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THE END OF CASH:
Investing in digital privacy and scarcity as a hedge against negative interest rates and Modern Monetary Theory

TECHEMY GROUP PROPRIETARY RESEARCH 2019

Executive summary

Around the world, central banks are in the process of taking the reins of money creation back from retail banks, which for decades have amplified the economic cycle with a credit cycle, to be the sole issuer of legal tender.

Cash is being siphoned from economies under several guises - anti-money laundering, black market activity, etc - to be replaced by a Central Bank Digital Currency (CBDC) kept on a centralized digital ledger. This will undermine retail banks' core business model of credit creation, and, with decentralized finance platforms fast-evolving along with the digitization of all asset classes, investors will soon be creating multi-collateralized loans, further undermining the banks.

With interest rates in developed economies around the world just above zero and no inflation in sight, digital central bank currencies will be used as an extra monetary tool during the next recession along with more 'radical' monetary policies such as Modern Monetary Theory (MMT) as an alternative to quantitative easing (QE) to stimulate inflation - growing the money supply even faster than QE. We believe demand for digitally scarce assets - in particular Bitcoin and Litecoin - will increase dramatically as the US and others move to extraordinary monetary policies to stoke inflation. We foresee a desire for commodity money, traditionally gold and silver, and also new commodity-backed money.

The decade-long absence of significant inflation combined with aging Western demographics has observers posit the West is now in a period of secular disinflation similar to Japan in the 90s/00s. To avoid 'Japanification', central banks, the IMF and the WEF have suggested moving interest rates into deeply negative territory (-2 to -4%) during the next recession, where money held on deposit will depreciate to entice spending. Using this negative-yielding CBDC alongside consumer data from Big Tech, such as Facebook's digital currency, governments will be able to artificially stimulate demand through targeted taxation and capital controls in a trend dubbed 'surveillance capitalism'.

In such a system we foresee a future with four types of digital money with various degrees of availability :

- *Official Central Bank Digital Currency (sole legal tender)*
- *Corporate currency e.g. Facebook coin, JP Morgan and similar stablecoins (unofficial but legitimate)*
- *Digital commodity money e.g. Bitcoin, Litecoin and commodity-backed (unofficial but mostly legitimate)*
- *Digital cash e.g. Zcash and Monero (unofficial and potentially outlawed)*

By virtue of 'Gresham's Law,' we believe these inflationary and invasive forces will stimulate long-term demand for digital commodity money and digital cash (privacy-focused coins such as Monero and Zcash) as a store of value while a CBDC will be preferred as the primary medium of exchange. Bitcoin and Litecoin will take a large share from gold and silver as they share statistically comparable scarcity traits but are more fungible and appeal to a millennial generation.

For those hedging volatility in international trade and politics, digital currencies backed by hard assets or a basket of commodities similar to the IMF's Special Drawing Rights will become a preferred supranational unit of trade settlement amid escalating trade and currency wars. We expect challengers of USD global reserve status, such as China, to issue similar multi-asset hard and digitally-backed currencies in the near future.

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Introduction: The end of cash

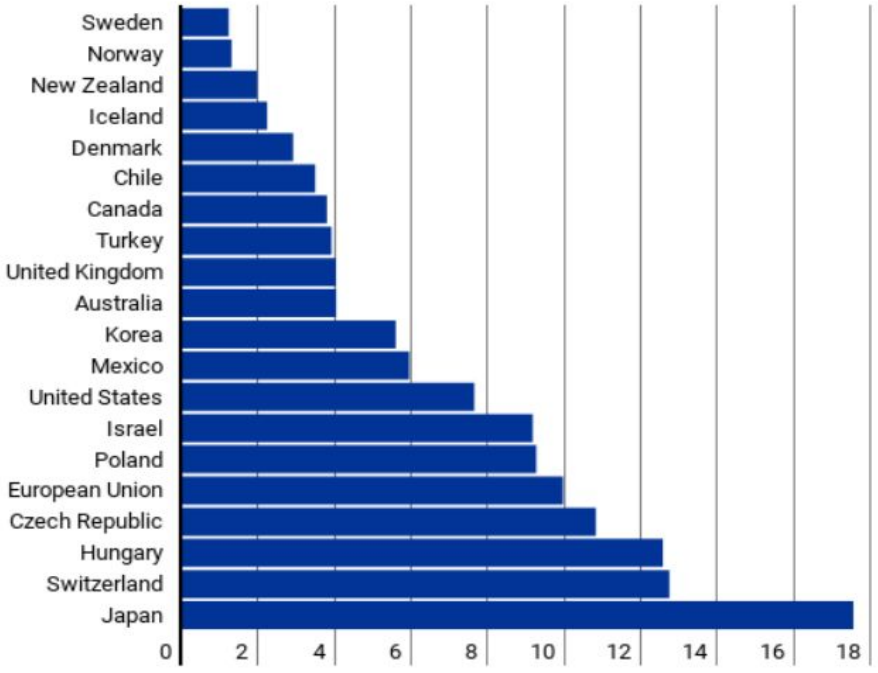
In the move to a cashless society, a power struggle is playing out between who controls and issues money in an era when corporations and individuals can create currency as easily as governments. At the same time, both central and retail banks now see cryptocurrencies as a threat to their business and economic models.

The fear among central banks is encapsulated by Stefan Ingves, the governor of the Swedish Riksbank, the world's oldest central bank. Ingves recently declared that he fears losing control of the Krona to private banks, companies, and cryptocurrencies, admitting they are "problematic".

Pushing back against the tide, the Swedish Riksbank and the IMF are trialing their own cryptocurrencies to explore the use of Central Bank Digital Currency (CBDC). Corporations are also front-footing crypto, JP Morgan has issued an internal USD stablecoin and Facebook is soon launching a stablecoin for remittances and e-commerce. These government and corporate currencies are centralized and monitored on permissioned blockchains - the antithesis of decentralized permissionless cryptocurrencies - and 'corporate cryptos' will be obligated to share transaction data with government agencies to operate in an official capacity.

As for cash, its days are numbered: India is now cashless since its government cracked down on the black market and migrated its population to the Aadhar digital identity system. Sweden is also mostly cashless.

Use of cash across countries is in decline



Sweden's central bank, the Riksbank, has removed almost all cash from circulation and is within a decade of being cashless. Source: IMF

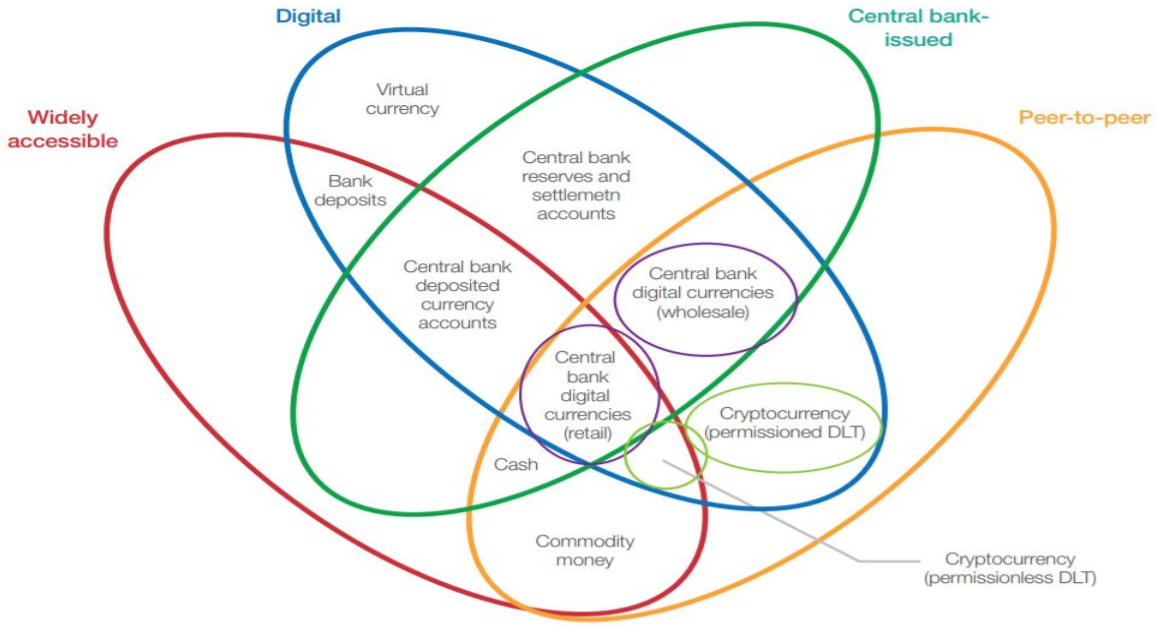
Japan is the main outlier and the most cash dense economy in the world. This is a legacy of almost 20 years of negative interest rates and deflation during which people hoarded cash as a store of value. This secular deflation (or 'Japanification') scenario is exactly what Western governments are trying to avoid by removing cash from their economies, giving them more control to stimulate inflation through extraordinary measures.

Sweden's e-Krona is the closest a country has come to issuing a CBDC. Although still being trialed, it would bear no interest and individual accounts balances would be held on the central bank ledger rather than a retail bank ledger. Deposit rates in Sweden are currently at -1% and if the government were to launch an e-Krona, it could ensure that the depreciating rate is being implemented on all money.

Cryptocurrency: The new digital cash and commodity money

According to the Bank of International Settlements, cryptocurrencies are a new petal on the 'money flower'. Permissionless cryptocurrencies such as Bitcoin and Litecoin are a hybrid of old commodity money in a digital, more fungible form, while their intrinsic value is still derived from scarcity and immutability.

Figure 1: The money flower: a taxonomy of money



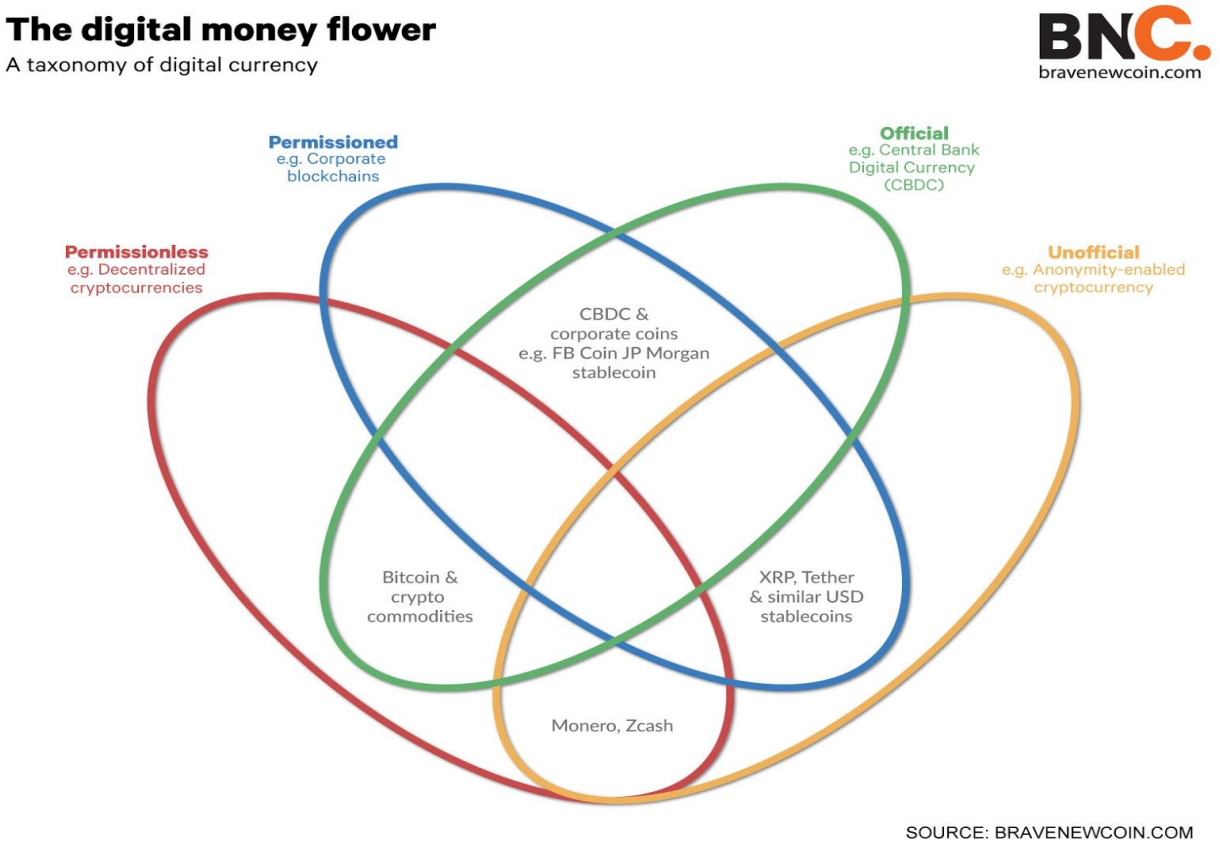
Sources: Adapted from M Bech and R Garratt, "Central bank cryptocurrencies", BIS Quarterly Review, September 2017, pp 55-70; As seen in "Cryptocurrencies: looking beyond the hype", BIS Annual Economic Report 2018 , p 94.

