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Blending Art & Science: Bitcoin Valuations

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How do we place value on an underlying unit of measure? In today's environment, where the intrinsic value of fiat currencies is increasingly being questioned, it is important to consider the value of alternative currencies such as Bitcoin. We believe there is demand for Bitcoin/crypto currency. While we do not attempt to derive a price target or formalize a valuation mode, we instead explore different analogies and dissimilarities that can be applied to Bitcoin and potentially other areas of crypto.

Traditional Values

The most commonly accepted definition of a currency is a store of value and a medium of exchange. By these accounts, Bitcoin fits the description of a nascent currency. With this in mind, some may hypothesize that measuring Bitcoin is as simple as applying traditional currency valuation models. However, many aspects of valuation are a relative exercise. For example, is 20x PE expensive? It depends and is relative to both the growth of EPS and also versus peers. Determining whether the Japanese yen is overvalued hinges on its relative value versus other currencies. Most mainstream currency valuation models, from Purchasing Power Parity to the Economist's Big Mac Index, generally revolve around the relative position of the issuing nation. Factors such as relative interest rates, imports/exports, reserves and national debt, among many other items, influence the valuation output. However Bitcoin and other cryptocurrencies are unique as there are no central banks, trade balance, geopolitics, etc. behind the issuer. In fact, the lack of issuer is by design. In its most basic essence, many purists argue that Bitcoin and other cryptocurrencies are a true global currency.

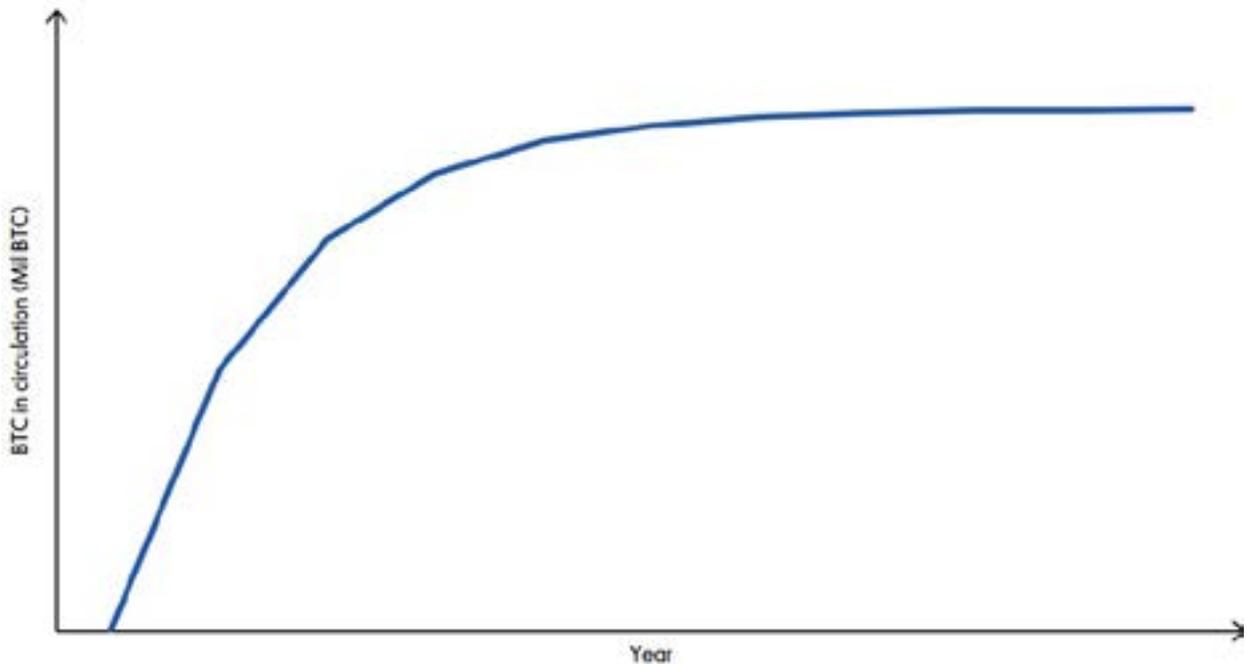
Another simplistic valuation method equates the global currency transaction volume relative to the global currency market and assumes that Bitcoin will increase market share. While this often yields astronomical valuations, it should be considered as part of the valuation mosaic. At the beginning of May 2020, a single Bitcoin was worth roughly \$8,800¹ and the total market value of all Bitcoin was worth \$160 billion², accounting for 0.4% of total global currencies. At current rates, if Bitcoin replaced 5% of the world's currency it would yield over \$100,000/Bitcoin.

