UNIVERSITY OF GOTHENBURG

Global Finance at Crossroads - Undisrupted Flow or Global Woe?

A qualitative approach to addressing financial fragmentation through understanding of networks and fintech

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Abstract

Financial fragmentation has accelerated post the sanctions on Russia as a coalition of nations seek alternatives to Western financial infrastructure. A scenario where two, or several, financial systems operate without an intermediary would be disastrous as it calls for increased complexity of conducting transactions, geopolitical tensions, disruption of trade and regulatory challenges. This exploratory thesis uses a qualitative approach to explore how financial fragmentation can be addressed, and what role fintech might play in applying potential solutions. The study was conducted through four semi structured interviews, and by utilising a theoretical framework concerning concepts and methods on fintech, network theory and network science, the data was analysed by utilising thematic analysis. The empirical results suggest themes of political will, regulation, technology, and collaboration being key variables in addressing financial fragmentation. Findings of this study imply that political will is the most crucial variable to consider as it acts as a driving force for addressing fragmentation, and that fragmentation should be addressed through concepts and methods serving from theories on networks as they reveal embedded power dynamics.

Keywords: Financial system, payment systems, Swift, financial networks, fragmentation, fintech

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1 | Introduction

For the last 75 years, the world has turned towards an ever accelerating state of interconnectivity and globalisation. That is, until now. Economists are broadly agreeing that the peak of globalisation has passed, and the term for what the global community is now heading towards has been suggested as "fracturing" (Shearling, 2023), with the expansion of BRICS demonstrating a clear shift in global power dynamics. Collectively, BRICS nations now account for approximately 35,6% of global GDP and 45% of the global population. In comparison, the G7 represents less than 30,3% in regard to the former and less than 10% in regard to the latter. An accelerating factor driving this shift is the sanctions on Russia in 2022, where the West weaponized financial infrastructure by disconnecting Russian banks from Society for Worldwide Interbank Financial Telecommunication (Swift). Swift is the leading global provider for facilitation of financial messaging, meaning it acts as the main instrument enabling financial institutions (FI), traditionally and particularly banks, to conduct transactions. Being severed from Swift is in practice equal to being isolated from the global financial system, which also was the aim of Western powers when imposing sanctions on Moscow in 2022. This weaponization of financial infrastructure has effectively caused Swift and the USD to be considered geopolitical risks (Greene, 2023), which in turn has urged, namely, non-Western nations to seek alternative infrastructure and establishment thereof. Since 2022, with Russia much in the forefront acting as a leader driving the initiative, BRICS have been promoting initiatives of de-dollarization and development of financial architecture which is decentralised and independent of Western mechanisms and policies. As stated during one of the BRICS summits of 2023, the coalition is aiming to make the use of local currencies in commerce and finance within and between emerging markets more attractive than the USD (Greene, 2023). Russian foreign minister Sergej Lavrov has reported that, "many are attracted by the fact that payment systems are being developed within BRICS. Which allows trading, investing, carrying out other economic operations without being dependent on those that decided to weaponize the dollar and the euro" (Dsouza, 2024).

Construction of parallel financial systems would, however, significantly alter the global financial landscape, and rather than being centralised, it could become fragmented. The objective of BRICS is to create a system fully parallel and independent of the dollar, which is of massive significance as it proposes a solution of independence away from Western infrastructure and the threat of

sanctions. However, successful development and implementation of a new payments system requires integration and interconnectedness to other infrastructure, as fragmentation without integration and interconnection with the ability to communicate between clusters would be disastrous for logistic and geopolitical reasons. Cross-border payments going through Swift are as of today subject to a range of issues, including high costs, lack of transparency and an average of between 2-5 working days for the money to reach the recipient. Lack of interconnection between clusters would magnify these issues, increasing the complexity of conducting cross-border payments, increasing the costs and the time required for the money to arrive. If a transfer in a centralised system requires a week to reach the recipient, how much time will it require to reach the recipient in a fragmented system where blocs are unable to communicate? Will it reach the recipient *at all*? Of course, all these effects have implications on global finance and geopolitics alike, including the effect on trade dynamics, regulatory challenges, and disruptions, putting states at risk of financial isolation.