The money flower distinguishes four key properties of currencies: the issuer, the form, the degree of accessibility and the payment transfer mechanism.

According to the BIS, the traits of permissionless cryptocurrencies are a unique blend: a modern medium of exchange; they are created/issued by anyone; and, most uniquely, they allow for peer-to-peer exchange. However, with the proliferation of digital currencies in new forms, corporations (Facebook),

commercial banks (JP Morgan), central banks (the Riksbank) and individuals (permissionless cryptocurrencies) we see the need to discern between the traits of new digital money.

We propose a 'digital money flower' to reflect the traits of new money: the degree to which *money issuance is centralized or decentralized*, and the degree to which *they are accepted in the official monetary system* or *designed to be used privately outside a government system*.



Important traits of new digital money include the degree to which issuance is centralized or decentralized and whether its transactions can be monitored by governments and banks or built for privacy.

As digital cash, privacy cryptocurrencies such as Monero and Zcash have an important and interesting role to play in the future of money, although they face an uncertain future as governments roll out their own digital currencies and tighten capital controls in a world of intensifying trade and currency wars.

For merchants, cash transactions have a higher acceptance cost than digital payments (handling, storage, accounting and security costs) so merchants will opt for the cheapest form of digital payment. The average transaction fee (sending not receiving) for Monero and Zcash is currently between USD 0-2c.

The rise of 'surveillance capitalism'

Several countries are in the latter stages of rolling out new digital payment platforms - the UK, Europe and Australia among them - which opens up retail bank APIs for faster payments between countries and enables fintech startups to innovate with the API data. It also opens up swathes of retail bank data to the government for AML, tax avoidance, and anti-terrorist activity. These new payment platforms could be a major hurdle to the adoption of cryptocurrency as a point-of-sale currency.

The Australian Black Economy Taskforce, which was established to investigate the elimination of cash, has suggested:

> *"Some non-cash payment methods, including the many cryptocurrencies which are being traded, are just as anonymous as cash. While cryptocurrencies play a niche role today, this needs to be monitored."*
> - *Australian Black Economy Taskforce*

Through new payment platforms, governments are more easily able to monitor electronic money transfers and limit cash transactions. Currently, in Italy, banks must report any electronic money transfer over 1,000 euro to authorities and ATM cash withdrawals are capped at E250. The rest of Europe is also clamping down with caps on cash payments; Spain is capped at E2,000, while France is capped at E1,000 to fight 'low-cost terrorism'. For the same reason, as of 2019, the ECB has stopped circulating the E500 note.

'Surveillance capitalism' is a term coined by Harvard Professor Shoshana Zuboff to describe the next phase of capitalism, where user/consumer data is collected by tech companies in excess of the need to improve their services. This data surplus can be used for targeted advertising and product design to influence consumer spending and shared with governments to target taxation at an individual level.

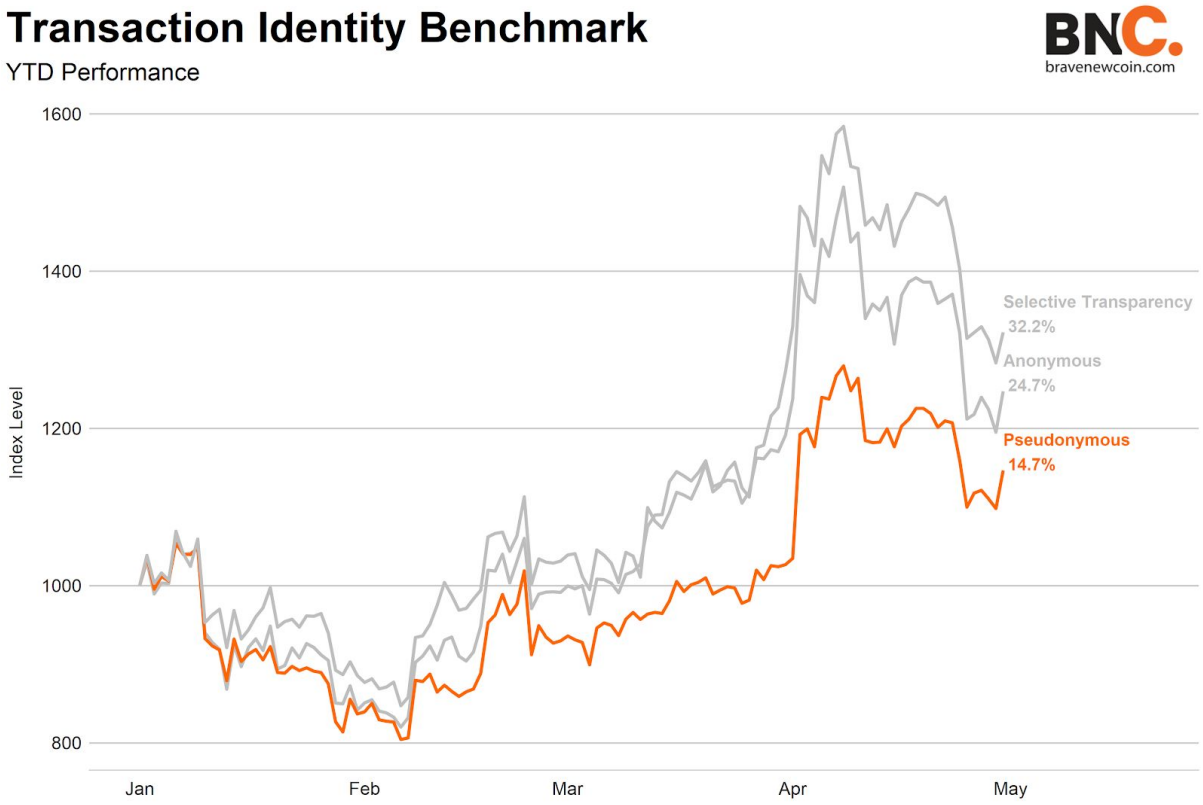
Zuboff contends that surveillance capitalism is not the same old capitalism only with extensive surveillance but a new "economic order," a new "market form".

Assets to benefit from the removal of cash and surveillance capitalism: Anonymous and Selective Transaction assets

With the rise of capital surveillance between governments and corporations and the elimination of private fiat - cash - we foresee certain privacy-focused cryptocurrencies becoming the new 'digital cash'.

While most cryptocurrencies add pseudo-anonymity to transactions, due to the visible nature of blockchain transactions they can be reverse-engineered to identify specific addresses and users. In late 2018, the US Department of the Treasury's Office of Foreign Assets Control (OFAC) blacklisted two specific Bitcoin addresses for the first time, both of which had been used for ransomware. With privacy-focused cryptocurrencies such as Monero (XMR), this is not possible as they obfuscate transactions automatically.

The BNC taxonomy of cryptographic assets categorizes transactions into 3 identities: Anonymous (always anonymous), Selective Transparency (optional anonymity) and Pseudonymous (never anonymous).



The BNC indexed performance of assets by transaction identity, shows the Selective Transparency group, which includes Zcash and Dash, performed the best year-to-date.

As opposed to coins focused solely on privacy like Monero (XMR), coins such as Dash (DASH) and Zcash (ZEC) offer transactions with Selective Transparency using a type of zero-knowledge proof called zk-Snarks. This gives the user the option to shield their transactions or leave them traceable.

Top 5 Anonymous Transaction assets by market cap

Index	Price (USD)	Market cap (USD)	Free Float Supply	Total 24hr Vol (USD)	24h price change	7d price change	30d price change
XMR Monero	88.8324	1,509,683,204	16,994,730	68,855,238	1.32%	8.03%	29.03%
XVG Verge	0.01130597	181,203,041	16,027,199,890	5,942,090	3.17%	36.59%	33.08%
BCN Bytecoin	0.00095615	175,995,498	184,066,828,814	416,003	0.89%	3.16%	7.17%
KMD Komodo	1.1868	134,755,136	113,545,301	2,313,501	6.56%	2.8%	9.73%
ZEN Horizen	12.8204	83,057,992	6,478,575	3,617,394	3.96%	0.01%	84.19%

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Top 5 Selective Transaction assets by market cap

Index	Price (USD)	Market cap (USD)	Free Float Supply	Total 24hr Vol (USD)	24h price change	7d price change	30d price change
DASH Dash	166.6549	1,469,729,952	8,819,004	296,716,467	2.1%	20.67%	36.86%
ZEC Zcash	75.1405	494,651,593	6,583,019	211,487,840	1.86%	13.74%	9.49%
PART Particl	4.6762	33,438,314	7,150,699	44,519	0.33%	1.01%	43.33%
GBYTE Byteball	39.5767	26,872,906	679,008	18,724	0.47%	18.07%	19.33%
ZCL Zclassic	1.9431	12,854,281	6,615,250	173,043	7.37%	26.8%	18.11%

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Top 5 Pseudonymous Transaction assets by market cap

Index	Price (USD)	Market cap (USD)	Free Float Supply	Total 24hr Vol (USD)	24h price change	7d price change	30d price change
BTC Bitcoin	7,958.9336	140,986,507,685	17,714,246	6,202,228,275	0.86%	0.95%	50.21%
ETH Ethereum	255.0322	27,075,524,044	106,165,099	4,595,962,263	0.78%	22.15%	50.16%
XRP Ripple	0.39741798	16,737,924,965	42,116,677,673	1,169,686,021	0.57%	0.41%	23.1%
BCH Bitcoin-Cash	418.7288	7,451,211,300	17,794,840	2,040,375,974	1.31%	9.95%	44.99%
EOS EOS	6.2934	5,740,852,103	912,198,830	1,410,243,692	0.21%	7.63%	20.74%

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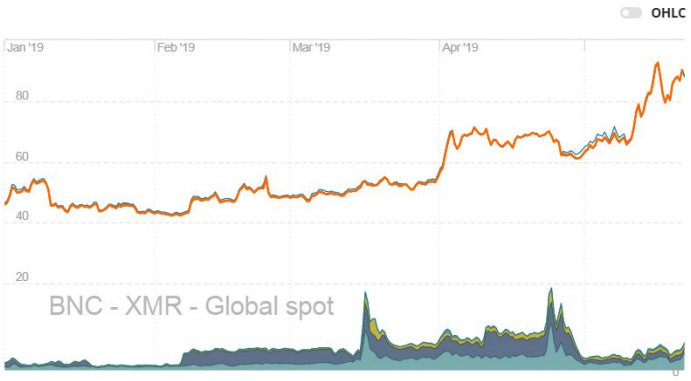
Year-to-date performance: Anonymous Assets

Monero (XMR)

Launched in 2014, Monero (XMR) was a pioneer in privacy coins due to its untraceable, unlinkable, private, and analysis resistant transactions. XMR privacy features leverage Multilayered Linkable Spontaneous Anonymous Group signatures (MLSAG), ring confidential transactions (RCT), and stealth addresses.