Unfortunately, there are few commercial transactions done with Bitcoin and to date, no central banks buy cryptocurrencies as reserves. Using conventional currency models will either be conceptually wrong (no sanctioning issuer) or wrong in practicality (lack of day-to-day usage).

All That Glitters isn't Gold

Bitcoin is also frequently compared to gold. Indeed, there are many similarities and gold is a worthy role model for Bitcoin. After all, gold has been accepted as a store of value and medium of exchange for centuries (nowadays, mostly as a store of value, almost none is used as medium of exchange). We believe gold is also the only globally accepted "currency" that has circumvented the issue of sanctioning entity. Supply is also fairly limited. According to the US Geological Survey, gold mine production grew at a compound annual growth rate (CAGR) of around 1.6% from 1970 to 2017. Using 2020 as a starting point to a theoretical end date of 2033 when 21 million Bitcoin will have been mined, Bitcoin production is expected to grow at a CAGR of about 1%. Theoretically, everyone is free to mine both gold and bitcoin and neither supply is monopolized by governments. Other similarities include no biological or time decay.

Total Bitcoin Generated Over Time



Source: Mellon. For illustration purposes only.

What about the uses of gold? In 2019, tech/industrial accounted for only about 7.5% the total uses of the commodity, central banks accounted for another 15% and the remaining 77.5% included jewelry and investment demand. We also view jewelry as investment demand since many cultures buy 24 carat gold jewelry (India and parts of Asia) as a savings vehicle. So far, it appears Bitcoin aligns nicely with gold in terms of both supply and demand. With this in mind, we will use gold as a starting point to discuss potential valuation methods for Bitcoin.

Gold and the Commodities Valuation Perspective

Commodities are valued from a supply/demand and marginal cost curve framework. In the chart on the following page, assume demand for this hypothetical commodity sits on the units demanded line. The commodity cost theory would dictate that the lowest cost producer will be the first to supply the demand, then the subsequent tranches of higher cost producers, until the market demand is satisfied. In this graphic, producers A, B, C, D and some of E will produce. We simply draw a horizontal line from the unit cost of the last unit produced and that is the implied equilibrium market price. In this example, Producer F (the last producer deployed) has unit cost of \$35 (assuming unit costs are “all-in” and incorporate a satisfactory rate of return). Thus the implied equilibrium price of this hypothetical commodity is between \$30-35/unit. In reality, commodity prices fluctuate enormously from the equilibrium price, particularly in the short- to mid-term (in part, due to compounding feedback loops, time lag effects and non-linear supply curves). However, in the long term, the underlying dynamics of supply/demand and marginal cost generally prevails.

