

Economic Framework of Digital Currencies

Regulatory Working Group (RWG)

Task Force: “Central Banks, Digital Currencies and Monetary Policy – CBDC & MP”

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This paper is part of a series of papers on central banks, digital currencies and monetary policy. We kick off our journey by examining the economic framework of crypto currencies and briefly addressing relevant issues, opportunities and threats, as well as shedding light on how Central Banks, Retail Banks, Governments and their constituents could be affected. While cryptocurrencies are becoming the evolutionary step of paper money, digital currencies have been in use for some time now, for example in interbank lending and electronic accounts for major financial institutions. However, when it comes to retail banking and more specific the public, digital currencies are destined to change the way we interact with money.

Currently, the public can only hold central bank money in physical form – as banknotes and coins, although money appears in digital form in their bank accounts.

We decided to embark upon this journey by establishing a simple definition of digital currencies and comparing it to existing cryptocurrencies – digital currencies. For simplicity we will refer to all cryptocurrencies as digital currencies and make the distinction between central bank and private issued. According to the Bank of England; “A digital currency is an asset that only exists electronically. Digital currencies such as Bitcoin were designed to be used to make payments, but today many digital currencies are held as speculative assets by investors who hope their value will rise.”¹

Expanding the above definition, when examining it from the perspective of economic theory, whether a digital currency is considered to be money depends on the extent to which it is used as a medium of exchange, unit of account and store of value.

Looking into the behavior of existing digital currencies it is evident that they have not assumed their true currency role and are treated mostly as speculative assets for the

pursue of profit. As such they may be considered as store of value (in the hope of price appreciation). However, such expectations restrain them from being used as units of account and medium of exchange.

Most of private digital currencies have aligned themselves closely with the pre-defined and limited coin supply model introduced by Bitcoin. Limited coin supply improves predictability and may lead to high coin prices which could be responsible for inflated price expectations. Inflated price expectations may stop a coin from being used daily as a unit of account and a medium of exchange. It may also be partially responsible for the increased volatility observed in many digital currencies. For example, Bitcoin’s high volatility (more than 5%) makes widespread usage challenging. Similarly, a fixed coin supply that leads to a continuously inflated price may also have negative macroeconomic impact, by deflating the prices of goods and services, as well as wages. Inherently coins with limited supply lacking an intervention mechanism in response to demand / supply variability may also increase volatility in prices over time.

Despite those challenges, we wish to dive deeper and uncover the true potential of

¹ Digital Currencies, Bank of England - <https://www.bankofengland.co.uk/research/digital-currencies>

digital currencies and their impact on all stakeholders i.e. business, households and the overall financial system (banks, financial institutions). We believe that if central banks decide to issue digital currencies which could be used to store value and make payments with electronic central bank money the impact on monetary policy and financial stability might be considerable.

The price stability and efficient allocation of money

We consider price stability and efficient allocation of money the two most important pillars of financial stability and economic prosperity in every society. Could the introduction of central bank or private digital currencies affect price stability and efficient allocation of capital?

Advocates set the framework accordingly. Those against the use of digital currencies and profoundly against private money point the inability of current digital currencies to be used as true money. If it cannot be used as money then it could not be inclusive of all people and neither could serve the society as the new mean of payments, transfers, and for satisfying daily financial interactions. Starting from private issued digital money they point out the inefficient distribution of wealth that favors the miners of those coins and early adopters, further pointing out that private digital currencies are used as speculative assets to exploit speculative demand. They go on to highlight the inefficient allocation in wealth distribution towards the above-mentioned participants and that private digital currencies, if were adopted as money, due to limited supply, could have pushed their values so high that would have deflated everything around them in terms of economic product as goods and services. In addition, concentration of wealth in the hands of those few could imply the formation of a new socioeconomic phenomenon and a potential shift of purchasing power towards those few participants. The risk of accumulation of

production sources and the control of such resources under such scenario could imply that the owners of such resources have contributed no meaningfully comparable output to the world that reflects to the acceleration of their wealth in such short time creating new forms of inequality.

Equally profound is the argument against price stability. Digital currencies lacking intervention mechanisms are subject to market moods expressed as supply and demand under the premise of efficient markets. However, considering the lack of unified cross-border regulation, diversity of recommended or applied regional regulations, crowd behavior, misinformation, etc. the efficient market, safety valve, assumption fast disappears leaving behind digital currencies susceptible to high price volatility. Price volatility is then expressed with deep price spikes and retracements rendering them inefficient mediums of exchange and units of account. Occasionally the suggestion that wider adoption of digital currencies would bring stability (i.e. high liquidity) is probably misspaced. The example is usually drawn out of the equity markets where large capitalization companies with large liquidity traded by a wider segment of the market participants tend to have lower volatility than those with small capitalization and small liquidity stocks. However, this interpretation is highly skewed to liquidity leaving aside market regulation, company and management accountability expressed through reporting, transparency and information dissemination, shareholder control, and high visibility where participants are known, easily traceable and recognizable.

On the other hand, digital currencies that suffer no limited supply and include some sort of monetary mechanism which responds to demand/supply spikes might offer a less volatile alternative. Although the volatility argument seems easier to address, there is not enough evidence to support that algorithmic trading cryptocurrencies might be able to

sustain an unexpected economic or market shock (black swans) that may require large amount of fiat money set aside as reserve capital to respond to significant and unexpected market drawdowns.