Constituent Prices

Name	Last Price	Price USD	24H Vol XMR	Vol %
BTC	0.01114414	88.77025346	508104.40954203	65.4385%
USDT	88.25619565	88.72471867	130077.52534941	16.7526%
ETH	0.34766899	88.96654801	90180.15001941	11.6143%
USD	88.56884436	88.56884436	28498.10231053	3.6703%
EUR	79.55154458	88.80701130	11354.91577550	1.4624%
BNB	2.77400000	88.29031950	4805.99800000	0.619%
KRW	105500.00000000	88.45331000	1654.50870346	0.2131%
USDC	89.00000000	89.04563564	1339.55278588	0.1725%
WAVES	36.51863786	90.20416808	286.45760934	0.0369%
TUSD	89.50630000	89.43718950	75.53010000	0.0097%
PLN	351.00000000	90.99275570	23.63550175	0.003%
EOS	14.08960000	88.50849113	15.99000000	0.0021%
EURS	80.66790000	90.77963014	13.28600000	0.0017%

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XMR has risen 86% year-to-date, compared to an overall 25% performance for the BNC Anonymous benchmark index. However, there has been a bearish divergence between a sharply rising price and falling global volumes since late April. The XMR/BTC pair is the most widely traded in the market.

Komodo (KMD)

Komodo (KMD), built by the team behind Bitcoindark, is often described as a 3rd generation blockchain because it has been built with core design elements utilized from the Bitcoin and Zcash blockchains (which itself is based on Bitcoin's core code). It uses a modified version of Bitcoin's original Proof-of-work consensus algorithm, and Zcash's zk-snark protocol for added encryption complexity.

Constituent Prices

Name	Last Price	Price USD	24H Vol KMD	Vol %
BTC	0.00015107	1.19323242	2042941.66265747	85.9469%
ETH	0.00465545	1.18580428	142881.76857808	6.0111%
KRW	1425.00000000	1.19244000	119319.96262274	5.0198%
USDT	1.16008900	1.16409739	69999.30000000	2.9449%
USD	1.13602000	1.13602000	1834.94057299	0.0772%
INR	81.01000000	1.16261177	4.60000000	0.0002%

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KMD has risen 44% year-to-date, compared to an overall 25% performance for the BNC Anonymous benchmark index. However, it's volumes have dropped off from earlier in the year and there isn't great depth of market.

Year-to-date performance: Selective Transparency Assets

Zcash (ZEC)

Zcash, launched in 2016, is renowned for its innovation of Zero-knowledge proofs called zk-Snarks, which allow transactions to be sent between parties without any information being revealed. zk-Snarks have been widely lauded as an innovation in cryptography and there are high hopes for the project led by Zooko Wilcox.

Constituent Prices

Name	Last Price	Price USD	24H Vol ZEC	Vol %
USDT	74.73753314	75.17078811	1797397.11669821	64.5241%
BTC	0.00946018	75.50482911	747355.49599964	26.8291%
ETH	0.29351909	75.30541747	118510.16373754	4.2544%
TRY	454.39653718	74.90441104	47914.58466115	1.7201%
USD	75.11679391	75.11679391	45921.34433033	1.6485%
USDC	75.29744207	75.36455091	7335.82833446	0.2633%
EUR	67.53922781	75.40418603	6423.87978466	0.2306%
KRW	89739.94118434	75.23976149	6394.11567620	0.2295%
BNB	2.32600000	74.66056981	2836.59500000	0.1018%
TUSD	75.22000000	75.23628663	1566.56086000	0.0562%
XRP	188.39220000	75.11484500	1222.79900000	0.0439%
OKB	52.50000000	75.19154842	1064.64134800	0.0382%
PAX	75.21000000	75.27091408	647.64656000	0.0232%

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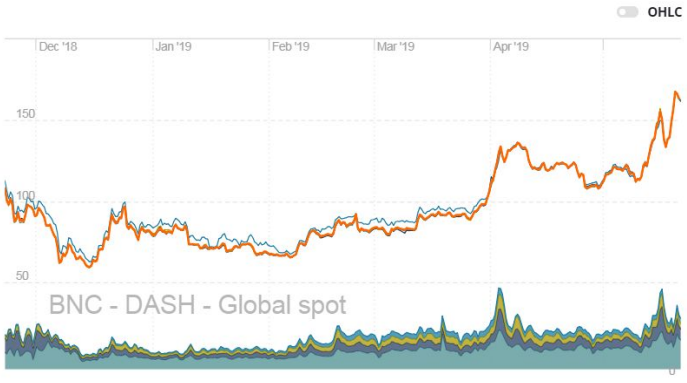
ZEC has risen 31% year-to-date with rising global volume in USDT while other market volumes have remained relatively flat. The 31% YTD performance is just shy of BNC Selective Transparency benchmark index, +32%.

Dash (DASH)

Dash has selective private transactions meaning the privacy setting can be turned on and off, although it appears to be rarely used for private transactions. DASH has ambitions to become adopted by merchants and consumers as a point-of-sale currency (its name is short for 'digital cash'). It has been heavily promoted in Venezuela over the past year as an alternative to the hyperinflated Bolivar.



Constituent Prices

Name	Last Price	Price USD	24H Vol DASH	Vol %
BTC	0.02096991	167.36781150	961762.15723725	54.0456%
USDT	166.10733711	167.07026467	351460.12000244	19.7501%
ETH	0.65220631	167.33040410	231055.16413994	12.984%
USD	166.12759108	166.12759108	166218.99924364	9.3406%
TRY	1004.35414429	165.56146338	35640.17575939	2.0028%
EUR	148.28737344	165.55547132	20700.27708682	1.1632%
XRP	419.02696072	167.07244359	4247.55400000	0.2387%
KRW	199700.00000000	167.43247400	2016.28617050	0.1133%
OKB	116.90000000	167.42651449	1935.77310500	0.1088%
HT	61.51439400	167.53612464	1522.97088646	0.0856%
BNB	5.16800000	165.88384556	767.53800000	0.0431%
UAH	4258.47409922	162.63461779	733.91582076	0.0412%
RUB	10448.50714766	162.34702332	652.97804922	0.0367%

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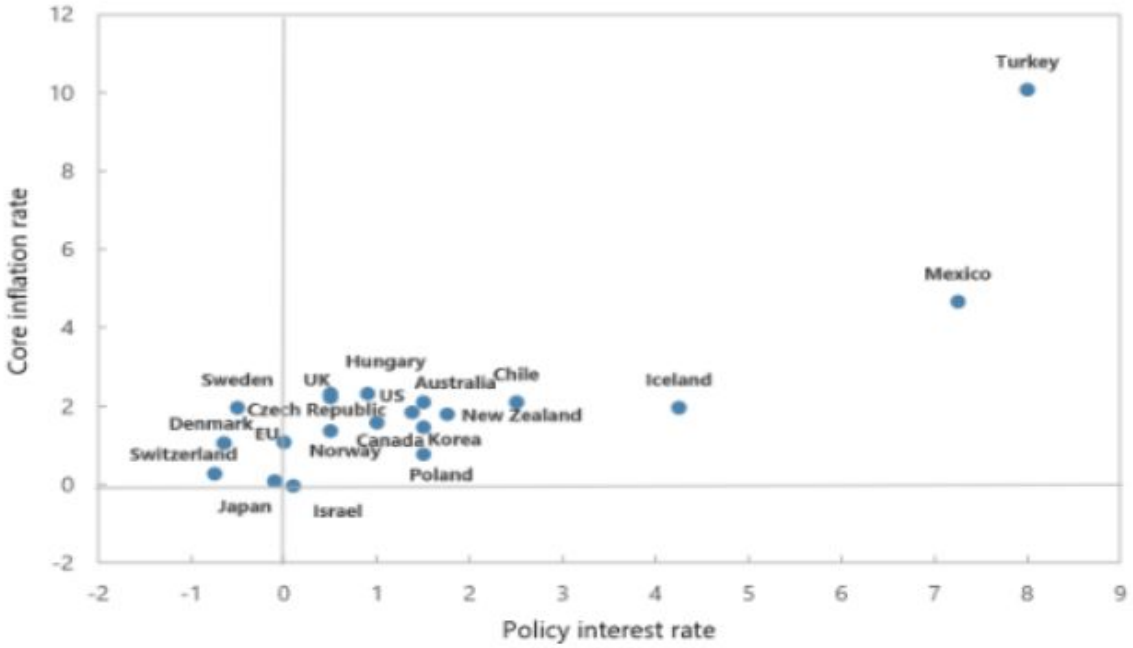
DASH has been on a bull-run since breaching price resistance around $100 at the end of March, rallying about 117% YTD, compared to 32% for the overall BNC Selective Transparency benchmark index. Coupled with rising global volumes across the most significant currency markets, DASH has strong short-term momentum.

A world of negative central bank interest rates

Acknowledging that central banks around the world have interest rates at historic lows and are restricted by the zero-lower bound in the next recession, the IMF, in a working paper titled Monetary Policy with Negative Interest Rates: Decoupling Cash from Electronic Money, advises central banks to remove cash from their economies to make interest rates work as low as -4%.

> *"In a cashless world, there would be no lower bound on interest rates"*
> - International Monetary Fund (IMF)



OECD countries have little room to maneuver interest rates after the next recession. Source: IMF

Learning from negative interest rate environments such as Japan where rates were negative for over a decade and had the opposite effect of stimulating spending, the IMF recommends introducing a dual-currency system of a central bank digital currency (CBDC) and cash, where cash on deposit has a decaying value relative to the CBDC.

> *"The behavioral response during the transition to a new system, when the public learns how it works, would be particularly unpredictable. Another behavioral question for the transition is whether the introduction of a dual local currency system would send a crisis signal that could erode trust in the central bank, and perhaps lead people to switch to other forms of currency for their payments, such as foreign currency, gold or even cryptocurrency."*
> - *IMF*

In a 2018 working paper, the Bank of Canada modeled the economic impact of a non-anonymous CBDC in an environment alongside cash and without cash. In the cash-CBDC model, there was no effect or increase in GDP, in the CBDC-only model it was found to permanently increase GDP in Canada by up to 0.64% and, in the US, up to 1.6%. The rationale is due to the expanded monetary toolkit it would give them to implement negative interest rates and charge citizens on deposits and discourage household savings with the end-goal to stimulate inflation.

The IMF's dual currency system an upwind for permissionless cryptocurrencies

A CBDC, although built on distributed ledger technology, would be antithetical in operation to a decentralized, permissionless cryptocurrency such as Bitcoin: permissioned, traceable, monitored and issued by one central entity.

To introduce a CBDC the IMF proposes not a blanket ban on cash, but instead siphoning it out gradually using a dual currency system where cash has a depreciating value (negative yield) to a CBDC. All goods would be priced at the CBDC rate to incentivize people to spend the lower-yielding cash and save the higher-yielding CBDC until cash is eventually flushed out of the system.

> *"The whole reason for introducing a dual local currency system is to be able to move interest rates into deeply negative territory in response to strong downturns when nominal interest rates are near zero."*
> - *IMF*

This decoupling of cash as a unit of account from a unit of exchange would also deter people from hoarding cash in a negative rate environment. In a dual currency system, the IMF proposes the central bank would be the "monopoly supplier of both cash and reserves".

