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Regulating Virtual Currency Payment Systems

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Abstract

This paper examines the functioning of virtual currencies as payment systems through crypto-currency exchanges and the likely impact their integration with traditional payment systems may have on the interdependent global payment systems. Being a potential global transformational phenomenon, should virtual payment systems be regulated like other traditional intermediaries to manage the risks from their operations? Which regulator has the requisite regulatory architecture to comprehend the fast-evolving dynamics of the innovative payment solution and better manage the risks? These are some of the questions attempted in this paper. The paper also examines the role played by central banks as the major regulator of payment intermediaries and their limitations on multinational financial institutions and payment activities. Finally, the paper suggests the adoption of international regulatory bodies as the major regulatory authority for the virtual exchanges in ensuring global cooperation and coordinated implementation of any developed action plan while fostering financial innovation.

I. Introduction

The participation of new financial technology providers in payment and settlement systems is driving a phenomenal change in the financial architecture of global economies.[1] Virtual Currency (VC) Schemes—through their Distributed

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1 See Jun Liu, Robert J Kauffman, and Dan Ma, "Competition, Cooperation, and Regulation: Understanding the Evolution of the Mobile Payments Technology Ecosystem" (2015) 14(5) Electronic Commerce Research and Applications 372–91.

Ledger Technology Blockchain—is the most recent of these innovations and notorious for benefits of transactional speed, efficiency, financial inclusion and most importantly, financial independence because it operates over a peer-to-peer (P2P) network without need for conventional financial intermediaries.[2] VC's new intermediaries—Crypto Currency Exchanges—provide online gateways and storage for VCs and facilitate VC transfers and convertibility with state-issued currencies within the virtual community. These exchanges are evolving rapidly and exploiting the economies of scale and scope of transnational payments processing because they operate on a global scale.[3]

Crypto-currency exchanges, like VC schemes, offer several potential benefits including faster and more efficient transnational payments and settlements at significantly lower costs. These benefits may soon transform the way global payment systems works if VC exchanges become widely used or their services adopted by Traditional financial institutions (TFIs) and other payment service providers (PSPs) engaged in large value cross-border payments and funds transfer.

But these new intermediaries are not flawless, their operations—predominantly outside the regulatory perimeter of traditional banking system—make them vulnerable to the risks of being used as vehicles for financial crimes, particularly fraud through cyber-attacks.[4] Collaborations between multinational TFIs within the banking system and technology providers is popular in both retail and wholesale cross-border payments. The principal drivers of these integrations are majorly the growth of e-commerce and the desire by TFIs to provide faster payment services to a broader demography of clients while reducing operational costs.[5] If (and when) this trend extends to VC crypto-currency exchanges, it could significantly impact the global payment systems through increased efficiency and cross-pollination of risks.

Attempts to regulate the VC intermediaries by national economies have not been unified and arguably inefficient due to territoriality and fragmentation

[2] Volker Brühl, "Virtual Currencies, Distributed Ledgers and the Future of Financial Services" (2017) 52(6) Intereconomics 370.

[3] Dan Awrey and Kristin van Zwieten, "The Shadow Payment System" (2018) 43(4) Journal of Corporation Law 775–816.

[4] International Monetary Fund, *Virtual Currencies and Beyond: Initial Considerations* (January 2016) <https://www.imf.org/external/pubs/ft/sdn/2016/sdn1603.pdf> (accessed 9 August 2018).

[5] Bank for International Settlements (Committee on Payments and Market Infrastructures and Markets Committee), *Fast Payments – Enhancing the Speed and Availability of Retail Payments* (November 2016) <https://www.bis.org/cpmi/publ/d154.pdf> (accessed 9 August 2018).

among national regulators.[6] This is primarily because VCs and crypto-currency exchanges operate on a global scale through the internet and can therefore not be controlled exclusively by a domestic regulator. Concerns about navigation of risks between connected financial systems become particularly amplified by the possibility of a consolidation between TFIs and cryptocurrency exchanges. This is because TFIs are key stakeholders indirectly connecting financial systems in the tightly interdependent global payments network. Any failure from such consolidation may potentially disrupt global financial stability through the spread of systemic failures among the interdependent systems.

For this reason, it's incumbent to consider how best to manage the exposures in the fast-evolving innovative payment intermediary without crippling its potential benefits to the global economy. And more importantly, being a global concern, which regulator possesses the regulatory infrastructure to manage the risks these new entrants pose to the increasingly interdependent global payment system without stifling financial innovation.

A. Aims and objectives

The aim of the paper is to critically analyse the possible impact of VC-intermediaries direct integration with key stakeholders (TFIs) in the global payment systems. The paper also examines how interdependencies among financial systems—driven by financial consolidation-creates an exposure to systemic risks through the indirect interconnectedness of payment systems with same multinational TFIs. The regulators of payment systems are examined with aim of analysing their efficiency in the management of cross-border risks by TFIs. Lastly, the objective of the paper is to argue for the regulation of VC-intermediaries by international bodies in collaboration with domestic regulators in managing systemic risks-particularly fraud from cyber-attacks— that may threaten the potential benefits of the integration between VC-intermediaries and TFIs.

To achieve this aim, the paper will examine the drivers of interdependencies in the global payment systems-particularly financial integration, and the possible benefits and risks of adopting the VC intermediaries as payment solutions providers in cross-border payment and settlements. The cross-pollination of risks between financial systems that may arise from VC-intermediaries consolidation with TFIs

[6] SJ Hughes and ST Middlebrook, "Advancing a Framework for Regulating Cryptocurrency Payments Intermediaries" (2015) 32(2) Yale Journal on Regulation 505.

are examined and a practical approach to managing these potential disruptions is suggested using the instrumentality of international bodies.

B. Value of research

Scholarly discourses on VCs are primarily on its functioning as an alternative payment or financial instrument. While this is laudable, it avoids the potentials of the innovative payment and settlement solution-Blockchain-used by the VC intermediaries in the provision of fast and cost effective cross-border payment services. Two major factors make the consideration of the potentials important presently: (a) there is a growing initiative among large TFIs on possible adoption of VC-Blockchain as an innovative payment and settlement solution to reap the benefits of economies of scale in cross-border payments processing; and (b) several central banks are presently considering the creation of VCs as an alternative payment instrument.

These factors make the financial consolidation between TFIs and Crypto-currency exchanges more likely than ever before if it becomes popular. The attendant risks of such integration are therefore worthy of consideration and more importantly, there is need to examine the regulatory infrastructure presently available to determine which of the regulators have the requisite infrastructure and expertise to contain any potential disruption to global financial stability that might result from this paradigm shift when it occurs. This paper will provide brief insights into the benefits and exposures of such financial integration and serve as a point of reference when considering the appropriate regulator for the financial innovation.

C. Scope of research

Due to the constantly evolving nature of payment systems, there is no comprehensive literature dealing exhaustively with the dynamics of the recent facts considered in this paper. In addition, the relative novelty of VCs and their intermediaries implies that the academic writings on the subject are still growing with not trusted empirical evidence on the phenomenon. The coverage of the paper is to critically analyse the dynamics of VCs as payment systems, not in themselves, but through crypto-currency exchanges. The benefits and risks of financial integration within an interdependent global payment system are also considered through an examination of the drivers that have transformed the global payment infrastructure. Finally, it considers (rather collectively), the functioning of

international bodies and argues for their adoption as the major regulators of VC-intermediaries.

The paper however has limitations, it does not consider the functioning of VCs as payment instruments or financial instruments generally. It also does not cover how VCs or other payment systems are regulated but instead focuses on the principal regulators. Other limitations not mentioned here are stated in the paper.

D. Methodology

The paper adopts the critical analytical approach. It considers the laws, rules, principles and guidelines of payment systems generally. The purpose is to criticise the divergent approaches by domestic regulators to the potentials of VC-intermediaries as a disruptor of global payment systems due to its present limited use. The paper also examines the benefits that VC system's inclusion might sequel for global payment market participants and while acknowledging the possible exposures. Due to the novelty of the research topic, sources researched include books, articles in law journals and other economic journals, publications by regional and international regulatory bodies and other publications in legal and related fields which provide the breadth and depth required for such analytical academic work.

E. Research structure

The research is divided into five sections. This section, Section I, has given a general introduction of the research topic by elucidating the aims and objective, reasons and value of the academic work, methodology and finally, the scope and limitations of the paper.

Section II has three main parts. Part A examines payment systems generally with focus on its core functions in the financial systems. In Part B, this paper examines VCs as a payment system and how it works. Finally, Part C examines whether VCs perform core functions of payment systems. This is achieved through a focus on the functions of crypto-currency exchanges relatable to TFIs.

In Section III, this paper examines how VC intermediaries may impact the global payment systems. Part A examines how global payment systems work with critical attention to the interdependencies of global payment systems. In Part B, the impact of a possible financial consolidation between a crypto-currency exchange and a TFI on the interconnected global systems was considered-particularly

systemic risks. Efficiency and cross-pollination of risks between the financial institutions and indirectly among their financial systems was also examined.

In Section IV, inferences were drawn from the global nature of any impact a consolidation between the VC-intermediary and TFI may have on the global financial systems. The aim of this is to determine who should regulate the VC intermediaries.

Part A examines concisely, whether VC systems require regulatory intervention from the regulators of traditional payment intermediaries. In Part B, focus was on Central banks as the major regulator of payment systems. The limitations to their scope and authority particularly to transnational payments and multinational financial institutions was examined. Finally, in Part C, an argument was made for the adoption of international regulatory bodies as appropriate regulator for the VC intermediaries because of their global operations. In arguing this, focus was on the need for international coordination and cooperation among key stakeholders in the global payment systems in jointly managing global risks. In the end, it was suggested that a joint effort of both national regulators and international bodies was critical to management of the exposures from the innovative payment service providers. I argue that this will guarantee financial innovation that divergent approaches of domestic regulators will otherwise cripple through overregulation.

This paper concludes in Section V by reflecting on the facts considered throughout the paper.

II. Virtual currencies and payment systems

The aim of this Section is to examine whether VCs-through Crypto-currency exchanges perform similar functions as conventional payment system service providers (TFIs). In achieving this goal, the Section is divided into three parts. Part A will focus on definitions of payment systems, its subcategories and core functions of TFIs within the payment network. In Part B, the Section examines VCs as a payment system generally and how it works. Thereafter, Part C considers the question of whether VCs perform similar core functions as payment systems. In this part, the functioning of crypto-currency exchanges is employed to answer the research question.

A. Payment systems

1. What are Payment Systems?

Money plays a crucial role in the overall stability of any economy. It facilitates trade and ensures the smooth running of government and the financial system.[7] Several attempts to define payment systems in legislative instruments and scholarly discourses focus on the banking system which performs core financial functions-including payments processing.