Digital currencies pegged by some sort of collateral might appear even more appealing as they mostly adopt the volatility of the physical asset or currency (some time a basket of currencies) or other digital currencies they pegged to. Those, however, tend to be concentrated around an issuing body that controls the monetary liquidity mechanism and thus may take away one of the three moral pillars of cryptocurrencies - decentralization.

Notably, proponents of fiat money find refuge in the writings of McLeay, Radia and Thomas (2014), where he states that “money in the modern economy may be thought of as a series of claims, or ‘IOUs’. Deposits held at commercial banks are an IOU, being a liability for the bank and an asset for the account holder. Most money is held as bank deposits and the principal way that new money is created is through the creation of loans. Whenever a bank makes a loan, it simultaneously creates a matching deposit in the borrower’s bank account, thereby creating new money.”²

Banknotes issued by a central bank are also a form of a non-convertible claim and are liabilities of the central bank and assets to the noteholder. In contrast to fiat money (banknotes, coins or bank deposits), digital currencies are not a claim on anybody. In this respect, and according to the Bank of England “they can therefore be thought of as a type of commodity. But unlike physical commodities

such as gold, they are also intangible assets, or digital commodities.”³

Similarly, the issuance of central bank digital currencies is currently rebuffed by some market participants, especially from those coming out of the ranks of Cryptocurrencies, as impossible or even undesirable. The major argument stands in the increased centralization and accumulation of power in the hands of a single institution. Similarly, proponents of classic economics adopt a stand that claims there is no need to replace paper money with digital as such move could potentially trigger global and unquantifiable risks i.e. by potentially unsettling the USD as a reserve currency, disrupting the two-tier banking system and rendering classic commercial banking obsolete. Even cause price instability at country currency level triggering interest rate differentials and inflation.

On the other hand, a more contemporary and, to my opinion, more realistic school of thought is shaping up that supports the introduction of digital currencies and in some cases even recognizes that the coexistence of both private and central bank digital currencies might be conceivable.

Cryptocurrencies is a combination of new payments systems with new digital currencies that are not issued by a central or a commercial bank and hence they are neither an IOU nor a liability. Thus, we should seek to understand the economic framework of cryptocurrencies in the context of digital currencies. One may also wish to ascertain the likelihood of private digital currencies coexisting with digital currencies issued by central banks. In both cases one should seek to identify the impact on monetary and fiscal stability.

² McLeay, M, Radia, A and Thomas, R (2014), ‘Money creation in the modern economy’, Bank of England Quarterly Bulletin, Vol. 54, No. 1, pages 14–27, available at www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2014/qb14q102.pdf.

³ The economics of digital currencies By Robleh Ali of the Bank’s Financial Market Infrastructure Directorate, John

Barrdear of the Bank’s Monetary Assessment and Strategy Division, and Roger Clews and James Southgate of the Bank’s Markets Directorate <https://www.bankofengland.co.uk/-/media/boe/files/digital-currencies/the-economics-of-digital-currencies.pdf?la=en&hash=BE28BE59F18E79CCE705643CF14F36DF8897E56D>

This impact should be examined under a scenario of creation, wide use linked directly to perception and acceptance of digital currencies as money, their growth potential, and their attractiveness and sustainability as low cost transaction alternatives.

Creation of digital currencies

Currently those Cryptocurrencies dominating the market have a predetermined coin supply, coin inflation mechanism and timeframe, i.e. Bitcoin, has a total supply of 21 million coins to be reached by 2040, where new coins are created to reward miners solving mathematic puzzles that testify to the verification of transactions among Bitcoin's network participants. This reward compensates for the energy power and effort expressed as cost of verification spent by the miners to resolve the puzzles and verify transactions. Considering that the reward may be above the actual cost, it resembles the reward central banks receive when issuing money in the form of seigniorage. Other digital currencies with smaller market share might have their complete number of coins issued at the point of their creation while some others might have no limit on the amount of issued coins. The challenge of any cryptocurrency with a capped number of coins in circulation might be the potential large and speculative increase in its price if demand for this digital currency increases as it transforms to "money" i.e. when world economic growth increases, followed by increase in demand for consumption of goods and services and thus transactions based on this digital currency. When the same scenario is assumed for a digital currency with unlimited supply, credibility, centralization and trust come to play as the nature of the mechanism responding to market's demand for that digital coin might closely resemble that of a central bank's monetary policy. With all those in mind, central banks seem to be working hard behind the scenes to identify the impact of issuing their own digital currencies could have on themselves, their 2-tier banking systems, and the economies they serve.

Central banks, in the context of the responsibility they hold to maintain monetary stability, will need to fully comprehend several macroeconomic and microeconomic implications when considering endorsing private digital money, issuing their own digital currency, or operating within a coexisting digital money environment. Such implications may include;

- How economic output growth and volatility could be impacted by the introduction of a digital currency and to what magnitude?
- What could be the expectations for economic cycles as well as behavior in economic output peaks and troughs?
- When and how should a digital currency enter the economy for wider use and through what channels (commercial banks or directly to consumer)?
- What could be the relationship of the central bank digital currency (CBDC) with other digital or fiat currencies – especially USD and commodities?
- How could the introduction of a CBDC affect decisions of individuals to consumption, savings, and borrowing?