Post the sanctions on Moscow, the potential of financial technology (fintech) was highlighted (Bank of Russia, 2023., IMF, 2022), with particular emphasis on its potential to be used as a tool to circumvent sanctions by use and development of alternative systems and cryptocurrencies. Fintech is the use of technology to enhance financial services, with the aim of improvement and automation, including digital payments and blockchain based systems. This paper aims to investigate how financial fragmentation can be addressed, and further how the potential of fintech as an advanced technology can be utilised in addressing solutions which can navigate the complexity, and facilitate interconnection of financial fragmentation.

The remainder of the paper proceeds according to the following structure: Chapter (1) presents the purpose of the paper and the research questions, academic relevance and limitations and delimitations. In chapter (2) I present an overview of literature, followed by (3), a short overview and background to key concepts in payments. Chapter (4) presents the theoretical framework and in chapter (5), I present empirical and analytical methods along with a discussion concerning validity and reliability of the research. In chapter (6) the results are presented, and in chapter (7) I invite the reader to an analysis of the results. The paper is concluded in chapter (8).

1.1 | Purpose and research questions

The effects of clustered financial systems without an intermediate connecting the clusters would arguably be disastrous, as it calls for increased complexity and cost of conducting cross-border transactions in addition to geopolitical tensions, disruption of trade and regulatory challenges among other effects. Although a scenario of parallel payments systems without an intermediate is not yet realised, it calls for speculation and proposal of solutions which address *how* communication between the clusters can be enabled. This is an exploratory thesis which "looks around the corner" at a phenomenon which has not yet been mapped sufficiently enough. Although financial fragmentation is evident and has been recognised by national equal international organs for several years, the solutions to fragmentation and clustered financial systems in particular remains dimmed and unclear. While aiming to contribute to filling a literary gap, the purpose of this paper is to investigate possibilities of how a financial fragmentation can be addressed and navigated. The paper puts specific emphasis on the potential solutions to financial fragmentation in regard to facilitation of not only cross-border, but also cross-bloc payments. Therefore, I propose the following question to act as a central point in this study: *How can financial fragmentation and clustering of global financial systems be addressed?*

As it has been indicated in the introductory chapter, this paper further takes interest in the phenomenon of fintech, which has become an integral part of the current and upcoming generation of financial services, and its potential to act as either an enabler or disrupter (or both) is widely debated, mapped, and speculated about. Deriving from a theoretical framework of network theory and financial technology, I further propose one additional question. *How can fintech be applied to these solutions?*

1.2 | Academic relevance

Monetary transactions are an integral part of our everyday life, and although seldom considered, so is the infrastructure facilitating them. Surprisingly enough, neither financial infrastructure nor payments or financial services and innovation within the field through financial technology have been particularly highlighted within the discipline of global studies, nor within the subdiscipline of global political economy. This despite their embeddedness in both major and minor phenomena

central within the field, such as globalisation and global (political) economy, security, and sustainability.

1.3 | Limitations and delimitations

The global financial system and movement away from its centralised nature gives rise to an array of rabbit holes to dive into. However, as of the limited scope of this paper, delimitations are to be made. The paper concerns financial fragmentation and possibilities of how it can be addressed. By financial fragmentation, the paper refers to financial infrastructure which facilitates payments, also known as and in this paper interchangeably referred to as payment systems. The scope of the paper is further delimited to exploring what solutions could be implemented to bridge the gap between clustered financial systems. Further, due to the vastness and contemporary nature of the phenomena of fragmentation, it is equally hard to measure as it is to speculate around what might or might not happen and what might be a reasonable, decent or even "good" solution to approach financial fragmentation and its implications through. Thus, this paper is ultimately of exploratory nature. Nonetheless, it might provide a basis for further hypothesis and research.

2 | Literature review

This chapter provides the reader an overview of previous literature concerning financial infrastructure, economic sanctions, weaponized interdependence, and de-dollarization and new initiatives.

