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LEVERAGING DECENTRALISED FINANCE FOR DATA-DRIVEN EDGE SYSTEMS: ASSESSING CRYPTOCURRENCY'S IMPACT ON FINANCIAL STABILITY (2008–2021)

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Abstract *The interval between 2008 and 2021 saw the emergence and swift advancement of cryptocurrencies, signifying a transformative era in the global financial system. Arising in the wake of the 2008 financial crisis, bitcoin contested traditional monetary systems by providing a decentralised substitute for government-issued fiat currencies. This paper analyses the progression of cryptocurrency markets, their growing impact on financial systems, and the consequent regulatory reactions. The emergence of stablecoins, decentralised finance, and smart contracts has revolutionised the cryptocurrency ecosystem into a sophisticated and intricate financial domain. Despite technical progress and increasing popularity, cryptocurrencies continue to provoke discussion over financial stability, monetary policy, security vulnerabilities, investor protection, and the potential for illegal activity. This paper examines the many regulatory strategies implemented worldwide, from complete prohibitions to measured acceptance, highlighting the absence of a cohesive framework for regulating digital assets. Moreover, it examines the increasing interdependence between cryptocurrency markets and conventional finance, emphasising the possible systemic ramifications. This research seeks to elucidate the impact of cryptocurrencies on financial policy and economic institutions by analysing their foundational principles, market dynamics, institutional reactions, and political economy, thereby facilitating future inquiries into their long-term ramifications. The paper examines the difficulties of reconciling financial innovation with systemic stability, investigating regulatory barriers and possible remedies. It underscores the necessity for progressive regulatory frameworks to maintain the relevance of monetary authorities in the advancing digital financial era.*

Keywords: *Finance, Digital Currencies, Cryptocurrencies, Bitcoin, Global Currencies*

INTRODUCTION

After the financial crisis of 2008, there has been a tectonic shift in the world of currencies with the coming of something new: cryptocurrency. Cryptocurrency, based on complex algorithms, is like money: it facilitates secure transactions. It is also a store of value that is trusted. However, it has no backing of any government, unlike national currencies that are trusted and accepted because of sovereign law. The Indian rupee has printed on it, under the signature of the Governor of the Reserve Bank of India, "Guaranteed by the Central Government" to show its sovereign status. Cryptocurrency, while widely accepted and trusted, has no such assurance. There is no 'fiat'. It is the underlying blockchain technology that is trusted[1]. The expanding cryptocurrency market and its impact on the formal channels have been eliciting academic interest, to understand the extreme interplay of non-conventional market participants in shaping the fast evolving and complex digital financial markets, without any governmental control or regulation. There has been an enhanced realisation that the changes taking place in the virtual currency world can have wider ramifications on the world monetary system in general and financial sector in particular. In the last 12 years, cryptocurrencies and

[1]A blockchain is a distributed database that permits secure transactions. See https://www.euromoney.com/learning/blockchain-explained/how-transactions-get-into-the-blockchain

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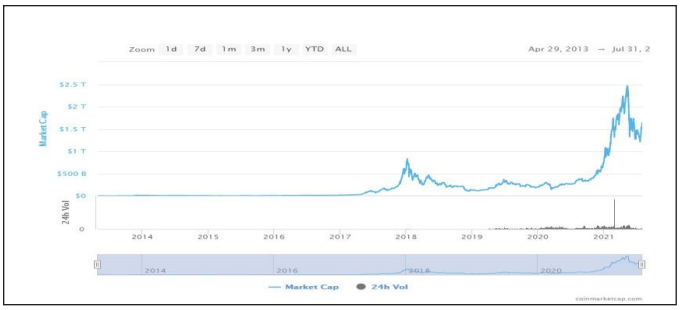
crypto assets markets have been fast becoming wider and deeper, at a time when the world economy is yet to attain normalcy (in terms of maintaining the pre-crisis rate of economic growth and financial stability), in the aftermath of the prolonged economic crisis. It was driven essentially by financial exposure to sub-prime assets, fintech-led derivatives, and worsened by regulatory interventions that did not have a methodology of handling systemic contagions as a priority area of regulation. The way the global financial regulatory framework has been reacting to the digital fintech transformation through cryptos, and their derivative-based products is rather intriguing, and a matter of concern given the regulatory response of the 2007–09 financial crisis, largely through quantitative easing. It is perhaps no coincidence that bitcoin emerged when the global financial crisis surprised global governments. While there is considerable expansion in the technologies that support the 'cryptocurrency market', as well as introduction of many cryptocurrencies with diverging functionalities and features, we are of the view that this is an opportune time for insightful studies that can enhance the understanding of the interconnectedness of the crypto assets to the financial system. Why has the cryptocurrencies market expanded so rapidly during the last three to four years and yet does not fall under a formal compliance framework? Why are the regulators across countries looking at it differently? How does the cryptocurrency generate returns, when, at the least, a few cryptos derive their values from the underlying legal tender monetary instruments like the USD or other legal tender fiats and ultimately who pays these returns in a market? What is the legal framework to deal with frauds and other IT security-related issues, when the currency is widely used as a 'fiat' currency – trusted, widely accepted – but not legal tender? What are the interlinkages between virtual assets and the regulatory fiats and how far can these linkages have a material impact on the monetary policy and financial stability, from the economist's point of view? What, if any, needs to be done (and by whom) for ensuring that regulation is forward looking, so that the monetary authorities stay relevant in a digital market? Although these questions are difficult to answer at this juncture, the purpose of this article is to bring to light the key issues that have been staring at the crypto markets and the regulatory responses to it, apart from discussing what steps need to be initiated to encourage financial innovations without compromising on financial stability.

THE CRYPTOCURRENCY MARKET

The world cryptocurrency market has been growing rapidly, and it is volatile[2]. It has no regulation or even regulatory restrictions. Since the creation of the first cryptocurrency, bitcoin, in 2008, the virtual currency market has added as many as 6,044 (as of July 31, 2021) cryptocurrencies, most of which are not as popular as bitcoin. There are products in the form of tokens, swaps, derivatives, and currency exchanges, attracting financial intermediaries, investors, IT companies like Facebook (through the cryptocurrency project Libra, announced in 2019), and several other 'unconventional' participants. The cryptocurrency market capitalisation has crossed the USD2.4 trillion mark across the world (Fig. 1) and keeps fluctuating. About 10% of global GDP has been estimated to be stored in blockchain[3], which is the digital channel of the virtual currency.



Source: coinmarketcap.com, accessed on July 31, 2021.

Fig. 1: World Market Capitalisation of Crypto Assets

This article focuses on 2008–21, a pivotal phase in the development of cryptocurrencies and their influence on the international monetary system. Bitcoin and the cryptocurrency sector came into being during the 2008 financial crisis, which began this era. Many people lost faith in conventional banks and government stimulus programmes after the crisis, which was caused by reckless financial lending and lax regulation. Given this context, bitcoin emerged as a decentralised digital currency with the goal of functioning autonomously from both governments and central banks. The bitcoin market saw dramatic shifts between 2009 and 2021. Altcoins like Ethereum (2015), which offered smart contracts and extended blockchain capabilities beyond payments, followed the steady acceptance of bitcoin in the early years (2009–13). Institutional interest, advancements in decentralised finance (DeFi), and rising public acceptance drove the exponential expansion of cryptocurrency markets between 2017 and 2021. During this time, governments and

[2] From 2014 to the beginning of 2018, oil prices did not change by more than 10% in one day unlike the value of Bitcoin which changed significantly – rising by 65% in one day and falling by 25% on another (Source: Bank of England. https://www.bankofengland.co.uk/knowledgebank/what-are-cryptocurrencies).

