The regulation of virtual currencies in comparative perspective: new private money or niche technological innovation?

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Abstract

Purpose – This paper aims to situate virtual currencies (VCs) in a landscape of regulatory questions that help orient the direction and purpose of a possible legal approach, vis-à-vis this relatively recent technological and financial phenomenon.

Design/methodology/approach – The triangulation of historical overview and comparative examination of regulatory interventions allows to situate VCs in relation to a range of regulatory topics: from monetary policy, to fundraising and money laundering. First, the paper charts the emergence of VCs in time, and situates this innovation on a continuum with historically observed forms of private money. Second, it provides an overview of different regulatory approaches that can be observed on a comparative landscape.

Findings – At present, several features of VC schemes (particularly their deflationary character and fixed supply) prevent them from working as private money, competitive with sovereign currency. Instead, three specific kinds of uses – as security tokens, utility tokens and currency tokens – offer a more realistic picture of the risks and potentials associated with different forms of use.

Originality/value – The paper puts forth an integrated framework for devising a more sensitive regulatory approach towards VCs.

Keywords Virtual currency, Regulation, Sovereignty, Private money, Tokens

Paper type Viewpoint

Introduction

Regulation of virtual currencies (VCs) is not only a controversial subject: it can be downright inflammatory. As VCs are a relatively new financial and technological innovation, interest on the part of national law enforcement agencies, tax authorities and financial regulators is a comparatively new phenomenon (Bank of England, 2014). This recent, but mounting, interest around the legal approach to be taken towards VCs justifies a deeper investigation into the nature of this monetary innovation (De Juvigny and Vigna, 2014).

Enduring uncertainty remains around the place of VCs in the contemporary financial landscape. For instance, mainstream economists have hesitated to classify VCs as "currencies", as they have not yet reached the point where they are able to fulfil widely acknowledged functions of currency proper: medium of exchange, store of value and unit of account (Carreau and Kleiner, 2017). This uncertainty reverberates on the regulatory approach that might best suit VCs, as a clear framework of reference is still lacking. This is

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why, for example, most existing national legislations fail to contemplate VCs when it comes to defining the remit of the central bank, as the body empowered to supervise and regulate the money market of a country (Hill, 2014).

This paper tries to situate VCs along the spectrum that goes from niche technological innovation – opening up specific investment opportunities and/or making available more expedient means of payment – to full-fledged currency simultaneously working as a store of value, means of exchange and unit of account. The payoff from attempting to position VCs along this spectrum is a better discernment of the actual risks and potentials associated with VCs, for the sake of devising appropriate regulatory solutions to the questions they raise. For this purpose, the first section reviews the history of VCs, and considers their possible impact on central banks' monopoly on currency issue; the section after that contextualises VCs historically, in relation to earlier forms of private money and state-issued currency. Then, the main risks and advantages connected to the technological innovations carried by VCs are charted out. This is followed by a comparative review of different regulatory approaches observed on a global scale, while also putting forth a modest proposal for tackling the regulatory questions VCs actually raise, depending on their different forms of use. Finally, the concluding section lays out the main findings from our analysis.

The emergence of virtual currencies

VCs were born shortly after the subprime crisis, as a response to the failure of the global monetary and financial system (Dabrowski, 2018). They grew out of an anti-authoritarian community known as "cypherpunks" [1], before being taken up by more established financial actors (Burnichon, 2014). The appearance of VCs poses a question around their place in the long history of money: from barter, to the creation of the first metallic and then fiduciary currencies, to today's prevalent scriptural currencies that benefit from new technological options-making possible the dematerialisation of exchanges.

When VCs are approached as the monetary expression of a global tendency towards decentralisation, one cannot overlook the positions of economists like Von Mises and Hayek. They have previously advocated for the withdrawal of currency from state control, estimating intervention by public authorities to be a manipulation of economic cycles (Hayek, 1990). Coming from a very different-and less optimistic-angle, Foucault (1975) envisaged an evolutionary trend, whereby power would stop being concentrated in a central authority, and move instead towards anonymous, automatic and distributed enforcement (Chen and Faz, 2015). Perhaps, are-affirmation of this trend might be gleaned from Lessig's (1999) observation that, in cyberspace, "code is law" (p. 5), or in Andreesen (2011) admonition that "software is eating the world".