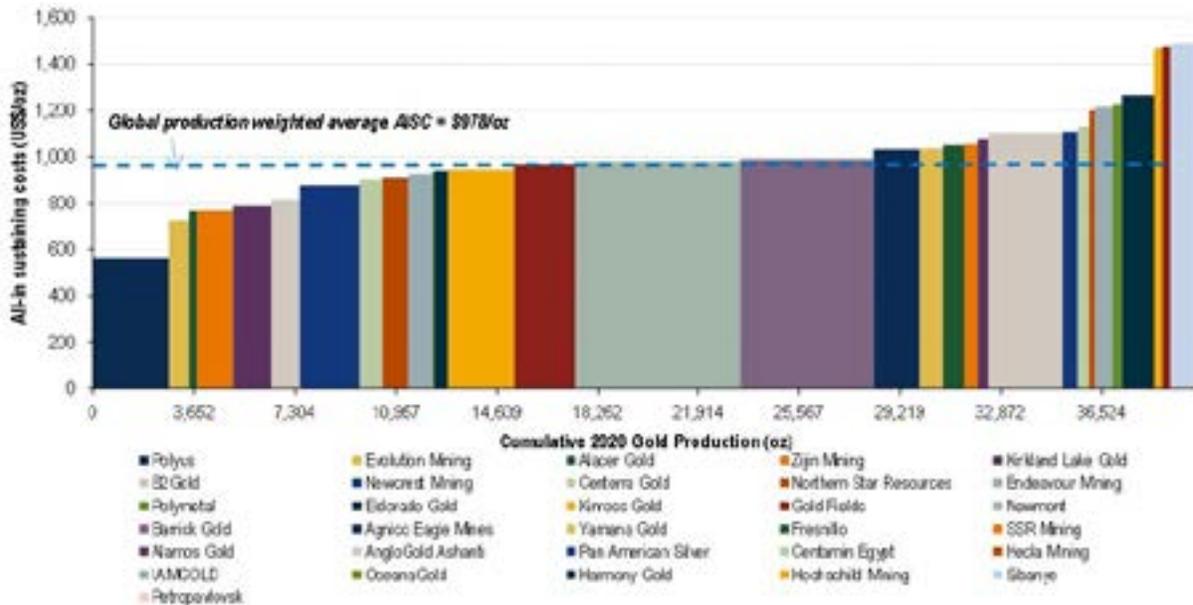
Commodity Marginal Cost Curve Model



Source: Mellon.

The following chart is fairly representative of the global gold cost curve. In 2020, the all-in industry cost average for gold was around \$980 per ounce. Yet gold prices have traded consistently near the \$2,000 per ounce range for most of 2020. Is the marginal cost curve model wrong? Marginal cost curve models best work on commodities that are driven by real consumption uses versus investment demand. In the physical world, when the price of oil spikes (i.e., the '70s oil embargo), the consumer finds alternatives and/or demand is rationalized (public transit, fuel efficient cars) until supply adjusts (exploration, lifting embargo).

2020 Gold All-in Industry Cost Curve



Source: Bank of America Gold Equity Research.