[3] A blockchain is a distributed database that permits secure transactions. See https://www.euromoney.com/learning/blockchain-explained/how-transactions-get-into-the-blockchain

financial institutions throughout the world were debating how to regulate digital assets considering the potential effects on monetary policy, financial stability, and investor protection. The crypto market's interconnection with conventional financial markets became apparent by 2021. The growing importance of digital assets in the financial system was further demonstrated by the emergence of stablecoins, NFTs, and CBDCs. Nevertheless, there were still unanswered questions regarding regulations, since different countries take different methods of taxation, monitoring, and compliance.

Thus, the years 2008–21, when cryptocurrencies were still a relatively small digital asset, are essential for understanding their meteoric rise to prominence and the difficulties policymakers and regulators had in striking a balance between financial innovation and systemic stability.

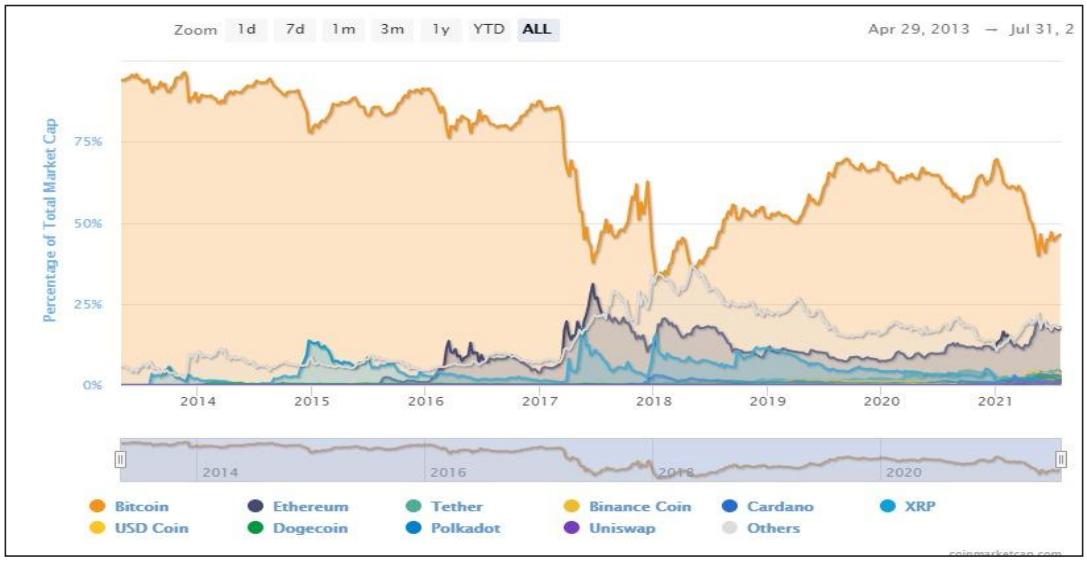
In India, a recent estimate showed that the cryptocurrency market has the potential to grow on par with the internet and would have created, in the absence of regulatory instructions, a market of about USD200 billion. The unconfirmed data indicate that during the years 2020 and 2021, about 1.5 crore (15 million) investors traded in cryptocurrencies in India. A look at the startups dealing with 'cryptos' shows many investors on the cryptocurrency exchange platforms for their investment and trading purposes[4]. The intriguing trend has been that the cryptocurrency market is growing during turbulence created out of confusing news of ad hoc regulatory interventions and clampdown signals on the one hand, and enhanced interests through participation by financial intermediaries and investors on the other. It is natural that a growing crypto assets market, especially outside the regulatory purview, can pose regulatory challenges as the increasing volumes of the virtual asset base can impact financial stability and fiscal discipline in its own (yet unknown) way. We are also not clear how the virtual currencies are becoming a concern of regulatory authorities – is it the cryptos, cryptocurrencies, or crypto assets. This requires a deeper analysis. Further, right now the legal framework that can regulate or provide a direction to the orderly growth, in either way, is lacking and it can have lasting impacts on financial intermediation and the traditional functions that the central banks perform. There are also issues relating to the ownership structure of the cryptocurrencies, whether the owners are institutions of repute, retail investors, or institutions of dubious backgrounds; the risk appetite of the investors; the way the regulatory authorities and the banks have been reacting to the market; and the nature of investors and their risk appetites.

Basics of Cryptocurrencies and Crypto Assets

Cryptocurrencies or virtual currencies are the currencies in digital form, and they are fiat money similar to the USD or INR, but the latter, although fiat, have sovereign guarantee. All currencies whether in hard or in electronic form are in general regulated by the designated authorities (central banks of the countries), being the issuer of such currencies, whereas in the case of cryptocurrencies (e.g., bitcoin, Ethereum, and many more), although they are digital currencies, they are virtual in nature, and issued to a specific environment (blockchain) by a private issuer for the transactions of peer-to-peer payments. Such currencies can be transacted by using digital wallets or through digital networks and there is no requirement of an intermediary like banks or an issuer such as a central bank. For instance, in the case of the most popular cryptocurrency, bitcoin (See Fig. 2), many complex cryptographic algorithms are used, their supply has been engineered to be limited in number and regarded as hard to counterfeit, as of now. The technology platform and the algorithms are subject to regular reviews for ensuring that they are capable of resisting vulnerabilities arising from information security threats (but the account can be hacked from an exchange house). They operate on a blockchain network and are designed for transacting without a third party like a central bank or a settlement mechanism. Bitcoin technology ensures that it cannot be released in unlimited numbers and the existing technology restricts the maximum number of bitcoins at 2.1 crore (21 million), out of which about 1.877 crore (18.77 million) has already been mined. Out of the 18.77 million mined, a few hundred thousand might not have got into circulation on account of misplacing of the unlock keys, or on account of the user not existing (like the dormant/inactive accounts of conventional banks) and on account of several other factors. Bitcoin cannot be printed but can be 'mined' by using hitech computers. 'Mining' is a term generally used to refer to the process of adding new bitcoin by solving computational requirements so that a ledger of transaction can be maintained to the cryptochain, for which the miners are rewarded with a few bitcoins, cryptocurrency. Miners refer to those engaged in the process of adding blocks to the cryptocurrency network, which on its own has become another business in many countries. Initially, the reward for mining was 50 bitcoins per block, the number has been consistently reduced, and as of now, the miner gains 6.25 bitcoins for every block added. The reduction has been to accommodate the lower inflation rate of the bitcoins. Given the fact that 1 bitcoin