Recounting the history of VCs, Desmedt and Lakomski-Laguerre (2015) report that Chaum (1985) first proposed a cryptographic currency in the article "Security without identification: transaction systems to make Big Brother obsolete". In 1990, he refined his early model and created the first anonymity-preserving cryptographic currency, known as "e-cash". Between 1998 and 2005, computer scientist Nick Szabo developed a decentralised digital currency called "Bit Gold", based on the idea of a scarce resource available in limited quantities – much like a metallic currency (Lietaer and Dunne, 2013). In 1998, cryptographer Wei Dai developed the concept of "B Money", a distributed and anonymous electronic money system. Common to all these projects was the ambition to establish a payment system outside of all state influence, untraceable and disintermediated. However, both Wei Dai and Szabo could not simultaneously solve the challenges of invisibility and traceability, which were instead overcome by Nakamoto (2009) – the inventor of Bitcoin – building on earlier work by Haber and Stornetta (1991).

Despite the ambitions of early VC developers, not all VCs are born with an aspiration to provide an alternative to legal tender – it suffices here to consider the digital payment system Ripple, or Initial Coin Offerings (ICO) used for fundraising purposes (Ernst and Young, 2018). These notwithstanding, some VCs, like the prominent example of Bitcoin, are built with such a goal in mind (Roussille, 2015). Despite stated intentions, questions remain as to whether VCs are practically capable of fulfilling all of the functions customarily associated with a functioning currency in the economic literature, as Jevons (1875). Namely: unit of account, intermediation of exchanges, and store of value. Next, we briefly consider how VCs fare in relation to each of these functions.

To date, few assets are denominated in VCs, calling into question their suitability as unit of account – especially given their high volatility. The potential multiplication of VCs could exacerbate such difficulty: suffice it to imagine the practical feasibility of simultaneously nominating prices in fiat currency, as well as in hundreds of VCs. At the same time, countervailing tendencies might in the future make VCs suitable candidates to provide a unit of account for transactions. This is because their overall number is likely to decrease due to natural selection and also to the emergence of solutions, like "stablecoins", to limit the volatility of crypto-assets (Hileman and Rauchs, 2017). Other trends to keep into account are the issuing of tokens, as part of ICOs that are denominated in VCs native to the blockchain like Bitcoin or Ether; and the partial remuneration of employees in VCs by companies carrying out blockchain projects.

To date, it also has to be said that VCs have known limited success as a medium of exchange: at present, they are still not widely accepted in shops. This might be ascribed to such reasons as volatility, transaction costs, and scalability issues. An example concerning this last point: when the payment platform Stripe begun accepting Bitcoin payments, this soon had to be reversed. The reason was the overly abrupt pace of expansion of the payment network, which caused transaction validation times of up to 190 mins. As such, VCs are not yet competitive with conventional payment systems like Visa and MasterCard, which support tens of thousands of transactions per second. At the same time, the foregoing example attests to the undeniable appetite for adopting VCs as a payment method – any enduring limits seem to be mainly technical. For this reason, some of the newer VC projects make greater allowance for their adoption as a medium of exchange. For instance, the EOS blockchain network theoretically supports up to 300,000 transactions per second. The same blockchain project also promises to curtail transaction costs, ensuring more favourable terms than traditional payment systems. Such developments suggest caution before making unflattering pronouncements towards VCs, as these are still in their technical infancy, as opposed to more established, decade-old payment systems.

VCs like Bitcoin have been known to display volatility, which suggests they might not be suitable as a store of value. However, the robustness of a store of value ought to be assessed in light of its long-term reliability. As such, if one extends the temporal horizon to a decade, a VC like Bitcoin displays greater reliability as a means to preserve holders' purchasing power. Trust in Bitcoin has never really dried up, and the number of holders has been increasing steadily. In addition, the fact that VCs come with built-in ceilings to their issue makes them deflationary assets. The fact that no more VC units might be extracted (beyond the quantitative ceilings programmed in from the start) implies an exogenous money supply. This is in contrast to state-issued currencies, the supply of which is endogenous because new money can be created continuously through credit. The import of this difference is that VCs do not allow adjusting monetary policy in light of economic contingency, as the rules of money issue are fixed from the start. This would prevent injecting liquidity in the economy at times of crisis, which has been the crux of the ideological opposition between economists like Hayek and Friedman.

