 | 1992 | 1.96 | 1.9% | 11.5% |
| 1993 | 1.98 | 2.03 | 2.20 | 2.39 | 2.42 | 2.45 | 2.54 | 3.05 | 3.01 | 3.07 | 3.01 | 3.30 | 1993 | 3.30 | 68.7% | 18.1% |
| 1994 | 3.72 | 3.39 | 3.17 | 3.04 | 2.99 | 2.89 | 3.01 | 3.14 | 3.13 | 3.19 | 3.15 | 3.15 | 1994 | 3.15 | (4.7)% | 15.1% |
| 1995 | 3.07 | 3.12 | 3.28 | 3.41 | 3.56 | 3.59 | 3.87 | 3.76 | 3.76 | 3.77 | 3.70 | 3.73 | 1995 | 3.73 | 18.6% | 15.4% |
| 1996 | 3.76 | 3.85 | 3.70 | 3.79 | 3.96 | 3.90 | 3.75 | 3.96 | 4.16 | 4.47 | 4.90 | 4.86 | 1996 | 4.86 | 30.3% | 16.8% |
| 1997 | 5.11 | 5.37 | 4.99 | 4.96 | 5.43 | 5.94 | 6.57 | 6.32 | 7.45 | 7.24 | 6.80 | 7.19 | 1997 | 7.19 | 47.9% | 19.3% |
| 1998 | 7.12 | 8.05 | 8.78 | 9.25 | 8.95 | 8.74 | 8.91 | 6.67 | 6.08 | 7.01 | 7.51 | 7.71 | 1998 | 7.71 | 7.3% | 18.3% |
| 1999 | 7.99 | 8.21 | 8.68 | 9.07 | 8.71 | 8.61 | 8.63 | 8.43 | 8.47 | 8.79 | 9.80 | 10.79 | 1999 | 10.79 | 39.9% | 19.8% |
| 2000 | 11.23 | 12.27 | 13.95 | 13.50 | 13.73 | 15.39 | 15.85 | 16.82 | 17.07 | 16.31 | 14.43 | 16.76 | 2000 | 14.43 | 33.8% | 20.7% |
| 2001 | 17.42 | 15.88 | 13.46 | 15.14 | 15.84 | 15.15 | 14.21 | 13.61 | 10.77 | 11.43 | 13.90 | 14.12 | 2001 | 14.12 | (2.2)% | 19.1% |
| 2002 | 14.74 | 13.78 | 15.09 | 15.11 | 16.38 | 14.14 | 12.92 | 12.10 | 11.23 | 11.06 | 11.33 | 10.50 | 2002 | 10.50 | (25.6)% | 15.7% |
| 2003 | 10.18 | 9.52 | 9.69 | 10.62 | 12.17 | 13.04 | 13.98 | 15.38 | 16.67 | 17.88 | 18.16 | 18.07 | 2003 | 18.07 | 72.1% | 18.4% |
| 2004 | 20.00 | 22.41 | 29.98 | 35.46 | 26.68 | 30.80 | 25.37 | 25.20 | 23.67 | 23.34 | 27.56 | 31.48 | 2004 | 31.48 | 74.2% | 20.9% |
| 2005 | 32.19 | 32.57 | 31.88 | 27.79 | 27.36 | 29.05 | 30.38 | 31.49 | 33.39 | 32.24 | 32.95 | 37.18 | 2005 | 37.18 | 18.1% | 20.8% |
| 2006 | 41.01 | 40.97 | 43.69 | 46.45 | 42.39 | 41.58 | 40.60 | 43.32 | 43.55 | 43.70 | 44.58 | 49.38 | 2006 | 49.38 | 32.8% | 21.3% |
| 2007 | 50.95 | 51.18 | 53.59 | 56.09 | 58.16 | 56.37 | 53.90 | 48.65 | 50.96 | 57.03 | 48.21 | 45.75 | 2007 | 45.75 | (7.3)% | 19.8% |
| 2008 | 38.71 | 39.71 | 38.59 | 40.18 | 39.25 | 35.10 | 34.59 | 33.33 | 26.09 | 18.72 | 14.50 | 15.79 | 2008 | 15.79 | (65.5)% | 13.3% |
| 2009 | 14.62 | 13.24 | 14.96 | 19.63 | 22.82 | 23.73 | 26.14 | 27.05 | 28.41 | 28.53 | 28.69 | 29.83 | 2009 | 29.83 | 89.0% | 15.8% |
| 2010 | 28.50 | 27.58 | 29.90 | 29.58 | 25.53 | 24.72 | 27.82 | 26.74 | 30.36 | 33.68 | 31.85 | 34.52 | 2010 | 34.52 | 15.7% | 15.8% |
| 2011 | 34.91 | 36.17 | 36.51 | 39.63 | 37.86 | 35.31 | 35.83 | 32.76 | 29.28 | 32.04 | 31.23 | 30.59 | 2011 | 30.59 | (11.4)% | 14.56% |
| 2012 | 32.12 | 34.36 | 35.67 | 35.08 | 31.03 | 32.92 | 32.66 | 34.17 | 36.33 | 37.28 | 38.11 | 40.73 | 2012 | 40.73 | 33.1% | 15.22% |
| 2013 | 43.61 | 42.58 | 44.42 | 49.29 | 50.40 | 47.75 | 50.58 | 49.32 | 52.49 | 55.65 | 55.41 | 58.88 | 2013 | 58.88 | 44.6% | 16.19% |
| 2014 | 55.35 | 58.98 | 61.86 | 59.92 | 59.05 | 59.89 | 57.84 | 58.64 | 55.47 | 54.37 | 55.77 | 54.31 | 2014 | 54.31 | (7.8)% | 15.24% |
| 2015 | 52.77 | 58.87 | 58.99 | 62.11 | 62.25 | 60.43 | 60.71 | 56.91 | 55.46 | 60.65 | 60.93 | 59.48 | 2015 | 59.48 | 9.5% | 15.04% |
| 2016 | 55.01 | 53.65 | 59.90 | 61.89 | 61.45 | 55.81 | 58.56 | 58.48 | 60.83 | 60.64 | 58.86 | 59.91 | 2016 | 59.91 | 0.7% | 14.53% |
| 2017 | 63.15 | 64.71 | 65.79 | 71.50 | 74.59 | 75.64 | 80.02 | 78.81 | 81.32 | 81.68 | 83.28 | 84.08 | 2017 | 84.08 | 40.3% | 15.28% |
| 2018 | 94.34 | 87.65 | 87.29 | 86.78 | 83.38 | 82.63 | 84.75 | 85.31 | 85.67 | 76.31 | 72.64 | 66.46 | 2018 | 66.46 | (20.9)% | 13.94% |
| 2019 | 74.78 | 79.39 | 81.00 | 86.52 | 82.17 | 91.43 | 91.77 | 89.72 | 89.03 | 91.00 | 99.15 | 104.96 | 2019 | 104.96 | 57.9% | 15.06% |
| 2020 | 106.00 | 96.18 | 74.11 | 83.74 | 90.44 | 96.95 | 103.21 | 108.33 | 98.58 | 95.78 | 114.41 | 123.15 | 2020 | 123.15 | 17.3% | 15.13% |
| 2021 | 122.96 | 128.04 | | | | | | | | | | | 2021 | 122.96 | (0.1)% | 15.08% |