The rise of alternative monetary policy

Official narrative turning against retail banks

For years, mainstream economics has ignored retail banks' role in credit creation in the economy, viewing them merely as intermediaries with 'loanable funds' facilitating lending between savers and borrowers. The loanable funds model propagated by influential economists such as Paul Krugman and Ben Bernanke omits the role banks play in creating credit which, in turn, drives aggregate demand and the business cycle.

> *"They [banks] must buy assets with funds they have on hand." - Paul Krugman*

However, since the GFC and the trillions of dollars of bank bailouts across the world, central banks and economists are starting to scrutinize retail banks' amplifying effect on economic booms and busts through credit. Official sentiment is starting to turn against them as central banks stem their ability to create credit.

In 2014, the Bank of England was one of the first central banks to dispute the 'conventional' role of retail banks:

> *"Rather than banks receiving deposits when households save and then lending them out, bank lending creates deposits." - Bank of England*

Since then, the Bundesbank has further debunked the 'loanable funds' model of banks and proposed retail banks should hold central bank money (or CBDC) against 100% of their deposits - in other words going back to full-reserve banking:

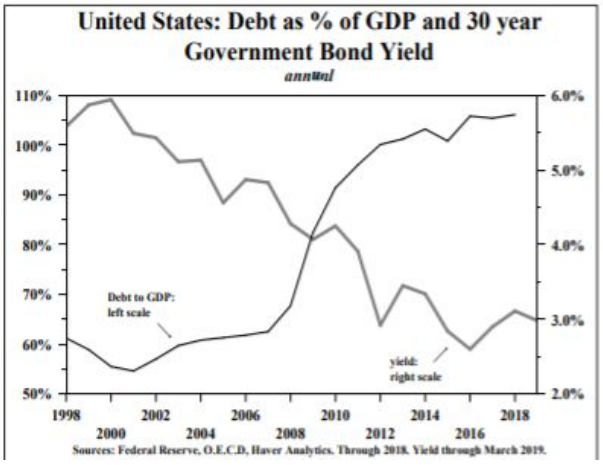
> *"This refutes a popular misconception that banks act simply as intermediaries at the time of lending - i.e. that banks can only grant credit using funds placed with them previously as deposits by other customers." - Bundesbank*

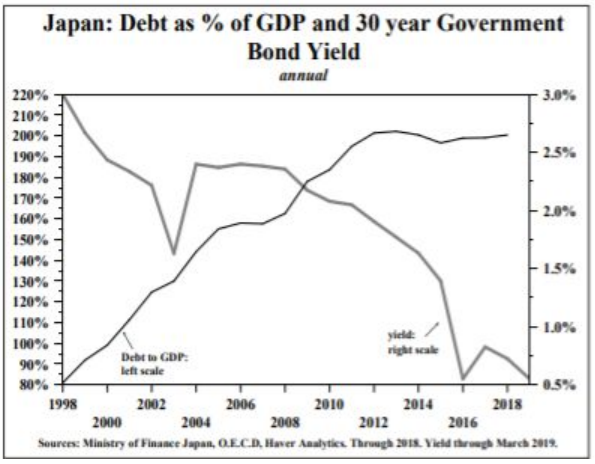
Acknowledging that they have lost the ability to affect economic growth through interest rate adjustments, central banks around the world are pulling in the reins of retail banks which we see declining in relevance as their business model is undermined in an era of negative interest rates and stricter reserve requirements.

The rise of Modern Monetary Theory

Modern Monetary Theory (MMT) is the most prominent alternative economic theory to challenge mainstream economics and a central topic in the 2020 US presidential campaign.

It attempts to address the failings in the 'neoclassical' model by taking into account the role of credit and the inefficacy of Quantitative Easing (QE) to stimulate inflation or even steepen the yield curve as desired. However, it does so by a controversial measure: unrestrained money printing.





Higher debt in economies has led to lower government interest rates and low inflation rather than higher rates and higher inflation, the intended effect. Lowering short-term rates has had a diminishing effect on GDP growth since 1998 and failed to steepen the curve, indicated by a plummeting 30-year rate.

A corollary of the inverse relationship government debt has on long-term interest rates (shown in the chart above) is that government debt growth also has a diminishing return on GDP growth, which hit its inflection point in the late 90s. "The production functions in the high-income economies indicate that greater use of debt will result in weaker real GDP growth, further restraining the standard of living, via the law of diminishing returns."

MMT has been popularized by progressive politicians such as Bernie Sanders, whose economic advisor Stephanie Kelton is an economics professor and leading proponent of MMT. The popular millennial democratic congresswoman Alexandria Oscasio-Cortez (AOC) is also an advocate of the policy. The progression of her and Sanders in the election should be watched as a barometer of change in US monetary policy.

AOC and her social democratic policies, which includes the Green New Deal, appeal in particular to the young generation of Millennial and Gen Z voters, who are broadly left-leaning in their pursuit of social equality and environmental protections. There is good reason to believe all these factors in confluence will provide Democrats an upwind in the next election.

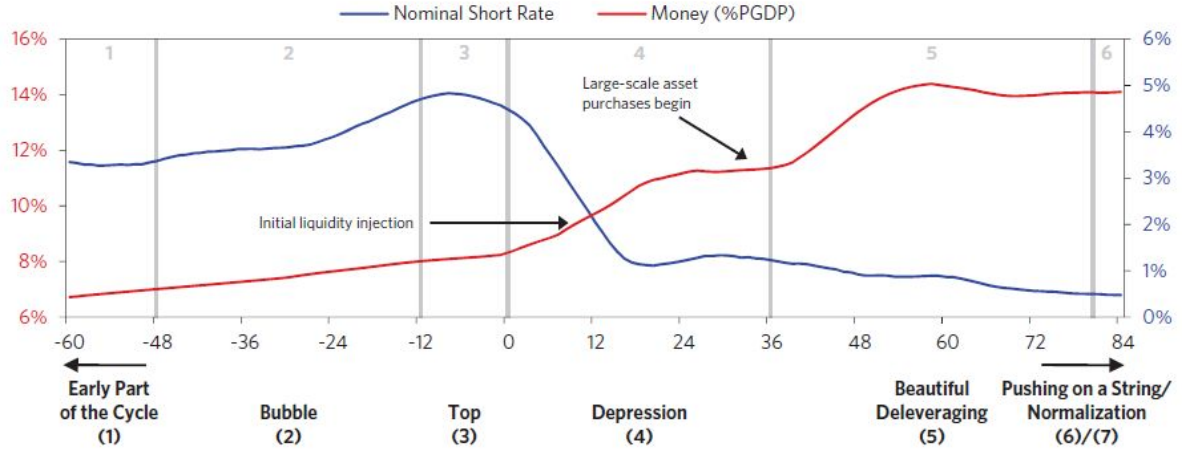
MMT: Creating artificial inflation and more debt?

The core tenets of MMT assert that a country with low external debt can print 'helicopter money' (implied here as the minting of a CBDC, rather than printing cash) to stimulate inflation and fiscal spending at any stage of a business cycle, by monetizing government debt. In effect, this would remove the debt ceiling and enable a government (such as the US with total debt near $22tr) to increase it exponentially.

In economies around the world, government debt has ballooned since the 1980s to a point wherein most developed countries it exceeds 100% of GDP - in Japan, it is closer to 200%. As the US has most of its debt denominated in USD and is the global reserve currency, a form of MMT could be implemented, although it would require a rewriting of the Federal Reserve's mandate.

MMT can be seen as an alternative form of economic stimulus to quantitative easing (QE) and low interest rates, arguably going further than both. A common misperception is that QE allowed the Fed to 'print' new money when in fact it bought Treasury assets without creating much new money. MMT, however, would enable central banks to rapidly expand the monetary base in lieu of commercial bank credit during recessions.

This form of money creation is done by monetizing government debt - making government liabilities legal tender - and is the same method used by the Weimar Republic and many South American countries to print money which has often led to hyperinflation. A hyperinflation scenario may sound far-fetched for a country as the US, but as inflation in a nonlinear event (it can be absent for years and arrive in a sudden flood), MMT critics are worried that it could have unpredictable outcomes for inflation.



The typical cycle of government debt monetization increasing the money supply and pushing down the nominal interest rate during a debt crisis. Source: Ray Dalio

Government debt monetization usually happens in response to a debt crisis but MMT would be used to avoid a deflationary debt crisis that Japan suffered in the 90s, and there are several similarities - demographic and economic - between the US now and Japan then.

Gresham's Law: How MMT could benefit crypto commodities

The most contentious proposition of MMT is that debt in an economy shouldn't restrain the government from printing money in the pursuit of inflation. Many prominent figures, including Fed Chairman Jay Powell, have warned of the unintended consequences of an MMT-style policy expanding government debt which as noted before, has a diminishing return on GDP growth.

> *"Typically the worst debt bubbles are not accompanied by high and rising inflation, but by asset price inflation financed by debt growth. That is because central banks make the mistake of accommodating debt growth because they are focused on inflation and/or growth—not on debt growth, the asset inflations they are producing, and whether or not debts will produce the incomes required to service them."*
> *- Ray Dalio, A Template for Understanding Big Debt Crises*

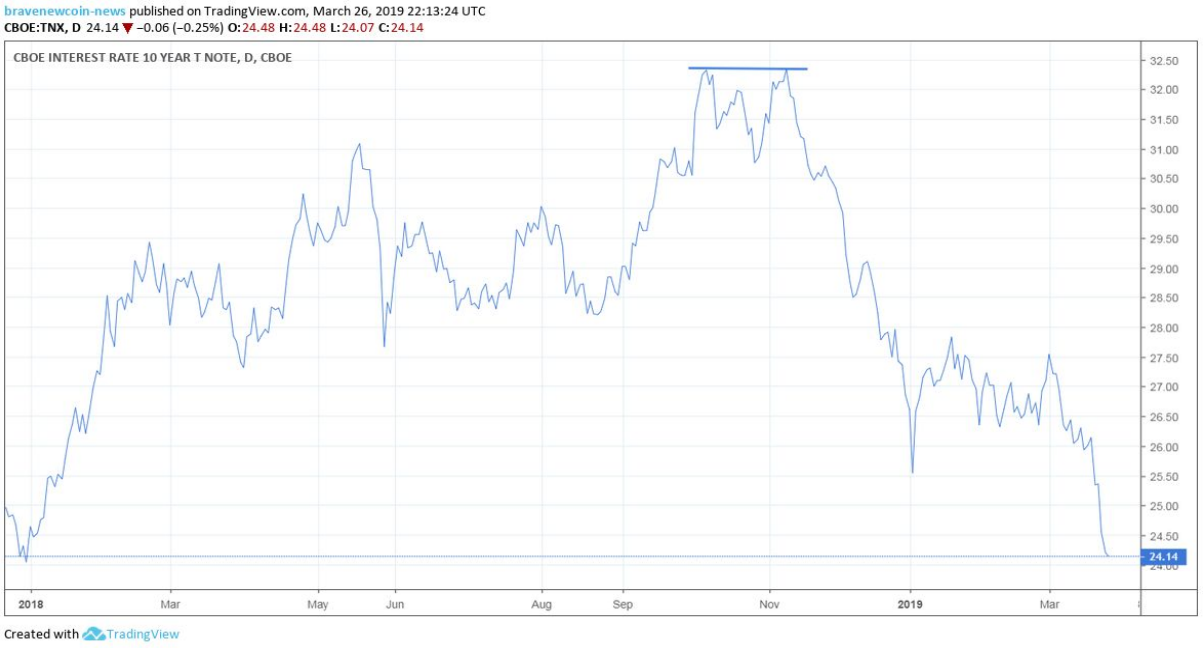
If the Fed was allowed to expand the monetary base with new money it would accelerate the money supply and drive money into yielding assets rather than bank deposits. Typically in high inflation periods, people flee to hard assets such as gold and commodities (with some lift in stocks) and people spend the national currency as quickly as possible before it declines further in value.

