THE USE AND ADOPTION OF CRYPTO ASSETS[*]

Silvia Bartolucci (Imperial College London),
Demelza Hays (University of Liechtenstein and Incrementum),
and
Andrei Kirilenko (University of Cambridge and CEPR)

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Opening remarks

Bitcoin, the direct ancestor of all existing crypto assets, was born in the aftermath of the global financial crisis and the unconventional monetary policies that followed. At that turbulent time, Bitcoin was presented as a global digital currency outside the domain of central banks or, for that matter, any third party (Nakamoto, 2008).

The price of Bitcoin's has since exhibited the booms and busts more present in physical commodities such as gold and crude oil. For example, in January 2017, Bitcoin was trading at around $1,000; by December it traded at the all-time high of more than $19,500. By the start of January 2018, the market was approaching a total capitalization of almost $1 trillion. However, the tides turned in January 2018, as it initiated a steep descent wiping out most of the gains made in 2017. The 2018/19 bust from peak to trough has lasted 405 days, which made it the second largest bust after the 2014/15 bust, which lasted 420 days.

The drop in price of Bitcoin also coincided with a significant decrease in its usage for payments. According to Chainalysis, by September 2018, Bitcoin payment transactions had dropped by 80% from a high of $427 million in December 2017 to $96 million. Yet, Bitcoin has survived the booms and busts and as of recently, its market capitalization, per Coinmarketcap data, is well over $100 billion. Meanwhile, during the decade that Bitcoin has been in existence, many other types of crypto assets from utility tokens to stable coins have come into being, including, most recently, Facebook's Libra.

This paper looks in the existing literature for answers to the following questions:

- What are the key attributes of crypto assets that have been *supplied* so far?
- What are key determinants of the *demand* for crypto assets?
- Is there a framework for analyzing the *adoption* of crypto assets?
- What are the *barriers* to mainstream adoption?

Supply

Desirable attributes promoting crypto use and adoption include scarcity, anonymity, and immutability among others.

Finite Supply

One of the factors contributing to a rise in popularity of crypto assets is a built-in finite supply. The aspect of finite supply rules out the possibility of inflation. Currencies controlled by central authorities are often subject to arbitrary inflation, especially in emerging economies (Folkinshteyn & Lennon 2016). But due to the absence of influence from third parties, crypto assets are not subject to inflation or dilution resulting from policy changes (Magro, 2016).

Anonymity

Use of crypto assets does not require access to sensitive personal information. Rather, users create pseudonymous or anonymous digital addresses for transactions without any link to their

real-life identities. Some crypto networks use advanced techniques to hide the origin of transactions and amount transacted (Joancomarti, 2014). Thanks to this feature, the use of digital currencies is particularly popular in such areas as the online gambling, gaming and betting industry, where anonymity is highly valued (Gurguc & Knottenbelt, 2018).

Immutability

Transactions on public distributed ledgers such as Bitcoin's blockchain are irreversible. This is in contrast to the reversibility of trade and securities transactions.

Transparency

Transparency is yet another important attribute of major crypto assets (DeVries, 2016) because every user can view every transaction on the public ledger. Though it is not easy to identify a wallet owner outright, advanced deanonymization techniques used by blockchain analysis companies can help identify wallet holders. While transparency offered by public platform crypto assets such as Ethereum is insufficient to satisfy KYC/AML requirements, such crypto assets as EOS and Stellar have the potential to satisfy KYC/AML.

Demand

Demand for crypto assets is driven by the increasing use of online payments, globalization, and high cost of established financial services.

Online transactions

Payment solutions for online transactions are evolving to keep pace with technology. Cash is gradually being phased out: this system presents severe limitations as—in order to correctly function—the parties involved in the exchange needs to be physically present at the same location. Crypto assets, and crypto currencies in particular, have opened up new avenues for spending facilitating smoother cross-border e-commerce transactions. The core principle of e-commerce is to offer optimal versatility so as to suit the diverse preferences of a global customer base (Polasik, Piotrwoska, Wisniewski, Kotkowski & Lightfoot, 2015).

Prior to the inception of cryptocurrencies, payment methods for this type of business relied on trusted third parties. As such, the industry had a dire need for a cash equivalent facilitating irreversible, direct settlement. In the recent past, crypto transactions in the industry have been on the rise. For instance, during the second quarter of 2015, online shopping accounted for at least 23% of all BitPay-processed transactions (Kasiyanto, 2016).