2.1 | Financial infrastructure

The scope of research concerning financial infrastructure in the sphere of GS and GPE seems to be relatively untapped. This might be explained by payment and other financial infrastructure being regarded as mere technical "architecture" or "plumbing" in finance. In the wider sense, there is a tendency to regard it as a "background stage" (Bernards & Campbell-Verduyn, 2019, p.3, as cited in De Goede, 2020, p.352) on which high politics of interests, ideas and institutions are played out. However, recent literature has started to highlight how infrastructure is embedded with inequality, and often more political than thought as financial infrastructure is embedded not only with inequality, but also power (De Goede, 2020, p.359). Infrastructure facilitating global payments is

profoundly political and historically built on colonial violence and political struggle (De Goede, 2020, p.352-3). Keeping the embeddedness of colonialism and power in mind, financial infrastructure becomes subject to political agendas equal to other kinds of infrastructure. This could be exemplified through literature concerning colonial infrastructural projects which have used "the material world" (in this case canals) to "shape the conditions of possibility for collective life" (Mukerji, 2010, p. 404. As cited in De Goede, 2020, p.354). This insight is of interest to apply to the case of this study, where BRICS is detaching itself from Western financial infrastructure. Rather than being passive, infrastructure plays an active role in defining functionalities, routing flows, and connecting and disconnecting communities. As infrastructure inscribes particular functions, it also inscribes particular constraints. (De Goede, 2020, p.355,358). As described by Mitchell (2014, p.438), "modern infrastructures often express a contradiction between durability and uncertainty, grandiosity and destructiveness" (As cited by De Goede, 2020, p.358-9).

2.2 | Economic sanctions

Power, inequality, and political agendas embedded or enabled through financial infrastructure leads us to the topic of sanctions and modern geopolitics of sanctions which seeks to weaponise technical financial payments infrastructure by the objective of achieving security agendas. De Goede refers to sanctions targeting financial infrastructure as "seizing" it while exploiting routes and nodes of historically embedded payments infrastructure in order to hardwire contested security regulations. In the case of Swift, which has been and to this day still is the main facilitator of global interbank transactions, weaponization in the shape of sanctions have most notably been demonstrated in the case of Russia in 2022, and Iran in 2012 and 2018. Literature argues the effect of sanctions being anchoring of such in routes existing connectivity while exploiting the fact cross-border payments, despite decades of financial globalisation and diffusion, depend on limited points of passage and a state where infrastructure facilitating cross border payments is near to monopolised. This is motivated by the vast number of transactions which go through Swift, which according to literature published in 2020 processed about 80% of global interbank payments. Economic sanctions and weaponization of infrastructure have been a means of "soft" power mainly for the United States.

Literature further argues that although the new generation of sanctions can be powerful, they are often unable to be calibrated to the extent of policy makers desires, or to the extent necessary to achieve the desired, strategic objectives. It is argued that the greatest asset of sanctions simultaneously are their greatest liability, as the utilisation of global financial markets (which enables the extent of leverage) often is difficult to predict in regard to reach and effect (Feaver & Lorber, 2015, p.23). Since the 2010's, the US has implemented economic sanctions of different nature than previously by using the significance and extent of the USD in the global financial system and its position as a hub for many key technologies necessary for development of industries in countries outside of the US. For example, the case of Iran which has been severed from Swift twice, the US used its position as the "financial capital" of the world and a leading market to coerce foreign companies to cease their businesses with Iran. Foreign companies were given two choices, either do business in US financial markets and have access to dollars, or do business in Iran. Consequently, a large number of companies ceased their operations in Iran, which increased economic pressure on the country. These sanctions, of which one of the objectives are isolating the targeted state from Western financial markets, proved successful enough for the then US secretary of treasury for terrorism and financial intelligence to state that "Financial power has become an essential component of our country's national-security toolkit. That fact may mean that we are called on to use it more frequently and in more complex ways than we have in the previous decade" (Feaver & Lorber, 2015, p.23-4). Scholars have suggested this to be a demonstration of enforcing US sanctions on companies and financial flows regardless if they touch upon US territory and/or jurisdiction or not. Scholars further suggest that it is a demonstration of "hardwiring" US security sanctions into global payments technologies while depriving citizens and companies alike globally from infrastructurally remitting money to sanctioned states (De Goede, 2020, p.352). This "layering" of sanctions and overall weaponization of financial infrastructure, namely Swift, has called for affected states and their banks to develop autonomous global financial payments infrastructure, independent of any payments systems under the control of the US and EU to protect themselves (Katasonov, 2019. As cited in De Goede, 2020, p.352). This is one aspect which explains why national payment systems such as SPFS and CIPS have been developed during recent years, and why initiatives such as BRICS Pay have emerged.