In each step of Gresham's Law, the old medium of exchange is supplanted by a lesser quality currency and it, in turn, becomes the store of value.

The supply of earlier commodity money was restricted by its natural scarcity until central banks moved to issuing currencies backed by fractional reserves of gold and silver, enabling them to adjust money in circulation according to supply and demand.

However, today there are far more alternative commodity-like currencies available which could provide an alternative market for trade and commerce in an environment of runaway inflation.

As the main levers of government stimulus (QE, interest rate tinkering, debt/credit growth) have all failed in recent decades to stimulate inflation and central banks are moving to replace retail banks as the sole issuer of legal tender, MMT in some form is a distinct possibility after the next recession. Indirectly, President Trump is advocating a form of MMT by calling for more quantitative easing and lower rates after nine years into the business cycle.



The 10-yr Treasury TNX ETF began climbing again at the start of 2018 as the Fed started selling bonds as part of quantitative tightening, pushing their prices down and yields up.

The Treasury 10-year bond - the term most affected by Fed rates - is back down to around 2.4%, where it was as the Fed began its quantitative tightening cycle in 2018, despite selling billions of assets. We are well on track for negative territory.

Either way, whether we have more QE or a form of MMT, the foreseeable future looks like more of the same: rolling the public debt snowball further along to avoid the system falling apart. Whereas as the last blow-up in the 2007/8 GFC was in private debt, this time it has transferred to public debt which is arguably even worse as it cannot be turned to equity and diversified.

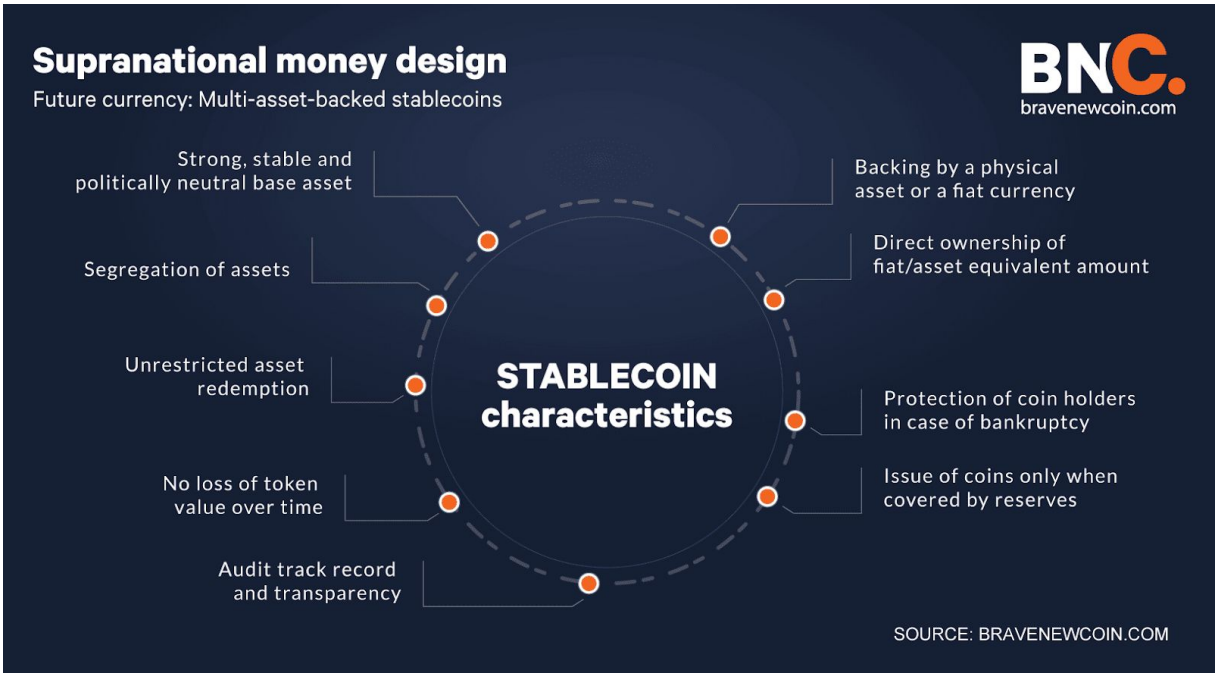
Negative interest rates and MMT could be an upwind for new forms of commodity money

Another, third, way of extending credit in is to use commodity-backing or reserves to control the supply of money/credit to enforce a natural limit.

This goes back to the tenets of commodity money and central banking - using a multiple collateral basket of commodities to back the currency in issuance and limit credit and money supply. It has been proposed by many leading economic thinkers in different forms over the years, including Benjamin Graham, Bernard Lietaer, Friedrich Hayek, John Maynard Keynes, and even former Fed Chairman Alan Greenspan.

The concept of commodity money is to hold commodity buffer stocks to smooth the supply of money, not commodities. When commodities are cheap, the government could issue commodity-backed notes to buy them. The point is not to manipulate the supply or price of commodities but to get money and credit to producers in an economy. However, the dynamic of economic cycles has changed in the past 50 years, now driven more by asset-based cycles than commodity-cycles - by speculation rather than supply and demand.

BNC views this multi-collateralized model as the future for good money design to create stablecoins, or stable currencies, that serve as reliable, redeemable and supranational units of exchange. Further, we see crypto-assets, in particular, scarce crypto-commodities such as Bitcoin and Litecoin, playing a significant role in the make-up of those baskets (for risk diversification) which will drive their prices as they are included in more global currency baskets and indices.



For years governments have been embattled in trade wars, devaluing their currencies to undercut each other and make them more competitive in international trade. Donald Trump has reiterated his intent to weaken the USD and called for more quantitative easing - or printing more money at the end of the business cycle which is akin to Modern Monetary Theory.

Investors should be aware that the trend towards MMT-style monetary policy coupled with negative interest rates could spur much higher levels of inflation - as intended. Following rate cuts, the value of a currency drops as traders sell it for higher-yielding currencies, thus re-enforcing consumer price inflation against a basket of goods.

We believe these two trends will contribute towards a desire for commodities and commodity money, which will supplant fiat currency as a store of value in a cycle known as Gresham's Law.

Venezuela's el Petro: The first national commodity-backed crypto

The latest and most controversial iteration of a commodity currency is Venezuela's oil-backed 'cryptocurrency', el Petro. In its last draft, 1 Petro was backed by and redeemable for 1 barrel of Venezuelan extracted oil 1km underground. It was doomed to fail due to lack of confidence in the Venezuelan government but the concept behind it is worth noting: a fusion of digital currency and rights to scarce resources to create stability and trust in the currency.

China, which is a prolific hoarder of many commodities and currencies, could be expected to issue a digital Yuan, which is little trust or demand internationally, and shore it up with this basket of assets. China has been the top bitcoin mining jurisdiction for years and we believe it possible the government would also include it in a basket.

This shouldn't surprise, as China has for many years called for the use of the IMF's Special Drawing Rights (a basket of currencies) as a unit for international trade settlement instead of the USD. It would make sense for China's expansive ambitions in Asia and Europe to fund infrastructure projects on its Belt and Road initiative with such a currency.

It is arguable that these forces will drive demand for 'commodity money' (hard-backed money such as during the gold standard) and in particular the more efficient digital commodities with built-in scarcity and value derived from immutability and network security such as Bitcoin and Litecoin, as well as hard-backed cryptocurrencies. Paxos, the NY-licensed company behind the Paxos USD-backed stablecoin, is also planning to issue a gold-backed cryptocurrency in 2019 which will bestow all the technology's efficiency on the physical asset.

To this point, Bitcoin has been classified as a virtual commodity by the CFTC since 2016 - and it and Litecoin are the two frontrunners to become digital gold and digital silver.

Commodity prices bouncing off decades' low

Commodity prices have been falling for the duration of this nine-year stock market bull run but seem to have recently found a bottom and have prices have begun making higher lows. However, stocks remain at their most overstretched valuation relative to commodities in history.

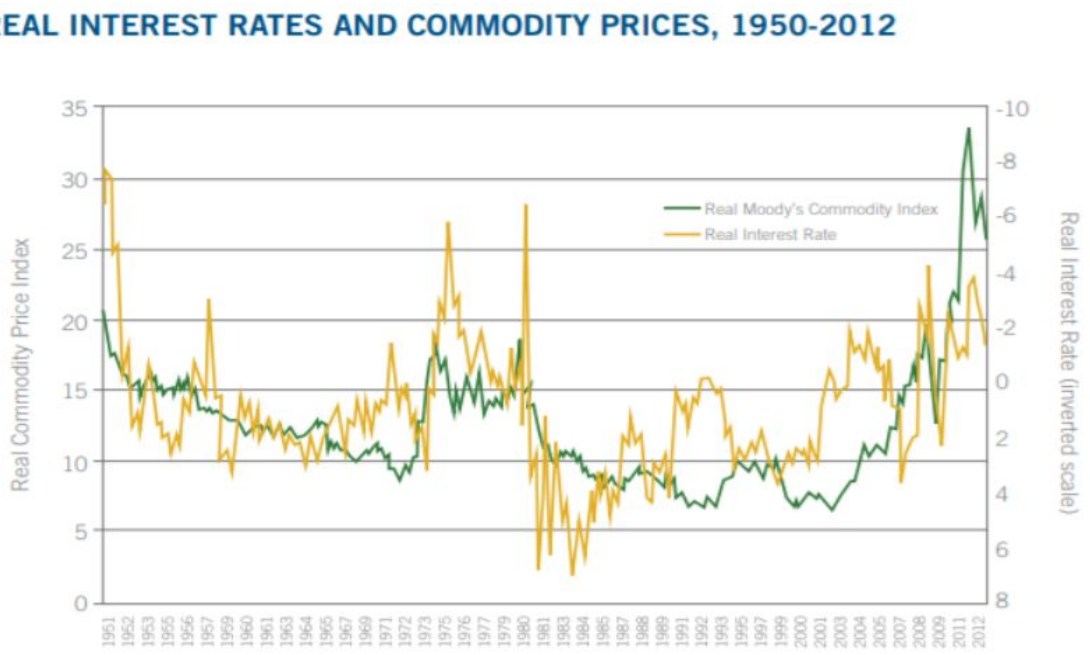
The spread between the S&P 500 (orange) and the PowerShares DB Commodity Index Tracking Fund (DBC) — the largest commodity ETF by assets under management — is at an all-time high divergence.

Historically, commodity prices have had an inverse relationship with real interest rates (nominal rate - inflation) and moving to a negative interest rate environment (and lower USD value) would be a big upwind for commodities and digital commodities. There is also a growing argument for holding the physical commodity such as gold or silver over ETFs, as there is no claim on the underlying asset of a paper derivative in case of a liquidity event.

This is an opportunity for commodity-backed cryptocurrencies which fill the gap between an ETF which doesn't entitle the holder to any claim on the underlying asset - and buying and storing the physical commodity. Although still a fledgling product, Digix Gold (DGX) in theory fills that gap: one token of DGX represents 1 gram of gold on Ethereum which is backed by gold from the London Bullion Market Association (LBMA) certified refiners (although its vaults are located in Singapore).

Historic relationship between commodity prices and interest rates

Although it is a complex relationship and correlations change over time, the interest rate of a healthy economy such as the US should move positively with its currency as the interest rate is a barometer of economic health and the currency becomes more desirable to hold bonds and deposits in when the rate is rising (absent runaway inflation).



Real interest rates and commodities have historically had an inverse relationship. Source: CoBank

All commodities are priced in USD and the 10-YR rate has an impact on the demand and price of commodities. Historically, commodity prices have been negatively correlated with real interest rates and the USD.