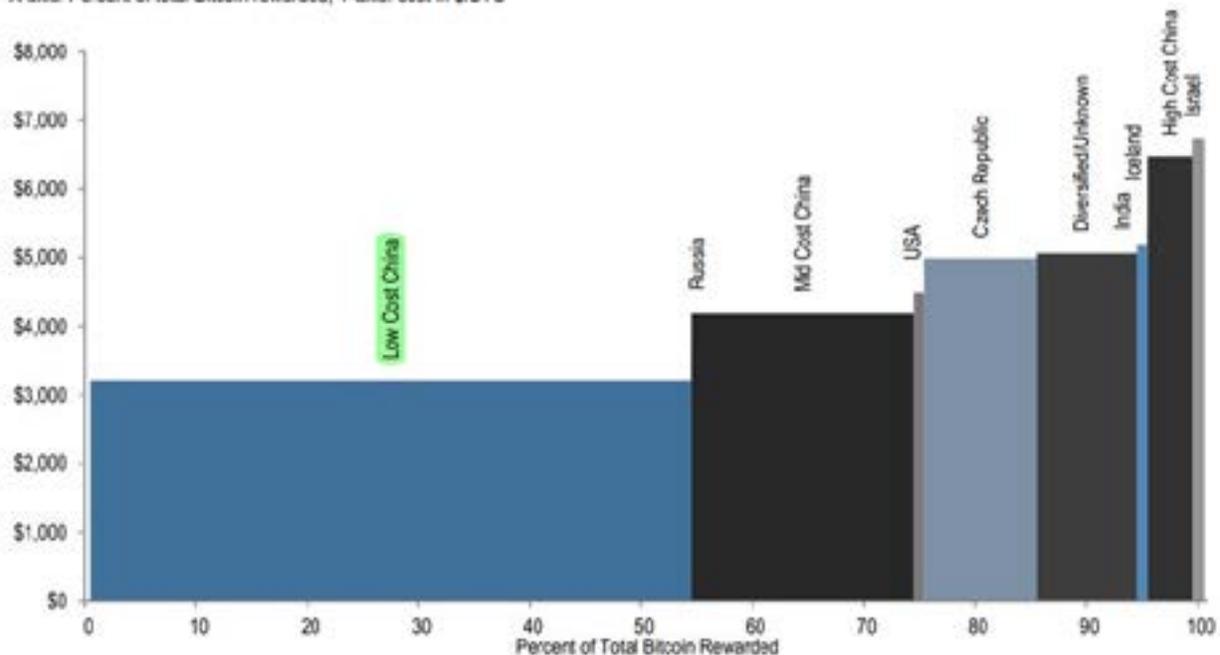
In the case of gold, it is the rarity value of gold that creates demand. There are no substitutions and supply is hard to increase in a short period of time. Pundits can argue that recycled gold will make its way back into the system, satisfying the demand. However, if we look at past gold cycles, the result is usually lower demand. Higher supply is rarely the main reason a gold cycle ends. For example, doubling annual mined production only increases total global stock by 3%. For investment commodities, we recommend focusing on the scarcity value and demand narrative.

Different Frameworks for Valuing Bitcoin

There are numerous models attempting to derive valuation for Bitcoin. First, the net cost model (physical cost of mining Bitcoin) is frequently mentioned for Bitcoin valuation. Various research papers have made good cases that Bitcoin does have an intrinsic value and models were formalized using pricing based on its marginal cost of production. “Mining” new Bitcoin requires real resources from participants utilizing both electrical and computing power as well as other capex/opex items. Intuitively, this also makes sense, something that requires effort to create has intrinsic value. However, does this cost set the price for Bitcoin? Arguably, no. It is easy to imagine a world where the cost of electricity is almost free, as renewable penetration is already making that possible in certain regions, and computing power improves by leaps. In a scenario where demand for alternative currencies/crypto continues to grow while mined supply is set, should the value of Bitcoin decline simply because the cost of mining is dropping? The Bitcoin cost curve chart below, highlights the same issue with gold’s cost curve – low predictive or causal value to Bitcoin price (Bitcoin trading roughly \$10 thousand, meaningfully above the mining cost curve).