Digital currencies have the potential to significantly improve the future conduct of online commerce. And as e-commerce continues to thrive, so does the potential of digital currencies to extend their reach and achieve critical mass. In 2017, retail e-commerce sales worldwide amounted to 2.3 trillion US dollars and e-retail revenues are projected to grow to 4.88 trillion US

dollars in 2021. The top 3 online stores' revenue amounted to almost 100 billion US dollars in 2017.[1]

Online shopping is one of the most popular online activities worldwide but the usage varies by region - in 2016, an estimated 19 percent of all retail sales in China occurred via internet but in Japan the share was only 6.7 percent.[2] Desktop PCs are still the most popular devices for placing online shopping orders but mobile devices, especially smartphones, are catching up.[3]

Crypto assets that are stable and have low transaction fees are also well-suited for micropayments as they eliminate the inconvenience and security risk of submitting credit card data for every minor transactions (Spilka, 2018). In certain cases, merchants have been put off by the high fees associated with low-cost transactions on traditional systems (Roos, 2015). With lower fees, higher security and fast transaction processing, more businesses could adopt micro-transactions using crypto assets (Spilka, 2018). This shift could enable new business models. For instance, browsers started to offer ad-blocking services by automatically paying websites visited by users. According to Business Insider, micropayments may help solve a series of issues faced by online content providers, related for instance to digital music and app purchases.[4]

Fundraising

Ethereum has led to the rise of an alternative fundraising model. Though these are often associated with fraud and poor investor protection, they have created new capital flow pathways with broader investor access. Creating digital representations of assets can reduce the costs and level of friction associated with management, transfer and issuance of traditional assets. They have therefore helped to enhance liquidity and transparency in the life cycle of such assets (Nagaraj, Hunter & Captain, 2018). These practical applications of the technology are highly likely to remain relevant and foster adoption.

ICO funding has also fostered the adoption of crypto assets in spite of the bad press that has resulted from scams in the sector. Lowering of the entry barriers for funding helps startups bypass early seed investment rounds or use crowdfunding in addition to early seed investment. Interestingly, ICOs have not eliminated traditional venture capital but made them adapt and evolve (Town, 2018). Start-ups raised $ 5.5 billion worldwide in 2017 by issuing tokens in the framework of ICOs – and this year the total amount has already swelled to $14.3 billion.[5]

Remittances

In 2018, migrants scattered worldwide sent upwards of $613 billion to their home countries (Huang, 2018). However, the use of traditional banking services also means high transaction fees and slow processing. The Philippines, which is one of the world's top remittance markets,

[1] Data available at https://ecommercedb.com/en/ranking/ww/all.
[2] https://www.statista.com/statistics/255083/online-sales-as-share-of-total-retail-sales-in-selected-countries/.
[3] https://www.statista.com/statistics/692846/online-shopping-device-worldwide-frequency/.
[4] Toplin, J. (2017). "THE MICROPAYMENTS REPORT: Problems and solutions for low-value payments". *Business Insider*. Retrieved from https://www.businessinsider.com/micropayments-report-2017.
[5] Figures according to Coindesk ICO Tracker, accessed September 19, 2018.

already has solutions like Toast and Coins.ph that use crypto and blockchain technology to address these weaknesses (Huang, 2018).

Gaming

The global gaming industry, which according to industry source Newzoo is expected to generate $152.1 billion in revnues in 2019,is yet another ripe market for virtual currency adoption. Virtual money is in fact not new to the sector since digital gold has for over a decade been used for in-game purchases. With the advent of crypto however, players can now trade virtual gaming items more easily with each other. It has also solved the problem of in-game assets' ownership through tokenization. Under this model, gamers will retain ownership of their acquired assets within a digital wallet till they decide to trade or sell them. Moreover, the gaming sector is mostly dominated by a younger generation of technically skilled people making the two sectors more compatible.

Tax Evasion

At the start of 2018, it was estimated that close to 7% of Americans owned cryptocurrency (Smith, 2018). However, only 0.04% of these crypto owners reported digital currency gains and losses to the Internal Revenue Service (IRS) during the year. In view of the libertarian attitude that prevails in the industry, this behaviour comes as no surprise. Its decentralized nature indeed makes tax avoidance easier than ever (Smith, 2018). An estimated 38% of the entire cryptocurrency market capitalization is attributed to offshore deposits; however, the figure is expected to rise to 71% in 2019 and 91% in 2020 (Satis Group, 2018). This growth has been attributed to the emergence of custody solutions in the sector (Satis Group, 2018). Offshore crypto accounts could also offer protection against hyperinflation, capital restraints and other extreme state measures.

Each country has a unique level of tax evasion, and that level is dynamic over time and depending on variables such as tax rates, public debt amount, history of nationalization of industries, culture, etc. According to Hines and Rice (1994) the big seven tax havens are Hong Kong, Ireland, Lebanon, Liberia, Panama, Singapore, and Switzerland.

Crypto assets offer tax evaders a new way to hide assets. Even if KYC/AML is implemented on every exchange, money could still be laundered and hidden with cryptocurrencies. One way to ensure access to untracked or "dirty" Bitcoin and other cryptocurrencies is to become a cryptocurrency miner. Cryptocurrency miners can simply buy graphics cards and electricity and turn this into untracked assets. There is, indeed, evidence that miners in Asia are entering the mining industry in order to get capital out of China and India without tax authorities knowing.