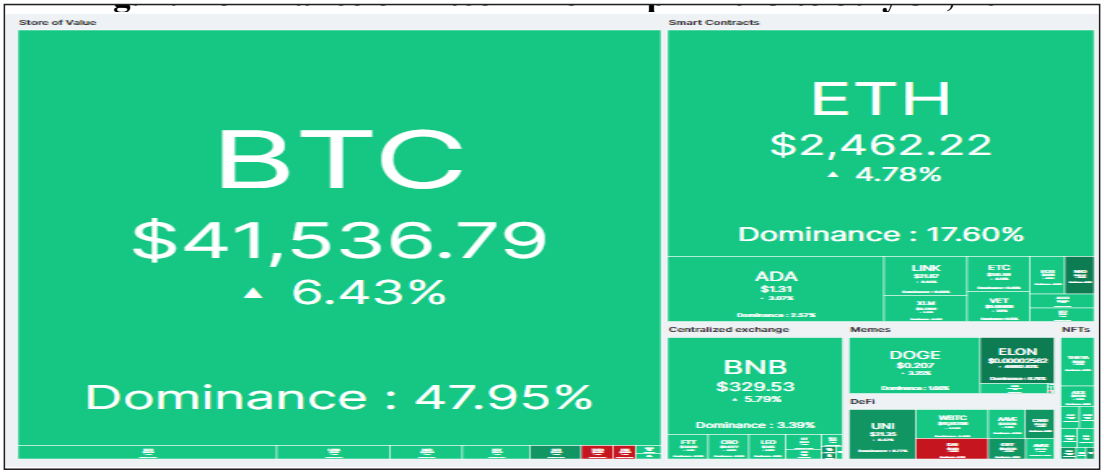
[4] As per the reports, CoinDCX has become India's first unicorn, which has raised USD90 million led by Facebook co-founder Eduardo Saverin's fund B Capital, valued at USD1.1 billon (August 10, 2021). Earlier, Mudrex, Bengaluru- and San Franciso-based crypto asset management (trading and investment) platform raised USD2.5 million.

equals USD41,536 (as of July 31, 2021, 9.41 p.m – Fig. 3), adding every block can approximately contribute INR1.92 crore (INR19.2 million (source: www.coindesk.com/price/bitcoin). The process of placing PCs (termed as rigs) is highly energy and internet intensive and can even impact the other segments in energy deficit countries, as the minimum power requirement can be approximately 1,000 kW. The interests of the internet industry and the issues relating to power supply in energy-deficit countries, although relevant, do not come under the purview of this paper; it can be another area to study.



Source: www. coinmarket.com

Fig. 2: Dominance of Bitcoin from April 2013 to July 31, 2021

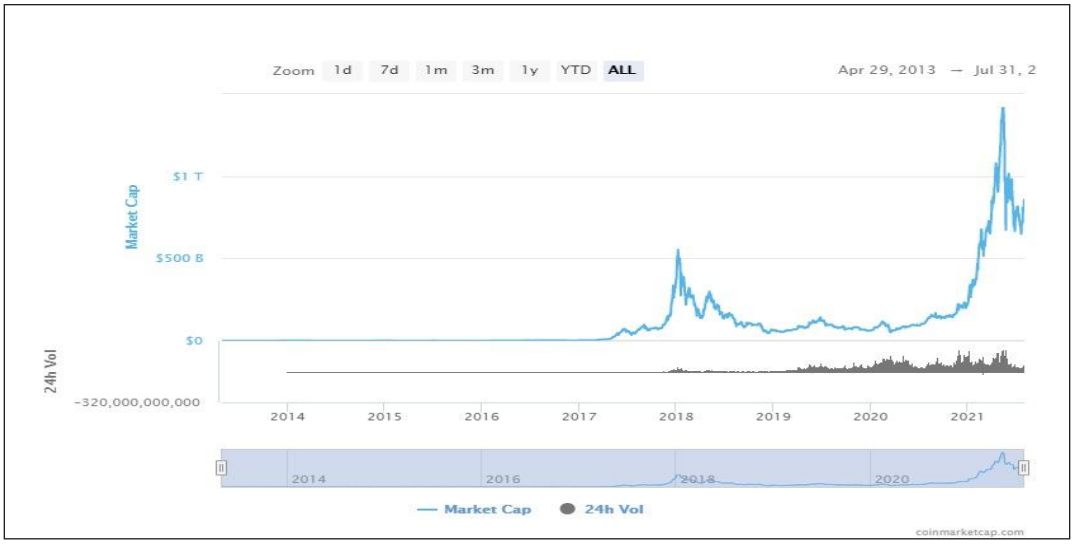


Source: www.coinmarketcap.com

(Note the wide variation in coin prices)

Fig. 3: The Dominance of BTC (Bitcoin) at 47.95% of the Market Share, ETH (Ethereum) at 17.60%, and BNB (Binance Coin) at 3.39%

An interesting development has been the widening of the crypto market with the emergence of a large number of cryptocurrencies. The market capitalisation of cryptocurrencies, other than bitcoin has been growing steadily during the last eight years (Fig. 4) and the growth has been quite steep during the last two years.



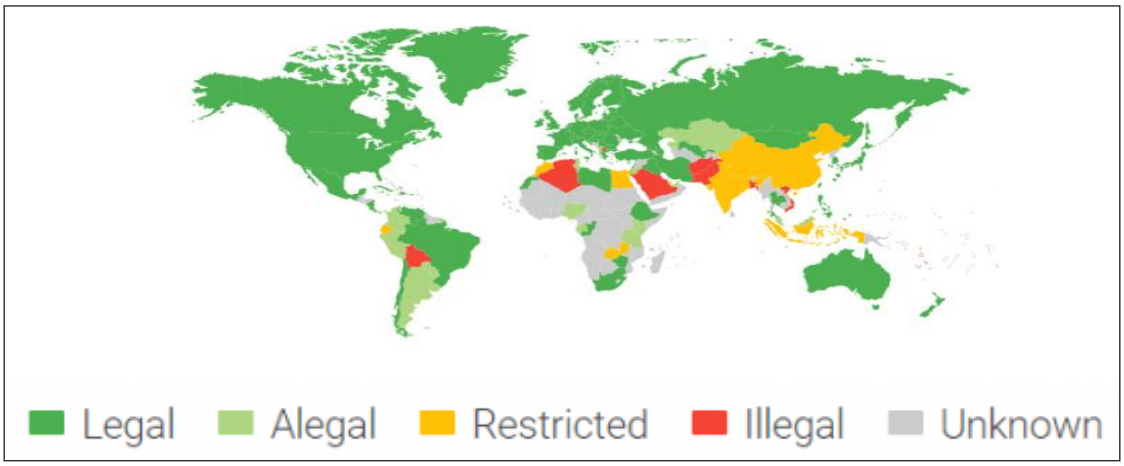
Source: www.coinmarketcap.com

Fig. 4: The Total Cryptocurrency Market Capitalisation, Excluding Bitcoin

Further, virtual currencies can also be represented in terms of crypto assets of tokens through which value exchanges; the identity of the true investor can therefore be masked. In the case of cryptocurrencies, the direct subscriber can be tracked through the verification of ledger, whereas in the case of different types of tokens, this task can be difficult. This is a feature and transaction process that goes against the kind of transparency that the regulators review from the KYC (Know Your Customer) Norms, PML (Prevention of Money Laundering) Act, and combating of financing of terrorism perspective as these are compliance requirements backed by international regulations. They are also the essential requirements and form part of the formal financial system. To meet with the investor interests, quite a few startups have emerged, and they have been adopting their own practices in the form of self-regulation in exchanging and trading cryptos such as dealing in cryptocurrencies based on government-approved KYC documents and income tax identification numbers like PAN (Permanent Account Number). Until the regulatory process considers these entities, they have the freedom to introduce their own systems. The investors who are taking risk by investing in the market are rewarded with returns; they must pay income taxes (either capital gains or tax on other incomes) that they receive, but the legality of the product as such has no certainty and at times legal. These aspects require enhanced clarity. A look at the customer distribution across the countries shows that the cryptos are being traded and invested across many countries. In a recent survey of 74 countries[5], it was observed that 32% of survey participants of Nigeria have made use of crypto services, the main intention seemingly to save on the cost of sending money abroad. The other countries in terms of the numbers are Vietnam (21%), Philippines (20%), Türkiye and Peru (16% each), Switzerland (11%), India (9%), China (7%), the US (6%), Germany (5%), and Japan (4%). In terms of concentration, in addition to Africa and Southeast Asia, Latin America has a growing concentration of crypto users. Thus, the users are spread across the world. While one may doubt the accuracy of the percentage of people using 'cryptos' and the relative ranking of countries in terms of usage, the point to be discerned is clear: there has been expansion across countries in terms of the market capitalisation, customer base, and services while the reasons for the expansion could differ across the countries. Nigeria witnessed a currency devaluation in 2020 and it has been witnessing rising inflation, high cost of fund transfer, and so on. In fact, the lower cost of fund transfer than the formal systems have been attracting many retailers to move to dollar-linked investment