Both real and nominal interest rates have been low for almost a decade now as inflation has been so low but if interest rates go deep into negative territory and inflation surges due to MMT-style policies, then this would provide an ideal environment for commodities and digital commodities (this encompasses hard-backed coins and coins with commodity-like traits such as Bitcoin).

The traditional relationship between inflation and commodity prices has reversed since 2015 with higher US inflation leading to lower commodity prices - commodities are generally a hedge against inflation.

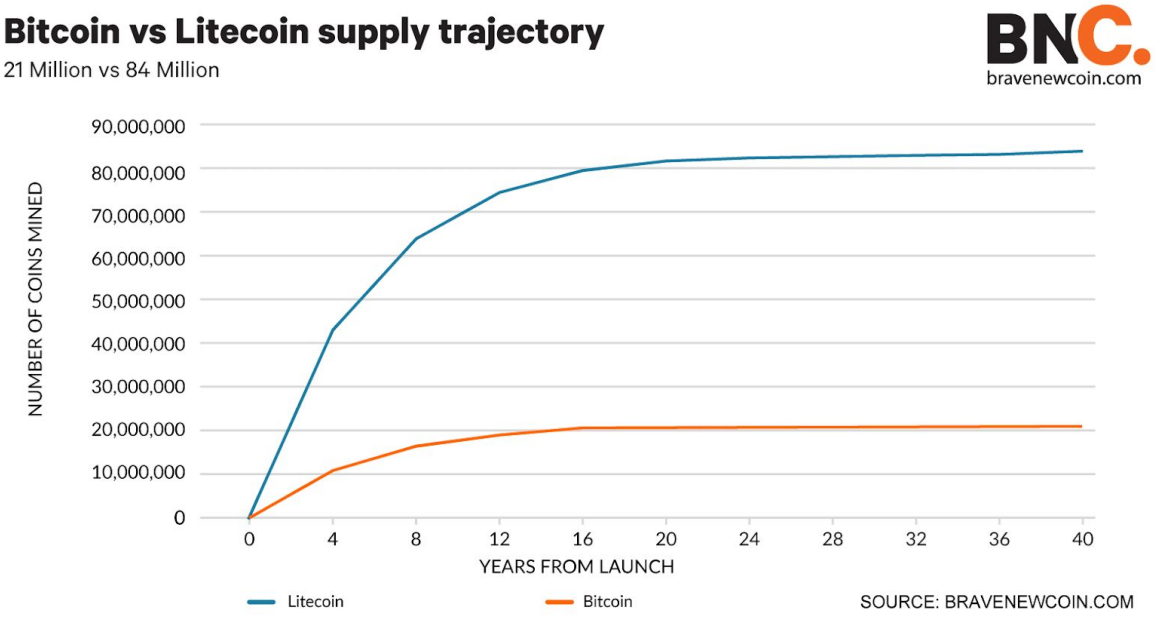
The traditional relationship between inflation and commodity prices has also reversed since 2015 as the rise of inflation has mainly been in financial asset prices. If the relationship returns to its historical positive trend it would suggest commodities will benefit from rising inflation in an era of MMT money printing.

Digital assets to benefit from Modern Monetary Theory and an inflationary environment

Digital Gold and Silver: Bitcoin and Litecoin

Born out of the 2007/8 financial crisis, Bitcoin is the 'digital gold standard' created to mimic the disinflationary supply curve of precious metals - and designed to operate as an autonomous currency and microeconomy. It is recognized as a commodity by the Commodity Futures Trading Commission (CFTC) and is often dubbed 'millennial gold' for its appeal to younger investors.

Litecoin was created from the Bitcoin source code and redesigned to improve upon Bitcoin in two ways: 1) Its block times were 2.5 minutes, four times faster than Bitcoin which is important for faster transactions and merchant adoption, and 2) It uses a different hash function to Bitcoin, called Scrypt, which prevents the high cost high-powered ASIC mining that dominates its predecessor - and thus allows for more distributed hobbyist mining on CPUs and GPUs rather than on dedicated mining farms.



The comparative supply schedule of Litecoin and Bitcoin - the annual rate of supply inflation in the two are actually the same starting from their year of launch, 2008 and 2011.

With faster block times also comes a high supply of Litecoin. The total amount released will be four times that of bitcoin with LTC's final supply converging at 84m units whereas BTC will finish at 21m. Litecoin was designed to be spent in smaller units as a point-of-sale currency as opposed to the more scarce BTC which has a better case as a store of value.

Bitcoin and Litecoin correlation

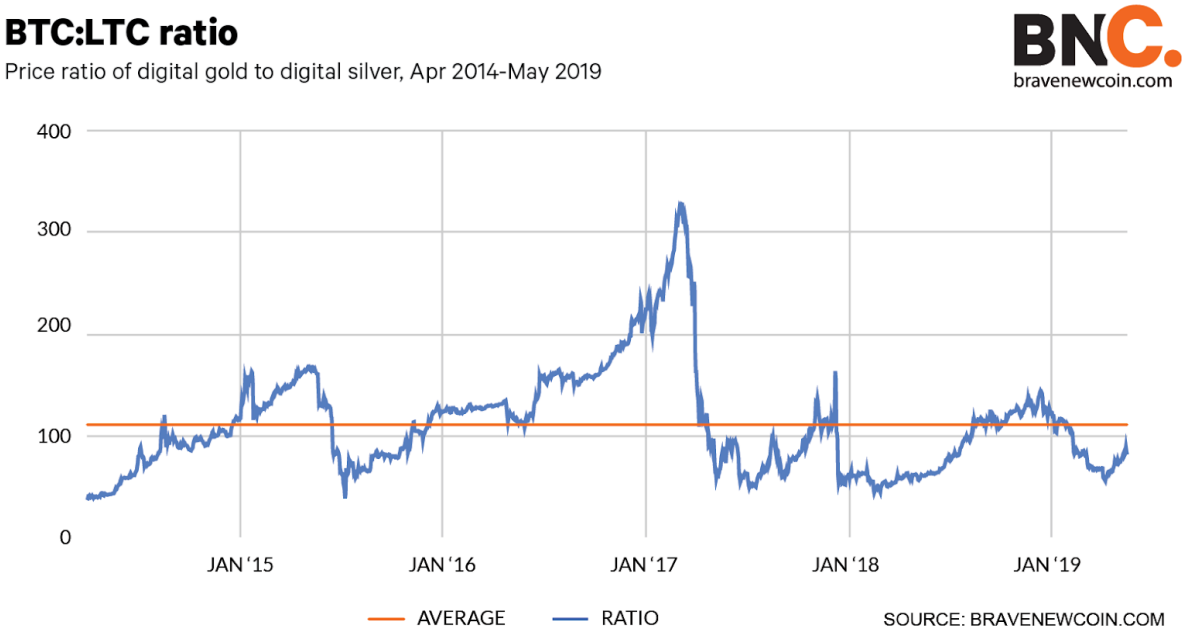
Despite their different value propositions both LTC and BTC are highly correlated in price.

Since Jan 2014, BTC and LTC prices have moved in close correlation, ranging between 0.70 and 0.85. However, BTC price tends to lead LTC. Source: CoinMetrics.

As Bitcoin and Litecoin share the same source code, are highly correlated and have the same inflation trajectory - albeit with four times as many LTC as BTC created every year - we could extrapolate, using the digital gold to silver analogy, that there is a relative 'fair spread' between two prices.

Bitcoin-Litecoin ratio

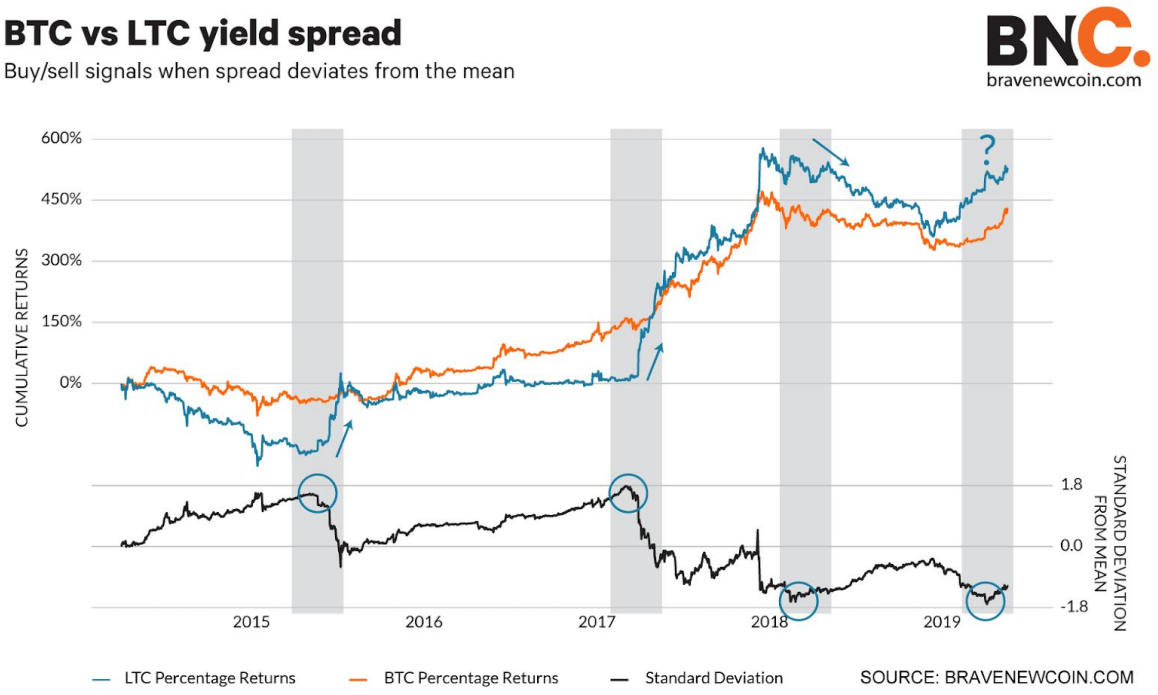
A common trading strategy in the metals market is the gold-silver ratio trade: When the price ratio between gold and silver deviates from its historical 'fair' level (e.g. 70), a trader will sell 1 ounce of gold to buy 100 ounces silver if it is at an extreme above the level, and sell 100 ounces silver for 2 ounces gold if it is below, to accumulate both assets. Historically this ratio has been set by central banks etc but it is now a floating ratio determined by markets. We propose a similar BTC:LTC ratio indicatively.



The average ratio between the price of Bitcoin and Litecoin since Jan '14 has been 110, with a high of 328 in March 2017 and a low of 36 in April 2014. We imply around the 110 level is a 'fair' spread and any extreme deviations from these levels are buying/selling opportunities. Timestamp: 05/21/2019 @ 10:41pm (UTC)

We can see, when lining up the previous correlation chart that the extreme low (~0.32), around March 2017, corresponded with an extreme high in the ratio (~330) before the ratio quickly reverted back to the average line as Litecoin's price rose quickly - closing the price spread. This was an extreme outlier for both correlation and ratio and was an opportunity to sell BTC for LTC.

We can also look at the yield spread between $BTC and $LTC prices in terms of standard deviation (STDV) from its mean. This can give us a more granular visualization of when the price ratio hits abnormal levels and presents buying/selling opportunities.



The yield spread (black line, bottom) in terms of standard deviation from the mean (0) between $BTC and $LTC returns (blue and red) since April 2014. Gray areas and circles show when STDV hit extreme highs or lows of 1.8 standard deviations from its mean, 0. Timestamp: 05/21/2019 @ 10:41pm (UTC)

On two occasions in June '15 and March '17, the STDV line hit an extreme high near 1.8 as BTC yield rose in relation to LTC. A fast rise in LTC price followed on both occasions as the yield spread sharply reverted back to the mean and closed the price gap with BTC.