The UK Banking Act 2009 defines payment systems within the banking structure as "an arrangement designed to facilitate or control the transfer of money between banks (and building societies) who participate in the arrangement".[8] The Financial Services (Banking Reform) Act also considers it "a system which is operated by one or more persons in the course of business for the purpose of enabling persons to make transfers of funds, and includes a system which is designed to facilitate the transfer of funds using another payment system".[9] In the same vein, the Committee on Payments and Settlement Systems (CPSS) defined it as "a set of instruments, banking procedures and, typically, interbank funds transfer systems that ensure the circulation of money".[10] In scholarly discourses, they are broadly defined "as a collection of institutional arrangements that facilitate the transfer of funds and other assets in satisfaction of financial obligations".[11]

The most explicit of the definitions is however contained in the Payment Services Directive (EU) 2015/2366 which defines it in Article 4(7) as "a funds

[7] Jürgen G Backhaus, "Money and its Economic and Social Functions: Simmel and European Monetary Integration" (1999) 58(4) The American Journal of Economics and Sociology 1075.

[8] Banking Act 2009, section 182(1).

[9] Financial Services (Banking Reform) Act 2013, section 41.

[10] Committee on Payments and Settlement Systems, *A glossary of terms used in payments and settlement systems* (March 2003) <https://www.bis.org/cpmi/glossary_030301.pdf> (accessed 10 August 2018).

[11] John Armour, *Principles of Financial Regulation* (1st Ed, OUP 2016) ch 18, citing Andrew Haldane, Stephen Millard, and Victoria Saporta (eds), *The Future of Payment Systems* (Routledge: Abingdon 2007) 2.

transfer system with formal and standardised arrangements and common rules for the processing, clearing and/or settlement of payment transactions".[12]

The nature of payment systems, discernible from these definitions may be summarised as the arrangement for facilitation of funds (in lieu of cash)[13] between a payor and payee for the settlement of financial obligations.[14]

2. Categories of Payment Systems

Save low-value transactions which are majorly facilitated by other payment instruments-credit and debit cards, e-money (including virtual currencies), electronic funds transfer, majority of funds transfer are facilitated through the banking system.[15] The in-depth mechanics of the payment systems are outside the scope of this Section.[16] But, it is germane to mention that payment systems are broadly categorised into wholesale and retail payment systems, depending on the channel through which the funds are facilitated and the market participants.[17] Wholesale payments (and the linked securities settlement) involve the facilitation of high-value funds or assets transfer (using interbank arrangements). The Central bank acts as the coordinator of wholesale operations through its special status as the regulator of the banking system. Clearing and settlement of funds-involving the reconciliation of payments and disbursal of funds to payee respectively, is facilitated within the bank, through clearing houses or the central bank in the case of interbank payments within the domestic jurisdictions.[18]

On the other hand, retail payments involve the facilitation of low-value transfer of funds between individuals, households, businesses and government agencies. The core features of this category identified by Professor Hal Scott include: "universality (*i.e.* the ability to transfer funds at both point of sale and

[12] Ross Cranston, Emilios Avgouleas, Kristin van Zwieten, *et al*, *Principles of Banking Law* (3rd Ed, OUP 2017) 348.

[13] Financial Services (Banking Reform) Act 2013, section 41(2).

[14] Bruce Summers, *The Payment System: Design, Management, and Supervision* (International Monetary Fund 1994) ch 1 ("The Payment System in a Market Economy").

[15] Cranston, *et al*, *Principles of Banking Law* (n 12) ch 12; The International Bank for Reconstruction and Development / The World Bank, *Payment Systems Worldwide: A Snapshot. Outcomes of the Global Payment Systems Survey 2010* <http://siteresources.worldbank.org/FINANCIALSECTOR/Resources/282044-1323805522895/121534_text_corrections_5-7.pdf> (accessed 10 August 2018).

[16] For extensive reading of payment systems' nature and mechanics, see Cranston, *et al*, *Principles of Banking Law* (n 12) ch 12–13; Armour, *Principles of Financial Regulation* (n 11) ch 18; Awrey and van Zwieten (n 3).

[17] See Awrey and van Zwieten (n 3).

[18] Cranston, *et al*, *Principles of Banking Law* (n 12) ch 8.

remotely); ease of use (including widespread acceptance by merchants); certainty of payment (subject to some degree of payment reversibility for mistaken payments); liquidity; recordkeeping; safety and security; and financial inclusion".[19]

However, a distinctive feature of the retail payment systems is that it includes a high volume of low-value transactions that are processed (predominantly) by technology firms which provide financial services outside regulated banking perimeter (termed "non-banks"). These non-banks facilitate payments through the provision of overseas remittance, foreign exchange and provisions of innovative payment solutions-payment cards, electronic transfers and mobile payments.[20]

3. Core Functions of Payment systems

The key elements of payment systems as argued by Sheppard include authorisation and initiation of payments, transmission and exchange of payment instruction and settlement between participant banks.[21] These elements are made possible through other core obligations including the clearing and settlement of payments,[22] storage of funds (custodial and transactional) and liquidity. Awrey and van Zwieten argued that the core functions of payment systems (through TFIs in banking systems) relates to the provision of storage facilities of funds and the promise of liquidity upon demand.[23] In this Section, I shall focus on the two core functions—storage and liquidity—identified by the writers.

(i) Storage

A cursory look at the evolution of money confirms that it has existed in many forms including: barter, commodity (gold, metal, copper, iron), coin, paper, and recently, e-money.[24] A driver of this evolution, apart from the double coincidence of want, revolves around ease of storage and transportation of money.[25] This is a

[19] See Awrey and van Zwieten (n 3).

[20] *ibid*; Bank for International Settlements (Committee of Payments and Market Infrastructures), *Non-banks in retail payments* (September 2014) <https://www.bis.org/cpmi/publ/d118.pdf> (accessed 10 August 2018).

[21] David Sheppard, *Handbooks in Central Banking No. 8: Payment Systems* (Bank of England Centre for Banking Studies, London, 1996), cited in Michael C Blair, George Alexander Walker, Stuart Willey, *et al, Financial Markets and Exchanges Law* (2nd Ed, OUP 2012) 332.

[22] For clearing and settlement systems generally, see Cranston, *et al*, *Principles of Banking Law* (n 12) 349–52.

[23] Awrey and van Zwieten (n 3) 781–4.

[24] William Warrand Carlile, *The Evolution of Modern Money* (Macmillan and Co 1901).

[25] George Alexander Walker, Robert L Purves, and Michael C Blair, *Financial Services Law* (4th Ed, OUP 2018).

crucial function performed by TFIs—particularly banks—which collects deposits, store and provide funds upon demand for satisfaction of financial obligations.[26] Specifically to bank-based payment systems, the storage functions may be divided into custodial and transactional storage. Custodial storage concerns the protection of client funds (or payment instruments) from theft, fraud and destruction prior to its use for payment transactions. This was traditionally performed through storage in giant vaults and later, with the advent of technology, electronically in bank accounts and ledger balances to which clients have proprietary rights as secured depositors.[27]

On the other hand, transactional storage is performed by TFIs (banks and clearing houses) by facilitating the secure and efficient transfer of stored funds to third parties upon demand by owners for satisfying financial obligations.[28] With the advent of technology in the modern payment systems, these functions are performed using innovative institutional clearing and settlements systems—real time gross settlement (RGTS), deferred net settlements (DNS) and other jurisdiction specific automated systems.[29] Non-banks also provide similar services in collaboration with TFIs in offering "account-based" or "web-based" remittance and payment services to clients (particularly payment cards and mobile money).[30] The funds are stored in payment cards secured by Chip and Pin issued by the non-banks or mobile money wallets providers.[31]

(ii) Liquidity

In payment systems, liquidity concerns the availability of an asset in the required form for use in the purchase of goods and services without delay as to transferability or access.[32] It could also broadly be expressed to mean the timely redelivery of funds stored by payment service providers back to their owners upon demand for the purchase of goods or repayment of debt.[33] Banks are able to provide this function through the maintenance of a portion of their capital in

[26] Awrey and van Zwieten (n 3) 781–91.
[27] *ibid*.
[28] *ibid*.
[29] Armour, *Principles of Financial Regulation* (n 11) ch 18.2; Cranston, *et al*, *Principles of Banking Law* (n 12) 349–51.
[30] *Non-banks in retail payments* (September 2014) (n 20) 1.
[31] *ibid*.
[32] See Armour, *Principles of Financial Regulation* (n 11) footnote 17.
[33] Summers, *The Payment System* (n 14) 2.

liquid assets (Treasury bills) which may be easily disposed in the interbank market to provide funds in satisfaction of customers deposit withdrawals.[34]

Although the challenges to the bank's liquidity is outside the scope of this Section, it's worth mentioning that banking system is inherently unstable. The instability results from the banks use of short term deposits in financing long term loans resulting in a maturity mismatch.[35] To ensure the that this instability does not affect overall payment systems, central banks as the principal regulator of the banking and payment system, performs the role of lender of last resort and emergency liquidity provider to the banks where it suffers liquidity crisis.[36] This fund is made available to banks subject to strict preconditions of solvency, attendant systemic effects and at punitive interests to avoid the moral hazard of intentional exposures.[37] In the case of an institutional failure, depositors in TFIs are protected by deposit insurance and guarantee schemes which compensates depositors for any loss to savings.[38]

B. Virtual currencies

1. What are Virtual Currencies?

Defining virtual currencies (VCs) depends on whether the attempt is to consider it as a currency, an investment, or a payment network.[39] The paper's focus is on payment systems and I shall therefore limit myself to the consideration of VCs as a payment system (and as a payment instrument only where necessary). As a payment system, VCs can be defined simply as a peer-to-peer (P2P) operational network governed by rules and standards for transfer of electronic cash among members of a virtual community without need for financial intermediaries.[40] Not all VCs are payment systems, but the openly convertible VCs (Bitcoin) function

[34] For banks liquidity requirements, see Cranston, *et al*, *Principles of Banking Law* (n 12) ch 2–3.

[35] Douglas W Diamond and Philip Dybvig, "Bank Runs, Deposit Insurance, and Liquidity" (1983) The Journal of Political Economy 91(3) 401, 401.

[36] Edward J Green, "The Role of the Central Bank in Payment Systems" in Andrew Haldane, Stephen Millard, and Victoria Saporta (eds), *The Future of Payment Systems* (Routledge: Abingdon 2007); Kern Alexander, Rahul Dhumale, and John Eatwell, *Global Governance of Financial Systems: The International Regulation of Systemic Risk* (OUP 2006) 184.