[5]Bitcoin Beach Experiment: World's Biggest Bitcoin Experiment Is A Surf Town In El Salvador (ndtv.com). "It will bring financial inclusion, investment, tourism, innovation, and economic development for our country," President, Nayib Bukele. https://www.reuters.com/world/americas/el-salvador-approves-first-law-bitcoin-legal-tender-2021-06-09/

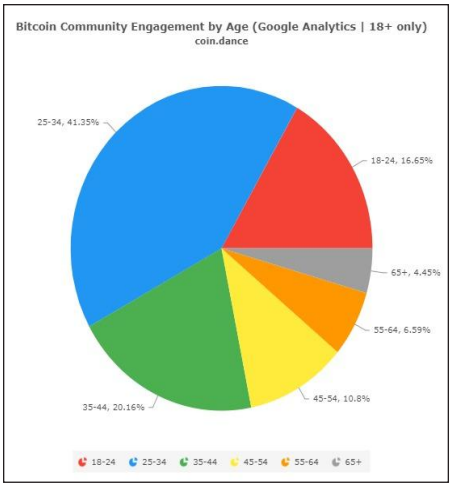
avenues that generate returns through bitcoin. The crypto assets and the cryptocurrency market have been growing with a multitude of currencies, products, and customers. As part of these developments, many currency exchanges and online platform services have come up to facilitate the customer requirements and quite a few of them are tech startups. Countries are following their own regulatory processes, and their approach on such exchanges has been a mix of passiveness, clampdown, regulation, and recognition. From the perspective of recognition to cryptos, at the top of the scale stands El Salvador, the first country that declared bitcoin as the legal tender as per a law passed by its Congress on June 9, 2021. It appears that El Salvador resorted to bitcoin as a solution to quite a few problems, such as to help Salvadorans living abroad to send remittances home[2]. Since El Salvador does not have its own currency, at present USD is its legal tender. It is either USD or bitcoin as of now. We have also seen countries such as Bolivia banned bitcoin and rejected cryptocurrencies in 2014; China has been imposing a clampdown on cryptocurrencies and their mining. In short, it can be legal, or illegal or restricted or Alegal (neither legal nor illegal) in countries across the world (See Fig. 5).



Source: www.coin.dance

Note: Alegal – neither legal nor illegal.

Fig. 5: Legality of Bitcoin



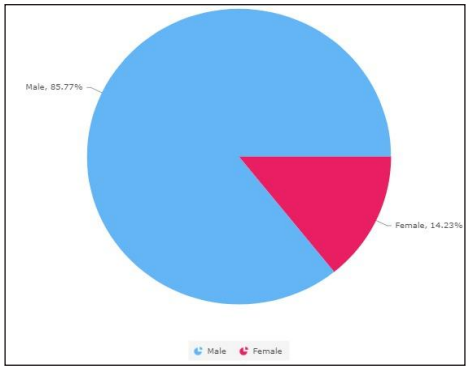


Fig. 6A **Fig. 6B**

Source: www.coin.dance (extracted on August 11, 2021)

Fig. 6: A & B. A Shows the Bitcoin Community Engagement by Age and B Shows the Bitcoin Community Engagement by Gender Based on Google Analytics

About 41.3% who are engaged with bitcoin were in the age group 25–34 years, 20.1% in the group 35–44 years, and 16.65% in the group 18–24 years. Around 37% were 18–34 years. In terms of gender, about 86% is males. Thus, the higher age group (above 45 years) has a lower percentage share of engagement in a way that augers well with the perceived risk positioning of the cryptos, in the sense that the risk appetite generally reduces with increase in age as the investors generally tend to be risk averse when they approach retirement age. Perhaps this pattern can be very similar to the stock market investments and that may not be surprising given the fact that those who invest always look for opportunities that can fetch better returns.

Derivatives and Complex Products

Over the last a few years, the cryptocurrency market has been widening and deepening with more instruments and market participants, as has been visible in the increased capitalisation figures, and many investors, particularly youngsters increasingly are getting into it. The trend of investing in crypto has been taking place among youngsters across India as well as being virtually driven by the internet, and being decentralised, like stock market investments. A common question is, can virtual currencies such as the cryptocurrencies market grow without having some kind of co-mingling with the formal legal fiats? Or in other words, has the market been expanding in isolation or merely due to its idiosyncratic characteristics? A look at the recent developments, especially the period 2019–21, showed that the cryptos have been emerging as a medium of exchange with other stable fiats, and is gaining momentum. The developments also show that the products are becoming diverse and their interlinkages with conventional fiat currency products and financial products are on the rise. In certain instances, although a limited number of currencies were planned to be mined, the continuous improvements in the algorithms and supporting medium of exchange have been ensuring that their volume can be driven through market factors, whereby fluctuations in values can be made orderly, which can further support the expanding crypto market and this may not be the end. Yes, a combination of factors boosts the market. Cryptos are gaining momentum as investors' choices have been driven by a few key factors: store of value, a product for speculative return, private ownership of the currency, and quick settlement process. The cryptos being generated out of complex algorithms have limited supply and their value unlikely to erode like fiat currency, offers considerable value over the period unlike their formal counterparts, central bank-led fiat currency. The cryptos have been generating returns far higher than the traditional asset classes like gold and stocks could offer. They are driven through private networks and therefore, no intermediaries for transactions and settlements are necessary. The internet, advances in IT, easy transferability through a dedicated private network have fuelled the crypto ecosystem that has supported expansion in the number of 'cryptos'.

Stable Coins

One of the recent developments in the evolution of cryptocurrency has been the emergence of 'stable coins' that can offer price stability, privacy with instant processing, and can be valued against other fiat currencies of legal tender. In this case, the market value of the cryptocurrency, 'stable coins', can be pegged against the value of an external reference such as USD or gold or a basket of currencies to minimise price fluctuations. Further, the price stability is achieved by managing the supply of the 'stable coins' against the underlying reference assets or its derivatives. Such coins are generally referred to as 'non collateralised algorithmic stable coins'. As has already been shown in the previous paragraphs, one of the criticisms against bitcoin has been the price fluctuation, which gets addressed by stable coins. he other variants to the stable coins can be from the way these coins are collateralised in the sense that the underlying reserves based on which the stable coins derive their price can be either 'fiat collateralised stable coin' or a 'crypto collateralised stable coin'. In the case of the former, a reserve of the legal tender fiat currency like USD is maintained and a proportion of the same is used to release cryptos, whereas in the case of the non-collateralised cryptos, the reserves are from cryptocurrencies. In such instances, the practice has been to provide higher degree of collaterals so that the minimum reserve proportion does not fall below the limit fixed by the issuer and works as a buffer to dealing with the extreme fluctuations. However, the approach to be followed for the determination of the minimum reserves, the basket of currencies or gold or cryptos to be taken, the validation mechanism, audit, assurance, and so on are other complexities that need to be investigated. The whole process of maintaining price stability with regard to the currency price movements can be achieved in crypto platforms without any human intervention by automatically adjusting to the price of the underlying assets and cryptocurrencies. The total market capitalisation of the 'stable coin' has reached more than USD100 billion, within this 'Tether' has a market capitalisation of about USD62 billion (See Fig. 7). Thus, the critical feature of stability is achieved by Tether.