In Feb/March 2018, the STDV line hit an extreme low near -1.8 as $LTC yield became overstretched from $BTC yield. This preceded a gradual fall of the LTC price during the bear market as the yield spread slowly closed toward the mean. The last STDV extreme occured in April 2019 when the year-to-date returns of LTC hit ~200% and BTC managed just ~40%. This yield gap has been closing since mid-April.

YTD the yield gap between BTC and LTC hit and extreme in early April, when LTC was +200% and BTC +40%.

With the spread still ~1.4 standard deviations from its mean, we infer that BTC is the preferable asset to stay as it has more upside potential than LTC until the spread closes to near 0. Note, this is only an indicative strategy to accumulate BTC and LTC.

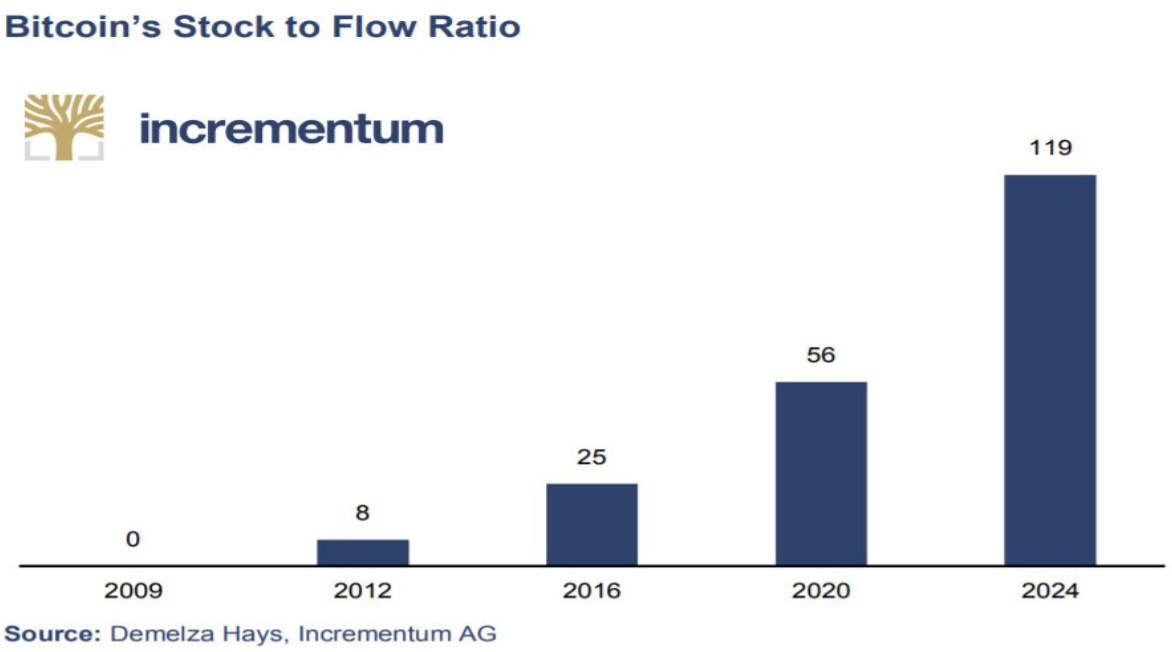
The importance of the stock-to-flow (SF) ratio of bitcoin

In the rush to push out bitcoin derivative products, ETFs, futures etc. the scarcity value of bitcoin has been sidelined from investors' minds. We believe the significance of bitcoin's scarcity in a world where MMT, QE and debt grow fiat without limit will come into sharp focus again in 2020 with the next halving of block rewards, from 12.5BTC per block currently, to 6.25BTC.

This will be a medium-term price driving force from the second half of 2019 onwards, as investors use BTC to hedge against USD volatility and an administration change if a progressive Democrat with MMT leanings wins the White House.

Through its proof-of-work consensus protocol bitcoin has a deflationary supply similar to gold or silver. Like gold, bitcoin is not a consumable commodity such as copper, zinc or brass as all BTC stock that has ever been mined remains in existence (apart from lost coins, keys etc) and similarly all gold ever mined remains above ground (reused in jewelry, computer components etc). This means bitcoin and gold have a high stock-to-flow (SF) ratio: a slow rate of supply and an increasing stockpile.

The stock-to-flow ratio = commodity mined/annual mining production, measured in years.



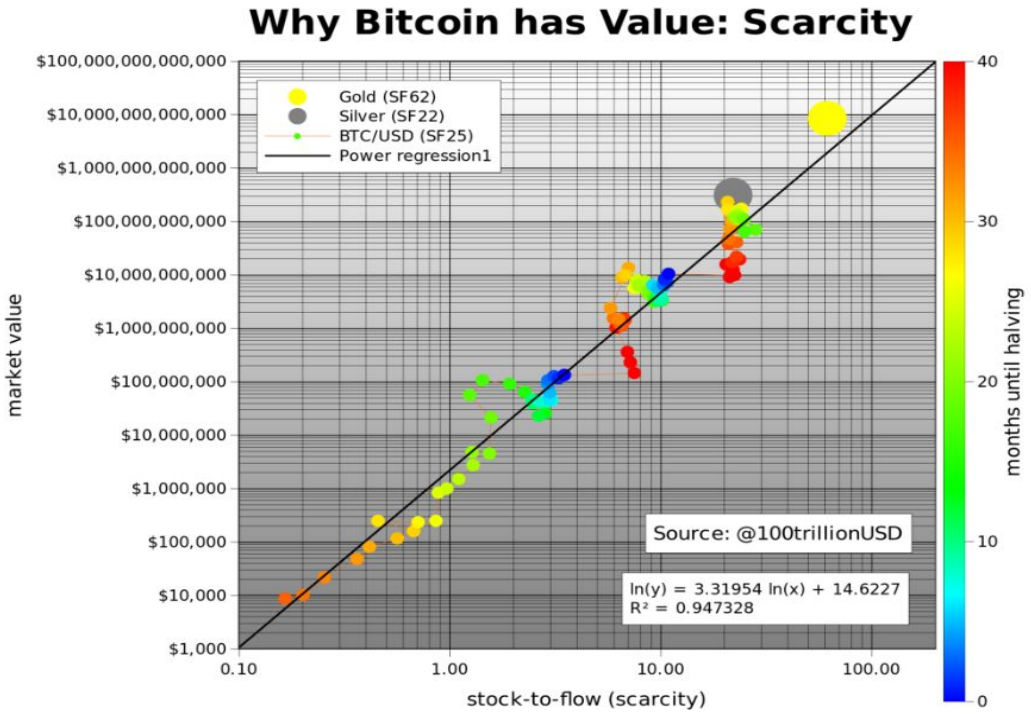
By 2020 the inflation rate of bitcoin will halve from 3.85% currently to 1.8% as the mining reward is halved from 12.5BTC per block to 6.25BTC.

Gold's stock-to-flow ratio is currently around 62 years, whereas bitcoin's is approximately 25 years, but after the next reward halving in May 2020, annual supply will drop to approximately half and the stock-to-flow should double to around 50 years (this could vary depending on mining technology and capabilities etc) which is close to gold's 62 SF.

Recent testing of the hypothesis that bitcoin's price is a function of its scarcity (or deflationary supply) shows that there is a strong statistical correlation between the two, or an R-squared of 95% (other externalities such as confidence, regulation etc also affect price). R-squared is a measure of how well a statistical model fits the data.

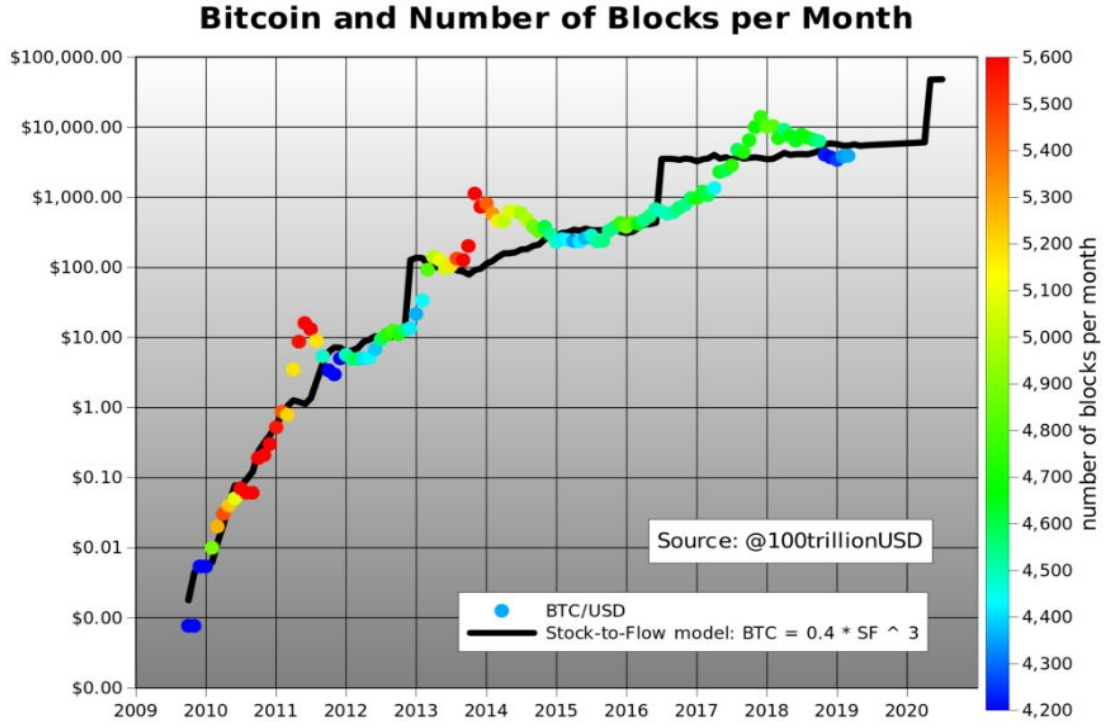
The research concluded:

> *"What is very interesting is that gold and silver, which are totally different markets, are in line with the bitcoin model values for SF... Note that at the peak of the bull market in Dec 2017 bitcoin SF was 22 and bitcoin market value was $230bn, very close to silver"*



The chart displays an R-squared relationship between SF and price of 95%. Source: @100trilion

Plotting the same SF price model for BTC (black line) against the number of blocks mined per month (in a colored scatter plot) shows a very tight relationship between the two, with sharp upwards adjustments in the black line occurring at block halvings every four years.