They should also make a reasonable assessment on what the impact on the local and global financial system could be and how financial stability could be maintained, considering for example;

- What could be a reasonable amount of fiat money that could be substituted by digital money?
- How could demand for retail central bank deposits (digital money deposits) be managed under different interest rate scenarios?
- How will the existence of digital money affect commercial bank funding behavior as well as cost of funding?
- Is the viability of commercial banks going to be under threat?

- How could a digital currency interact with existing financial stability tools (i.e. government backed deposit insurance, and the lender of last resort function)?
- How could a digital currency be used to protect the banking sector from periods of excess aggregate credit growth that have often been associated with the build-up of system-wide risk?
- How would the central bank issued digital currency interact with the unwinding of Quantitative Easing?

The answers to the above questions will somewhat vary depending whether private, central bank or coexisting digital money is adopted. For example, a central bank digital currency will be centralized, and act as a direct substitute of the central bank's own fiat issued money that appear as liabilities in its Balance Sheet. Moreover, its use almost certainly will be directly linked to the central bank's monetary policy (i.e. inflation target) and potentially in some isolated cases even used as a back stopper to ill-conceived fiscal and budgetary policies.

Wider use of digital money

Wider use of digital money is primarily driven by acceptance of digital currencies as money. Could digital currencies be used as stores of value, medium of exchange, and units of account? Clearly, many participants and private digital currencies holders recognize their value as stores of value under the premise that their price has risen and is expected to rise further. This expectation is defended under the premise of limited supply and increased usage. Unfortunately, by itself such claims may transform those digital currencies into speculative assets used in pursuit of extraordinary profits. Thus, they may promote buy and hold behavior, instead of

daily usage for purchasing goods and services. Sadly, such behavior deviates from the wider use of digital currencies as money that has as prerequisite some degree of stability and certainly, predictability.

Despite the somewhat speculative behavior of major private digital currencies, the fact that trades take place between a number of parties indicates that those private digital currencies are seen and accepted as units of account. Their prices and the assumed agreement to trade between those parties, mostly through exchanges, testifies to the existence, at least amongst those parties, of the notion of a unit of account. It is our understanding then that it can be assumed that both the store of value (at least when price is equated to value) and the unit of account (at least amongst the trading parties which are estimated between 13 to 25 million⁴) are achieved.

However, the third characteristic of money, medium of exchange remains as yet unachieved. As we mentioned above, volatility and the expectations of abnormal returns have stood obstacle to the wider acceptance of digital currencies by enterprises. Currently, no more than several tens or maybe a couple of hundreds of thousands of enterprises are accepting private digital currencies, predominately bitcoin, but still a drop in the ocean compared to possibly a couple of hundreds of millions of enterprises worldwide. Having said that we believe the opportunity is in place for those "stable" digital currencies that might mitigate volatility through a "monetary policy" that absorbs irrational exuberance or through a "pegging" into a less volatile, and more predictable "asset". Both recommendations come with some caveats as mentioned before but may also extend to include pegging policy, availability of the asset, third party risk, rebalancing of baskets, etc.

⁴ How Many People Own Cryptocurrencies, July 12, 2019 ICO Manager, <https://icomaking.com/how-many-people-own-cryptocurrency/>

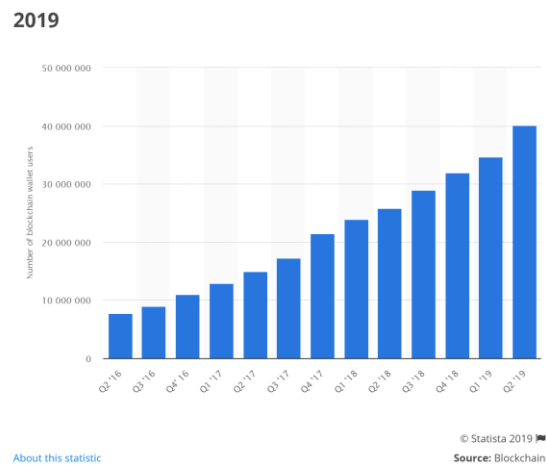
Assuming central bank digital currencies are issued as partial replacements of fiat money through some undisruptive means, those may also enjoy some inherited competitive advantages vs private issued digital money. Pending the choice of the most efficient channel to the market, dissemination to parties within the economy/country may be done simultaneously and seamlessly through commercial banks – where state and private sector employees’ salaries are partially distributed in digital money. This could be coupled with simultaneously generating commercial and consumer bank accounts for digital money with the central bank, or with consumer banks issuing digital wallets linked to conventional bank accounts etc. Safety may automatically be assumed the way it is currently assumed for conventional bank accounts. Similarly, trust and acceptance may also automatically be assumed by enterprises and consumers as those digital currencies could come with the seal of their nation’s central bank. Equally important is to realize that in such a scenario all enterprises will have a vested interest to ensure daily business continuity through an undisruptive trading environment.

At this point we ought to consider whether people will be willing to expense some amount of anonymity when central banks issue their own digital currencies that promise faster transactions at lower costs, with a currency “guaranteed” by the nation’s central bank.

Growth potential of digital currencies

When counting the number of digital wallets, we see that in Q2 2019 the number stood just above 40 million a 55.6% increase of Q2 2018 of 25.7 million. Comparing with Q2 2016 the CAGR is 28.1%. the graph below demonstrates the joystick potential. However, this might not be an absolute true representation as an

individual might own many wallets and many wallets might have been set up, used once and never to be used again.