Literature around sanctions, as confirmed by international FI's such as the IMF (Arsanalp et al., 2024), further suggests that central banks shift their reserves away from currencies which are at risk of being redeployed, and in recent years, the shift has much been in favour of gold. Although CB's have increased their purchases of gold since the financial crisis of 2008, gold purchases have accelerated in the last few years. Notably, in 2022 and 2023, the volume of gold purchased was more than double the annual volume of the previous ten years (Tran, 2024). This could, however, be explained as a move due to increased geopolitical risks rather than de-dollarization. While diversification of CB reserves does not cause fragmentation in itself, it can contribute to undermining of the dollar and initiate de-dollarization which in turn can cause fragmentation.

2.3 | Weaponized interdependence

Global economic networks are embedded with security as they increase interdependence between states which previously have been increasingly autonomous (Farrell & Newman, 2019, p.43). While globalisation and a liberal world order has contributed to greater interconnectivity, the idea of cooperation and interdependence which has shaped contemporary global society has also granted certain states new forms of coercive leverage, as states which are occupying important network nodes can take advantage of their positions in those very networks (Ahram, 2022, p.37-8). We have already established that infrastructure can be weaponized, and Farrell and Newman argue further for *how* it can be weaponized. States with political authority over central nodes in a network can, given they have appropriate domestic institutions, weaponize networks in order to gather information, choke economic and/or financial flows, discover and exploit vulnerabilities, and coerce policy change and unwanted actions. The US has in combination with its allies in regard to financial messaging both jurisdictional control and appropriate domestic institutions to force actors which constitute hubs in the network to provide it with information and to sever other actors or states. Thus, institutions designed as per a liberal world order to generate market efficiency and reduce cost of transactions while increasing cooperation have become tools of coercive agendas. This phenomenon is by Farrell and Newman referred to as *weaponized interdependence* (2019, p.45-7).

Literature does however also suggest that targets of weaponized interdependence often find ways to "claw back autonomy" by taking advantage of network asymmetries and seeking alternative networks. However, disputes over the terms of membership in global networks have consequences for both security and stability. While weaponization of interdependence and economic coercion may be alternatives to military intervention, the effects hold the possibility of being crippling. This causes some states to forego membership as a measure to avoid being a target of weaponised interdependence or coercion, which in turn is causing global fragmentation (Ahram, 2022, p.38).

2.4 | De-dollarization and new initiatives

Desire to create alternatives to Western infrastructure, namely Swift, has not emerged as a result of the sanctions on Russia in 2022 as this phenomenon is related to the dollar and undermining thereof, which has been a topic for discussion since the financial crisis of 2008. The crisis did not only raise questions about the reliability of preserving the dollar's hegemonic position in the global financial system, but opened the door for emerging powers to seek and establish greater status and representation in global governance. Former Russian president, Dmitry Medvedev, hosted the first BRIC summit with the objective of exploring how to "overcome the crisis and establish a fairer international system ... and discuss the parameters for a new financial system (Liu & Papa, 2022, p.1). Undermining of the dollar has security implications for the US, as it relies on the dollar's position as a hegemon among currencies to exercise coercive economic statecraft and sanctions. De-dollarization would thus weaken the ability of the US to alter the behaviour of other states, which consequently would alter the state of national security. On the other hand, for emerging states or coalitions such as BRICS, reduced exposure towards the dollar enables establishment towards greater financial and geopolitical autonomy and/or global influence (Liu & Papa, 2022, p.3). BRICS initiatives of de-dollarization can be demonstrated through BRICS's New Development Bank (NDB), which is committed to the use and settlement of local currencies rather than the USD. As an example, the share of USD in trade settlements between China and Russia fell from close to 90% in 2015 to 46% in 2020 (Simes, 2020. As cited in Liu & Papa, 2022, p.1). As earlier mentioned, both China and Russia (among others) have launched their own payment systems, CIPS and SPFS, as alternatives to Swift. Further, BRICS has just introduced BRICS PAY to the market, a "decentralised, multi-currency, digital, international payments system" (BRICS

Pay, n.d.) which is aimed to work as a payment system for transactions and retail payments among member states. Although introduced to the market only recently and still under development, literature suggests its "rapid progress" being enabled by fintech (Liu & Papa, 2022, p.1).