Positioning virtual currencies with respect to private and state-issued currency

When assessing the vicinity of VCs to conventional money, it is evident that – beyond their network effect – they do not benefit from the formal sanction of a community of citizens, as expressed by the state. State-issued notes, instead, reflect a centralised monetary order, guaranteed by the state on behalf of a whole nation. In contrast, VCs provide a unit of account with no legal status, as they are not governed by a central bank and are not issued by a regulated financial institution (Sodeberg, 2018; Yermack, 2015). Moreover, they operate entirely on a self-referential basis, without a peg or reference that could serve as their "monetary base". This consideration militates against viewing VCs as interchangeable with state-issued currency.

At the same time, the presence of monetary instruments different from state-issued currency is not without historical precedent. While, today, money predominantly comes from the central bank monetary system, the reality has often been more complex. This is because various financial instruments, freely issued by the competitive market, have also been used to meet society's demand for money: this group encompasses securities, electronic currencies, and today extends to VCs (Dabrowski, 2017). These instruments might be seen as forms of "private money", i.e. currency issued and guaranteed by an agent independent of the state – like a private bank. They differ from state-backed currency, which is subject to a monopoly on direct or delegated monetary issue by the central bank. In contrast, private currencies develop within a competitive monetary system [2].

Sovereign currencies enjoy two advantages over private money (and also over VCs). Namely: network externalities, and the potential to address adverse selection and informational asymmetries. "Network externality" describes the condition whereby economic agents on a given market widely and unanimously accept a currency, so that it fulfils all the functions of money. This condition results in a sufficiently large and liquid flow of transactions. Such network effect is less likely when several private currencies compete with one another, as they circulate in parallel. Indeed, the circulation of private currencies has historically resulted in higher transaction costs for all economic agents – in the territory in which those currencies were circulating – and has driven up prices. The issuing of private currencies can also affect the business cycle by triggering a credit-driven boom, followed by a contraction: this was one of the main reasons for banning currency issue by private banks. In contrast, sovereign currencies eliminate competition between means of payment, thereby creating homogeneous internal markets for goods and services under a single monetary jurisdiction.

Information asymmetry is another recurring problem in financial intermediation, which state-issued currency helps keep in check [3]. It has to do with abusing one's position – of being able to access or provide inside information on market transactions – for one's own profit. Contrary to Hayek's (1990) view, a freely competitive banking sector does not automatically select in the best financial products and the best providers of credit, because their decisions may well be thwarted by partial information. At least in theory, tackling information asymmetry – as well as adverse selection [4] – justifies government monopoly over monetary policy, to enable interventions towards stability through such policies as inflation targeting (Eichengreen, 1988) [5].

Even though the use of sovereign currency issued by a central bank is backed by rules around legal tender, there are limits to their enforcement. One of the effects of globalisation has been openness to foreign investment, as well as to financial transactions and international trade with non-residents. This has meant the frequent adoption of currencies, other than the national currency, for holding savings, and for making transactions or investments. Indeed, this is now the baseline for the growing number of economies that

accept the convertibility of currency and capital. Regardless of legal restrictions to convertibility, illegal capital flight and the use of foreign money in lieu of national currency (when the latter experiences instability) demonstrate the contemporary fragility of legal tender regulations.

This state of affairs creates an opportunity for the adoption of VCs, which could take the place of foreign currencies when economic agents might wish to forego use of the national, state-issued currency. This flags an important regulatory question: should VCs be regulated as yet another form of private money? Or should they be subject to regulatory supervision, under a more prudent and diversified vision of their possible uses?

Signs of an imminent relinquishment of the centralised model of currency issue are by and large lacking. For instance, since the 2008 financial crisis, demand for liquidity in the narrow sense – as state-issued currency – has actually increased, a demand that has been met with an expansion of fiat currency issue in the main monetary zones (Jobst and Stix, 2017; Gros, 2018). In parallel to this, it would also be naïf to dismiss a trend towards increasing competition between sovereign currencies: in the face of political instability or macroeconomic uncertainty – or both – there are strong incentives to flee sovereign currency and seek refuge in another (Hayek, 1990). This phenomenon is known as "monetary substitution". Developments like Venezuela's interest in mining Bitcoin (Venezuela is suffering from hyperinflation) suggest that VCs might provide an added option for monetary substitution – despite being marginal compared to historical trends like the flight towards the dollar.