Source: https://coinmarketcap.com/currencies/tether/

Fig. 7: The Market Capitalisation of Tether (Cryptocurrency)

Certain Issues

Generally, for any currency to yield returns, someone needs to purchase the currency at a higher cost than the invested price as cryptocurrencies do not generate interest, else the product must generate other income flows or must generate profits. Since the crypto assets on their own are unable to generate profits, just because of the limited supply, secure platform, and ease of transfer they do not necessarily generate such substantial returns as we have been witnessing in the marketplace. There must be a deeper analysis that can offer insights to understand how a currency that has no sovereign support, and is neither backed by any assets that can generate profits or cashflows could generate such abnormal returns. This issue assumes importance from the regulatory perspective as well. Since stability is a key factor that determines the value and reliability of a currency, the recent initiatives like stable coins and so on are welcome initiatives. Currency stability being the key feature that the regulatory authorities look in a currency, such products can have better regulatory acceptance. Conversely, in case of expectation of higher returns from a currency in the future, the public would like to hold the currency, in turn impacting their circulation. Despite the mechanism to stabilise prices, and in case the stable coins show a substantial jump in the prices, this would be yet another area of study.

While the underlying fiat or commodity-based stable coins address the price fluctuations, in the absence of regulation, validation and assurance processes of existing crypto architecture and methodologies can be potential risks. In the absence of required transparency, the issuer can have multiple options of dealing with the minimum reserves; one of the easiest ways is to back it up with a sub-prime portfolio or similar asset classes, and in such a scenario, we can have a repeat of the derivative-led crisis, perhaps in a smaller style. Several other alternatives are possible, that the investor must be guarded against. In this context, the recent initiatives of Tether have been assuring to the investors. The Tether website confirms that it is getting assurances from independent assurance firms and confirms that the reserves held for its digital assets issued exceeds the amount required to redeem the assets token issued. Tether also has launched a digital token backed by gold. Thus, there is diversification from the bitcoin types to more sophisticated varieties either backed by virtual currencies or fiats and other commodities. Tether terms its coin as the money built for internet that can offer the best of both worlds, as it has the advantages of blockchain technology and the traditional currency. These changes are interesting. Given there are thousands of cryptocurrencies, a lot them are not so popular like bitcoin or Tether, these currencies may be following their own methodologies, and these details would be difficult to be brought into this paper. One can probably discern that given the maturity in terms of technology, products, architecture, and administration, the regulatory agencies may have a huge task on their hand in understanding them, in case they would be interested in taking informed decisions on this market.

Blockchain Economies and Crypto Assets

The interaction between virtual assets and the fiat is something of interest to the economists and financial regulators. Towards this, we need to understand the

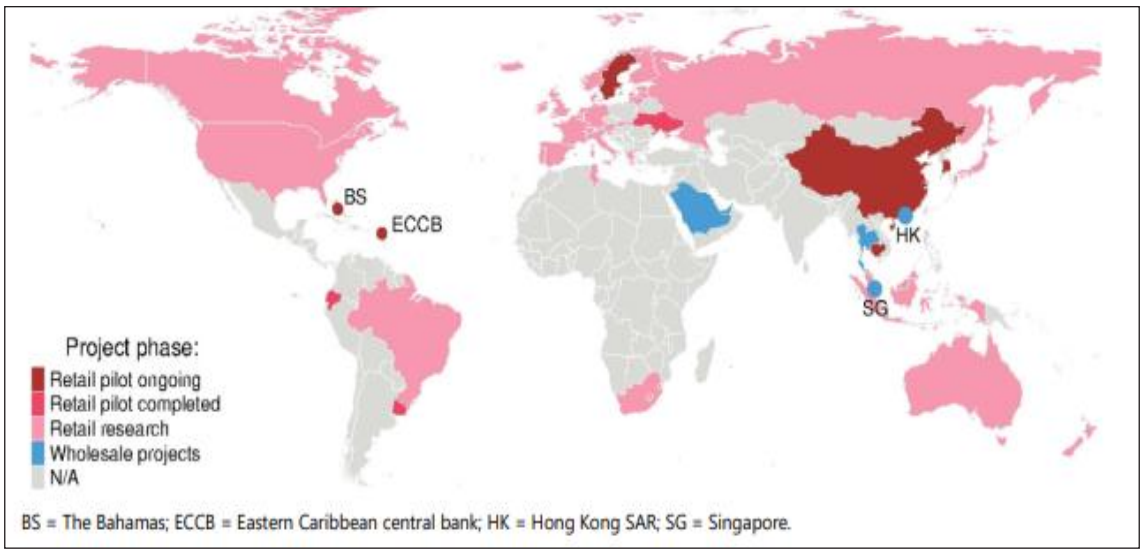
distinction between blockchain-based economies and crypto assets. Cryptocurrencies are a medium of exchange like the USD or INR and use encryption techniques that control the creation of digital monetary units. Blockchain technology is the platform that enables the generation of cryptocurrencies. Blockchain technology also allows the creation of digital assets (tokens) and decentralised applications (Dapps) in their specific environment. Cryptocurrencies can be bought straight away or can be bought as specific target-oriented assets. From an investor point of view, purchasing a cryptocurrency like bitcoin is like taking a stake in the earnings of the company that generates the coin, whereas buying a bitcoin token is intended for specific purposes; they are crypto assets. Depending upon the intention of use, the tokens can be used as payment currencies, privacy coins, utility coins, and so on. From the perspective of an economist, there must be enhanced focus on how the cryptocurrencies and tokens impact the financial system through the fiat (legal tender). From a financial risk management point of view, in addition to the financial stability-related issues, the whole set of issues ranging from hacking of the network and stealing of cryptocurrencies is important and hence has a wider scope of both blockchain network and crypto assets. From an investor perspective, the fiat money can be deposited into the e-wallet opened with the crypto exchange and the money can be used to buy crypto assets. Similarly, the returns can be either in the form of cryptos or can be converted back to fiats (availability of currencies depends on country-specific regulations) to make it clear that the cryptos are linked to the fiats. However, beyond these concerns, just having cryptocurrency can also expose the investors to the risk of theft, as hackers can penetrate the computer networks that maintain the crypto assets and e-wallets. One high-profile exchange declared bankruptcy in 2014 after hackers stole hundreds of millions of dollars in bitcoins. These are not the typical risks for investing in stocks and funds. One of the biggest cryptocurrency thefts has taken place recently on the blockchain based-platform, Poly Network, where hackers stole USD613 million worth of crypto assets. Since the identity of the hackers was not known, Poly Network has made an open request, and the hackers have returned USD260 million (as of August 11, 2021). Despite the complex blockchains and cryptos, the wallets that store the cryptos can be compromised and would be difficult to trace. To whom do investors complain in case the country has not yet accepted cryptos? These issues need to be addressed as part of the formalisation of the cryptos.