Bitcoin Cost Curve

X-axis: Percent of total Bitcoin rewarded; Y-axis: cost in \$/BTC



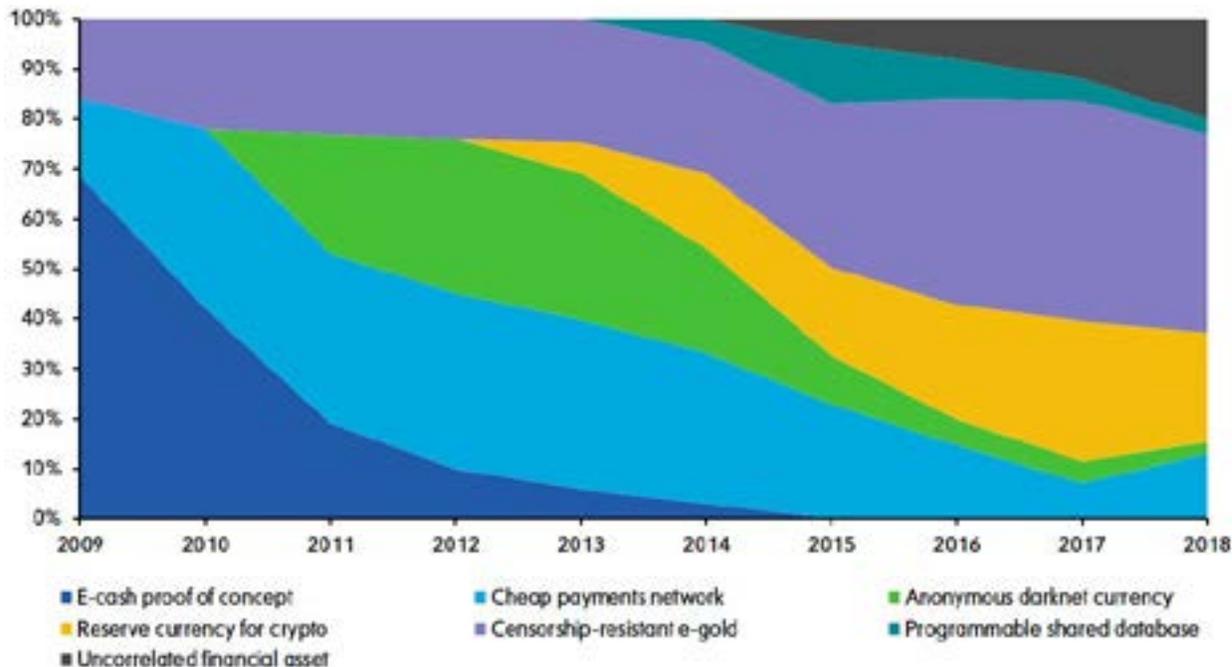
Source: StormGain (Bloomberg New Energy Finance, Bitmain, Eurostat, EIA, Rosstat, News Reports, J.P. Morgan). As of January 1, 2018 - February 12, 2018.

Next, the stock-to-flow ratio (S2F) is one of the more interesting valuation concepts and is worth understanding despite its flaws. A stock-to-flow ratio is simply the current stock of a commodity (total amount currently available) divided by flow of new production (new amount mined that year). Commodities such as gold have the largest stock-to-flow ratios (over 50), meaning it would take over 50 years of gold production to get the current gold stock. Bitcoin has a current S2F ratio in the 20s. Common S2F linear models extrapolate a price based on the increasing Bitcoin S2F ratio (from halving) to eventually reach gold’s market cap.

What are the advantages of this ratio? It does not recreate the wheel, nor does it argue an esoteric case of intrinsic value for an intangible digital asset. This ratio pegs a relative “scarcity” measure to something that is already commonly well received as an alternative currency and store of value. Critics of S2F will say that supply doesn’t define price, highlighting that the price of gold has fluctuated massively in its history while its S2F has stayed near 60. They argue that the majority of gold’s movement can be explained by the purchasing power of the US dollar, and buying/selling of gold is based on inflation or currency debasement expectations. To all of these points, we agree. Recall the problem of valuing Bitcoin from a traditional currency basis due to a lack of relativity. In many forms, the S2F model is elegant (and potentially flawed) in its simplicity. It provides that relativity to link Bitcoin with a much more established gold market/framework.

Another possible valuation model is the stock-to-flow cross asset model (S2FX). The natural evolution for the S2F ratio was to apply it to a cross asset valuation framework in relation to gold and silver. In this model, the role of Bitcoin evolves from a proof of concept in the late 2000s to Bitcoin’s current role as a counter-fiat/uncorrelated asset.

Bitcoin Narrative Over Time



Source: Nic Carter and Hasu. https://medium.com/@nic__carter/visions-of-bitcoin-4b7b7cbcd24c. As of December 31, 2017.