These considerations complicate the choice of regulatory approach *vis-à-vis* VCs. Some of the traits of VCs make one question whether they would really be able to revolutionise the monetary landscape in the same way as historical forms of private currencies have. At the same time, the combination of advance limitations in VC supply, the absence of a lender of last resort, and the lack of legitimacy beyond technical expediency could replicate at least some of the shortcomings already observed under historical regimes of competition between private currencies (like the free banking period in the USA, in the second half of the 19th century). These include high transaction costs, the absence of a lender of last resort, the need to hold multiple accounts in different private currencies and the ensuing fragmentation of exchanges.

The aspiration for VCs to replace sovereign currencies is strongly supported by libertarian ideals (demand for a pure and stateless currency, the promotion of individual freedoms, defence of the free market and anonymity), which – at the moment – do not seem to hold sway in the mainstream conversation around monetary policy. Moreover, even some users and initiators of VC schemes are not in agreement around the objective to offer VCs as a new kind of money. Many VCs have even preferred the qualification of "crypto-assets" over the name "virtual currency" (like Ripple). Often, these actors view VC as a niche technological innovation that might work more narrowly either as a financing tool, as store of value, or as a new payment system. The next section takes up this point of view, to figure out its regulatory implications.

Mapping the risks and promise of virtual currencies

If we leave aside for one moment the question around VCs' potential to compete with state-issued currency, other vistas open up. On a very basic level, VCs may be simply taken as virtual assets capable of effectively solving everyday problems. Compared to other means of payment, VCs record and verify transactions on the blockchain, doing away with the need for centralised recordings. This simple feature results in a number of practical advantages.

The first is a reduction in transaction costs for payments and money transfers, in the order of 1%, compared to the current rate currently of 2-4% for traditional online payment systems (EBA, 2014), and of up to 7% on cross-border remittances (World Bank, 2015).

In practice, this could amount to an overall reduction in the order of 20bn euro (EBA, 2014). Another area of potential is in promoting financial inclusion by making access to finance easier, including in the absence of a traditional bank account (Cheston *et al.*, 2016; Cull *et al.*, 2014). On the opposite end of the spectrum, VCs can be a tool for portfolio diversification for financially savvy customers.

Distributed ledger technology can also improve the speed and resilience of payment systems thanks to three basic features of VC architecture: blockchain, private keys and mining. The blockchain undertakes recordings of all transactions, private keys implement cryptographic security, and mining fulfils the task of verifying transactions. Units of VCs are stored in "wallets": electronic addresses that have unique identifiers in the form of unreadable string of letters and numbers that can be decoded only by a computer guessing the precise combination of letters and numbers. Every VC transaction gets a different encryption and is recorded chronologically in a decentralised ledger (blockchain). This scheme did exist before the creation of Bitcoin and was widely used to secure commercial transactions and government communications (Badev and Chen, 2014).

Although all transactions are recorded in a general ledger, the traces of the transactions are not linked to legal or private persons but simply to email addresses: this makes possible a degree of anonymity not available under traditional banking services (which is also one of the problems of VCs, as we discuss below).VCs have a public persona and private persona: the public persona is known as an address, while the private persona is called the private key – a secret piece of data that is protected by cryptographic algorithms. Bitcoin, for example, employs two types of cryptographic schemes: cryptographic hash functions – for recording transactions anonymously on public ledgers – and digital signatures to attest that a transaction actually comes from a particular counterpart, who can no longer retract. This improvement in the traceability of exchanges, and the unfalsifiable nature of the blockchain, considerably reduce the risks of fraud and corruption (Aldaz Carroll, 2018), as well as facilitating the resolution of disputes through certification on registers. The same infrastructure can make VCs useful for simplifying international trade procedures, where a standard transaction can involve up to forty bilateral exchanges between the various actors involved – individuals, insurers, banks, customs and maritime operators, among others.