INSTITUTIONAL RESPONSE TO CRYPTO MARKET

The technology-driven fast-paced developments in the crypto market have been responded to by many institutions in their own ways. Many central banks across the globe have been experimenting with their own research projects either to intervene or to introduce alternative products. Taking advantage of the market sentiments, financial corporations are also in the fray. J P Morgan a few days back announced the launching of its own digital coin and has given access through fund investors; Facebook has launched Project Libra and has been debating on the different models of cryptocurrency market that integrates tokens, payment systems, and many more. Bank of America has created a team to investigate the whole virtual currency space. The US Federal Reserve has been worried about the impact of the cryptos on the financial stability. In early July 2021, China's People's Bank of China launched a regulatory crackdown on mining establishments, adversely impacting the cryptocurrency market by billions of dollars. In India the RBI (Reserve Bank of India) circular dated April 6, 2018, prohibiting the entities regulated by the RBI from dealing Virtual Currencies was struck down by the Honourable Supreme Court of India on March 4, 2020, citing 'disproportionality' and, for the RBI not considering availability of alternatives. The petition in this case was filed by the Internet Mobile Association of India, and shows how the wireless technology market has a stake in an otherwise complex financial market. The complexities in the marketplace are also enhanced by the interplay of computer engineering, blockchain, internet, fintech companies, monetary authorities concerned with financial stability, and so on. Although the central banks world over have been warming up to comprehend the areas that they need to intervene in, the market would require orderly regulation through an in-depth understanding of the processes and technology, which protects the investors and ensures financial stability. This is a challenge to the regulatory process. The regulatory efforts must be complemented by a learning process of digital governance from a regulatory perspective. This is seemingly overdue.

Central Bank-Led Digital Currency

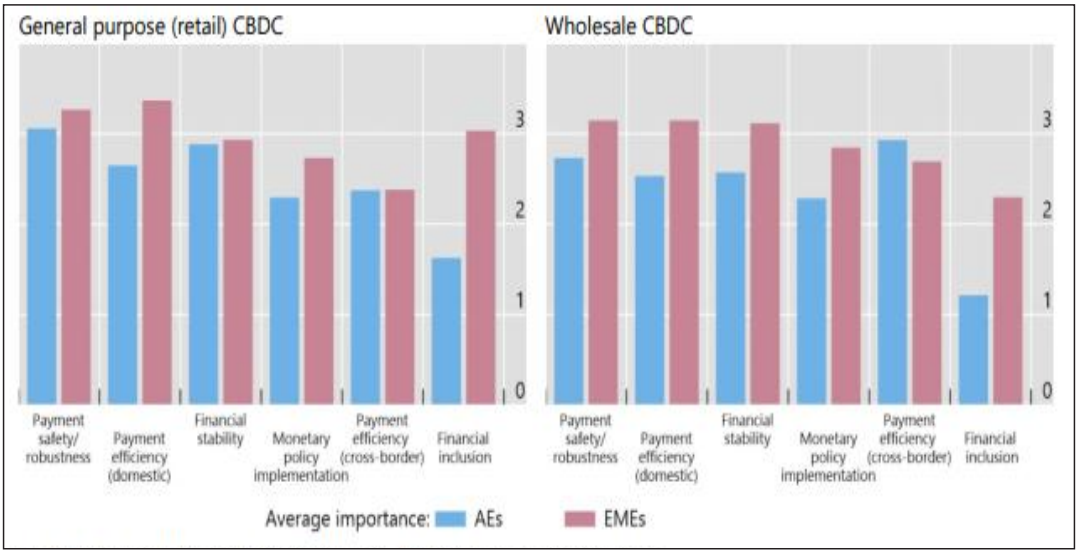
One of the ways the central banks try to respond to the market has been to introduce a central bank-led digital currency (CBDC). Although on the drawing board the CBDC will be like fiat money, in digital form, it will be operated either through a centralised or a decentralised ledger system.



Source: BCBS working paper No 880. Pg 7. August 2020.

Fig. 8: The CBDC Project Status of Central Banks

The regulatory comfort stems from the view that they can continue to be the monopoly issuer of cash, like fiat money. They are a true digital legal tender. This would also ensure better financial stability outreach by the central bank and can offer compliance from the KYC and AML point of view. Recent reports indicate that the RBI is also proposing to introduce its own digital currency, and the timing suggests that this can possibly counter the cryptos. The fundamental structure of the CBDC can bring about major changes in the deposit holding structure, intermediation, and payment systems.



Source: Reproduced from BCBS working paper No 880. Pg 9.

Note: AE – Advanced Economies; EMEs – Emerging Economies.

Fig. 9: A Graphical Representation of the Motivations for Issuing a CBDC

As evident from Fig. 9, the very important purpose of introducing the CBDC has been to ensure payment safety/ robustness, payment efficiency, and financial stability across the retail and wholesale uses. Our considerate assessment is that a CBDC although helpful for achieving faster payments and settlement processes and last mile tracking of transactions, unlike cash, from the perspective of settlement process, may not add much value to countries that follow a real-time electronic settlement system like India. Nonetheless, much depends on the way in which the CBDCs are introduced and the type of cryptocurrencies dominating each country. Yet another key change that CBDC can bring forth has been the ability of the financial intermediaries to accept and hold deposits, which will considerably vary depending upon the ledger system that the CBDC follows. In general, CBDCs are directly linked to the ledgers and in that case the deposit function of commercial banks with respect to CBDC would impact to that extent, with commensurate increase in the risks. Central banks also need to categorise the monetary structure in which the digital currencies can get classified, either in the M0 or M1 categories. In general, M0 categorisation is the central bank money or monetary base or in other words currency in circulation plus the deposits of commercial banks with the central bank. Whereas the M1 category, also known as narrow money, comprises currency with the public and the demand deposits of the public with the banks and other deposits with the banking system. Since the digital currency transactions can be tracked, regulatory authorities will have complete control over the money supply and its circulation process, which will enhance the oversight function. In a fast-integrating digital world, the CBDC as a currency will strengthen the compliance-related aspects. During this process how the privately held cryptocurrency market will fare is something time will answer. Yet, there are concerns CBDC perhaps may not fully address. How the CBDCs would ensure store value unlike the fiat currency, which apparently has been the key driver of speculative market making of the cryptos, is not clear. When CBDC is brought in as a replacement to the cryptos, easy exchange with fiat currency can dampen the speculative opportunities for the investor. The cryptocurrencies involve critical steps like (in the case of bitcoin, for example) the process of mining, blockchain transactions and tokens for ensuring anonymity. Satoshi Nakamoto, the creator of the first and the most popular cryptocurrency, bitcoin, said, "What is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party." When the central banks become the third party, probably many investors who are unwilling to disclose their identities might not form part of the market. Overall, we need to wait and see how the cryptocurrency market will be reacting to CBDC.