Source: Number of Blockchain wallet users worldwide from 2nd quarter 2016 to 2nd quarter 2019, by M. Szmigiera, Statista, <https://www.statista.com/statistics/647374/worldwide-blockchain-wallet-users/>

Thus, we will be inclined to make some wider assumptions to try to understand the potential opportunity for digital currencies expressed through wider adoption. Hence, and according to the World Economic Forum that has predicted that around 10% of the world’s GDP will be held in the form of tokenized assets by 2027. If we took 2017’s global GDP as a reference point, which amounted to 75 trillion US Dollars, then 10% of that would be 7.5 trillion.⁵ The equivalent number for 2019 could be closer to 8 trillion US Dollars, not too short of the value of gold 9.8 trillion.

Accounting for world GDP growth rate of 3.5%⁶ then by 2027 the tokenized assets will account for just above 10.5 trillion US Dollars. At that time gold is expected to be valued at 11.7 trillion US Dollars.

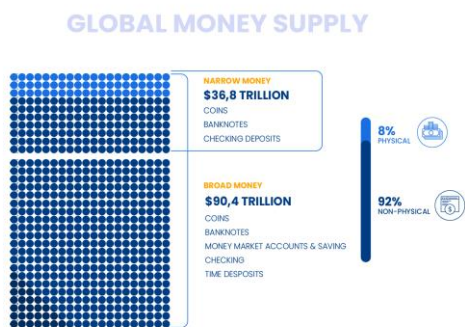
Considering that private digital currencies are permissionless, and censorship resistant, a great potential exists for people living in countries where the economic system is fragile and trust for the purchasing power of their

⁵ The multi trillion dollar potential of cryptocurrency, Kai Bennink, <https://blog.blockport.io/the-multi-trillion-dollar-potential-of-cryptocurrency/>

⁶ World Economic Outlook Update, January 2019 <https://www.imf.org/en/Publications/WEO/Issues/2019/01/11/weo-update-january-2019>

currency is declining fast. Furthermore, there are approximately 2 billion people that have no or limited banking access but most of them own a mobile phone. Those people offer another potentially lucrative opportunity for private and central bank digital currencies.

Moreover, we think there is potentially an even greater opportunity for digital currencies to grow. It is tapping into the Global Money Supply. We are aware though that most market participants will find the idea of private digital currencies gradually replacing fiat money at a magnitude that will impact the global money supply improbable.



Source: The multi trillion dollar potential of cryptocurrency, Kai Bennink, <https://blog.blockport.io/the-multi-trillion-dollar-potential-of-cryptocurrency/>

However, to unlock this growth opportunity a trigger is needed. We believe this trigger is counterintuitive and contrarian and it assumes the issuing of central bank digital currencies. By doing so central banks will be legitimizing the transition from fiat into digital money and endorse digital money as the new money. Private digital money then could find themselves competing not for legitimacy but for a bigger slice of the pie as consumers would feel more comfortable dealing with digital money for daily transactions and not only for trading profit.

We ought though to highlight that digital currencies growth potential will also be affected by regulation. Classifying private digital currencies as assets, commodities or anything else other than currencies and digital

money may reduce their growth potential shifting people's interest back to seeking abnormal, speculative returns. Here again the issue of central bank digital currencies might help in setting up some uniformity across the board. Assuming central bank and private digital currencies exhibit similar characteristics, it would be conceptually difficult to assume distinctively different regulatory definitions for the two. Moreover, it would be not unrealistic to assume that regulation opting to govern central bank digital currencies will recognize them as digital money and thus private digital currencies might also recognized as such. If this hypothesis holds its ground, then the introduction of central bank digital currencies might trigger wider adoption of private digital currencies by the public as their creditability might receive a boost.

Attractiveness of digital currencies as low cost transaction alternatives

Payment with private digital currencies carry transaction fees that are lower than those of retail electronic payments (credit cards) and international transfers using fiat currencies through centralized banking/clearance payment systems.

While those transaction fees are lower than the fees of centralized payment systems marginal mining costs are higher. A centralized system is likely to have lower marginal cost due to economies of scale. Moreover, a scenario of higher adoption of private digital currencies with constrained supply could lead to increased size of blocks requiring even more computational power to be verified as well as to even greater competition between the mining companies as rewards decrease while transaction volume and effort increases. Larger computational demands and higher competition could lead to more asset/capital incentive mining operations (more and faster hardware), thus increasing the marginal and real cost of mining. Apparently and for now this paradox can be explained if we recognize that part of the reward miners receive is in

mined coins instead of actual money which would have increased the cost of verified blocks of transactions. Worth noting is that as long as the miners believe the price of future mined coins will increase, they will be willing to subsidize their cost with coins and thus keep the cost of verified transactions low. This is somehow a peculiar situation where adoption of the private digital currencies is encouraged by the low transaction fees while it is curtailed by the increased price per coin!