[37] Thomas L Hogan, Linh Le, and Alexander William Salter, "Ben Bernanke and Bagehot's Rules" (2015) 47(2) Journal of Money, Credit and Banking 333–48.

[38] Armour, *Principles of Financial Regulation* (n 11) ch 18.2.4.

[39] For further readings on virtual currencies generally, see David Lee Kuo Chuen, *Handbook of Digital Currency: Bitcoin, Innovation, Financial Instruments, and Big Data* (Academic Print, Elsevier 2015).

[40] Satoshi Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System* (2008) <https://bitcoin.org/bitcoin.pdf> (accessed 9 August 2018); Hughes and Middlebrook (n 6) 517–8.

as payment systems through VC-intermediaries. Defining VCs as electronic cash is perhaps misleading, the primary reason is because, unlike electronic money, VCs are not expressed in the traditional fiat currencies of particular sovereign jurisdiction[41] or 'expressed in traditional accounting units, such as in Euro, but in virtual accounting units, such as the "bitcoin".[42] The system operates through an open source software (called "blockchain") accessible over the internet by all members of the virtual community and is used in the facilitation of VCs between members without the necessity of a trusted third-party intermediary.[43]

Since the creation of the first and most popular VC, Bitcoin in 2009 by Satoshi Nakamoto—an unknown software developer—several other VCs (termed 'altcoins') have been created using similar software protocol as bitcoin for their payment systems.[44] While some of these VCs operate in closed systems-with no convertibility to conventional fiat currencies, the focus of this Section is limited to freely convertible VCs (that is, VCs with values substitutable for fiat currencies)—particularly Bitcoin (termed broadly as "cryptocurrencies").[45] Bitcoin has the highest market capitalisation among the over 1700 VCs presently in existence and its freely convertible (through exchanges) to fiat currencies, thereby making it significant to traditional payment systems.[46] I will therefore briefly consider how it works and subsequently comment on it functioning as a payment system through Crypto-currency exchanges.

2. How Does Bitcoin Blockchain Work?

To understand how Bitcoin works as a payment method, it's prudent to briefly comment on its nature as a payment instrument, though outside the scope of this paper. Bitcoin may be defined as a private unregulated digital cash which is neither issued nor controlled by a sovereign institution (central bank) but created through special algorithms (cryptography) in a decentralised open distributed

41 Armour, *Principles of Financial Regulation* (n 11) 370.

42 *ibid* citing European Court of Justice, C-264/14 *Skatteverket v Hedqvist* [2016] STC 372 at [11].

43 Brühl (n 2); Tracey Anderson, "Bitcoin-Is it a Fad? History, Current Status and Future of the Cyber-currency Revolution" JIBLR 428, 429; Nicholas A Plassaras, "Regulating Digital Currencies: Bringing Bitcoin within the Reach of the IMF" (2013) 14(1) Chicago Journal of International Law 377.

44 For a comprehensive list of existing virtual currencies. see www.marketcap.com (accessed 10 August 2018).

45 Financial Action Task Force, *Virtual Currencies: Key Definitions and Potential AML/CFT Risks* (June 2014) <https://www.fatf-gafi.org/media/fatf/documents/reports/Virtual-currency-key-definitions-and-potential-aml-cft-risks.pdf> (accessed 10 August 2018) 4–8.

46 *ibid*.

network node (called 'mining') by its developers or special users (called miners).[47] Its distinguishing feature is pseudonymity of ownership because it exists essentially in virtual form capable of transfer through the internet using cryptography over a P2P network without regulation from any government authority or facilitation through a trusted TFI.[48]

For facilitating the transfer of value in bitcoin between the members of the virtual community (apart from crypto-currency exchanges platform), it uses an innovative payment protocol-Blockchain (a type of distributed ledger technology "DLT").[49] To initiate a transfer, the anonymous holder of the unique identifier number (called 'private key') effects a transfer of the agreed unit of the VC to a transferee's public key from the encrypted digital wallet ('bitcoin addresses') using an electronic signature. This generates a complex algorithmic problem with a timestamp on the transaction initiated—making it unalterable and irreversible.[50] While the timestamp is to prevent the likelihood of double spending or counterfeiting by the payor, the electronic signature and algorithmic puzzle is used to verify the ownership of the transferor and the validity of the initiated transactions.[51] The verification of the transaction is done by special users (called 'miners') using heavy computational protocols and cryptography in solving the complex mathematical problems generated by the transaction within 10–20 minutes through a 'proof of work'.[52] This verification ensures the integrity of the network by preventing internal/external fraud (by hackers) and encourage continuity by rewarding successful miners with newly created bitcoins. The verified transaction is thereafter entered as a block into the public network blockchain that is readily accessible by all members of the virtual community.[53]

Blockchain functions outside the traditional banking system using instead a P2P open network that can be accessed by the members of the virtual community at any time globally via the internet Web. Further, VCs operate within a self-regulatory framework-using cryptography and blockchain to prevent double-spending, fraud, and cyber-attacks (the adequacy of this measure is considered elsewhere in this paper). Although still significantly lower than other payment

47 Cranston, *et al*, *Principles of Banking Law* (n 12) 369.

48 See Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System* (n 40).

49 Bitcoin, "How does Bitcoin work?" <https://bitcoin.org/en/how-it-works> (accessed 20 July 2018); Hughes and Middlebrook (n 6) 505.

50 Cranston, *et al*, *Principles of Banking Law* (n 12) 370.

51 *ibid*.

52 Brühl (n 2) 371–3.

53 *ibid*.

systems, the acceptability of VCs as payment system is growing progressively. This is despite the shunning by most regulators because it is unregulated and the bad press since its inception.[54] In the next Part, I shall examine whether VCs-through crypto-currency exchanges-perform core functions like TFIs in conventional payment systems.

C. Do virtual currencies perform core payment functions?

Earlier in this Section, I examined payment systems and the core functions performed by TFIs as PSPs. Two core functions—storage and liquidity—were considered using the banking system as focus. VCs, as evident from the facts in Part B, operates within a self-regulated open network outside the perimeter of regulated banking system without need for financial intermediaries in facilitating transfer of value. This financial independence was primarily born out of a distrust for TFIs which grew after 2008 Global Financial Crisis (GFC) that occasioned substantial losses to consumers.[55] This point, in addition to a craving for financial inclusion, was canvassed as the foundation for VC initiative in the white paper by Satoshi Nakamoto.[56] Attempts to avoid limitations and costs resulting from dependence on TFIs in payment processing heralded the era of 'shadow payment systems'—which are payment service providers who perform the core functions of traditional banks (deposit taking, storage and liquidity) outside the perimeter of the regulated banking system.[57] They are broadly classified into P2P payment systems (Paypal), mobile money platforms (M-Pesa) and Crypto-currency exchanges (Mt.Gox, Coinbase, CoinCheck).[58] This Section will focus on how Crypto-currency exchanges perform core payment functions like TFI.[59] I have chosen crypto-currency exchanges instead for individual VCs for two reasons: (a) there are presently over 1700 VCs; and (b) not all VCs are payment systems (including

[54] Cranston, *et al*, *Principles of Banking Law* (n 12) 370.

[55] For further readings on the global financial crisis, see Iain MacNeil and Justin O'Brien, *The Future of Financial Regulation* (Hart 2010); George A Walker, "Financial Crisis and Financial Resolution" (2013) 29(1) *Banking and Finance Law Review* 55.

[56] See Nakamoto, *Bitcoin: A Peer-to-Peer Electronic Cash System* (n 40).

[57] Awrey and van Zwieten (n 3) 796.

[58] *ibid* 777.

[59] For furthering readings on shadow payment systems generally, see Awrey and van Zwieten (n 3) Part V.

Bitcoin) but a significant number of VCs function as payment systems through Crypto-currency exchanges.[60]

Crypto-Currency Exchanges

Although Nakamoto argued against the use of financial intermediaries, most VCs transactions are facilitated through crypto-currency exchanges (hereinafter called 'the exchange') who perform similar functions as TFIs within the VC system.[61] Before its bankruptcy in 2014, Mt Gox.—founded in Tokyo in 2009—was reputed as the cornerstone of the Bitcoin system, facilitating more than 70% of the total bitcoin transactions globally.[62] In recent times, Coinbase (with other exchanges) collectively facilitate VC-transactions for more 30 million clients globally (including top retail merchants like PayPal, Microsoft and Amazon).[63] These exchanges operate outside the perimeter of the regulated banking system though they provide payment services like TFIs.[64] Their core services include: facilitating the interconvertibility between VCs and conventional fiat currencies (US Dollars, Euros, Pounds Sterling); providing online wallets on their servers for the storage of VCs to prevent theft and fraud and; providing a platform gateway for matching users in settling financial obligations.[65]

While exchanges facilitate the speedy transfer of value in VCs between users, their existence do not prejudice the ability of individuals to use the web-based system independently. It is the global network of the exchange's platform through which faster pairing of users is made possible that make their use attractive.[66] They provide storage facilities to users by issuing high security passwords to their clients for access to VCs deposited on the exchange's server (either stored online or offline).[67] To initiate a transfer of VC, the user need only request that a payment be effected in favour of another member of the virtual community using the specialised password provided upon registration.[68] Once matched, the exchange ensures the completion and settlement of the transaction. The record

60 Hughes and Middlebrook (n 6) 517–8.

61 *ibid*.

62 Robert McMillan and Cade Metz, "The Rise and Fall of the World's Largest Bitcoin Exchange" WIRED (November 2013) <https://www.wired.com/2013/11/mtgox/> (accessed 10 August 2018).

63 See Coinbase <https://www.coinbase.com/> (accessed 10 August 2018).

64 Awrey and van Zwieten (n 3) 797; Hughes and Middlebrook (n 6) 495.

65 Awrey and van Zwieten (n 3) 797.

66 *ibid*.

67 See Coinbase (n 63).

68 Awrey and van Zwieten (n 3) 797–800.

may be added to the blockchain or off the block depending on whether both users are members of the same exchange.[69]

The second core function performed by exchanges like TFIs is the provision of liquidity upon demand. This function is performed by allowing the prompt conversion of VCs to fiat currencies through the server at prices determined by the forces of supply and demand between the VC and specific fiat currencies.[70] Where payment is made in VC for goods purchased from merchants, the exchange absolves the liquidity and currency exchange risks by its immediate obligation to pay the going exchange rate of the VC at the time of the transaction. This implies that if the value of the VC drops after the transaction, the merchant will still be entitled to the transactional value. Although the challenges to this function is not strictly the focus of this paper, it suffices to mention that exchange users are regarded as unsecured creditors unlike TFIs and have no first claim during bankruptcy.[71] This was what happened with Mt. Gox in 2014 after it suffered losses to assets (worth $470m) through cyber-attacks.[72] The exchange's operation outside regulated banking system implies that it does not receive support of emergency liquidity or lender of last resort from central banks like TFIs. It also does not benefit from deposit insurance schemes or guarantees.[73] While these concerns may cripple its functioning, it is without doubt that, except where an institutional failure occurs, VCs function as payment systems through crypto-currency exchanges. The operational network and standardised transaction rules are enforced by the exchanges and like TFIs, they perform core functions of payment systems within the financial systems.