Another possible way is to buy coins with cash; however, demonetization of large denominations and inflation has reduced the ability to transact with large quantities of cash. Therefore, a large portion of tax evasion and money laundering in this space will focus on mining. This is a form of tax evasion for high net worth individuals (HNWI) and corporations. The Tax Justice Network estimates that governments lose $189 billion a year from $21 - $32 trillion in offshore accounts

of private wealth.[6] Tax evasion by institutions and HNWIs will be more likely to target privacy coins and low-volatility coins such as stablecoins and Bitcoins, rather than physical fiat cash, because of the sums involved.

Financial repression

Crypto assets currently are the only non-confiscatable asset class. Fiat currencies can be frozen in bank accounts, double mortgages can be placed on real estate (as occurred in Germany after the war), gold can be detected by metal detectors and was outlawed in the United States from 1933 through 1971.

Safe haven in unstable economies

Similarly to sovereign currencies, the value of a cryptocurrency is based on the trust that users accepting payment in crypto can in turn use the same crypto to make purchases (Kelly, 2014). In countries that have suffered very high inflation rates, digital money has become a sort of safe haven for wealth protection as people lose trust in sovereign currencies. For these reasons, cryptocurrency adoption in countries like Venezuela, Argentina and Zimbabwe has been significantly high during periods of economic turbulence (Wulf, 2018).

Users of Crypto Assets

Over the past four years, authors have employed two main methods for collecting demographic data on cryptocurrency users: market sentiment analysis and surveys. Using Google Trend data from 2011 through 2013, Yelowitz and Wilson (2015) found four main groups of people who demand cryptocurrencies: criminals, libertarians, investors, and computer programmers. In 2014, Lui Smyth released survey results of Bitcoin users that were collected between the years of 2011 and 2013.[7] Bohr and Bashir (2014) analyzed the dataset and found libertarians and criminals to be among the main adopters.

In 2014, researchers at MIT conducted a behavioral experiment with 4,494 undergraduates on Bitcoin adoption (Catalini and Tucker, 2016). The authors explored the proponents of adoption and found that individuals who identified as first-movers were likely to adopt if they heard about Bitcoin before their peers had. Similarly, the first-movers were less likely to adopt Bitcoin if they heard about Bitcoin after their peers.

Similar to Catalini and Tucker (2016), Kumpajaya and Dhewanto (2015) analyse Bitcoin adoption in different countries. Krombholz et al. (2016) use surveys to understand Bitcoin's security and privacy. The most recent survey was conducted by Abramova and Böhme (2016). The authors investigated the perceived benefits, ease of use, and risks of cryptocurrencies using a Venkatesh and Davis (2000) Technology Adoption Model (TAM). The survey was distributed

[6] https://www.taxjustice.net/topics/more/estimates-of-tax-avoidance-and-evasion/

[7] The data comprising 1,193 responses from Bitcoin users were collected between February 12, 2013 and April 4, 2013. More information can be found at http://www.iamsatoshi.com/tag/lui-smyth/.

on social media, online forums, and blogs that cryptocurrency users frequent. Based on 86 responses, the authors found the TAM model to accurately explain Bitcoin adoption.

In addition to academic surveys, blockchain-based companies conducted various online surveys on cryptocurrency users' demographics. Age, political orientation and geographic location among other factors seem to play a role in adoption. Presthus and O'Malley (2017) offer insights into the typical profile of the average Bitcoin user. There are a number of traits that they identify in the average crypto user. Typically, users are 32 years old – 95.2% are males, 61.8% are non-religious, 55.6% are in a relationship, 44.7% have a full-time job while 44.3% are libertarian or anarcho-capitalists. They based these statistics on non-probabilistic sampling, which is then based on a 10-question survey issued to 135 individuals from three groups of people, namely Oslo Bitcoin meetup attendees, a group of Forex brokers, students and staff members from the University of Oslo.

Bohr and Bashir (2014) also analyzed some common characteristics that define Bitcoin users. Almost half of them lived in the United States with libertarian inclinations. Participants in the sample also support freedom (16%), distrust in the traditional banking system (10%) and appreciate anonymity (8%).

Schuh and Shy (2015) based their findings on a Survey of Consumer Choice (SCPC) provided by the Federal Bank of Boston. They explain that typically, a white male with high income and a high level of education is more likely to be aware of virtual currency. This conclusion was based on their survey of crypto consumers' adoption in the United States. Interestingly though, the typical Bitcoin adopter or owner bore distinctively different characteristics. They would still be male, but non-white, relatively young, with lower education and hopes that the crypto price will increase (Schuh and Shy, 2015).

Consumers who have adopted a wide variety of payment methods are likely to be aware of crypto, to own and use it (Schuh & Shy, 2015). Most of the US adopters surveyed in this research expected that exchange rates for digital assets would keep rising. This study also established a correlation between age and adoption, concluding that older people were less likely to use virtual money.