Unfortunately, miners retain a great quantity of the coins they receive as compensation, thus, creating a form of artificial liquidity shortage in the expectation of abnormal returns. It would not be farfetched to assume some form of occasional market collusion where miners who are congregated geographically in one area unofficially “collude” to keep their coin holdings out of the market, especially if they are seeing a clear upward trend. This could be unfortunate because it jeopardizes the notion of digital money and converts private digital currencies into speculative assets. In addition, extracting liquidity out of the system has a negative impact on the wider adoption of private digital currencies as there is not enough coins to “go around” to be used as mediums of exchange by the wider public and commerce. Notably, some of those mining companies might borrow fiat money to cover their working capital requirements giving coins as collateral (Possibly 2x or more the amount they borrow). A black swan scenario, where unexpected pressure pushes the price of the coin(s) down, could trigger margin calls or even the immediate sale of the complete collateral positions and possibly lead to simultaneous dumping of relatively large amounts of coins in a market without depth (triggering price gapping). Historically, black swans do happen and is a matter of time until the next one takes place. Such an event might increase the risk discount assigned into private digital currencies. Finally, both black swans and high competition between the miners (assuming

the cost compensation model remains the same vs reduced coin supply of those coins with fixed supply) could lead to some miners going out of business and to a larger miner concentration in the hands of fewer miners, resembling a mining oligopoly. Alternatively, could lead to the demise of fixed supply coins and the growth of those with unlimited supply.

These problems could be sufficiently resolved if miners were to agree to maintain only a minimum coin reserve and recycle the remaining coins back into the market. However, we recognize that agreeing to such initiative implies a very democratized market that pursues stability and normality in the expense of relentless profit. Similarly, the efficient market theory could not apply in a market where a great chunk of the “trading instrument” is held by a small number of participants that have a vested benefit to overcompensate themselves for the risk of increased costs and pursue extraordinary profits. A democratic mining market will imply a “colluded” agreement without the supervising hand of a regulator to cap the maximum amount of coins held out of market circulation as part of those mined and paid as cost compensation. It would loosely resemble the regulated utility companies (water/electricity etc.) where tariffs reflect cost of capital (replacement of pipes, generators, energy production machinery) plus a capped top up. In this case the utilities compete in reducing the cost and stealing market share in order to increase profitability and revenues respectively as they cannot increase prices far and above what the regulator has imposed after extensive consultation with all market participants.

Another positive note could come from the field of technology of lower electricity consumption and the shift towards payments that are linked to the number of transactions instead the number of coins mined.

Can a monetary system in which privately issued digital currencies circulate as media of exchange work?

The viability of a monetary system that includes or is led by private issued digital currencies depends on its stability, which in turn sets the benchmark for their wider adoption. There is no reason to discount the viability of private issued digital currencies on the back of volatility, low participation or speculation. An ecosystem evolves and digital currencies will evolve to address their weaknesses too. When it comes to monetary policy, self-regulated private digital currencies possibly, could do even better than those government by people. It is not difficult to imagine that an emotionless, potentially decentralized, well defined, rule following system with hard coded procedures within a number of smart contracts is difficult to be influenced. Usually, monetary policy failures are observed when the signals are read incorrectly, central banks are slow to respond or over-respond exacerbating irrational exuberance or stalling their economies.

Private digital currencies have the potential to facilitate frictionless trade, bring down the cost of money to almost “zero”, reduce exchange rate differential and potential even inflation. They could also be used in the same monetary instruments employed by central banks. When it comes to functionality, private digital money with no supply constraints, could be used in the same way to jumpstart or slow down an economy.

However, one must bear in mind that a monetary system based on private digital money may require some evolutionary innovation when it comes to how the monetary policies will be channeled to the heart of the economic activity, the households and enterprises. The impact will be felt most in

the structure of the two-tier banking system, with the role of commercial banks changing to facilitate the new paradigm shift in the banking system. Commercial banks might evolve as points of product sale and support, especially during the phase out period of fiat money to digital money. Thereafter they might still manage digital wallets, transform to trading exchanges, issue their own digital money, co-manage central bank issued digital money or phased out.

Is such a system stable?

Advocates against the use of private digital money claim that economic theory would suggest that social welfare would be lower in a hypothetical economy based on a current digital currency compared with a second hypothetical economy based on a fiat money system⁷. If we accept that the dominant private digital currency will be drawn from the ranks of those with limited supply, a number of potential macroeconomic risks might be envisioned including a potentially dangerous price deflation of wages, goods and services. The reason can be isolated on the inability of digital currencies with fixed money supply to respond to changes in demand of that digital currency. In simple words increased volatility that might have deep negative implications in the fabric of a society by affecting its weakest part which replays on welfare, as well as real production in areas of i.e. agriculture, and production/processing of raw materials.

When prices of goods and services are falling, households have an incentive to postpone or even abandon spending until they reach “bargain level”. The savings ratios increase while price deflation raises even more as consumption declines. In response, providers of capital require higher ROI trapping in between companies which in turn underinvest and stop expansion, even contract production,

⁷ The economics of digital currencies By Robleh Ali of the Bank's Financial Market Infrastructure Directorate, John Barrdear of the Bank's Monetary Assessment and Strategy Division, and Roger Clews and James Southgate of the Bank's

Markets Directorate <https://www.bankofengland.co.uk/-/media/boe/files/digital-currencies/the-economics-of-digital-currencies.pdf?la=en&hash=BE28BE59F18E79CCE705643CF14F36DF8897E56D>

letting people go and thus increasing unemployment.

When this scenario is assumed, according to economic theory both aggregate demand and subsequently output are likely to fall. If the subsequent deflation could not be reversed, i.e. due to lacking an intervention mechanism (digital currencies with fixed money supplies and no monetary mechanism that response to supply/demand imbalances) the risk of higher unemployment could be increased.