I have established in this Section that VCs—through crypto-currency exchanges—perform similar functions as the TFIs in conventional payment systems. In the next Section, I will focus more on the indirect interdependencies of global payment systems through the activities of multinational TFIs. I will also

69 *ibid*.
70 *ibid*.
71 *ibid* 799.
72 *ibid* (footnote 132).
73 *ibid*.

examine the impact a collaboration between a crypto-currency exchange and a TFI might have on these interdependencies.

III. Impact of VC exchanges on global payment systems

The aim of the Section is to critically analyse how VC intermediaries may pose potential disruptions to the global payment and settlement systems. The Section is divided in two parts. Part A will examine how the global payment system works with a focus on financial consolidation and technological innovation as major drivers of the interdependencies in transnational payment systems.

In Part B, I will attempt the question of whether exchanges may pose potential disruptions to the global payment systems through a possible financial integration with key stakeholders (TFIs) in the global payment network. In this part, I will employ a hypothetical situation in which VC exchanges collaborate with multinational TFIs to consider the effects such integration may have on the global payment system. My reasons for choosing financial consolidation over other factors are twofold: (a) Recent trend in global systems confirms large TFIs are considering the adoption of blockchain (though a modified permissioned closed systems format) as an alternative to the costly and time consuming processing of cross-border payments using traditional systems; and (b) The initiative for the creation of Central Bank Digital Currencies (CBDC)as an alternative payment instrument is gaining momentum among major central banks globally.[74] These two initiatives suggest the likelihood of a collaboration between VC exchanges and TFIs soon if adopted.

A. How global payment systems work

Due to the transnational scope of VCs and exchanges, I have opted to focus on the role of TFIs in the taxonomy of cross-border payment systems. However, the global payment system comprises a network of both domestic and cross-border systems which are interdependent in achieving the efficient flow of funds among global financial systems.[75] The network comprises multinational TFIs (operating

[74] Bank for International Settlements (Committee on Payments and Market Infrastructures and Markets Committee), *Central bank digital currencies* (March 2018) <https://www.bis.org/cpmi/publ/d174.pdf> (accessed 6 July 2018).

[75] See Bank for International Settlements (Committee on Payment and Settlement Systems), *The Interdependencies of Payment and Settlement Systems* (June 2008) <https://www.bis.org/cpmi/publ/d84.pdf> (accessed 10 August 2018); *Payment Systems Worldwide* (n 15). For further readings on domestic payment systems, see Cranston *et al*, *Principles of Banking Law* (n 12) ch 13.

directly or as 'correspondents or custodians'), central banks, other PSPs and central clearing depositories as its key participants.[76] Interdependence of financial systems may be system-based or institution-based depending on whether the relationship is direct or indirect. Direct relationships arise from the use of the same payment messaging service providers, central clearing depositories, payment processors and risk management.[77] On the other hand, indirect interdependencies emanates predominantly from the activities of Large TFIs (termed globally systemically important financial institutions, "GSIFIs")[78] or PSPs operating within multiple jurisdictions and indirectly linking the stability of each financial system to the smooth running of the others in which they operate.[79]

The crucial drivers of the evolution of interdependencies among financial systems identified by the CPSS (now CPMI) include: globalisation, trade liberalisation; financial consolidation; regional integration; technological innovation, public policies.[80] This list has expanded to include E-commerce and mobile telecommunications in recent times.[81] Cross-border wholesale payments (termed 'Systemically important payment systems')[82] which initially involved the use of traditional legacy-based payment methods-documentary credits,[83] are now predominantly facilitated through modern 'interbank' payment methods.[84] These drivers also influenced the dynamism of retail payment systems, making them significant processors for non-cash transnational payments processing.[85] Modern payment methods provided by TFIs and non-banks-payment cards, electronic

[76] *ibid*.

[77] See *Interdependencies of Payment and Settlement Systems* (*ibid*) 1–5; *Payment Systems Worldwide* (n 15) 81.

[78] Financial Stability Board, *Policy Measures to Address Systemically Important Financial Institutions* (November 2011) <https://www.fsb.org/wp-content/uploads/Policy-Measures-to-Address-Systemically-Important-Financial-Institutions.pdf> (accessed 10 August 2018).

[79] *ibid* 2.

[80] Chris Brummer, *Soft Law and the Global Financial System: Rule Making in the 21st Century* (CUP 2012) 10.

[81] Bank for International Settlements (Committee on Payment and Settlement Systems), *Innovations in Retail Payments* (May 2012) <https://www.bis.org/cpmi/publ/d102.pdf> (accessed 10 August 2018); for further readings on E-commerce, see Paul Todd, *E-Commerce Law* (Cavendish 2005).

[82] Bank for International Settlements (Committee on Payment and Settlement Systems), *Core Principles for Systemically Important Payment Systems* (January, 2001) <https://www.bis.org/cpmi/publ/d43.pdf> (accessed 10 August 2018).

[83] Alastair Hudson, *The Law of Finance* (Sweet & Maxwell 2013) ch 30.

[84] Awrey and van Zwieten (n 3) 791; Bank for International Settlements (Committee on Payment and Settlement Systems), *New Developments in Large-Value Payments* (May 2005) <https://www.bis.org/cpmi/publ/d67.pdf> (accessed 10 August 2018).

[85] European Central Bank, "Retail Payments and the Real Economy" Working Paper No. 1572 (August 2013) <https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1572.pdf?0568b27871896eb-01f54b0c4c40a8f63> (accessed 10 August 2018).

fund transfers, mobile money and web-based payments have since become the preferred alternatives for domestic and cross-border payment transactions.[86]

Apart from technological innovation, financial consolidation (particularly mergers and joint ownership) has been the major driver of indirect interdependence of global payment systems.[87] TFIs are increasingly collaborating among themselves and with other entities: financial technology firms (Fintech), Central depositories and risk management providers in becoming an all-round financial services provider in the global financial system.[88] This has influenced the volume and value of non-cash payment transactions (over $400 trillion in 2014) facilitated within the global payment system and the increase in global gross domestic product (GDP).[89]

While wholesale large-value systems (facilitated by TFIs) are considered systemically important payment systems because of the value of transactions processed, the retail payment systems have also witnessed an upward review in recent times.[90] This shift predominantly resulted from financial consolidations between TFIs and new market entrants into the payment industry—Non-banks (or Fast payment schemes).[91] Non-banks (and Fast payments) are institutions which provide payment services (and other financial functions) outside the perimeter of the regulated banking system with the capacity to process payments and settlement at any time of the day in (near) real-time.[92] The major drivers of the integration are profit maximisation and regulatory arbitrage.[93] Profit maximisation results from the economies of scale and scope that comes with the expansion of business and efficiency associated with the use of technology in facilitating payment processing and settlement. Arbitrage—the legal avoidance of strict compliance with regulations— is an incentive to the TFIs because technology firms (non-banks) provide payment services outside the complex regulatory perimeter of TFIs.[94] By

[86] Awrey and van Zwieten (n 3) 800–2.

[87] For further research on Financial Consolidation and Corporate Restructuring see Patrick A Gaughan, *Mergers, Acquisitions, and Corporate Restructurings* (6th Ed, Wiley 2015).

[88] *Interdependencies of Payment and Settlement Systems* (n 75) section 2.

[89] Awrey and van Zwieten (n 3) footnote 1.

[90] *Innovations in Retail Payments* (n 81) Introduction.

[91] "fast payment" is defined as a payment in which the transmission of the payment message and the availability of "final" funds to the payee occur in real time or near-real time on as near to a 24-hour and seven-day (24/7) basis as possible: see *Fast Payments – Enhancing the Speed and Availability of Retail Payments* (n 5) section 2.1.

[92] Bank for International Settlements (Committee on Payments and Market Infrastructures), *Non-Banks in Retail Payments* (September 2014) 1; *Fast Payments – Enhancing the Speed and Availability of Retail Payments* (n 5) Executive Summary.

[93] For further readings on Arbitrage, see Joanna Benjamin, *Financial Law* (OUP 2007) ch 23.

[94] *Non-Banks in Retail Payments* (n 92) section 3.

extension, services provided by TFIs through the non-banks are not subjected to the strict regulations and attendant operational costs.[95]

Perhaps a more important question is how financial consolidation drives the interdependence of global payment (and financial) systems generally? A CPSS survey suggests that new payment systems are based majorly within domestic jurisdictions with several existing globally.[96] The report further suggests that these new payment systems (non-banks, P2P systems and mobile money) benefit from cross-border transactions through cooperation and standardisation among themselves and through collaborations with TFIs.[97]

These revelations have two crucial impacts on the global payment systems. The first and most evident is that it creates an efficient system of interlinked financial systems and institutions within the global payment system.[98] The collaborations between TFIs and non-banks (through joint ownership or outsourced payment and technology related services) ultimately creates an indirect interdependence between several financial systems in which the institutions operate thereby facilitating the speedy processing of transactions within the global network.[99] The second and arguably negative consequence of these integration is that it creates a form of 'systemic risk' between the interdependent financial systems.[100] Major risks of payment systems include: internal/external fraud, employee misconduct and model design collapse (termed 'operational risk'); inability to complete transaction due to lack of immediate funds (called 'liquidity risk' or 'payment and settlement risk'); institutional failure (broadly termed 'market risk')and ;credit risks from time delays.[101] Consolidation among TFIs (and new market entrants) results in exposure

[95] *ibid*.

[96] *Innovations in Retail Payments* (n 81) Executive Summary.

[97] *ibid* section 4.2.

[98] *Interdependencies of Payment and Settlement Systems* (n 75) Part II.

[99] *ibid*.

[100] Systemic risk is defined as "the probability that cumulative losses will occur from an event that ignites a series of successive losses along a chain of [financial] institutions or markets comprising... a system": see Steven L Schwarcz, "Systemic Risk" (2008) 97(1) Georgetown Law Journal 193, footnote 11; G Afonso and HS Shin, "Systemic Risk and Liquidity in Payment Systems" (2009) Federal Reserve Bank of New York Staff Report No 352. For further definitions and readings on systemic risks, see: Alexander *et al*, *Global Governance of Financial Systems* (n 36) 23–4 and ch 7.