Significantly, new forms of VC-based crowdfunding (Initial Coin Offering, "ICO" in short) or the launch of tokens accepted as payment only on certain, widely used, platforms like those managed by Google, Apple, Facebook and Amazon will make companies less dependent on banking establishments, as well as on issuers of payment cards like Visa or MasterCard (Storrer, 2014) in particular, ICOs are the VC equivalent Initial Public Offerings (IPOs). ICOs make use of the blockchain technology to issue tokens, which can be purchased to obtain access to services or technologies provided by the issuer. The first ICO took place in 2013 as the "Mastercoin" project, which aimed to add functionality to Bitcoin, helping to raise the equivalent of $500,000 in 30 days. This new method of financing makes it possible to raise funds, without intermediaries, and is intended primarily for an informed technophile audience and for start-ups specialising in blockchain technology (Storrer, 2014).

At the same time, beyond these potential benefits, VCs also present a number of real or potential risks for users, merchants, sovereigns, financial markets regulators and financial stability in general (McKenna, 2017). VCs are in the early stages of development. In fact, many of the core developers still consider them to be an experiment. Due to the lack of prudential regulation, the EBA (2014) have identified 70 potential risks associated with VCs (Legeais, 2017). Among the main threats to VCs are hacking, deliberate fault (in the absence of a regulator or of a legal remedy), and most of all the risk of unexpected and significant fluctuations in the exchange rate. Although this last point is not exclusive to VCs – as

examples of currency volatility abound also in relation to sovereign currencies – the intensity (probability and magnitude) of fluctuations appears to be higher for VCs than for sovereign currencies. Changes in the exchange rate of VCs of up to 20% in just one day have been observed in the past, as a result of speculative bubbles or market manipulation. Beyond the role of speculation, the volatility of VCs also reflects the trading behaviour of "miners". These are users owning powerful computers that perform the brunt of the work of transaction verification on the blockchain. To pay their above normal electric bills, they constantly need to sell and convert VCs into state-issued currency.

One of the main advantages of VCs – anonymity – is also one of their main regulatory criticalities. VCs contribute to non-transparent transactions by withholding the identities of legal and private persons placing orders, and performing exchanges and transactions. Unsurprisingly, this feature greatly appeals to operators involved in criminal or illegal activities: for example, Foley *et al.* (2019) have estimated that approximately one quarter of Bitcoin users, and one half of overall transactions, remain associated with illegal activities.

Regulatory approach to virtual currencies in major financial jurisdictions

The regulation of VCs thus poses different questions: how to regulate assets that are transnational in scope, at a national level? Should all VCs be treated the same, or should they be differentiated into categories? How to fine-tune regulation in such a way as not to stifle innovation? These are some of the issues currently being discussed, both nationally and internationally. Individual countries have taken different attitudes towards VCs: from outright ban to *laissez-faire* approaches.

The first challenge for lawmakers is to fashion regulation around a protean instrument, characterised by a diversity of uses, objectives, modes of emission, possibilities of exchange and different sets of associated rights. The second section has looked at the vicinity of VCs with currency (stressed by the use of the term "coin" in VC denominations), while the section just before this one has reviewed some applications of VCs that have a narrower scope, either being limited to a particular market or to a particular activity (the word "token" is often appropriate here). Some VCs aim to promote a parallel exchange system for internet transactions (Bitcoin), others (Ethereum) are more in the business of guaranteeing the execution of "smart contracts" – programmed contractual clauses that are enforced as soon as they are verified between the members of a blockchain network. Still others are meant as a bridge to facilitate international transactions (Ripple).

It is not surprising – given the protean nature of VCs – that great diversity can be observed in the regulatory attitudes adopted *vis-à-vis* the VC phenomenon. It is not always the case that this diversity can be traced back to a coherent conceptual and legal approach. In sketching a comparative regulatory landscape, it is useful to signpost the two main reasons for public authorities to take an interest in VCs: surely, as regulators, but also as potential issuers themselves.

Today, the USA, Europe and several Asian jurisdictions appear to be on the frontline VC regulation. In general, attitudes range from caution and even restriction of use to *laissez-faire*, to encourage technological companies to base themselves in a state's territory. What is beyond doubt is that all jurisdictions are still in a phase of observation and reflection when it comes to the regulation of VCs.

On the cautious side, China (in 2013) and South Korea (in 2017) prohibited holding – or carrying out transactions in – VCs on the part of institutions and insurance companies. China has also banned the use of VCs as a means of payment and, in September 2017, both countries proscribed the raising of funds through Initial Coin Offerings, to contrast illegal capital flight. In 2017, the main Chinese cryptocurrency exchange platforms came to

suspend their trading due to regulatory risks and, in 2018, Chinese authorities cracked down on trading platforms that were not complying with government bans, and implemented a strategy to eliminate mining farms, which contribute to the creation of new VC units and to the functioning of the blockchain ledger. It is a possibility that China might temporarily prohibit VC-related activity on its territory, with the aim of developing a controlled domestic sector – as attested for example by the launch of experimental VCs in two cities in March 2020.Morocco, Vietnam and Bolivia have adopted a similar, conservative approach and banned VCs.