However, the above risks could be mitigated under a digital currency that meets the following criteria:

1. A new digital currency with no limited supply replaces the digital currency of limited supply
2. The new digital currency has in place a mechanism that links the issue and removal of coins to the real demand, independently of a centralized authority, and
3. The new digital currency is designed in a manner that counteracts speculation in order to inspire confidence, stability and predictability as a currency and not to be used as a speculative asset in pursuit of abnormal returns.

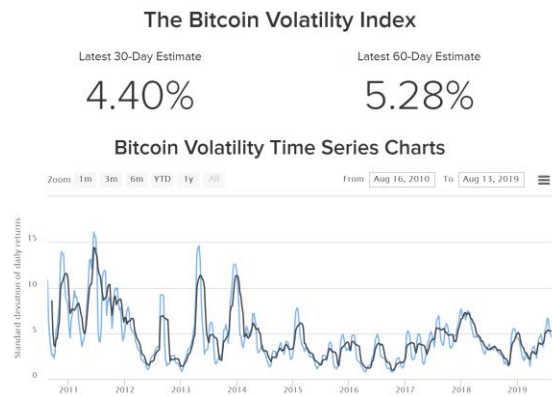
Considering the above points, it is not improbable to assume that such private digital currencies are in the making. Assuming a private digital currency that meets the above criteria is widely adopted it would be unlikely price deflation could ever become a problem. Hence, economic theory will be supportive rather than against digital money. Moreover, it is likely that economies relying on trusted digital currencies might push towards the equalization of interest rates among countries and thus, the reduction of even the complete removal of forex differentials. Such initiatives could benefit the global trade and hence the world economy by hundredths of billions per year - benefiting buyers/sellers. In addition, considering the degree of automation such a monetary mechanism will have, it is likely the

reaction to monetary shocks (unexpected – black swans, seasonal – periods of festivities, or structural – technological evolution) to be instantaneous and progressive, hence, neutralizing the shock in its route and thus ensuring more balanced economic cycles. Another aspect of a widely adopted digital currency is that it is unlikely to see economies in hyperinflation. In some cases, central banks have been used as money printing machines and monetary policies used to deflate debt rather as source of stability. When combined with mismanagement of government finances (including fiscal policies) economies were led to hyperinflation and national currencies in lightning speed depreciation hand-in-hand with deterioration in the living standards of their citizens. A digital currency that inspires stability and provides predictability most likely will reduce the probability of such behavior.

Financial and Monetary Stability

When comparing the impact digital currencies can have in the financial and the monetary stability of an economy it is easier to assess the financial risks applied directly at the microeconomic level. Understanding and addressing those risks could accelerate the adoption of digital currencies. In a fragmented market where many independent digital currencies coexist the financial risk is significantly reduced. However, in a digital currency ecosystem where a dominant currency has a disproportionate market share any price crash could significantly affect households, companies or financial institutions with significant exposure to it. Considering the number of people actively involved in trading large amounts of the dominant digital currency (Bitcoin) we could safely assume that at present the financial risk is minimum, both at local and global economy level.

Looking at price volatility of Bitcoin a significant price appreciation or price crash is not inconceivable. Although there is a school of thought which insists that price corrections



Source: <https://www.buybitcoinworldwide.com/volatility-index/> For comparison, the volatility of gold averages around 1.2%, while other major currencies average between 0.5% and 1.0%.

will result in higher lows, the technological risk seems to have been discounted disproportionately to the expense of large market share. One should look no further for examples of technological jumps and the impact on the incumbents i.e. what happened to Walkman, hand-held cameras, floppy disks, phone land-lines to see how fast a dominant player/technology can be overtaken by a new technology that makes things better, faster, cheaper, easier to use etc.. If this was to happen today “old” digital currencies may go out of fashion and fade away fast causing great losses, leaving the space for new and more “advanced” digital currencies to take over. But even if this was to happen today the financial impact would have been contained as the number of people that hold significant amount of digital currencies as percentage of their financial assets is small and the number of companies completely relying on digital currencies even smaller. That is not to say that the use of digital currencies will not increase neither that there is no way to mitigate such risks in the future.

For example, risk could be significantly increased if people use leverage to obtain larger positions in digital currencies on expectations of significant price increase.

Considering that currently few digital currencies are directly linked to the production of any measurable economic value i.e. directly linked to the real economy, such expectations would be purely speculation. A price crash could have resulted in losses for both the borrower and the lender. Extrapolating on this scenario, if a systematically important financial institution (or a number of them) was(were) to build an open position(s) which was(were) unhedged, a collapse in price of the digital currency⁸ could have led to loss of credibility and “institution runs” – Lehman Brothers debacle. In such a scenario a digital currency problem could contaminate an otherwise healthy financial system by affecting financial institutions without prior exposure to digital currencies but with direct exposure through other financial instruments to the failing financial institution with exposure to the digital currency. The situation could become even more complex considering that all financial institutions are using complicated derivative contracts to leverage positions. Use of such derivatives could magnify the impact beyond the borders of the country the institution could be based.