[101] *Interdependencies of Payment and Settlement Systems* (n 75) Part II; Alexander *et al*, *Global Governance of Financial Systems* (n 36) 188–90.

by one financial institution to the risks particular to other participants due to their interconnectedness.[102]

Thus, failure of either of the interconnected institutions could pose systemic risks to the consumers, market participants. These failures may also extend to the several national economies in which the affected institutions operate because of the crucial role payment systems play.[103] For example, the institutional failure (through license withdrawal) of the Bankhaus Herstatt—an international financial institution— in 1974 resulted in settlement risk to the foreign exchange market in which it was an active participant.[104] The failure of this GSIFI affected finality of transactions facilitated through it. Thus, triggering systemic failures not only in the financial institutions connected to the German bank but the financial systems in which these affected institutions were key stakeholders of financial stability.[105]

From facts and examples briefly considered above, its discernible that the global payment systems function through the interdependence among the financial institutions and systems which are key stakeholder in the payment systems network. These interdependencies have the advantages of increased efficiency, economies of scale and scope and better risk management among participating systems and institutions due to broader risk sharing and risk management.[106] However, these advantages may be whittled down considerably if one considers the impact the failure of any of the interdependent institutions or systems may have on other participants or even the global financial system generally. The role played by TFIs is also evidently crucial to the network. In the next Part, I will examine how VC exchanges may impact the global payment systems (positively or otherwise) if (and when) it becomes a key stakeholder (by consolidation) in the global payment and settlement systems.

B. How VC exchanges may impact global payment systems

Despite VC-blockchain's lack of upper limit to the value of funds that may be processed through the network, the system is used for low-value transactions

[102] *Interdependencies of Payment and Settlement Systems* (n 75) section 5; Bank for International Settlements (Committee on Payment and Settlement Systems), *Cross-Border Securities Settlements* (March 1995) <https://www.bis.org/cpmi/publ/d12.pdf> (accessed 10 August 2018); Bank for International Settlements (Committee on Payment and Settlement Systems), *The Role of Central Bank Money in Payment Systems* (August 2003) <https://www.bis.org/cpmi/publ/d55.pdf> (accessed 10 August 2018).

[103] *Interdependencies of Payment and Settlement Systems* (n 75) 26.

[104] Armour, *Principles of Financial Regulation* (n 11) 399. For research on similar failures, see also: Dominique Rambure and Alec Nacamuli, *Payment Systems: From the Salt Mines to the Board Room* (Basingstoke: Palgrave 2008).

[105] Armour, *Principles of Financial Regulation* (n 11) 399.

[106] *Interdependencies of Payment and Settlement Systems* (n 75) section 5.1.

presently.[107] This prevents it from being considered as systemically important to the global payment systems.[108] Perhaps, this is because VC exchanges are still relative new and do not benefit from the goodwill enjoyed by TFIs.[109] The European Banking Authority in a recent report concludes that VCs and its exchanges are predominantly used by private individuals with little institutional participation which drives the significance of TFIs as systemically important to wholesale payments systems.[110] This may not come as a surprise considering that VCs systems were designed to facilitate payments without need for trusted third party or financial intermediaries. But, considering the focus of these Section, the question could be asked that what impact can VC exchanges have on the interdependent global payment systems if they integrate with TFIs? To answer this question, I will assume that the VC exchanges become integrated with TFIs in the banking system—a key stakeholder in the global payment system. Financial consolidation occurs when two financial institutions performing similar or complementary functions come together under any form of corporate restructuring.[111] Put simply, what impact would a consolidation between a major bank (for example, JP Morgan Chase, Goldman Sachs) and a VC exchange have on the global payment system?

Like the drivers collaborations between TFIs and Non-banks identified by the Committee on Payment Markets Infrastructure(CPMI), the motivators of a consolidation between TFIs (which indirectly connect the global payment system) revolves around the benefit of technological innovation.[112] Through consolidation, ancillary benefits such as profit maximisation from economies of scale, lower transactional and regulatory costs and increased efficiency become available to TFIs.[113] For VC exchanges, the most important driver will likely be the increased trust and integrity the consolidation will bring to its operations.[114] However, this consolidation may also create a pathway for VC exchanges direct link to the global payment system. This is because TFIs in banking systems indirectly connect

[107] See Blockchain, "Blockchain Size" <https://www.blockchain.com/en/charts/blocks-size> (accessed 7 August 2018).

[108] European Central Bank, *Virtual Currency Schemes* (October 2012) <https://www.ecb.europa.eu/pub/pdf/other/virtualcurrencyschemes201210en.pdf> (accessed 7 August 2018).

[109] Financial Stability Board, *Letter to G20 Ministers and Central Bank Governors* (18 March 2018) <https://www.fsb.org/wp-content/uploads/P180318.pdf> (accessed 7 August 2018).

[110] European Banking Authority, *Opinion on Virtual Currencies* (July 2014) <https://eba.europa.eu/sites/default/documents/files/documents/10180/657547/81409b94-4222-45d7-ba3b-7deb5863ab57/EBA-Op-2014-08%20Opinion%20on%20Virtual%20Currencies.pdf?retry=1> (accessed 7 August 2018) Introduction.

[111] See Gaughan, *Mergers, Acquisitions, and Corporate Restructurings* (n 87).

[112] *Non-Banks in Retail Payments* (n 92) section 3.

[113] See *Interdependencies of Payment and Settlement Systems* (n 75); *Virtual Currencies and Beyond* (n 4) 18–20.

[114] Hughes and Middlebrook (n 6) 499, footnote 9.
Awrey and van Zwieten (n 3) 797.

several national payment systems through their activities globally. Emerging issues of TFIs modern consolidations with new entrants (particularly non-banks) revolve around exposures to operational risks (cyber security, identity theft and fraud), liquidity risks and prudential regulation of new market entrants.[115] To combat these issues, several measures including: Chip and Pin security and Know-Your-Customer (KYC) requirements have been created by regulators to ensure safety.[116] The efficiency of these measures are beyond the scope of this paper.

Having mentioned the drivers of a possible consolidation between TFIs and VC exchanges, the likely positive impact the integration will have on global payment systems may include: increased efficiency, financial inclusion-to the underbanked national economies with limited access to TFIs, and economies of scale to market participants from the speed and relatively reduced cost associated with use of blockchain as an innovate payment solution.[117]

In the next Section, the more important question of what impact an interdependence between TFIs and VC-exchanges may have on the global payment system stability is examined. The immediate and extended effects of an exposure by the TFI to VC exchange's operational risk-cyber security is analysed critically.

Implications of Cross-Pollinating VC Exchanges' Risks to Global Payment System

Despite the several risks of VCs generally, the most systemic risks of VCs and their exchanges revolves around cyber-security.[118] Although not peculiar to the VC exchanges, the frequency with which cyber-attacks have ravaged the exchanges since their inception has generated concerns among domestic and international financial systems' regulators.[119] These attacks are from cyber-criminals who hack into the exchange's platform and cause theft of VCs through surreptitious mining activities. The vulnerability of the exchanges to attacks are primarily from the features of VCs including: anonymity, lack of centralised authority (regulator) and

[115] Armour, *Principles of Financial Regulation* (n 11) 407–8; Bank for International Settlements (Committee on Payment and Settlement Systems and Technical Committee of the International Organization of Securities Commissions), *Principles for Financial Market Infrastructures* (April 2012) <https://www.bis.org/cpmi/publ/d101a.pdf> (accessed 9 August 2018).

[116] Awrey and van Zwieten (n 3) 796; Armour, *Principles of Financial Regulation* (n 11) 407.

[117] *Interdependencies of Payment and Settlement Systems* (n 75) 14.

[118] Bank for International Settlements (Committee on Payments and Market Infrastructures), *Digital Currencies* (November 2015) <https://www.bis.org/cpmi/publ/d137.pdf> (accessed 9 August 2018); *Opinion on Virtual Currencies* (n 110) 21–36; Lawrence J Trautman and Alvin C Harrell, "Bitcoin versus Regulated Payment Systems: What Gives" (2017) 38(3) Cardozo L Rev 1041.

[119] *Opinion on Virtual Currencies* (n 110) 44; and generally, *Virtual Currencies and Beyond* (n 4).

irreversibility of transactions.[120] Since the Mt. Gox bankruptcy in 2014, several cyber-attacks involving millions in stolen VCs have ravaged subsequent exchanges with the recent in CoinCheck where $500m worth of Bitcoins were stolen from the exchange's online wallet.[121] These attacks pose systemic risks to the entire virtual community presently but not the financial systems because they are not interlinked with the banking system TFIs.[122]

Thus, a consolidation between TFIs and VC exchanges may result in the cross-pollination of risks of cyber-attacks and liquidity crisis through their interdependence. This will likely emanate from TFI's use of VC exchanges for the processing of high-value cross-border payment instructions due to the blockchain's speed, reduced costs and efficiency in clearing and settlement of payment transactions. An example could be made of the likely effect a loss (through cyber-attacks) of a high-value cross-border payment transaction jointly processed by a TFI and VC exchange will have principally on the banking system as a key stakeholder in the global payment network and the 'knock-on effect' the banking systems failure will have on financial systems and institutions interdependent on it. This indirect interdependence through the activities of GSIFIs results in a new breed of "cross-system" risks— in which the failure of a financial system or institution could have a domino effect on all other systems that are dependent upon its continuity for their stability.[123]

Apart from the Bankhaus Herstatt failure earlier used as an example in this Section, a closely related example could be made of the effect the failure of Lehman Brothers—another multinational TFI— in the United States had on all other financial institutions and national economies linked to the US Subprime Mortgage market.[124] Admittedly, this example does not concern payment systems, but it serves as a reference point for the increased interdependence of the global financial systems. It also confirms the domino effect the failure of a key stakeholder can have on other market participants, consumers and national economies interdependent on it.[125]

The examples considered above suggests that VC exchanges effect on global payment system could result in increased efficiency and a possible paradigm shift in

[120] *Virtual Currencies and Beyond* (n 4) 24–33

[121] See Cointelegraph, "How to deal with Cyber-Attacks" (March 2019) <https://cointelegraph.com/news/mt-gox-coincheck-binance-and-more-how-exchanges-are-learning-to-deal-with-cyber-attacks> (accessed 9 August 2018).

[122] *Virtual Currency Schemes* (n 108) 39–40.

[123] *Interdependencies of Payment and Settlement Systems* (n 75) 28–30.

[124] Mark T Williams, *Uncontrolled Risk: The Lessons of Lehman Brothers and how Systemic Risk can Still Bring Down the World Financial System* (McGraw-Hill 2010).