A majority of the adopters in the survey said that their reason for adoption was an interest in new technology. Notably, one in three consumers said that they adopted crypto for the purpose of making payments. In contrast to previous assertions, only one in ten consumers cited a distrust of sovereign currencies and banks as a reason for holding digital assets. Furthermore, less than one in five consumers held them for investment purposes.

There are two main groups of investors that target cryptocurrencies and hard assets such as gold: disillusioned investors and users seeking to hedge uncertainty. Investors who are disillusioned with legacy systems make up a significant percentage of cryptocurrency users (DeVries, 2016). These include the aforementioned residents of countries that are undergoing economic uncertainties. Supporting this hypothesis, Darlington (2014) posits that people living in struggling economies are among the highest adopters. The technology's potential to address problems such as counterfeiting, limited access to financial services and hyperinflation are among the reasons for popularity.

However, users are not limited to regions with economic problems. In other cases, political aspects also contribute to increased interest in the sector. For instance, when the United Kingdom opted out of the European Union, global financial markets suffered losses due to uncertainties. Notably, a reverse effect was experienced in the crypto market (Bouoiyour & Selmi, 2017) as investors fled the traditional financial markets. At the time, Bitcoin price shot up from $550 to $650 within a single day (DeVries, 2016). Investors seeking refuge from collapsing financial markets find the crypto market conveniently agile.

The Adoption of Crypto Assets

Successful adoption of crypto assets hinges on network effects.

According to Varian (2017), "The concept is easy to describe: a good exhibits network effects if the value to a new user from adopting the good is increasing in the number of users who have already adopted it. This generates a positive feedback loop: the more users who adopt the good, the more valuable it becomes to potential adopters. This positive feedback loop also works in reverse: if adoption fails to reach a critical mass of users, the good or service may fall into a "death spiral" and ultimately disappear."

Varian (2017) also points out that network effects are a demand-side rather than a supply-side, transactions costs or learning phenomenon: "Network effects are due to value increasing with the number of units *sold*, while increasing returns to scale have to do with the cost declining or the quality improving with the number of units *produced*."

The creator of Ethereum, Vitalik Buterin, outlined the following " [major] network effects at play in the cryptoeconomic context[8]:

1. Security effect: systems that are more widely adopted derive their consensus from larger consensus groups, making them more difficult to attack.
2. Payment system network effect: payment systems that are accepted by more merchants are more attractive to consumers, and payment systems used by more consumers are more attractive to merchants.
3. Developer network effect: there are more people interested in writing tools that work with platforms that are widely adopted, and the greater number of these tools will make the platform easier to use.
4. Integration network effect: third party platforms will be more willing to integrate with a platform that is widely adopted, and the greater number of these tools will make the platform easier to use.
5. Size stability effect: currencies with larger market cap tend to be more stable, and more established cryptocurrencies are seen as more likely (and therefore by self-fulfilling-prophecy actually are more likely) to remain at nonzero value far into the future.

[8] See "On Bitcoin Maximalism, and Currency and Platform Effects," Vitalik Buterim, Ethereum Blog, November 19, 2014.

6. Unit of account network effect: currencies that are very prominent, and stable, are used as a unit of account for pricing goods and services, and it is cognitively easier to keep track of one's funds in the same unit that prices are measured in.
7. Market depth effect: larger currencies have higher market depth on exchanges, allowing users to convert larger quantities of funds in and out of that currency without taking a hit on the market price.
8. Market spread effect: larger currencies have higher liquidity (i.e. lower spread) on exchanges, allowing users to convert back and forth more efficiently.
9. Intrapersonal single-currency preference effect: users that already use a currency for one purpose prefer to use it for other purposes both due to lower cognitive costs and because they can maintain a lower total liquid balance among all cryptocurrencies without paying interchange fees.
10. Interpersonal single-currency preference effect: users prefer to use the same currency that others are using to avoid interchange fees when making ordinary transactions.
11. Marketing network effect: things that are used by more people are more prominent and thus more likely to be seen by new users. Additionally, users have more knowledge about more prominent systems and thus are less concerned that they might be exploited by unscrupulous parties selling them something harmful that they do not understand.
12. Regulatory legitimacy network effect: regulators are less likely to attack something if it is prominent because they will get more people angry by doing so".

Buterin continues, "these network effects are actually rather neatly split up into several categories: *blockchain-specific network effects* (1), *platform-specific network effects* (2-4), *currency-specific network effects* (5-10), and *general network effects* (11-12)."

It is worth noting that (1), (5) and (6) qualify as demand-side network effects; (2), (3), and (4) are supply side effects; (7), (8) and (10) are transactions costs effects, and (9), (11) and (12) are learning (cognitive) effects.

Network effects (1), (5) and (6) feature two key attributes – security and stability.

Bartolucci and Kirilenko (2019) present a unified and intuitive framework to categorise crypto assets in terms of their intrinsic features, summarised by the same two main parameters, namely stability and security. By crypto assets they generically refer to "intangible digital assets whose issuance, sale or transfer are secured by cryptographic technology and shared electronically via a distributed ledger (blockchain)". Their modelling framework, where they simulate investors' selection of assets, applies to both existing and future (not yet mainstream) crypto assets.