At the European level, it was a report prepared by the European Central Bank (ECB) that first launched a debate on VC systems (ECB, 2012). Following on from this, the European Banking Authority (EBA) suggested that an appropriate regulatory framework for virtual currencies would only be achieved in the longer term. Until then, the national authorities of EU member states have called for a ban on the acquisition, holding or sale of VCs on the part of credit and payment institutions, as well as by providers of electronic means of payment. The EBA also recommended that the European Anti-Money Laundering Directive also apply to VC platforms (Cvetkova, 2018). The EBA's position on VCs has gone through two different stages. In the first, the EBA recommended extreme caution due to the novelty of VCs, and the financial, technical, commercial and legal risks arising from their use. In the second stage, the EBA engaged more closely with the economic and financial realities brought on by VC trading platforms, and called for the development of specific and gradual regulation.

Other jurisdictions have opted for a more *laissez-faire* model. While in 2014, Russian authorities were continuing to issue "crypto-sceptic" opinions, 2017 marked something of a turning point under the impetus of Russian president, Vladimir Putin, who took an interest in VCs as a way to protect national sovereignty – especially to circumvent international economic sanctions against Russia – and met with Vitalik Buterin, the Russian founder of Ethereum. This interest has been translated in a receptive regulatory approach by the Russian Ministry of Finance on January 25, 2018, who drafted a law establishing procedures for ICOs, as well as outlining the legal regime applicable to mining and VC platforms.

In the USA, the state of New York implemented in 2015 a "BitLicense", i.e. a specific system of banking licenses issued by the Department of Financial Services (DFS). BitLicenses demand holders to comply with various obligations, in particular with regard to capital requirements, consumer protection, regulations against money laundering and the financing of terrorism, cybersecurity, as well as transparency of consumer information relating to VC transactions. To date, eight BitLicenses have been issued, the first of which to Circle in September 2015.

Of greater interest is one last group of jurisdictions that are taking an avant-garde approach and could impose their regulatory model on an international level. These are: Switzerland, Malta, Estonia and Japan – all of which have opted for a strategy of promoting the development of crypto-assets, whether to attract start-ups to their territory or to strengthen public services with the technology VCs make available. In this group, Switzerland allows providers of VC platforms to establish a commercial foundation and to access banking services via the *Banque Cantonale Neuchâteloise*. In the summer of 2018, Malta has promulgated three key laws: the Malta Digital Innovation Authority Act; the Innovative Technology Arrangements and Services Act, and the Virtual Financial Assets Act. These are particularly aimed at promoting innovation at the level of VCs and ICOs.

Concerning the public use of VCs, no country has yet officially launched a national VC scheme, although this is an option being considered in several jurisdictions – namely to create official and public VCs, backed for example by a central bank and benefiting from a

fixed conversion rate. In Switzerland, a pilot for launching an "e-franc" is being considered. Estonia is also exploring its own VC (the "Estcoin" token), which would be used primarily as a fundraising tool. In Japan, the government has officially recognised Bitcoin as a payment system in April 2017. Consequently, it was estimated in December 2017 that more than 30% of global Bitcoin conversions were undertaken with the yen. As a result, Japan has introduced a requirement for VC exchange agents to register with the Japan Financial Services Agency (JFSA) – as of February 2018, 15 operators had done so. Registration comes with obligations relating to the verification of customer identity, minimum capital requirements, accounting and compliance standards and the need for internal audit. In Brazil, 2019 saw the state-owned National Bank for Economic and Social Development launch a stablecoin project on the Ethereum blockchain, backed by national currency (*real*). Last, but not least, Venezuela has introduced a government-sponsored VC scheme known as "Petro". This is backed by the country's oil reserves, and specifically indexed to the oil reserves of Venezuelan companies. Created to circumvent economic sanctions from the USA, the Petro might be the first VC to replace a national currency, because of the Venezuelan *bolivar*'s hyperinflation (Fanusie and Frai, 2018).