[125] *ibid*.

the global payment infrastructure. These effects will stem from an increased volume in the number large-value payments across several financial systems through TFIs collaborating with VC exchanges. The blockchain open distributed network may also eliminate payment and settlement risks associated with cross-border payments while encouraging financial inclusion and transparency since transactions are concluded in (near)real-time and recorded on the block.[126] On the flip side, the consolidation could result in additional exposures by TFIs (and banking system) to the operational risks (particularly cyber security) of VC exchanges if not managed.

While this risk may appear minimal presently, it may quickly pose considerable risks if the desire for increased profitability by TFIs occasion an increased use of the VC exchanges for high value transactions. If this happens, the failure of any such transaction from exposures (to which VC exchanges are vulnerable) could cause potential disruptions to the reliant global payment systems. This could further result in systemic failures of interdependent financial systems (their consumers and market participants) who rely on each other for payment processing, risk management, liquidity and settlement in transnational flow of financial assets.[127] Disruptions from indirect relations are known to creep spread within interdependent networks through complex paths with uncertain levels of intensity.[128]

For regulators of payment systems, the emerging issues from this VC-TFI consolidation will primarily concern the role of Central banks as provider of liquidity and prudential oversight for the domestic payment systems.[129] The use unregulated VC exchanges pose two major challenges to regulators. First, stability of the banking system (and payment system) is maintained by central banks through the provisions of emergency liquidity and general monetary and economic policies.[130] A consolidation between TFIs and VC exchanges which operate globally may affect the functioning of Central banks. This challenge and possible solutions are dealt with later in this paper.[131] Lastly, VC exchanges operate a predominantly self-regulatory regime (using cryptography and blockchain) outside the perimeter of the regulated banking system despite its provision of core financial functions. The anonymity of its transactions implies that its popularity

[126] For payment and settlement risks, see *Interdependencies of Payment and Settlement Systems* (n 75) 27; Alexander *et al*, *Global Governance of Financial Systems* (n 36) ch 7.

[127] *Interdependencies of Payment and Settlement Systems* (n 75) 31.

[128] *ibid* 42.

[129] *Virtual Currency Schemes* (n 108) 33–42.

[130] *ibid*.

[131] *Non-Banks in Retail Payments* (n 92) section 6.

could have serious consumer protection issues that are beyond the scope of the users and (possible the central banks) as regulators.[132]

In concluding this Part, it is arguable from empirical evidence that TFIs adopt innovative payment solutions in the form of collaboration with modern technology providers for the provision of financial services with minimal operational costs.[133] Although the banking system is not directly linked to VC exchanges presently, the evidence of initiatives by TFIs on adopting blockchain suggests the likelihood of a future alliance.[134] If this trend gains popularity among financial systems and TFIs who are key stakeholders in the global payment systems, it could potentially set in motion a form of interdependence in which VC exchanges are stakeholders. This could ultimately result in potential disruptions and systemic risks to the entire global payment system if any institutional failure occurs to VC exchanges considering the interdependence it would have with TFIs. The primary barrier to the popularity of VC wide acceptance of VC exchanges emanates from its operational risks—particularly cyber security— in addition to its unregulated, anonymous and irreversible payment operations.[135] These challenges are not uncommon to technological innovations (as can be seen from the activities of other financial technology PSPs) and can be tackled using the technology and coordination.

From the above reasons, I argue that a financial consolidation between a VC exchange and a TFI could make the global payment system more efficient and cost friendly. However, the collaborations could also pose potential disruptions and systemic risks to the interdependent global payment systems if the exposures of VC exchanges are left unchecked. A possible cross-pollination of risks could result in the future if the exchanges become widely accepted -particularly in high value payments. This conclusion is admittedly speculative considering the likelihood of such consolidation is dependent on the actualisation and success of several proposed initiatives. Still, it provides an insight into the implications such integration could breed.

In the next Section, having established that VC exchanges could advance the functioning of global payment systems if the operational risks are better

[132] See *Non-Banks in Retail Payments* (n 92): Drawing inference from the similarity in the mechanisms of Virtual currency systems and non-banks operating outside the regulated perimeter of banking system.

[133] *ibid* Executive Summary.

[134] See Blockchain, "Major Banks Have adopted Blockchain" (November 2017) <https://blockchain.works-hub.com/learn/Which-Major-Banks-Have-Adopted-or-Are-Adopting-the-Blockchain-> (accessed 9 August 2018.

[135] *Virtual Currency Schemes* (n 108) 42.

managed, I would examine whether VCs and their exchanges require regulatory interventions like TFIs and more importantly, by who?

IV. Who should regulate VC payment systems?

In the preceding Section III, I examined the benefits and potential disruptions-systemic risks-that VCs exchanges may pose to the global payment system through a possible financial consolidation with TFIs. The major exposure of VC exchanges identified revolves around cyber security primarily resulting from anonymity and irreversibility in VC dynamics. In this Section, my aim is to examine whether VC exchanges require regulatory interventions from central authorities like TFIs in payment systems? If yes, By who? To achieve this objective, the Section is divided into three parts.

Part A will briefly consider the desirability of regulatory intervention on VCs exchanges. In Part B, focus will be on the regulators of TFIs in traditional payment systems. For this part, I shall limit my scope to central banks as the major regulator. Their limitations on extraterritoriality will also be analysed. Lastly, Part C will consider the desirability of regulating VC exchanges through international regulatory bodies in collaboration with domestic regulators. I should state presently that the aim of this Section is not to provide an exhaustive research on the subject but merely to explore some conceptual legal alternatives that may be referenced for further research.

A. Do VC exchanges require regulatory intervention?

As mentioned in Section II, VCs operate a self-regulated system in which all members of its virtual community (especially its developers) are responsible for maintaining the safety and integrity through their activities on the blockchain.[136] VC exchange system are especially designed this way to ensure financial inclusion and independence by avoiding the regulatory costs and limitations that plague TFIs.[137] Studies suggests that while VC exchange's system is essentially technology driven, its self-regulatory approach is not entirely new. Similar practice was recorded in the 19th century under the 'Suffolk banking system' where payment settlement and clearing is done 'in house'.[138] But, the regulation of any payment system must

[136] Awrey and van Zwieten (n 3) footnote 141.

[137] *ibid* footnote 140.

[138] *ibid* 790, citing Charles Calomiris and Charles Kahn, "The Efficiency of Self-Regulated Payment Systems: Learning from the Suffolk System" (1996) Journal of Money, Credit and Banking 766, 780; Gary Gorton, "Free Banking, Wildcat Banking and the Market for Bank Notes" (Wharton Financial Department, Working Paper, 1989).

critically focus on its efficiency, convenience, and safety.[139] While blockchain web-based system appears efficient and convenient for its continuous availability, the continuous cyber-attacks that have plagued VC exchanges suggests that the safety of the system leaves much to be desired presently.

Whether this vulnerability is because of a flaw in the blockchain system or internal negligence of the crypto-currency exchanges is beyond the scope of this paper. Suffice to reiterate that an emerging issue concerning VC exchanges (like other 'shadow payment systems') revolves around their capacity and incentive to take adequate measures to assess and manage the risks to which their systems (and their consumers) are exposed.[140] For example, during the notorious Mt.Gox bankruptcy, the users of its platforms were not protected by any form of insurance for their deposits and where therefore regarded as unsecured creditors under bankruptcy laws.[141] In this example, it appears that the losses suffered by the consumers using the Mt.Gox platforms was as a result of lack of prudential regulation guiding the internal structure and functioning of the exchange. To prevent the occurrence of this risk on its platform, Coinbase stores only 20% of its VCs holdings in the online wallets while the rest are stored offline.[142] While this measure might ensure better efficiency to custodial storage, it leaves open the window of possible attacks during the use of the platform as gateways for online virtual payments. To remedy the exposures in the VC exchanges, Awrey and van Zwieten have proposed some strategies including: storage of deposits with TFIs (Piggy-banking), deposit insurance with third-party schemes and the holding of deposits by VC exchanges as trusts.[143] While these strategies are plausible, their efficiency in the event of a financial consolidation between VC exchanges and TFIs cannot be determined conclusively. This is because the laws attempting to regulate VCs are divergent and uncertain presently.

The VC-TFI consolidation, as earlier mentioned, may pose significant systemic risks to global payment systems interdependent on it.[144] With the likelihood of VC exchanges facilitating transnational large-value payments through the conglomerate, special attention must be given to ensuring the safety of the system to avoid disruptions and externalities its failure might result on consumers, market participants and the global payment systems.[145] Reputational risks to the integrity

[139] See *Non-Banks in Retail Payments* (n 92).
[140] Armour, *Principles of Financial Regulation* (n 11) 407.
[141] Awrey and van Zwieten (n 3) 809.
[142] See Coinbase <https://www.coinbase.com/> (accessed 12 August 2018).
[143] Awrey and van Zwieten (n 3) 808–816. For measures to virtual currencies generally, see *Opinion on Virtual Currencies* (n 110) 38–45.
[144] *Opinion on Virtual Currencies* (n 110) 35.
[145] *Interdependencies of Payment and Settlement Systems* (n 75).

of the whole global payment systems from a failure of VC exchange also makes it imprudent to leave the regulation of such a potentially significant institution in the hands of "unknown regulators".[146] As a potential systemically important payment system (by association with the TFIs), VC exchanges require adequate rules on prudential regulation to ensure best practices within its internal and external functioning.[147] These regulations should naturally be from authorities with vast expertise and experience in financial dynamism and risk management which is hardly possessed by the software developers in which VC exchange's control are presently vested.[148]

Discernible from the facts considered above is that while VC exchange self-regulatory regime might appear efficient for miniature payment systems, it is grossly inadequate where it involves a broader interdependent network of financial systems.[149] The oversight by an external experienced regulatory body (for instance, a central bank) will not only give credence to the integrity of the payment system as a viable alternative, it would also opportunity to study the taxonomy and better manage possible risks from its operations.

In the next Part, I will examine the role of central banks as the major regulator of traditional payment systems. Its limitations as to scope of authority and efficiency in cross-border payments will also be analysed. The purpose of this examination is to tease out the challenges of the present divergent attempts by national regulators to regulate the global operations of VC exchanges.

B. Who regulates traditional payment systems?

The question of who regulates payment systems, TFIs and PSPs within national economies is not hard to answer. This is because, as mentioned in Section II, payments facilitation is among the core financial functions performed by traditional deposit-taking banks.[150] By implication, they are regulated alongside the traditional banking system. Other regulators of the securities system (including the Securities and Exchange Commission) also play significant role in the regulation of payment systems although through collaboration with the banking system.[151] The major regulators of the banking system (and by extension, payment systems) within domestic jurisdictions are the central banks.[152] For example, the Bank of

[146] Hughes and Middlebrook (n 6).
[147] *ibid*.
[148] *ibid*.
[149] For different virtual currency schemes, see *Virtual Currency Schemes* (n 108).
[150] Awrey and van Zwieten (n 3).
[151] Armour, *Principles of Financial Regulation* (n 11) section 18.3.3.
[152] Green, "The Role of the Central Bank in Payment Systems" (n 36); *Payment Systems Worldwide* (n 15) 1.