CRYPTOCURRENCY MARKET AND POLITICAL ECONOMY

Ever since globalisation and digitisation, fintech-led expansions have deeply influenced the financial markets. The 2007–09 financial crisis was a sub-prime crisis, and a financial derivative-led crisis, which resulted in the run on many banks and ultimately made several sovereigns go into deep financial distress. The elaborate regulatory process was criticised for not being proactive as they could not adequately assess the underlying risks and could ensure capital adequacy ratio commensurate with the risks taken by the institutions in their books. In a sense, the financial crisis was also a fintech-driven crisis. The financial system including the regulatory mechanisms has learnt many lessons, introduced Basel III norms, and the most important one in this context has been the norms regarding assessment of the risks being posed by the financial derivatives, placing limits on balance sheet leverages, introducing stricter conditions to be treated as eligible capital funds, introducing stricter measurement norms on capital adequacy assessment by the regulator, and so no. The regulatory agencies have also introduced systemic risk surveys, stress testing exercises, and a yearly financial stability report, which can forecast the emerging systemic and contagion risks, apart from identifying systemically important financial intermediaries. While the regulatory response to the systemic risks can be yet another major area of research, from the view of the issue of cryptocurrencies, yet another notable factor that has contributed to the sub-prime crisis was the deployment of idle petro dollars into the banking system, which has also significantly landed up into sub-primes. This context assumes relevance, given the reality that the cryptocurrency market has the features of private networks in virtual environments, and they are out of regulatory oversight, at present. An abnormal speculative return has the potential to attract substantial investments across the globe. At this juncture we do not have data to show the volume of petro dollars that flew into the cryptos; given the limited investment avenues, one cannot rule out its presence. During the period of the global COVID-19 pandemic when the markets continued to be sluggish, perhaps, a lot of such investments could have got into cryptos. There can be many other assumptions. Global market capitalisation of USD2.4 trillion dollars may not be big enough, not a smaller share either, or they have the potential to increase further, given the neoliberal phase of the development process.

The recent developments suggest that the financial corporates are showing keen interest in cryptos either by introducing their own products or through opening investment channels to their wealthy customers. The financial corporates can get substantial benefits from such newer investment avenues, and they would be at their ease given the fact that they

offer the most sought-after rewards: higher returns and secrecy of the transactions. We are also not sure whether this can justify the rather confused and delayed positioning by regulatory agencies across countries. Certainly, many financial institutions are showing considerable interest in this market. The social media giant Facebook has been developing 'Libra', a global virtual currency project, and this would integrate savings banks, virtual currencies, payment systems, and perhaps many more features and has the potential to become a modern virtual bank. This can position the virtual currency market at an entirely different league.

It will be equally interesting to see how the neoliberal regimes respond to the corporate cryptos and their participation in cryptocurrency trading. As of now, many of the developed countries are yet to make up their mind either to clamp down on or to promote this market. In this way, the policy outcomes can become yet another test of neoliberal monetary policy. Suppose the corporates develop substantial stake in the cryptos market, the regulators may have to give way, and that has been the world order of our times. The recent reports suggest that the G-7 and G-20 meeting of the finance ministers have been discussing on how to arrive at a global minimum corporate tax based on an 'Inclusive Framework on Base Erosion and Profit Sharing', wherein as part of the framework, 130 countries are also engaged in the discussions. Perhaps an approach like that can offer much in terms of developing an orderly cryptocurrency market as this can avoid compliance issues arising out of international financial transactions (Ahmad, 2013). The other alternative will be to use the BCSB (Basel Committee of Banking Supervision) platform for arriving at a consensus approach among the central banks and develop rules. While the confusion persists, we are of the view that a post-COVID pandemic market revival would see actions, either triggered by the private financial corporation or by the tech firms driving the fast payment services or by the governments.

REGULATORY DIRECTIONS KEY TO CRYPTOCURRENCY MARKETS

The increasing volume of market capitalisation and investors make regulatory interventions inevitable and there is nothing unusual to bring order in the crypto market. However, there are critical issues the regulatory mechanisms need to take into consideration while pursuing the key objective of financial stability. The most important aspect has been value creation from the virtual world of cryptos. Is this due to limited availability of cryptocurrency, or due to the investment of ill-gotten money, or investments as part of the 'layering' process of money laundering? This requires a review. There is a need to go bottom with the value creation in the cryptocurrency market. The next key issue has been the linkage between crypto assets and the financial system. Today, the returns from the cryptos can be easily transferred into leading currencies such as the USD and therefore to other major global currencies. Like the estimate of the non-resident fund flows, a review of the fund flows needs to be initiated starting with the crypto exchanges. The cryptocurrencies and its linkages with financial technology platforms such as fast payment systems (FPSs) require deeper understanding as the linkages between digital currencies with the last mile FPSs can have a wider impact on the future financial systems and this has implications for spreading risks at a faster pace. As of now, the FPSs make use of a large amount of customer data and, if their sponsors, given an opportunity, can access the cryptocurrency market, this can have a significant impact. The abnormal returns that the cryptos are generating in an unregulated speculative market, unlike the asset classes such as gold and equities, warrant a deeper analysis to understand the factors that attract and trigger investors. While the need for compliance review for using cryptos as a medium of exchange is most critical (as this would mean cryptos as digital money as a public good), in case the cryptocurrencies cease to exist as a medium of exchange, it will have its own adverse impact on the investor community. Since transactions do take place across geographies, mechanisms need to be evolved for tracking the transactions beyond geographical jurisdictions. The impact of cryptos on the financial exclusion-related aspects is to be investigated in case the investor size increases as the transactions are enabled through internet/power supply. The crypto exchanges and their compliance and reporting requirements also need review. All these interventions require a non-conventional and proactive approach to supervision. In India, a committee was constituted in 2017 to study and propose specific actions to be taken in relation to virtual currencies. In its report submitted in 2019, the committee recommended banning virtual currencies and argued for a distributed ledger-based virtual currency to be piloted by the RBI. We are yet to see the final policy directions. However, given the global advancements in financial digitisation, the emerging policy directions will also depend on how other country regulators will be looking at this segment.

Virtual Currencies to Virtual Banking

The rather divergent regulatory responses across the world show complexity in addressing the issue on hand. At the same time, the market has been growing during regulatory inaction and passiveness. Since digitisation has been