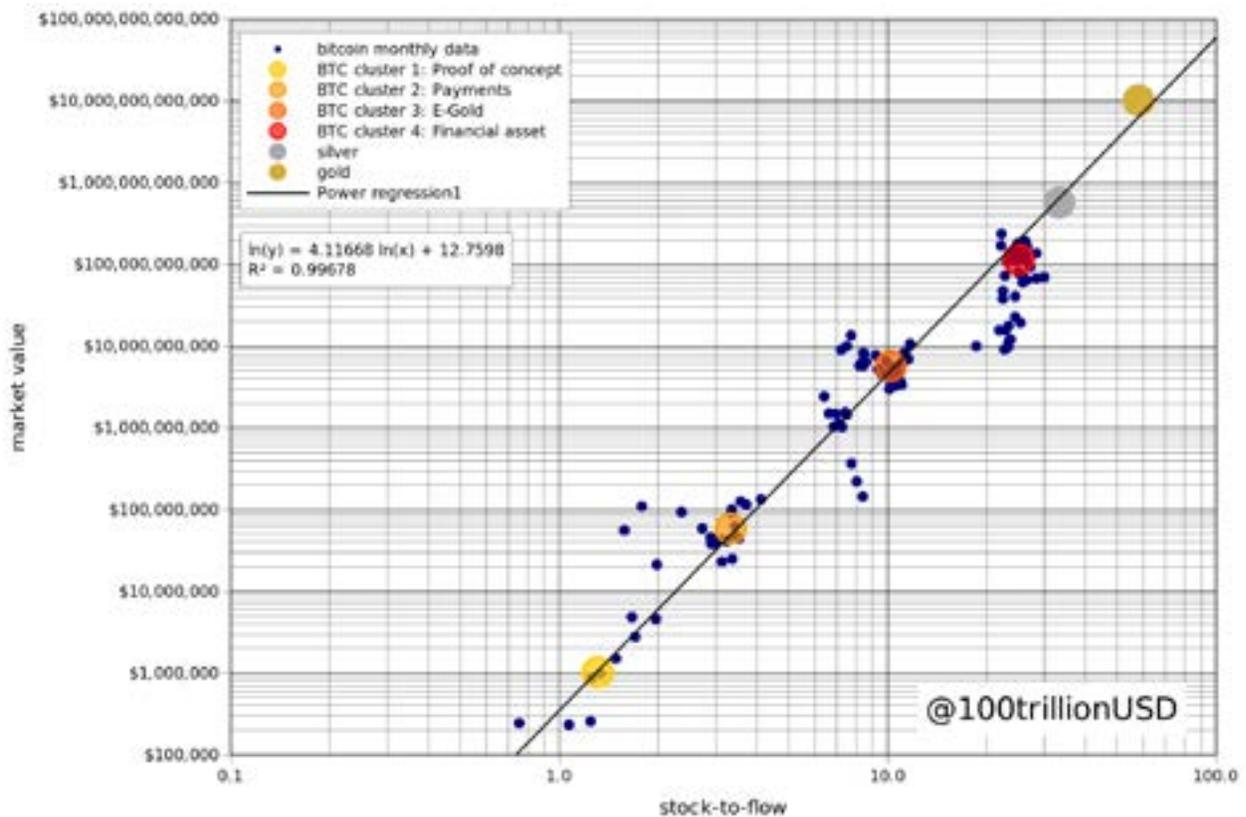
The creator of S2FX frameworks notes the financial milestones and phases passed by Bitcoin. Each phase is marked by an abrupt phase transition in how Bitcoin is viewed and utilized and also a cluster of higher prices. In the table below, we summarize each phase.

Phase	S2F Ratio	Market Value	Description
Proof of Concept	1.3	\$1mm	Bitcoin white paper
Payments	3.3	\$58mm	USD parity, 1BTC = \$1
E-Gold	10.2	\$5.6bln	1 st halving, gold parity, 1BTC = 1oz gold
Financial Asset	25.1	\$114bln	2 nd halving, \$1bln daily transaction, CME futures
Silver	33.3	\$561bln	
Gold	58.3	\$10.1trn	

Source: Mellon and @100 Trillion. As of April 30, 2020.