England in the United Kingdom, the Federal Reserve in the United States and regional European Central Bank in the Eurozone.[153] The central bank is specially crafted as a regulator of payment systems through its role as a catalyst and liquidity provider.[154]

As a catalyst, the central bank oversees the activities of TFIs and ensures stability of the payment systems through regulations, rules and guidelines reflecting its risk reduction policies.[155] This could be in the form of extended monetary policies on the flow of financial instruments (particularly fiat currencies) and broader prudential regulations on activities of key players within TFIs. This prevents operational risks that may result in institutional failures and negative effects on interdependent payment networks and markets.[156] As a liquidity provider, the central bank regulates the stability of payment systems by providing liquidity gap-filling through emergency intra-day credit facilities to TFIs(banks). In extreme cases that may threaten stability of financial systems, it acts as a lender of last resort in addition to its special resolution regimes on, market entry and exit of TFIs.[157]

This role played by central banks is crucial to the overall functioning and stability of the payment system within the national economies. In cross-border payments—involving several TFIs within different jurisdictions—the different central banks act as the central clearing institutions for the payments facilitated through their TFIs. For this role, they employ automated international payment messaging systems (for example, SWIFT) and foreign exchange clearing and settlement system-continuous linked settlements (CLS).[158] While regulatory policies and objectives are clearer in domestic payment systems, issues arise with their implementation on TFIs which operate within multiple jurisdictions.[159] Critical queries which challenge efficient implementation include: Which of the central banks in the different jurisdictions should regulate the TFI? Should it be the central bank in the home country where the TFI's headquarters is situated? Or better still should every central bank treat each subsidiary within its jurisdiction as a distinct entity and Brummer regulate it as such?

These questions are important for two major reasons: (a) central banks are established pursuant to the legislative instruments of sovereign jurisdictions with clearly defined powers and scope. They therefore (in most cases) lack the powers to regulate TFIs operations outside their territory because it poses threat to

[153] Hughes and Middlebrook (n 6) Part II.
[154] Alexander *et al*, *Global Governance of Financial Systems* (n 36) 184.
[155] *ibid*.
[156] Awrey and van Zwieten (n 3).
[157] *ibid*.
[158] Armour, *Principles of Financial Regulation* (n 11) section 18.2.3.
[159] Brummer, *Soft Law and the Global Financial System* (n 80) ch 1.22.

sovereignty of other jurisdictions; and (b) since cross-border large-value payments are majorly facilitated through multinational TFIs, the risk of systemic risks crossing territorial borders from through a TFI subsidiary to other branches in the financial conglomerate (and the financial systems in which they operate) increases exponentially.[160]

Consequently, although a central bank may efficiently manage risks within its jurisdiction, it remains permanently exposed to systemic risks from other jurisdictions due to its indirect interdependence through reliance on activities of TFIs operating in multiple jurisdictions.[161] The concerns are particularly exacerbated by the fact that central banks—as a limb of the sovereign authority—have diverse approaches to how TFIs and financial systems should be regulated.[162] While some financial systems, for example the United States, are heavily regulated, others—like Switzerland—operate a loosely regulated financial system. This disparity and competition among central banks results in regulatory arbitrage—through which financial institutions fashion payments within regulatory gaps for profit maximisation.[163]

Drawing inference from the above, are central banks capable of regulating VC exchanges alone? The answer is arguably, 'no'. This is because, like Mt.Gox, most exchanges, although located within national jurisdictions, operate significantly on an international network outside the regulatory scope of the domestic regulators. Second, recent trend suggests that the approach of national regulators is not unified.[164] While some countries have welcomed the financial innovation and reviewed their laws to regulate its activities (for example, United States) , others have either banned its operations or remain indifferent(for example, China).[165] The latter group's action is essentially premised on their believe that the VCs and exchanges are incapable of developing into a significant means of exchange over

[160] Masayasu Kanno, "Assessing Systemic Risk using Interbank Exposures in the Global Banking System" (2015) 20 Journal of Financial Stability 105; Ouarda Merrouche and Erlend Nier, "Payment Systems, Inside Money and Financial Intermediation" (2012) 21(3) Journal of Financial Intermediation 359.

[161] Alexander *et al*, *Global Governance of Financial Systems* (n 36) 23–6; *Interdependencies of Payment and Settlement Systems* (n 75).

[162] For a concise reading on present approach by states to the regulation of Virtual currencies, see Hughes and Middlebrook (n 6) 507–12.

[163] Defined Regulatory Arbitrage as "those financial transactions designed specifically to reduce costs or capture profit opportunities created by different regulations or laws": see Frank Partnoy, "Financial Derivatives and the Costs of Regulatory Arbitrage" (1997) 22 Journal of Corporate Law 211, 227, cited in Hughes and Middlebrook (n 6) 500. For further readings on arbitrage, see also, Annelise Riles, "Managing Regulatory Arbitrage: A Conflict of Laws Approach" (2014) 47 Cornell Law Review 63; Benjamin, *Financial Law* (n 94) ch 23.

[164] Hughes and Middlebrook (n 6) 507–12.

[165] *ibid*.

and above traditional payment systems.[166] Cross-pollination of risks between VC exchanges and TFIs connected to it make the likelihood of a cross-system risk more likely than ever if the financial consolidation considered becomes a reality. This draws from the same argument as the indirect interdependence of payment systems. For this reason, I argue that a domestic regulator-central bank-cannot efficiently manage the risk potentials stemming from the global network of VC exchanges operating independently or in consolidation with multinational TFIs.

In the next Part, I will consider the desirability of international bodies acting as regulators of VC exchanges and therefore managing the risks emanating from its operations as a global concern.

C. Should VC payment systems be regulated by international regulatory bodies?

Perhaps I should state presently that the term 'international regulatory bodies' is used in this Part to collectively refer to international organisations, institutions and agencies including: The Group of 20 (G20), Financial Stability Board (FSB), Basel Committee, Organisation for Economic Cooperation and Development (OECD), Bank of International Settlement (BIS), IOSCO, Word bank and International Monetary Fund (IMF). While their evolution and scope of application is admittedly invaluable, it is beyond the scope of this present paper.[167]Suffice to mention that their memberships account for more than 90% of central banks and key financial officers of both emerging and advanced economies.[168] My aim is to briefly examine why these bodies (including institutions and agencies which make up the international financial regulatory architecture) should be considered as the regulators of VC exchanges as a potential stakeholder in the interdependent global payment system.

In arguing the desirability of international bodies over domestic regulators, my primary focus will be on the need for international coordination and cooperation. This is because, empirical evidence from the recent financial crisis suggests that divergent approaches by states towards managing potential disruptions to global stability resulted in regulatory arbitrage.[169] This arbitrage

[166] *ibid* 514.

[167] For broad readings on the evolution and functioning of international financial institutions and organisations, see Brummer, *Soft Law and the Global Financial System* (n 80); Armour, *Principles of Financial Regulation* (n 11); Alexander *et al*, *Global Governance of Financial Systems* (n 36); James Calvin Baker, *The Bank for International Settlements: Evolution and Evaluation* (Quorum Books, 2002).

[168] Brummer, *Soft Law and the Global Financial System* (n 80) 68.

[169] Christopher Arup, "The Global Financial Crisis: Learning from Regulatory and Governance Studies" (2010) 32(3) Law & Policy 363.

in turn fostered the disruption's navigation through several financial systems and the attendant systemic crisis failures.[170] A similar trend of divergent approaches are observable in the attempts at regulation of VC exchanges several financial systems.[171] To prevent the likelihood of another disruption navigating clandestinely through the interdependent payment network, there is need for cooperation and coordination among global regulators to manage potential disruptions.

International Coordination and Cooperation

As mentioned in Section II, global payment systems (and financial systems) are interdependent with the major drivers being technology, deregulation, and innovation.[172] The interdependence also means that potential risks and failures of each financial systems or GISIFIs could have adverse effects on other interconnected systems if not jointly managed.[173] These exposures to 'cross-system' risks make it incumbent on all financial systems and their regulators to cooperate (through 'dual supervision') in assessing potential risks to and jointly coordinating any risk management agenda.[174] The argument for the need of international coordination and cooperation for VC exchanges stem primarily from three reasons: (a) they operate through a web-based system globally and their risks are "a global problem that require global response";[175] (b) the attempt by national regulators are uncoordinated and overregulation could lead to regulatory arbitrage and transfer of systemic risks within the global payment network;[176] and (c) The authority of central banks are limited to their sovereign jurisdiction and inefficient for transnational supervision required for VC exchange activities.

The international bodies referred in this Section are mostly created in response to major crisis and disruptions that have threatened the global financial stability at one point or the other.[177] For example, the BIS (also termed the 'central bank's central bank') which manages the risks associated with international settlement and foreign exchange (with IMF, created during the Bretton Woods Agreement 1944) between payment systems was established in response to the

[170] *ibid*.
[171] Hughes and Middlebrook (n 6) 507–12.
[172] Brummer, *Soft Law and the Global Financial System* (n 80); Armour, *Principles of Financial Regulation* (n 11) 10.
[173] *Interdependencies of Payment and Settlement Systems* (n 75).
[174] *ibid*.
[175] Brummer, *Soft Law and the Global Financial System* (n 80); Armour, *Principles of Financial Regulation* (n 11) 16.
[176] Brummer (*ibid*) 227; Armour (*ibid*) ch 28.
[177] Brummer (*ibid*) 61; Alexander *et al*, *Global Governance of Financial Systems* (n 36) ch 2.

failure of German Bankhaus Herstatt earlier discussed.[178] Through the CPMI (formerly CPSS), the BIS has conducted several surveys on trends in payments and settlement systems to identify potential disruptions including recently on VCs.[179] It (like most international bodies) also has the general mandate of promoting the safety and efficiency of payment, clearing and settlement arrangements within and across financial systems.[180] Similarly, the G20 (formerly G7) comprising the largest economies globally was created to contain the systemic failures resulting from the 1997 Asian financial crisis which started Thailand.[181]

VC exchanges (like TFIs) perform core payment functions within multiple financial systems which may one day be crucial to stability of financial systems. The internationality and dominance of their operations may also be amplified if the integration with the TFI becomes a reality. If so, the internal complexities associated with the operations of exchanges and possible exploitation by TFIs will arguably make attempts by individual jurisdictions in regulating the institutions Herculean and inefficient.[182] Thus, they may become "too big to manage" (a subset of the notorious 'too big to fail').[183] The likely cross-pollination of risks from an important VC exchange to other institutions (and indirectly their financial systems) could result in potential disruptions to the global payment systems.[184] If this occurs, individual efforts of central banks will have little effect in containing the economic disruptions and spill-over except there is a communal approach between financial systems regulators globally. The communal approach canvassed here is one of the core features of international regulatory bodies.[185] The different bodies in the international financial architecture, while separate, complement one another through information-sharing, synchronised objectives, joint surveys,

[178] Brummer, *Soft Law and the Global Financial System* (n 80); Armour, *Principles of Financial Regulation* (n 11) 75.