taking place at a rapid pace across the globe including in the financial sector, the market needs bolder and forward-looking initiatives. One of the approaches the regulatory process can follow is to assume that banking intermediation has the potential to become virtual in the coming years. In this case, rather than resisting the virtual world, would it not be appropriate to embrace the change? Emergence of virtual banking is a possible reality in the days to come. This is a reasonable assumption given the reality that social media platforms are getting into virtual currency markets (Sana et al., 2016). Some of the virtual currency platforms can get integrated with conventional banks to become virtual banks as they can have synergies in payment settlements, investments, trading, savings bank functions, and so on; this can be yet another possibility. Similar combinations are possible from an entirely new set of market entrants. Some of the FPSs can also form part of the virtual banking network in case they can develop a stake in the virtual currency platforms, which is a clear possibility and perhaps such a move would have already been in the offing. From the perspective of financial risk management, the stable coins backed by fiat reserves poses financial risks very similar to the risks arising from the usual demand deposits of conventional banks. Being the intermediaries, these on-demand deposits in general are placed in asset classes that have different risk profiles in terms of liquidity risk, counterparty risk, and maturity risk. Other than the key aspect of virtual platforms, the risks are almost similar, at least in such products. Both the systems use fiat money, one is legal and the other illegal, as of now. Rather than avoiding the risks, the reward lies in better appreciation of the risks and their management, so that the intermediaries will be able to seize opportunities. Similarly, a closer look at a digitised form of a bank with an integrated financial intermediary role can have similar synergies emerging. This would open space for the regulatory process to work. From the perspective of systemic risk, an integration of different fintech service providers can pose systemic issues, which the regulators need to ensure order. Our considerate assessment is that the fintech-driven financial risk and information security risk including the risks relating to IT systems and cross-border fund transfer risks would assume considerable prominence in the days to come and this is the context in which the regulation of virtual currencies is to be viewed (Mangala et al., 2015). For the present, in case the investor has a grievance on the services provided by the exchange houses that deal in cryptos, and in case of any issues relating to the wallets being used, the legal recourse does not look clear. Perhaps a comprehensive law is needed today to promote or regulate e-wallets of cryptos, even as a separate entity. There can be greater security risks from exchange platforms, which can also include theft of customer data and missing wallet keys. There must be efforts to understand the changes to be affected in the nostro accounts in case the cryptos have their own currency settlement mechanisms with respect to cross-border transactions. All these processes would lay brickworks for brickless banking in the future. Among the alternatives available, one of the quicker alternatives has been a legal clamp on the virtual currency and crypto assets, as they are anyway not the legal tender. Since the issuer of the currency has been the historical monopoly of the financial regulatory authorities, the virtual currencies emerging as a medium of exchange can pose challenges to the monetary authority. The obvious explanation for a ban on cryptocurrency/virtual currencies has been justified for the impact that it can have on the monetary system and therefore on financial stability. Since the primary driving factor for a crypto ban is, seemingly, to ensure financial stability, we are not sure such a ban can ensure financial stability and perhaps, not necessarily. The internet led digital fintech's open up newer ways of financial intermediation, newer products, and methods for value creation; if the value exists for the investors, the markets thrive, and most certainly in a digital world, irrespective of the ban. These traditional tools did not work in the past and may not work in the future as well. Further, given the emergence of crypto stable currencies, significant market capitalisations, and emerging innovations, such a move might create 'work arounds and a thriving parallel system, which can also have its own challenges to the financial stability. The most critical thing to do at this stage is to study how the virtual currencies create speculative abnormal values, when most of them are neither backed by securities, nor supported by cash flows and income. This can offer valuable leads.

CONCLUSION

A regulatory framework on cryptos therefore must be preceded by a learning process through an embedded regulatory review driven by a team of experts from the fields of computer and financial engineering, financial risk professionals, data scientists, information security experts, and big data analysts, among others. The regulatory agencies need to work in parallel, before being overwhelmed by the market size. The regulatory interventions cannot be like the concurrent audit process of the mark to market transactions of treasury. Rather, an embedded supervisory process argues for learning first through passive participation and a detailed methodology must be worked out in this regard. There must be simulation and stress testing of the outcomes based on assumed scenarios to assess the impact on the financial system. There must be processes to monitor the

existing fast-fintech payment service providers whose integration with the cryptocurrencies can pose challenges. When social media gets into banking services, the impact needs to be studied through simulations and stress testing. Perhaps the time is ripe for a Basel IV norm that can include non-financing and technical firms that have a large public database as potential segments that can fuel systemic risks. Electronic systems can quickly trigger systemic risks without the participation of international economies, especially when cryptos can be traded with regulatory fiat money and the payments can be settled through private networks. In such a situation whether the traditional scope of the nostro accounts might require a review. From the investor point of view, there must be awareness campaigns regarding the risks and uncertainties of virtual currency trading through appropriate campaigns especially the aspects relating to compliance risks and the source of value. Given substantial economic values the cryptocurrencies have already brought in, proposing to ban the private crypto market purely based on the legality of currency issue, especially when the other alternative products that can store value as such has not been introduced, might be construed as too much conservatism, a way of risk avoidance, and even missing out on a learning opportunity. A clear understanding of the process can open leads on the factors those folk investors. A study of the investments and their returns and how the cryptos get integrated into the formal system through the legal fiat can offer insights from the perspective of financial stability and therefore, can support a sound regulatory framework that can promote or limit cryptos. However, a sound and balanced regulation is something that the financial market is looking forward for adding economic value. One must wait and see how far the regulatory bodies would stretch their risk appetite for maintaining financial stability by protecting the investor interests. Our considerate view is to develop a virtual regulatory review mechanism that can be adapted to the emerging virtual environment, including virtual banking. This would require substantial changes in the way central banks function.

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REFERENCES

Auer, R., & Tercero-Lucas, D. (2021, July). Distrust or speculation? The socioeconomic drivers of US cryptocurrency investments. BIS Working Papers No 951, Monetary and Economic Department.

Mangala, D., & Kumari, P. (2015). Corporate fraud prevention and detection: Revisiting the literature. *Journal of Commerce and Accounting Research*, *4*(1), 35–45.

Sana'a, N. M. (2016). Recognition and measurement obstacles of the conceptual framework of financial accounting underlying e-commerce business. *Journal of Internet Banking and Commerce*, *21*(1), 1–20.

Ahmad, M. A. (2013). Effect of e-commerce on accounting information system, computerization process and cost productivity. *American Journal of Computer Technology and Application*, *1*(1), 1–6.

BIS. (2021, June). Consultative document prudential treatment of cryptoasset exposures. Basel Committee on Banking Supervision.

Auer, R., Cornelli, G., & Frost, J. (2020, August). Rise of the central bank digital currencies: Drivers, approaches and technologies. Monetary and Economic Department, BIS, JEL classification: E58, G21. Working Papers No 880.

BIS. (2021, June). CBDCs an opportunity for the monetary system, annual report (pp. 65–95).

Brunnermeier, M. K., James, H., & Landau, J. P. (2019, August). *The digitisation of money* (pp. 1–31). Princeton University.

Department of Economic Affairs. (2019, February). Report of the Committee to propose specific actions to be taken in relation to Virtual Currencies. Govt of India, New Delhi.

https://www.coindesk.com/price/bitcoin

https://economictimes.indiatimes.com/markets/cryptocurrency/top-cryptocurrency-prices-today-ethereum-dogecoin-and-polkadot-shed-upto-7/articleshow/84258186.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

https://www.statista.com/chart/18345/crypto-currency-adoption/.

Chandrashekhar, C. P. (2021). *The global minimum corporate tax: not high enough, not fair enough.* Retrieved July 23, 2021, from https://www.theindiaforum.in/article/global-minimum-corporate-tax-not-high-enough-not-fair-enough

Retrieved August 7, 2021, from https://www.economist.com/leaders/2021/08/07/why-regulators-should-treat-stablecoins-like-banks?frsc=dg%7Ce

Bruhl, V. (2020). Libra - A differentiated view on Facebook's virtual currency project. *Intereconomics, 55*(1). Retrieved from https://www.intereconomics.eu/pdf-download/year/2020/number/1/article/libra-a-differentiated-view-on-facebook-s-virtual-currency-project.html

Bitcoin Law - Wikipedia

Bitcoin Beach Experiment: World's Biggest Bitcoin Experiment is a Surf Town in El Salvador (ndtv.com)

IMF warns against widespread crypto adoption; says its 'most direct cost' is to macroeconomic stability - The Financial Express

https://cryptonews.com/guides/countries-in-which-bitcoin-is-banned-or-legal.htm

https://tether.to/

https://tether.to/wp-content/uploads/2021/03/tether-assurance-feb-2021.pdf

https://www.nerdwallet.com/article/investing/cryptocurrency-7-things-to-know#

https://www.statista.com/statistics/863917/number-crypto-coins-tokens/

Endnotes

[1] https://www.statista.com/global-consumer-survey has made use of about 1,000 to 4,000 respondents per country and the survey was carried out in online mode.