Liu & Papa have mapped de-dollarization strategies in two categories, "go-it-alone" and "reform-the-status-quo". The prior refers to establishment and government of new institutions and/or market mechanisms independent of the dollar which allow coalition members to diversify currency risks and maintain access to the global financial system while facing sanctions. Expansion of these initiatives are suggested to lead to establishment of an alternative or parallel system which is independent of the dollar and "rules" made by Western powers. The "reform-the-status-quo" strategy on the other hand suggests efforts of renegotiating how the current system is being regulated and involves coalitions negotiating "collective bargaining" with incumbent powers to alter the hegemony of the US (2022, p.2-3).

3 | Background

Before diving into the theoretical framework, we will go through and clear a few concepts within global finance which play a part in the facilitation of global payments infrastructure as we know it today. These concepts, which are financial messaging, core banking systems and the nature of banks, and de-dollarization, serve as important factors both in regard to what led to the situation of today and the way forward. Hence, this chapter aims to help us connect the dots in the remainder of the paper.

3.1 | A short overview of correspondent banking and the role of the USD

Financial infrastructure with specific emphasis on payment systems cannot be discussed without mentioning the dollar. This is because the centralised global financial system as of today is bound to US hegemony, which in turn is powered, or legitimised, by the dollar and its central position among currencies and the fact that it (still) is the main reserve currency. Infrastructure facilitating payments is, as of today, mainly being routed through Swift, which depending on sender and receiver may call for correspondent banking, a process which takes place when cross-border transactions are being conducted. Domestic and cross-border transactions are conducted

differently. While domestic transactions usually are settled in local currencies, cross-border transactions may be subject to correspondent banking and currency conversion. The fastest way for a transaction to be conducted is a payer sending money from Bank A to a receiver from Bank B - and Bank A and Bank B having a direct relationship with each other (which in the world of banking means that Bank A and Bank B hold accounts in the bank of each other). The financial message will then be sent from Bank A to Bank B and the transaction will be settled. Now, if there is no direct relationship between the banks, an *intermediary* bank is required - which calls for the process referred to as correspondent banking. An intermediary bank, or correspondent bank, is a bank which has a direct relationship with both Bank A and Bank B, or one of them. In the case of the intermediary having a direct relationship only with one bank, a second, third, or fourth intermediary is required - creating a chain, or network of banks which facilitate the money to ultimately move from Bank A to Bank B. Consequently, the more correspondent banks are used, the longer, more expensive, more complex, and harder to trace the route of the money becomes. Now, going back to the point of dollars and de-dollarization. In the case of transactions, certain currencies may be subject to currency conversion and will be converted to dollars upon settlement. That means that transactions going through current payments infrastructure are dependent on USD as it acts as an intermediate.

3.2 | What about banks?

So, what's wrong with banks and why cannot the USD just be swapped to another currency for settlement? Well, there is nothing *wrong* with banks. They have a purpose and fill a specific function in financial systems. Or, one could argue that while looking at all the issues concerning banks and payments going through banks, that there is a lot wrong with them. Now, financial infrastructure as of today is mainly built to accommodate and facilitate the operations of incumbents, and this infrastructure is, arguably, faulty. The current global financial system, with specific regards to cross-border payments, is subject to an array of inefficiencies such as high costs, lack of inclusion especially in regard to correspondent banking, delays and overall slow processes for conducting monetary transactions. (Bank of International Settlement, 2022). One of the reasons for this is that the infrastructure is built to accommodate and facilitate incumbents. FI's were among the earliest actors in the private sector to make significant investments in technology,

and while that very technology often remains as a core of their operational business, they have acquired technical debt (Arslanian & Fischer, 2019, p.28). The systems which facilitate the services of incumbents are often more than 40 years old and code wise[1], massive. Modification of such a system is not only subject to major expenses but also risky, as changes to the core can alter the whole system and its functionality - compromising the entire operational activity of the incumbent. In a wider sense, the complexity of these systems which are commonly referred to as legacy systems, causes banks to be vulnerable to change. FI's have struggled with staying up to date with new opportunities facilitated by technology, partly because of reliance on systems which due to their age make implementation "extremely difficult" (Arslanian & Fischer, 2019,p.28).