[179] Brummer (*ibid*) 85; Bank for International Settlements (Committee on Payments and Market Infrastructures), *Digital Currencies* (November 2015) <https://www.bis.org/cpmi/publ/d137.pdf> (accessed 9 August 2018).

[180] Bank for International Settlements (Committee on Payments and Market Infrastructures), *CPMI Charter* <https://www.bis.org/cpmi/charter.htm> (accessed 9 August 2018); *Payment Systems Worldwide* (n 15) 115; Armour, *Principles of Financial Regulation* (n 11) 621.

[181] For concise readings on the Asian crisis, see Roman Terrill, "The Promises and Perils of Globalization: The Asian Financial Crisis" (1999) 9(1) Transnational Law & Contemporary Problems 275.

[182] Fariborz Moshirian, "The Global Financial Crisis and the Evolution of Markets, Institutions and Regulation" (2011) 35(3) Journal of Banking and Finance 502.

[183] *ibid*.

[184] *Interdependencies of Payment and Settlement Systems* (n 75).

[185] Brummer, *Soft Law and the Global Financial System* (n 80); Armour, *Principles of Financial Regulation* (n 11) 65–75.

implementation and compliance.[186] To facilitate the symmetry, they are classified broadly into agenda setters, standard setters, compliance monitors and sector setters.[187]

On the part of the participating economies, they function as implementers, peer reviewers and compliance monitors among themselves to ensure uniformity in compliance of the recommended standards and best practices to issues deliberated during sessions.[188] Compliance are ensured through binding laws by international institutions created by charter or statute (IMF, World Bank) and economic sanctions for breach.[189] However, save the two institutions mentioned, the predominant bodies in the international financial structures are established through international agreements, bylaws and declarations.[190]

This method has two significant implications: (a) Their existence and legitimacy are entirely dependent on the voluntary participation of member states; and (b) They have no powers to make binding laws but instead regulate through recommendations or published minimum standards which members voluntarily implement by reviewing the laws in their domestic financial systems (termed 'international soft laws').[191] The functioning of the international bodies considered above are crucial to the managing of potential disruptions that may affect the stability of financial systems (including payment systems). For VC exchanges, these bodies are through their global network able to gather information from several financial systems essential to the understanding of the dynamics of the innovative payment system.[192] This way, a uniformed regulatory approach could be devised through legislations and 'soft laws'. These will in turn be implemented

[186] Armour (*ibid*).

[187] Agenda setters are "organizations with broad and diverse memberships, including both regulatory and to, a lesser extent, political actors that are tasked with defining broad, strategic objectives for the international system'. Standard setters are lesser less political actors tasked with devising standards for ultimate adoption or implementation by national regulators and authorities. International monitors are 'organizations responsible for identifying whether (and to the degree to which) regulators comply with international financial law": see Brummer, *Soft Law and the Global Financial System* (n 80); Armour (*ibid*) 70, 74, 91; Alexander *et al*, *Global Governance of Financial Systems* (n 36) ch 2.

[188] Brummer (*ibid*) ch 2.; Alexander *et al* (*ibid*) ch 3.

[189] Brummer (*ibid*).

[190] *ibid* 63–4.

[191] *ibid*; "International soft laws refer to legal norms, principles, codes of conduct, and transactional rules of state practice that are recognized in their formal or informal multilateral agreements": see Alexander *et al*, *Global Governance of Financial Systems* (n 36)138.

[192] Brummer, *Soft Law and the Global Financial System* (n 80) 69.

globally by participating central banks with compliance monitored closely by both international agencies and peer review by member states.

However, as appealing as this strategy appears, it is not without criticisms that can limit its efficiency. First, since international regulatory bodies are comprised of both emerging and advanced financial systems, it raises a query on whether any approach adopted will suit either system.[193] This is especially because the intricacies of domestic financial systems are shaped significantly by the level of development of its financial markets, level of exposures of its consumers and political ideologies.[194] To have all these interests represented in the international forum results in significant clash of interest and political manoeuvrings.[195]

Second, a significant proportion of rules by international bodies are soft laws which are non-binding but subject to the voluntary implementation by member states.[196] Peer review and monitoring could be limited by states clinging to territorial sovereignty and economic protectionism which prevents a unified implementation of approach.[197] The challenges however do not, in practice, affect the effectiveness of the functioning of international financial bodies. States are in fact persuaded to cooperate amongst themselves because it guarantees better economic development to their financial systems.[198]

In conclusion, it is arguable that the limitations of the international regulatory bodies stated above could be easily circumvented through an increased autonomy to states in the implementation of the recommendations. This could be achieved by allowing member states to implement a slightly altered approach to the general recommendations by international bodies (termed 'subsidiarity').[199] This is because regulators of domestic systems—central banks—have better knowledge of the peculiarities of their financial systems and how best to manage potential disruptions.[200] This first-hand knowledge is not available to international bodies since they rely predominantly on information shared by members for conducting surveys into global concerns.[201] Most of the information may be doctored by central banks to protect the integrity of their payment systems and state sovereignty.[202]

[193] *ibid* 65–6.
[194] *ibid*.
[195] *ibid*.
[196] Alexander *et al*, *Global Governance of Financial Systems* (n 36) ch 4.
[197] Alexander *et al*, *Global Governance of Financial Systems* (n 36) ch 4.
[198] *ibid*.
[199] Brummer, *Soft Law and the Global Financial System* (n 80); Armour, *Principles of Financial Regulation* (n 11) ch 3.
[200] Brummer (*ibid*) 69.
[201] *ibid* 61–3.
[202] *ibid* ch 5.

Subsidiarity could admittedly create a situation where states abuse the privileges for political motives.[203]

But, this could be curtailed by subjecting any modification to strict compliance to the universal objective upon which such recommendations are made.[204] Furthermore, joint monitoring effort by regulatory agencies and peer review could also help ensure uniform implementation of the recommended best practices.[205] It remains to be seen whether the international community will move past the present dismissive attitude towards potential disruptions of VC exchanges to the global payment systems and take steps to manage the exposures while harnessing the economic benefits it offers.

V. Conclusion

This paper has identified what payment systems are, the categories and core functions they perform through the functioning of traditional financial institutions. The role of payment systems and financial institutions as key stakeholders in the global financial system stability was also discussed in the paper to exemplify the importance of their activities. I further examined the taxonomy of virtual currencies as payment systems, how their open distributed ledger network functions over p2p networks and importantly their functioning as payment systems through crypto-currency exchanges. Due to the role of payment systems in global stability, the paper also considered how the global payment systems work with focus on the role of multinational financial institutions as stakeholders of global payment system. The indirect interdependence of financial systems through the activities of financial institutions among other major drivers and its implications were identified. This was to establish a trend of how traditional financial institutions have survived as key stakeholders despite the recurrent innovations in payment systems.

As a foundation to the possible integration of virtual currency payment exchanges into this indirect relationship, the paper identified the major drivers of global interdependencies particularly technological innovation and financial consolidation between traditional payment systems and new entrants. The paper thereafter analysed the transactional advantages of using blockchain in the facilitation of large value payments as a possible driver for the integration between virtual exchanges and traditional institutions to benefit from the economies of scale and scope. To balance the scale, the attendant exposures of such integration, particularly the vulnerability of virtual exchanges to cyber-attacks and the systemic

[203] *ibid.*
[204] *ibid* ch 3.
[205] *ibid.*

risks to connected institutions was used as the baseline for the likely implications of a financial consolidation on the interdependent global payment systems.

Systemic risks arising from interdependencies of financial systems breeds a new form of cross-system failures where financial systems are exposed to the risks of other financial systems through the activities of financial institutions operating within multiple jurisdictions. The traditional risks of payment systems- payment and settlement risks and the knock-on effect it could have on connected systems and institutions were exemplified by the failure of Mt. Gox within the virtual community and Bankhaus Herstatt in the real economy. While these risks may be eliminated through blockchain system, it leaves open the possibility of exposure by the traditional institutions to the operational risks of VC exchanges if not closely managed. The risks, while possibly having immediate effect on the connected financial institutions, has the potentials of transferring to the financial systems in which they are popular.

Consequent upon the identification of these risks, the paper considered the possibility adopting a regulator that has the financial architecture to manage the exposures likely to emanate from the integration of the VC exchanges into the global payment network. A first reference was made to the activities of central banks as the major regulators of financial services providers in national payment systems. While their efforts are laudable, the paper argued from facts and examples that the limitations to the scope of authority resulting from sovereignty and lack of interoperability of central banks make them inefficient as the adequate regulator of VC systems. This conclusion was premised on the fact that virtual exchanges operate on a global network which central banks are incapable of controlling. The divergent attempts by different financial system regulators also breeds regulatory arbitrage that may affect trade balances and foster activities that might generate risks within regulatory gaps.

To ameliorate the challenges of regulating traditional institutions and multinational VC exchanges, the paper argued for the adoption of international bodies as the major regulators of VC exchanges. The core of the argument was anchored on the need for cooperation and coordination among financial systems to manage the global concerns arising from the operations of VC exchanges and by extension the payment instrument. The limitations of international bodies, particularly relating to the predominance of non-binding soft laws and concerns of political manoeuvrings between emerging and advanced economies during sessions was identified. As a possible solution to this challenge, the paper suggested a form

of subsidiarity where states are giving autonomy but subjected to the overriding good-faith towards the objectives of the international soft laws.

I argue that the views expressed, if adopted, will foster an enabling environment to usher in an era of global payment systems transformation through financial inclusion, transparency and efficiency. Risks arising from financial activities are not abnormal, the only abnormality arises from not paying attention to them until they result in catastrophic situations. The reactive approach to regulation is grossly inadequate to match the meteoric evolution of financial systems and activities. The integration of VC exchanges and traditional financial institutions will no doubt benefit the global payment systems and the broader financial system whose financial assets they facilitate if financial innovation is fostered and the risks jointly managed.