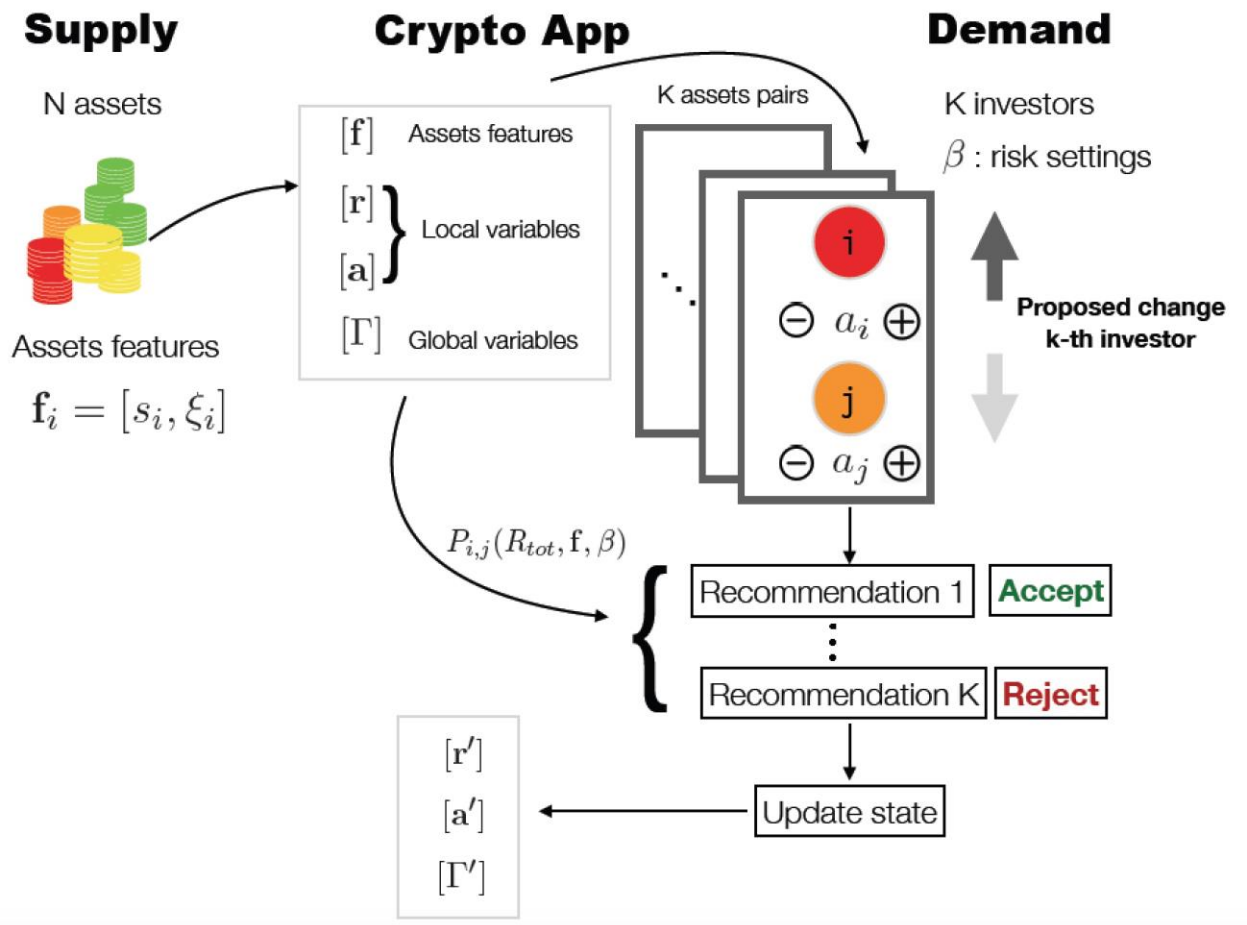
In Bartolucci and Kirilenko (2019) the security of a crypto asset is intended in terms of "the technological sophistication of the [underlying] cryptographic and electronic communication technologies". More advanced cryptographic features would render a crypto asset more secure compared to other assets reducing the exposure to cyber attacks and manipulation. The stability of a crypto asset is instead related to "its potentially faulty governance that may allow for a loss, misappropriation or dilution of its value". According to this definition, stability would, then, increase if "a credible legal, regulatory, and credible self-regulatory (e.g., consensus mechanism) system" is put in place, by for instance representing a crypto asset as "off-ledger

liability on an identifiable entity such as a central bank, foundation, company or special purpose vehicle among others".

In particular, they analyse how the intrinsic assets' features may drive the dynamics of their adoption and investments and how different stable configurations emerge as the outcome of the users' and investors' decisions.