3.3 | Financial messaging

Finally, financial messaging, the process which facilitates transactions. All payments, local or cross border, are facilitated through information being sent from one financial institution, traditionally a bank, to another. The bank will initiate the message which contains details about the transaction, i.e. amount, sender and receiver, and payment instructions. A large percentage of transactions go through clearing houses or other systems of settlement to facilitate the actual transfer of funds. Once the receiving institution has confirmed receipt of the message, it is validated against regulatory policies and compliance requirements to prevent fraud, errors or other suspicious activities. The receiving institutions will then process the message and, once the transaction is completed, send a message of confirmation back to the originating institution.

Being severed from Swift is largely equal to being cut off from the global financial system, as it makes the process of conducting cross border transactions considerably more complex, time consuming, and inefficient. Although there in recent years has been increasingly amounts of new financial messaging services introduced to the market, such as the Single Euro Payments Area (SEPA) in the EU which facilitates euro-denominated cross border transactions, Russia's System for Transfer of Financial Messages (SPFS), and China's Cross-Border Interbank Payment System (CIPS) which facilitates cross border transactions in RMB, a vast amount of transactions globally are still dependent on Swift as intermediary due to cross-border transactions being subject to

[1] Authors note: financial systems are based on programming

correspondent banking and settlement in USD. The centralisation of Swift and the isolation that follows states which are disconnected from it along with reliance on USD for conversion and settlement is why the sanctions on Russia in regard to disconnection are so severe, and why it has provoked both interest and urge to establish an alternative.

4 | Theoretical approach

In this chapter I present two frameworks, based on concepts and methods from fintech and networks, which I am utilising in my analysis.

4.1 | Finance and Technology, Financial Technology

Not particularly long ago fintech was a rather niched market. Today it is one of the fastest growing sectors in tech, with a global market value exceeding USD$ 294 billion in 2023 (Fortune Business Insights, 2023). In literature, it has been referred to as "a dynamic segment at the intersection of the financial services and technology sectors where technology-focused startups and new market entrants innovate the products and services currently provided by the traditional financial services industry" (PWC. As cited in Chiu, 2017, p.190). The result? A transformation of how people manage and interact with money. Every aspect of finance, from deposits, loans, wealth management and investment to compliance, risk management and clearance and settlement (Hendershott et al., 2021, p.1). Fintechs ability to alter the financial landscape is among others demonstrated in a study conducted in 2016, where 83% of FI's reported that they believe various aspects of their business to be at risk to fintechs (PWC, 2016,. As cited in Lee & Shin, 2018, p.35). And indeed, while the rapid acceleration of technology is enabling fundamental reformation of FI's, there are simultaneously new actors with potential of upending the traditional structure of the industry entering the market. Consequently, winners and losers are being created during the process (Arslanian & Fisher, 2019, p.25). In order to stay relevant and competitive, FI's need to either leverage and/or invest in fintech which has driven incumbents to either acquire or partner with fintechs for the advantage of enhancing operational efficiency, expanding product offerings and strengthening customer relations (IMF, 2023, p.5).

The choice of fintech as a theoretical tool in this study is motivated by its disruptive nature and potential to modify the landscape of traditional financial systems and financial models through technology and innovation by offering alternatives to conventional systems, services, and applications. While there is an array of segments within fintech, and within the particular segment of payments, the scope of this study does not allow us to facilitate all, neither in this chapter nor in the analysis. Consequently, I have chosen to focus mainly on decentralised segments of financial technology, namely decentralised finance (De-Fi), on the basis of its disruptive yet innovative nature, and its potential to decrease reliance on centralised financial systems, and within a network, on centralised hubs. By combining De-Fi with concepts and models concerning networks, which will be addressed in the next section of this chapter, we will be able to explore the potential equal challenges that follow by implementation, with specific emphasis on its potential of addressing financial fragmentation.