At the very least, the foregoing examples attest to the breadth of application of VCs, and advise against their blanket regulation – for example based solely on their digital nature. Instead, a more principled approach would be to start from specific forms of VC use, and apply the regulatory safeguards that would ordinarily cover activities with the same risk level: this is the "same risk, same regulation" principle (Nelson, 2018). Taking this approach, one could distinguish three main forms of use: as securities tokens (risk-wise, these might be assimilated to conventional financial securities), as utility tokens (these confer a status or a right of use, without necessarily entailing the transfer of an asset, and can be used as means of exchange) and as currency tokens (VCs with the stated purpose of being used as a means of payment). According to this classification, VCs that implement the blockchain to settle transactions in securities (like those that financial market authorities and actors imagine to implement or have sometimes already implemented) all constitute "tokens of utility". These VCs are really only signs (of "debts"), standing in for legal tender. Their added value is essentially linked to this specific use, outside of broad monetary application.

If one takes Bitcoin instead, wide application and the generalised possibility of making purchases are one of the driving purposes of the scheme. When they fail to establish themselves as a widespread form of currency, this type of "monetary tokens" often turn into securities tokens. These may or may not offer particular rights to their possessors, and can often be used for speculation. But that's not always the case: other VC tokens that work similarly to financial securities (like tokens issued in ICOs) can be very useful as instruments for financing technological innovation. Thus, a "principled approach" suggests that, as soon as a VC has characteristics that closely follow those of a financial security (a major segment of VC offerings), then it should be subject to a comparable form of regulation, to that of the matching financial instrument.

Conclusion

This article sketches a picture of the VC landscape with two objectives in mind: to avoid casting technological opportunities as prejudicially risky and forbidden, and to find regulatory ways of accompanying the path of technological innovation (Kurzweil, 2007). As such, the paper has reviewed the place and possible uses of VCs in the monetary and financial landscape, suggesting a proportionate, far-sighted and balanced approach to VC regulation. This would be a step-by-step approach, which takes into account the degree of maturity of this technology, and which aims to protect investors and consumers, and ensure

operational security, while also making room for technological development, especially when it might serve the public interest.

By way of summary, we begun by placing the emergence of VCs on a continuum with the tendency towards the dematerialisation of currency, backed by the advent of the internet and disruptive technologies allowing increasing disintermediation. Indeed, VCs designate a transaction medium, and enable transactions in a free, disintermediated, anonymous and decentralised manner, without having to resort to a sovereign currency.

Thus, the development of VCs destabilises customary way of thinking about banking intermediation, the role of financial markets, trade clearing and business financing. At the same time, VCs are not just a re-enactment of the "private versus public money" debate: instead they can also afford a new space for the exercise of national sovereignty – as demonstrated most strongly by the exploration of national VC schemes.

Notwithstanding its economic and technological benefits, VC technology is still in its infancy, meaning that unpredictability and volatility keep accompanying the process of cryptocurrency innovation. To avoid closing down pathways for technological improvement – while safeguarding users from the financial, economic, technical and legal risks associated with VCs – requires a particularly careful regulatory approach. Obviously, VCs are linked to money markets and therefore fall within the scope of the regulatory powers conferred on central banks. However, the extant comparative landscape remains fragmentary, and an integrated regulatory framework for VCs must track closely different forms of VC use (e.g. as security tokens, utility tokens or currency tokens), and regulate them according to the specific level of risk they entail.

Notes

1. The *Crypto Anarchist Manifesto* (May, 1992) and Hughes (1993) *Cypherpunk Manifesto* form the ideological background to VCs, stating a wish to "completely change the nature of government regulation, the ability to tax and control economic interactions, but also the ability to keep information secret" (May, 1992).
2. Private money has been viewed favourably by liberal economists like Hayek, as a means to diminish the ability of states to intervene in the economy for their own benefit.
3. 'Information asymmetry' captures the advantage enjoyed by the provider of financial services over its clients, due to the latter's fully to assess the quality of a financial product, which might also be a private currency.
4. A large body of economic literature on asymmetric information and adverse selection goes back to the seminal papers of Akerlof (1970) and Stiglitz and Weiss (1981).
5. At the same time, there are historical examples of abuses of this monopoly over monetary issue (Reinhart and Rogoff, 2009).

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