Bartolucci and Kirilenko (2019) posit that investors make choices over crypto assets similarly to how they make choices by using a recommender app. In Figure 1, we report the scheme of the model characterised by (i) the supply of cryptoassets with defined intrinsic features (security $[s]$ and stability$[\xi]$), (ii) the crypto app, i.e. the platform over which investors interact with the crypto assets and (iii) the investors' demand for crypto assets.

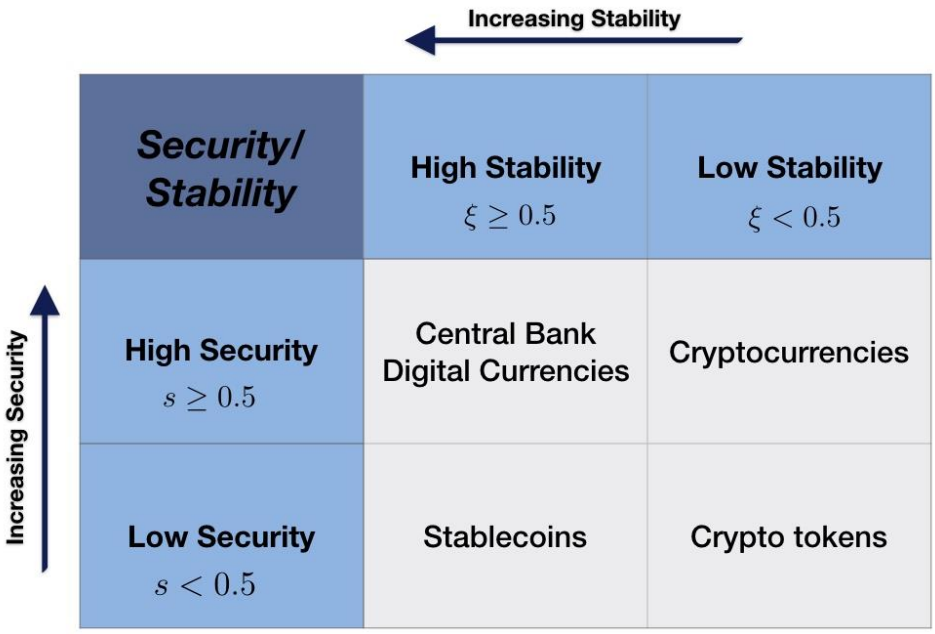
Figure 1: Bartolucci-Kirilenko Optimal Crypto Assets Selection Model. Source: (Bartolucci and Kirilenko 2019).



The app presents each investor with a pair of crypto assets characterised by a certain security-stability level; each investor compares the two assets and submits its preference for adopting one of the two to the app.
The investor, then, receives a notification from the app on whether the proposed adoption is advisable given the assets' features, the choices of all other investors stored by the app, and the expected future economic benefits of adoption. Investors keeps on submitting their preferences over all pairs of crypto assets until their expected future economic benefits can no longer be improved upon. These steps are part of the optimal selection process.

In the simulation of the optimal selection process, investors can choose within an ecosystem comprising four main types of crypto assets: high security/high stability, low security/high stability, high security/low stability, and low security/low stability. For expositional purposes, those assets can be assimilated with existing categories of crypto assets, namely central bank digital currencies (CBDCs), stablecoins (SC), crypto currencies (CC), and crypto tokens (CT). In Figure 2, we display the table with crypto assets categories organised according to their security and stability features taken from (Bartolucci and Kirilenko 2019).

Figure 2: Main Categories of Crypto Assets. Source: (Bartolucci and Kirilenko 2019).



As a brief summary, we report the definition of the crypto assets categories, as per (Bartolucci and Kirilenko 2019).

A Central Bank Digital Currency (CBDC) "can be defined as either a digitally native form of fiat currency of a country or a balance held in a digital form in a reserve account at the country's monetary authority".

Stablecoins (SC) "are crypto assets whose values are pegged to baskets of fiat currencies or cash equivalents, existing financial instruments, physical assets such as commodities, as well as baskets of other crypto assets".

Cryptocurrencies (CC) are "decentralised crypto assets relying on cryptography to secure the transfer of value between peers in the network". This category, indeed, includes the first cryptocurrency–Bitcoin—and its successors (e.g. Ethereum, Monero, etc.).