Another risk factor could be triggered by the wider adoption of a given digital currency and is directly and proportionally related to the concentration of power that lays in the hands of the miners. A small number of miners that controls a significant part of the mining process could theoretical collide to influence the nature of transactions that are verified or not. Even to perform double spending in extreme fraudulent situations. This risk could be mitigated if the system moves from Proof-Of-Work(POW) towards Proof-Of-Stake (POS) which transforms miners into validators, rewards them with a transaction fee, and is combined with a framework that restricts miners holding significant amounts of coins and their incentives are directly aligned with the efficient and uninterrupted operation of

⁸ Yermack, D (2013), ‘Is Bitcoin a real currency? An economic appraisal’, NBER Working Paper No. 19747

the digital currency network. A POS network might be a safer network as attacks become more expensive: if a hacker is going to attack the network, he would have to buy 51% of the total number of coins. In this case the market will react by fast price appreciation making it extremely expensive. However, in POW instead of having 51% of coins the miners need to have 51% of the mining capacity to control the network.

At this stage we do not consider bank runs as a credible risk. A bank run digital currency risk would imply not simply a wider adoption of digital currencies but also a framework that connects them directly to fiat or digital currencies banks' operations. Although this is inevitable, it will imply a pre-requisite and tight regulatory framework at the point of the physical/digital currency bank. We think it will be unrealistic to assume a fractional reserve banking system based on a digital currency subject to high volatility. However, we see it as a very probable scenario when stability and predictability is assumed under a digital currency that meets the criteria we set above. In the case of central bank digital currencies, the issuer could also provide the liquidity insurance as it would still be the source of digital base money creation. Furthermore, a central bank issued and administered digital currency might cause no risk for the Macroprudential tools (constrain on leverage and composition of balances in banks and systemic financial institutions) available to fight financial risk in times of extreme uncertainty. In a scenario where private digital money are widely used, central banks can still use their reserves as a safety net. They could hold private digital currencies or other reserves (easily convertible to private digital money) as sources to provide liquidity insurance. A scenario of hybrid digital currencies that is the product of central banks working closely with the private sector could also be likely. We will examine this option in the following sections.

Shifting our attention to monetary risks we should strive to understand how and to what degree the adoption of digital currencies will affect people and businesses spending decisions. A digital currency that is built to replace fiat money while maintaining the predictability and relative stability of its outdated predecessor could cause no significant changes in the spending patterns among all participants. However, digital currencies used as speculative assets which under some unique circumstance were to gain wider adoption under a speculative frenzy could curtail spending in favor of the digital currency accumulation in pursuit of profit. Reduced spending among households could influence the aggregate economic activity, as well as alter the inflationary state of that economy.

Monetary policy targeting price stability (low and stable inflation) is achieved through central banks and special designed committees (i.e. MPC for UK). Their role is to draft, implement and monitor policies designed to adjust money supply. This is done in order to achieve primary targets (i.e. 2% inflation, official interest rates, exchange rates), for example by adjusting bank rates (the interest rate paid on commercial banks' reserves held at the central bank which then transmitted down to commercial bank accounts), as well as secondary targets (i.e. managing forex and gold reserves, been the lender of last resort and ensure stability that support optimum level of employment). Sometime the monetary policy is closely linked to the exchange rate policy, however countries with "pegged" or stable currencies have little room to maneuver on the exchange rates.

When private digital money is set to replace fiat money it will be necessary to redefine the role of commercial banks through the role of central banks. It might be possible that central banks' role is transformed from issuer to administrator, still handling digital deposits and all necessary functions to ensure the legitimacy of the system. As money supply will

be demand/market driven and independent of individual state policies it might be necessary for us to start thinking of a more unified, a more universal digital currency that knows no borders. A private digital currency built to achieve price stability could be linked to a clearly defined target (i.e. global growth, global inflation, gold production etc.) and apply mechanisms that ensure an independent monetary policy closely aligned to the target. Such scenario will transform all banks into “distribution channels”, product and customer services centers but remove the ability to issue their “own” money through the process of fractional reserves. Assuming a successful transition and implementation of a universal currency (not necessarily one currency but one that is available to everyone allowing people to choose between national digital currencies, conventional cryptocurrencies as speculative assets, and a universal currency as described above) the benefits to the world could be substantial if global stability, low inflation, and low or no exchange rate differential were to be achieved.

Is private digital money consistent with an efficient allocation of capital?

The current banking system has been unable to access more than 1.5 billion people, especially in emerging and third world countries. For many people having conventional bank accounts and the ability to borrow or save has been far beyond their capabilities. High banking charges for remittance has led many fintech companies to innovate and offer online banking services through mobile phones. However, most of the time, still requiring a conventional commercial bank end point. In the event of a widely used digital currencies operating in environment where transactions for goods and services are done using digital currencies without the need for non-digital currency ending points, transaction costs

should be expected to decline fast. Lower costs and higher accessibility to financial products and services would allow more people to jump onto the financial wagon and enjoy the benefits of access to money sources.

Moving into mature and growing economies, we observe that the middle class and low-income families are those that have more debts when compared to their financial assets. For example, in the UK “35% of those in the lowest income decile have debts of greater value than their financial assets. This compares with 10% in the highest income decile.”⁹ Assuming the adoption of digital currencies under a scenario that price stability is achievable, such households run lower risk of facing the impact of inflationary shocks translated into higher interest rates that could increase further the burden of servicing their debts.

Hence, it is likely that digital money could achieve a better and more efficient and fair allocation of capital among a wider segment of participants across the world.

Can private and central bank issued digital currencies coexist?