| S.No. | Ticker | Name | Initial Amount Invested | Shares Purchased | Date of Investment | Current Index Value |
|-------|-----------------|-----------------------------------|-------------------------|------------------|--------------------|---------------------|
| 1 | IGM CN Equity | IGM Financial Inc | \$1,000 | 73 | 31/11/1986 | \$ 2,014 |
| 2 | IVZ US Equity | Invesco Plc (Previously Amvescap) | \$1,357 | 1,153 | 1/31/1991 | \$ 13,009 |
| 3 | SDR LN Equity | Schroders Plc | \$1,208 | 505 | 3/31/1991 | \$ 24,728 |
| 4 | RAT LN Equity | Rathbone Brothers Plc | \$1,208 | 736 | 3/31/1991 | \$ 15,860 |
| 5 | CIX CN Equity | CI Financial Corp. | \$2,585 | 3,224 | 6/30/1994 | \$ 45,377 |
| 6 | EMG LN Equity | Man Group Plc | \$2,862 | 6,344 | 10/31/1994 | \$ 10,107 |
| 7 | AGF/B CN Equity | AGF Management Ltd-CI B | \$3,343 | 1,346 | 1/31/1996 | \$ 7,367 |
| 8 | 8739 JP Equity | Sparx Group Co Ltd | \$11,762 | 108 | 12/31/2001 | \$ 32,435 |
| 9 | AZM IM Equity | Azimut Holding Spa | \$21,908 | 4,977 | 7/31/2004 | \$ 114,846 |
| 10 | PGHN SW Equity | Partners Group-Reg | \$36,848 | 578 | 3/31/2006 | \$ 696,621 |
| 11 | ASHM LN Equity | Ashmore Group Plc. | \$36,888 | 9,873 | 10/31/2006 | \$ 56,923 |

Cryptocurrency COMPENDIUM

This report was produced by Horizon Kinetics (“HK”). The following persons employed by HK contributed to this report: Murray Stahl, Chairman, Steven Bregman, President, and Peter Doyle, Managing Director. HK is located at 470 Park Avenue South, New York, NY 10016. At the time of this report, there are no planned updates to the recommendations. To the extent HK has provided previous recommendations concerning the same issuer(s) during the preceding 12-month period, such recommendations do not differ from the recommendations contained here.

HK is the parent company to registered investment adviser Horizon Kinetics Asset Management LLC. It manages a variety of investment products including mutual funds, private funds and separate accounts. PCS Research Group LLC (“PCS”) is the exclusive marketer and distributor of this and other reports produced by HK. HK and PCS are not affiliated with one another. Neither entities perform or are expected to perform investment banking services for the issuer(s); are not market makers, and are not party to any agreements with the issuer(s). The issuer(s) has not been a client of HK or PCS. None of the research analysts involved in creating this report have received compensation from the issuer(s). HK analysts are compensated based on the success of the firm in general, along with the quality and accuracy of the analysts’ research. Remuneration from HK to research analysts is not linked to investment firm activities of any affiliates. Conflicts of interest for employees of HK and PCS, and their affiliates, are managed by a formal code of ethics and information barrier procedures which include, but are not limited to, policies related to restricted lists, personal trading rules, and the prohibition of misuse of material non-public information.