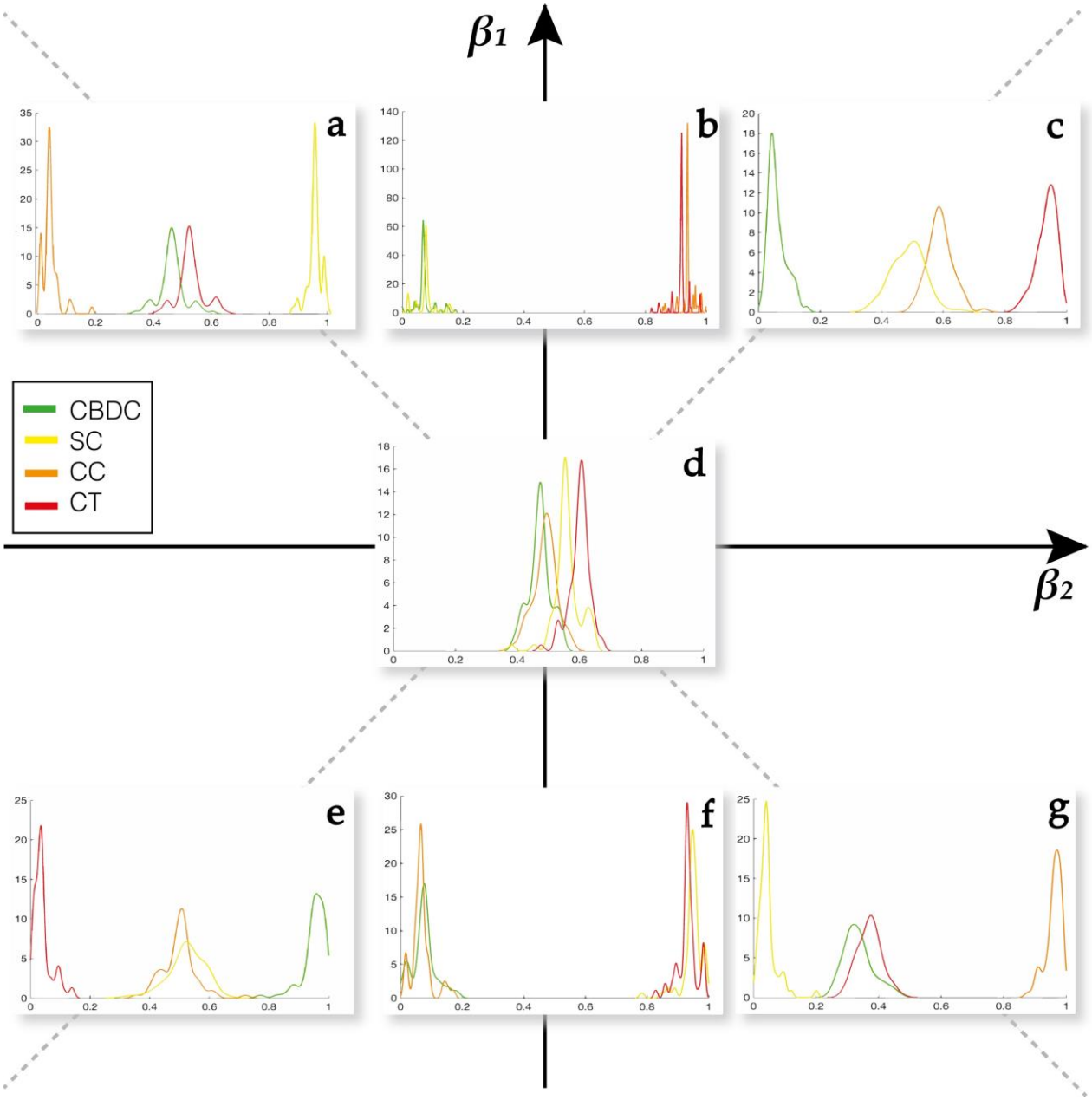
Crypto tokens (CT) are "tradable crypto assets and utilities built on distributed ledger platforms". They correspond to utility tokens if their ownership also grants access to an existing or future product or service built on a blockchain.

The simulation of the demand for crypto assets and the interactions crypto app-investors is performed considering different propensity levels (β) for each agent towards the two types of features—security (β_1) and stability (β_2)—of the crypto assets. Moreover, different compositions of the crypto ecosystem—in terms of assets features—are explored.

The outcome of the optimal selection process is observed in terms of the mean adoption probability of each crypto asset (class), under different conditions. In Figure 3, taken from (Bartolucci, Kirilenko 2019), the authors show the mean probability of not adopting a given crypto asset class varying the propensity levels (β). For instance, for high (β_1) and (β_2) (Panel c) the most likely assets that will be adopted are the most stable and secure ones, namely the CBDC (see categorisation in Figure 2).

By varying the parameters, they find multiple stable configurations for adoption of the four types of crypto assets, illustrating how network effects may translate into successful or unsuccessful adoption of crypto assets.

Figure 3: Adoption of Crypto Assets.
Source: (Bartolucci and Kirilenko 2019).



Barriers to Mainstream Adoption

DeVries (2016) summarises the problems hindering widespread adoption by highlighting that the market is far from being mature. In the current state of the sector, liquidity, media perception, regulatory clarity, user friendliness, and volatility contribute to slowing down the adoption process.
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Liquidity

Users tend to hoard their digital coins in hopes that prices will increase. Consequently, this speculation drives volatility up and reduces liquidity in the market (Spenkelink, 2014). Due to low liquidity, big players from the mainstream shy away from the market as they cannot buy large quantities of crypto from exchanges without affecting price stability.