We believe yes. It is inevitable that central banks will issue their own digital currencies. We feel confident that the first major central bank issued digital currency will be available to retail as early as 2022. There is no credible central bank in the world that is not actively examining, testing or preparing itself for the introduction of its own digital currency. It is a matter of when and not if. The need becomes even greater when considering that corporations with global footprint are enlisting talent into their ranks that is recruited to design corporate global digital currencies. We expect to hear more initiatives from such corporations within 2020. Simultaneously, there is a continuously growing ecosystem of

⁹ Andrew Hood Robert Joyce David Sturrock, “Problem debt and low-income households”, The Institute for Fiscal Studies, January 2018.

private digital currencies that evolve into more efficient forms of digital money, addressing some of the problems the first digital currencies encounter, including volatility.

Considering the above, it would be a tactical mistake if central banks fail to take the initiative. It is now widely agreed that digital currencies can serve a similar function to cash as a semi-anonymous medium of exchange accessible to both banks and people. The nature of digital currencies is attractive because it may be cheaper and easier to manage than fiat money. Assuming a scenario where both private digital currencies, corporate digital currencies, and central bank digital currencies are available, the attention will be shifted into how this ecosystem could coexist. Would they be of equal value, and could it be that footprint might be the factor that will define dominance within the ecosystem, or they could coexist by offering complimentary benefits? For example a central bank digital currency might offer a small compensation in the form of interest to attract digital money deposits while a global digital currency the low cross-border transaction fees when transacting in goods and services and the flexibility to pay with the same digital money everywhere in the world without incurring extra currency conversion and banking charges.

How should governments react to digital currencies and are we moving towards a unified legislative framework for digital currencies?

Currently there is no unified framework for private digital currencies. The diversity of opinions rest on the lack of urgency to set a regulatory framework as many policy forming parties still consider the overall size of private digital currencies non-material when compared to alternative financial instruments.

The example becomes evident if one pays attention how private digital currencies are still treating the in US by each of the five agencies:

- *The Securities and Exchange Commission (SEC)*, that oversees the US securities market and protects investors from fraud, sees private digital currencies as **securities**.
- *The Internal Revenue Service (IRS)*, that collects taxes and enforces tax laws, sees them as **properties**.
- *The Financial Crimes Enforcement Network (FinCen)*, a bureau of the US Department of the Treasury, with the responsibility to analyze financial transactions to counter money laundering, terrorist financing etc., sees them as **money**.
- *The Commodity Futures Trading Commission (CFTC)*, that regulates futures and options markets and is responsible for protecting participants from fraud, sees them as **commodities**.
- *The US Office of Foreign Assets Control (OFAC)*, that enforces economic sanctions in support of U.S. national security and foreign policy, sees them as **money**.¹⁰

The legal framework outside the US remains equally rich in its interpretations with some countries perceiving private digital currencies as money (e.g., Germany, Japan), some others as unregulated, speculative asset (e.g., Mexico, Denmark), while in some others they are simply banned altogether (China).

Worth noting that while China has banned Bitcoin, miners and exchanges, it is likely to be the first major country to issue its own

¹⁰ Kate Rooney, Your guide to cryptocurrency regulations around the world and where they are headed, <https://www.cnbc.com/2018/03/27/a-complete-guide-to-cyprocurrency-regulations-around-the-world.html>
PUBLISHED TUE, MAR 27 2018,

wholesale digital currency¹¹ in 2019 with Russia most likely to accept it as legal tender for cross border trade. Although some countries have set themselves against digital currencies, most understand the inevitable transformation of fiat into digital money and thus their focus will be moving into regulating the income generated.

We believe the regulatory framework may become more comprehensive and lead towards a more unified interpretation of private digital money as soon as the first country/central bank digital currencies become available. A central bank issued digital currency will most likely be a direct replacement of the nation's fiat money. As such, it may receive a digital money status, setting some form of legal framework. Subsequently, it could not be improbable to assume that private digital currencies, at least those under some sort of centralized structures, could use that framework as a footprint to achieve equal status digital currency identities.

Conclusion

Private and central bank digital currencies are the evolutionary step of fiat money. With a high degree of decentralization – even with central bank issued digital currencies – people might find them more democratic, more inclusive, and seek to enjoy their benefits in the expense of fiat money. While private digital money could offer greater privacy and anonymity, central bank digital currency might also opt to offer some added degree of privacy, lower costs, faster execution at the expense of anonymity. Private digital money does not reduce the impact of monetary policy in its effort to achieve stability and support economic prosperity. Exactly the opposite can be claimed. Digital currencies, especially private digital currencies could accommodate a fairer distribution of money independent

from any government intervention and hold greater promise to achieve a more balance world. Moreover, digital money, both private and central bank administered, might offer exceptional benefits to fiscal policy with tax collection taking place at source and instantaneously, making tax evasion a thing of the past. Of course, it will be difficult to deny the impact on commercial banks the wider adoption of digital currencies could have and even more the issuing of central bank wholesale digital currencies. We believe central bank digital currencies will coexist with private digital currencies soon and we expect the role of private issued digital currencies with wider adoption to expand and gain significant market share out of fiat money.

¹¹ China's c.bank to issue own cryptocurrency as soon as Nov – Forbes, <https://www.reuters.com/article/crypto-currencies->

[china-cenbank/chinas-c-bank-to-issue-own-cryptocurrency-as-soon-as-nov-forbes-idUSL3N2500QK](https://www.reuters.com/article/crypto-currencies-)

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