The SF price model, in black, against blocks mined per month (blue=high, red=low). Source: @100trilion

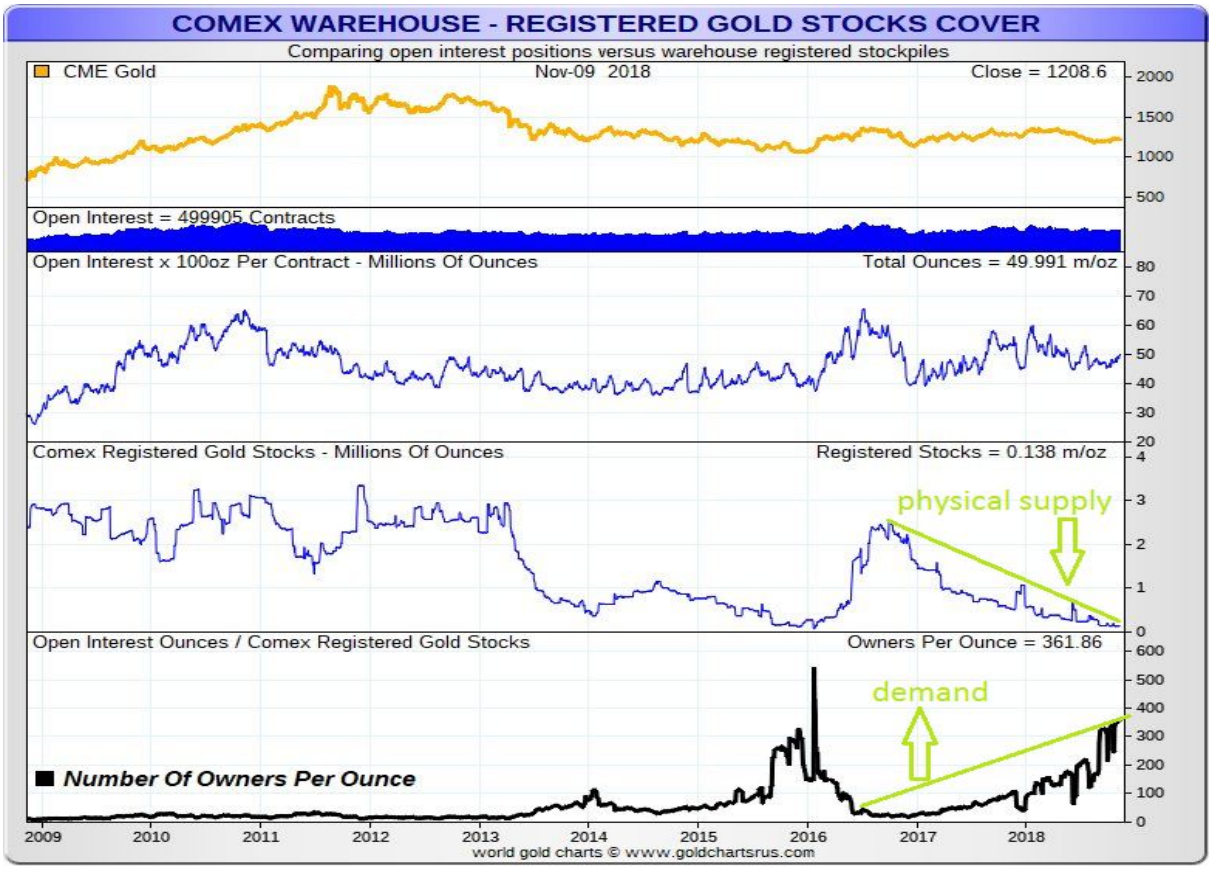
According to this model, extrapolating the BTC stock-to-flow price past the next block halving in May 2020, implies a BTC market cap of $1tr and a price per coin of ~$55,000 sometime between 2020-2021.

While we don't endorse this price model or its predictions it does attempt to quantify what we believe is an important function of bitcoin: digital scarcity. Incidentally, the halving will also occur at the height of the US presidential campaign which concludes in November 2020 and we expect bitcoin to perform well as a hedge against both political and monetary uncertainty at that time.

Trading bitcoin scarcity

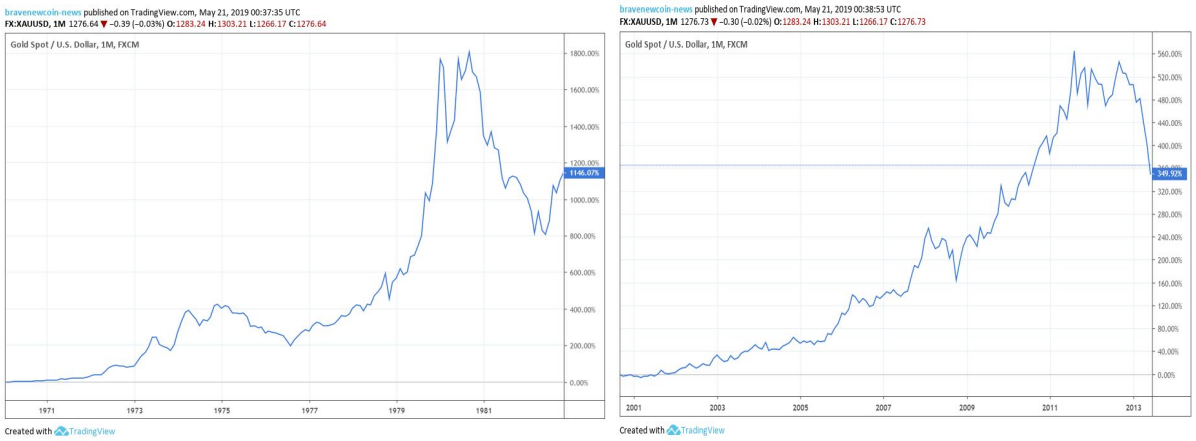
While we don't refute the strong correlation between price and SF, we believe it is attributable to a small 'paper' market for BTC. Funds, ETFs, and derivatives such as futures and options are still in their infancy and most BTC trading is conducted in the spot or OTC market, but this dynamic will change.

In the gold market there has been growing concern over the high paper-to-physical ratio and price manipulation though derivatives, which some believe suppress the spot price of gold. Of particular concern is the depleting gold inventories at the world's largest commodity exchanges, Comex, where the ratio of open interest in its futures market to physical gold in its vaults is over 360:1.



The paper demand for gold per ounce of physical gold in inventory at the COMEX warehouse is at a record high 361:1. Source: GoldChartsRUs

The high ratio has also been attributed to putting a price ceiling at certain levels because there is 'more gold' to short it. While this manipulation has not been proven we don't dismiss it as a contributory factor as the availability of so many gold derivatives surely dilutes its scarcity value. Comparing price during the two biggest bull runs in gold, 1970-80 and 2001-2011, the former soared 1800% while the latter managed 480%.



Price of gold (XAU/USD), left chart, rose 19x during 1970-1980, when the first gold funds appeared whereas in the last big bull run 2001-2011 it rose just over 5x.

There is reason to believe, among other factors, the first bull run was triggered by initial excitement of gold being opened up to a wider audience with the first gold funds while during the last bull run funds, ETFs, futures and options were all widely available which diluted its scarcity value.

With the rapid proliferation of derivatives these days we foresee a similar BTC price trajectory to gold as more derivatives are introduced, which will eventually undermine its scarcity value. Just as many investors now prefer to hold physical gold over paper, some BTC investors extol the benefits of holding your own private keys.

Gold-backed and asset-backed coins: Digix Gold

The nascent hard-backed cryptocurrency market is thin in liquidity and live projects, despite the proliferation of many such whitepapers in 2018. However, it will become an important sector and marks the start of the digitization process of all asset classes.

Digix (DGX) whitepaper is light on technical detail but assuming the token derives its price purely from the price of gold per gram (which spot price is valued per ounce) then the DGX token's current price of about $42.80 per gram is "undervalued" compared to the spot price of gold of about $46.20 per gram ($1,224 per ounce).

The price of DGX has remained steady around $40 since the start of the year; however, the volumes have fallen off a cliff.

Digix also has a DAO governance token (DGD) which allows access to the platform to tokenize any real asset. This is one live example of gold-backed crypto that fits between gold ETF and holding the physical. and Paxos, issuers of the PAX USD stablecoin, is also planning a gold-backed coin in 2019.

Central bank digital currencies and trade wars

National currencies have long been tools of geopolitics and the US has a disproportionate upper hand on the rest of the world by defacto of being the world's reserve currency. As the US has lost most of its manufacturing base to cheaper emerging countries in Asia (and will continue to do so for the foreseeable future) its reserve currency status is the last protective moat around an aging superpower.

China is using the Belt and Road trade route from China, through Asia and into Europe to expand the use of its yuan currency - with state-owned banks and the People's Bank of China (PBoC) funding the infrastructure projects overseas. China has also been stockpiling commodities from grains to metals for years and is the world's biggest importer of oil (its excess inventories are notoriously negative for oil prices). It also recently issued a Petro Yuan contract, the first futures contract to break the USD hegemony in oil settlement and a direct rival to the US Petro-dollar which it could use to trade the surplus inventories.

To keep capital controls on its currency while also internationalizing it, China is experimenting with a form of distributed ledger technology to issue the world's first CBDC.

> *"It would allow the central bank to have a perfect capital control mechanism, since PBoC's private blockchain would create records of all capital flows. The enormous ledger would also provide reliable references for tax collections, which could even be written directly into the currency's code."*
> *- Jennifer Zhu Scott, Radian Partners*

A blockchain/DLT currency could also serve a dual purpose - both as an enormous private ledger of all transactions in a country and also an alternative system to the SWIFT international interbank network, from which China and others have been trying to escape for years. This has become a pressing concern for the growing list of countries trade embargoed by the US and cryptocurrency has been proposed as a way to skirt these sanctions, with Venezuela having already issued its 'Petro' cryptocurrency and Iran proposing to issue a 'crypto-Rial' to this end.

US lawmakers have even introduced two bills "to impose sanctions with respect to Iranian financial institutions and the development and use of Iranian digital currency."

Special Drawing Rights tokens

While short-term the USD's strength is likely to continue as there are few safer alternatives, it could be wise to hedge against the USD in the long-term. This can be done through commodities which are correlated with emerging market currencies or even through cryptocurrencies that build a basket of commodities and currencies similar to IMF Special Drawing Rights (SDR).

Two stablecoin projects yet to be launched, Saga and Terra, will both use a form of algorithmic monetary supply within dual token economies (similar to the IMF's central bank proposal) and use the SDR model, pegging to a basket of currencies and commodities.

The SDR is an IMF-issued convertible token tied to an underlying basket of currencies including the USD, EUR, RMB, JPY and GBP. Its price is adjusted daily and can be converted into any one of the basket's currencies. Although USD has the heaviest weighting in the basket, the SDR has a negative correlation with it and instead moves more in correlation with safe haven currency the Swiss Franc in times of market uncertainty.

In a similar vein to Saga and Terra, Globcoin, which is also yet to be launched, is a multicurrency backed stablecoin designed to be a multicurrency bank account, and will offer its customers a zero Forex markup.

The IMF's Special Drawing Rights (XDR), in red, is negatively correlated with the US Dollar Index (DXY), in blue.

Conclusion

Intensifying trade wars (e.g. China and the US) and their growing frequency coupled with the rise of populist policies (eg Brexit and trade protectionism) point to a future of more stringent monetary policies rather than the open borderless trade that we've become accustomed as part of 'globalization'. Investors should be aware of the potential effects of negative interest rates and artificial inflation stimulus in an era of lower growth and what this could mean for fiat currencies, commodities and new forms of digital private and commodity money.

We are in the process of Gresham's Law, where old money (cash) is being supplanted by a lesser quality (ie higher inflation, lower privacy) digital currency issued and controlled solely on a central bank digital ledger. As cash is gradually phased out - as happened when we left the gold standard - people will seek inflation protection (traditionally gold and hard assets) and permissionless cryptocurrencies, in particular Monero and Zcash, will become the new digital cash. With the proliferation of, and easier access to, digital commodity money we will witness a complete rebound in demand for precious metals, Bitcoin and Litecoin (BTC-based currencies) for their deflationary traits.

On a geopolitical level, there is rising competition and demand for a new global reserve currency from China, Europe and Russia who are working on alternatives to the SWIFT network and the USD in international trade settlement using supranational indexed currencies such as the IMF's Special Drawing Rights (SDR). We also believe Venezuela's el Petro is just the start of commodity-backed national cryptos, with more to come, and if an alternative to the USD was established for international trade settlement it would undermine the US' reserve status and its $22tr debt would become a serious issue.

On an enterprise level, stable digital tokens that emulate a basket of commodities or a form of digital SDR could be a viable solution to hedge against currency volatility in international trade.

Author Bio

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Andrew writes research on macro-investment themes in the digital asset markets and token-economics with data from BNC. He also leads the Economic Analysis Working Group with the Government Blockchain Association exploring the use of blockchain in the economy, environment and society.