Anonymity and Questionable Use Cases

On the other hand, Schuh and Shy (2015) posit that cryptographic security, which is one of the key advantages of cryptocurrencies, has turned out to be a double-edged sword. Indeed, criminal and terrorist players have entered the scene by taking advantage of this feature to enjoy anonymity in financial transactions. Silk Road, a dark-net online marketplace, is a relevant case in point. Drug dealers and other illicit traders used Bitcoin to transact with over 1 million customers on this platform between 2011 and 2013 (DeVries, 2016). However, questionable uses of fiat cash for criminal activity does not deter other people from using cash; therefore, the fact that cryptocurrencies can be used illicitly should not constitute a huge obstacle for adoption.

Government Restrictions and Bans

Governments and regulators have reacted to illicit crypto transactions by setting strict regulations to govern the space, or at times even imposing bans. Some of the concerns that have raised disquiet among authorities in various countries include market manipulation, consumers' protection, terrorist financing and money laundering (Mandeng, 2018). These uses are made possible by the pseudo-anonymity and limited identification of participants.
China has consequently imposed a blanket ban on crypto trading and Initial Coin Offering (ICO) activities. In South Korea, trading is still legal but ICOs are not. The Indian government in April 2018 prohibited financial institutions from offering services to businesses and individuals transacting in virtual currencies (Jani, 2018). Such restrictions have greatly stifled the industry's growth and subsequently, the potential for mainstream adoption.

Steep Learning Curve Compared to Legacy Systems

Another key obstacle to widespread use is the complexity of use that has to a great extent limited adoption to technical experts (Hoang, 2017). Transacting in these digital currencies is still rather cumbersome and some users fear exposure to security risks and potential loss (Spenkelink, 2014). For as long as the entry barriers remain as high as they are (Gurguc & Knottenbelt, 2018),

locking everyone but technically savvy individuals out, adoption might well remain an elusive mirage.
In spite of the general awareness of the benefits that alternative payment systems offer, users still find them complex and unintuitive. Until developers formulate better solutions with a smoother learning curve, people seem to prefer to tolerate the weaknesses of the incumbent systems. For these reasons, though cryptocurrencies hold massive promise in streamlining the financial system, legacy frameworks will continue to retain higher popularity for a considerable period of time (Baur, Bühler, Bick, & Bonorden, 2015).

High Volatility

Price instability has also contributed to the lack of trust in virtual money as a medium of exchange and store of value. Both consumers and merchants are consequently wary of holding them for long periods (DeVries, 2016; Spenkelink, 2014). One of the factors that contribute to high volatility in these markets is low liquidity. As crypto assets mature, they are expected to become less volatile. Furthermore, the industry is already working on solutions to the volatility problem, for instance through the creation of "stablecoins" (Nagaraj et. al., 2018). At the moment, the sector has already carved out a niche market. Additionally, more and more countries are contemplating the creation of their own national cryptocurrencies (Hofman, 2014).

Concluding remarks

DeVries (2016) summarises the state of crypto assets' adoption quite well in what he refers to as the "fire triangle": just like how fire requires oxygen, fuel and heat to exist, crypto assets require innovation, user acceptance and vendor acceptance. Without these three aspects working together harmoniously, mainstream adoption is likely to remain elusive. In this regard, there are numerous non-users who state that they are waiting for digital assets to gain more widespread adoption before they start using it (Presthus & O'Malley, 2017). This attitude seems to have given rise to a deadlock as "everybody waits for everybody."

However, Gurguc and Knottenbelt (2018) assert that widespread use of crypto is gradually becoming an inevitable eventuality. The evolutionary process that the money concept has already undergone from hard cash to plastic money and on to contactless payment systems is likely to continue. Widespread crypto adoption is the next logical step in the process, as it holds the potential to reduce frictions in the global economy.

Oftentimes, a string of economic crises preludes a new step in the evolutionary process of financial systems. Considering the high potential that crypto assets hold in addressing the weaknesses of current financial systems, they simply need to hit a watershed moment and the actual timing of mainstream adoption is difficult to tell (Baur et. al., 2015).

Most of the problems standing in the way of adoption and trust have solutions (Gurguc & Knottenbelt, 2018). For instance, the use of digital money for illicit activities and its tendency to undermine the reputation of the crypto economy is a problem that better regulations may solve. Enhancing regulations will also reduce the number of scams within the sector that are turning away institutional money and mainstream retailers.

When it comes to scaling problems that limit transaction speeds on most virtual currency networks, the solution is time. Major networks already have plans in place to improve technical aspects of their networks, with the likes of Bitcoin's Lightning Network and Blockstream's liquid. With regards to user-friendliness, as more traditional institutions (e.g. Fidelity Bank, Vontobel and Falcon to mention a few) and businesses start examining the technology, systems will undoubtedly improve, lowering the entry barriers.

Overall, Gurguc and Knottenbelt (2018) note that time is the best solution for most of the problems hampering adoption. At the current speed of adoption, they point out that it could take about a decade to see these currencies on the high street.

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