According to the S2FX model, Bitcoin is currently in cluster 4 (red dot cluster in chart below). The implication from this model is that as Bitcoin gains more mainstream momentum and is viewed more like gold, the scarcity value (as measured by S2F) and subsequent halving will ultimately drive prices to the gold dot cluster and implied total market value. However, while each cluster/phase evolution drives pricing progressively higher, the price range within a cluster is quite wide. For example, the May 2020 halving implied Bitcoin pricing in the \$50,000 range versus the current \$10,000 range.

Bitcoin S2F Cross Asset Model



Source: <https://medium.com/@100trillionUSD/bitcoin-stock-to-flow-cross-asset-model-50d260feed12>. As of March 31, 2019.

Finally, the network value to transaction model is focused on the utility of crypto assets as a digital transaction currency, and the volume of transactions factors highly into this model. One concern with this framework is that recent data suggests the majority of investors buy Bitcoin as a store of value and holding duration is increasing. This is similar to gold, where the commodity is bought/sold as a store of value and very little is used as medium of exchange. However there are many signs that both consumers and merchants have a willingness to transact in Bitcoin and generational changes are likely to provide a tailwind to these efforts.

More Art than Science

Valuation is more art than science. Case in point, the largest financial market is the global currency market. Currencies have been utilized in one form or another for centuries. Yet to this day, there are still several competing models for currency valuation, each with its own strengths and flaws. Ultimately, Bitcoin valuation will likely be a combination of several models and be constantly evolving, especially as it gains mainstream acceptance.



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Erik is a senior research analyst covering the software and IT services industries. He also serves as portfolio manager of the Blockchain Innovation, Mobility Innovation and the Core Research Technology Sector Equity strategies.

Prior to joining the firm, Erik was a Technology analyst at Exis Capital. Previously, he was a senior analyst at Pilgrim Baxter and Associates, covering the software, IT services and Internet industries; and research analyst at Credit Suisse First Boston, covering the enterprise software industry. He has been in the investment industry since 2000.

Erik earned a BS in finance from Lehigh University.



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Justin is a senior research analyst on the Global Research team. He is responsible for covering the global cyclical technology sector. Justin is also a portfolio manager on the Core Research Technology Sector Equity and Internet of Things strategies.

Prior to joining the firm in 2007, Justin worked as an equity analyst for Sentinel Asset Management where he covered the technology, media and telecommunications sectors. Previously, he served as a senior equity analyst at AmSouth Asset Management on the AmSouth Capital Growth and AmSouth Large Cap funds, and as an associate investment analyst at American Century Investment Management on the American Century Technology fund. Justin has been in the investment industry since 1998.

Justin earned a BS in economics from the University of Kansas. He holds the CFA® designation and is a member of the CFA Institute and the CFA Society of Boston.



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He began his investment management career in 1998. Prior to joining the firm, Albert spent several years as a senior energy analyst for SAC Capital and as an energy portfolio manager at Citadel LLC where he was responsible for managing a long/short equity portfolio focused on Energy and Materials.

He earned his BA in political science and Asian studies from the University of Michigan at Ann Arbor and his MBA from Cornell University. Albert also holds the CFA® designation.



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Prior to joining the firm in 2007, Jonathan was a member of the investment team at Commonfund Capital, where he identified and evaluated private equity and venture capital opportunities on behalf of endowments and foundations. He began his career as an analyst with UBS' Health Care investment banking group. Jonathan has been in the investment industry since 2003.

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Endnotes

- ¹. Yahoo Finance. <https://finance.yahoo.com/quote/BTC-USD/>
- ². Blockchain.com. <https://www.blockchain.com/charts/market-cap>

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