De-Fi refers to financial services being provided by multiple participants, intermediaries, and end users over multiple jurisdictions (Zetzsche, Arner, Buckley, 2020, p.174). De-Fi is based on distributed ledger technology (DLT), which refers to using a network of independent nodes in the form of computers to record, validate, share and synchronise (in this case transactions) in respective, decentralised ledgers (ledgers referring to a "record book" or "registry" instead of one centralised ledger. The most commonly known form of DLT is Blockchain, which was published in a white paper along with a peer-to-peer version of electronic cash in 2008. This electronic cash is what we today know as "Bitcoin". While conventional finance is characterised by major intermediaries and centralisation of functions and financial resources (Zetzsche, Arner, Buckley, 2020, p.175), (i.e. Swift), they are embedded with risk. It can be explained due to the increasing role of governments regulating financial centres which traditionally have been rather self-regulatory, especially post the financial crisis of 2008 which underlined the significant correlation between markets and conventional finance. By not relying on governments and regulation, De-Fi promotes an idea of potential elimination of inherent risks which are embedded in the very centre of finance (Zetzsche, Arner, Buckley, 2020, p.176-7). This is simultaneously one of the main challenges De-Fi is facing, as decentralisation has potential of undermining conventional form of transparency, and effectiveness of regulation and enforcement thereof. However, it is also suggested that where parts

of the value chain of financial services are decentralised, reconcentration in a different part of the chain is expected, although it might be less regulated, transparent and visible (2020, p.173-4). However, disruption - as for payments in this case - is not always a straight and easy path as the industry is characterised by "network effect", which means that the value of using a service increases parallelly with the number of users. As Arslanian and Fischer explain, "a phone isn't a useful innovation until someone you want to call also has a phone" and, indeed, the same applies to payment networks. A financial network facilitating payments is not useful unless someone you want to pay also is using that very network (2019, p.33). This is an example which underlines the correlation and significance between financial infrastructure and networks, especially in regard to distribution.

4.2 | Networks

On a daily basis, most of us interact with numerous kinds of networks. It might be through infrastructure which facilitates transportation, social media or even by reading this paper - which presumably has been accessed through the World Wide Web, which in turn is powered by the Internet - another network. In each of these systems, various entities such as humans, devices, or stations, are connected through a series of links which enable them to view and share information, services or resources. Networks consist of a series of "nodes", which are points of connection representing either actors or locations, "hubs", which are nodes with multiple connections, and "links" which act as roads or connections between nodes and hubs and can be either unidirectional or bidirectional, and the number of connections a node has is referred to as "degree". These nodes and links are arranged, physically and logically, and the structure of the arrangement determines the functionality and development of the network. As we already have established, financial networks are *networks*, and by combining concepts deriving from network theory and network science, which study the structures of networks, we are able to gain insight and understanding about the structural dynamics of complex networks in a sense of how they operate, evolve, and interact. We are able to identify whether a network is centralised or decentralised, and risks thereof. We are also able to identify their strengths, vulnerabilities, and opportunities, as well as challenges and opportunities for integration between networks. I have specifically utilised concepts and models deriving from the work of Barabási (2009, 2013) and Liu, Slotine & Barabási (2012). Indeed, it is

argued that “network theory is indispensable in the study of complex systems” (Barabási, 2012, p.15). By incorporating concepts and models based on networks and gaining a holistic understanding of networks, we will be able to understand fragmentation, and arguably more importantly, how to address it. Addressing financial fragmentation in this study takes note of how fintech can be applied, and by understanding networks we are able to adapt and implement fintech solutions more effectively, and more strategically.

The structure of a network which determines the functionality and development is referred to as “topology”. Literature suggests that many “real” networks, ranging from cells to the Internet, independent of age, function, and scope, adhere to similar topologies, and that no networks in technology are completely random (Barabási, 2009, p.412-13). Topology affects various aspects of the functionality of the network, and there are several different types of topologies, each one with advantages and disadvantages. Barabási suggests that networks which are perceived as complex, such as economic networks, consist of an “extraordinarily” large number of components, which interact via intricate networks. It is argued that the underlying connectivity has such an extensive impact on the behaviour of the system, that no “approach” to complex systems can be successful unless it exploits the topology of the network (Barabási, 2009, p.413). Topologies in turn can be found in many shapes, such as “star” topology, which is structured in a way that all nodes are connected to a central hub. The name refers to the way the nodes are positioned around one central node, resembling a star. The advantage of the star topology and the positioning of the nodes around a central hub is convenience of management and maintenance, strong prospect of expandability, and faulty nodes being easy to detect and isolate in case of any faultiness. That will say, unless it is the central hub which is affected, as that will affect the whole network (IBM, n.d.).

Similar to topology is distribution, which refers to how information, service and resources are distributed across the network. For example, there are *scale* networks which refer to most nodes having a degree which is close to average, resulting in the degree distribution that follows Poissons

curve. That in turn suggests there being very few nodes which are either highly connected or hardly connected at all. An example of scale networks following a Poissons curve is displayed below.[2]

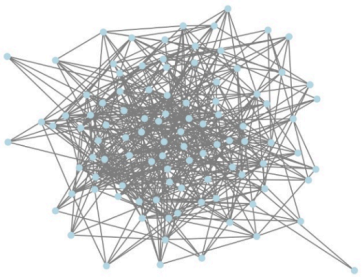

Figure 1. *Scale network.*

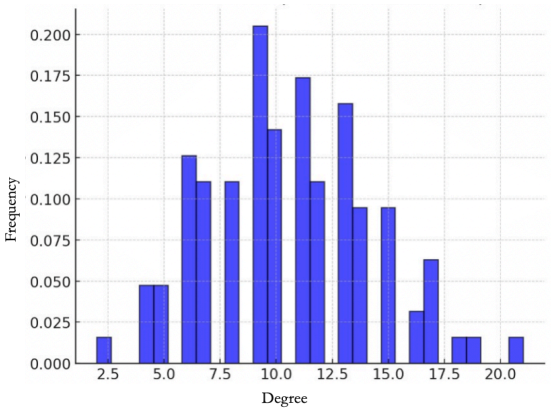

Figure 2. *Poissons curve.*

Scale free networks on the other hand are unevenly distributed, and feature very few nodes which are highly connected and majority of nodes being less connected than average. Effectively, such networks are often held together by a small number of highly connected hubs and follow a degree distribution of power law. (Barabási, 2013, p.1-2). An example of scale-free networks following Power Law is displayed below.[3]

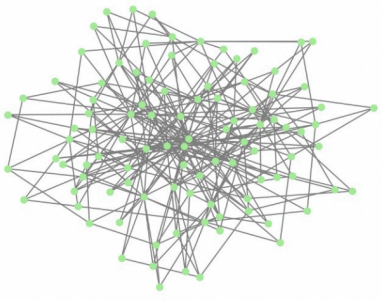

Figure 3. *Scale-free network.*

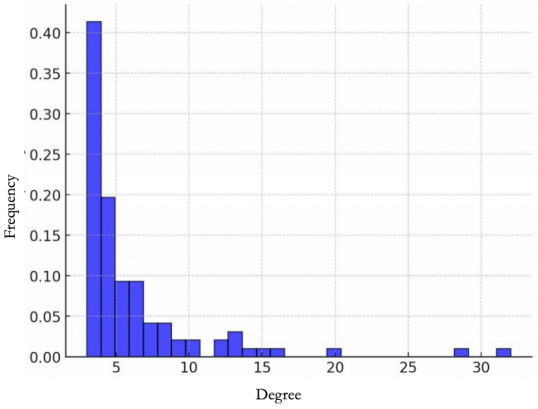

Figure 4. *Power Law.*

[2] Kindly note that the figures are based on fictive numbers and are solely intended to visually demonstrate the structure of scale networks according to Poissons curve.

[3] Kindly note that the figures are based on fictive numbers and are solely intended to visually demonstrate the structure of scale-free networks according to Power Law.

As an example of the latter, mapping of Swift has shown that messaging exhibits "...much more clustering than would be expected in random networks of the same size" (Cook & Soramaki, 2014, p27. As cited in De Goede, 2020, p.161) and that global financial connectivity seems to be selectively routed and centred around a limited set of clusters and correspondent banks while large parts of the globe are either poorly connected and/or dependent on specific hubs. Such phenomena further serve as an example of *preferential attachment*, which Barabási refers to as networks expanding through the addition of new nodes, and that new nodes are more likely to attach to older, well known nodes which already are highly connected. A network which grows by preferential attachment demonstrates a scale-free nature, mainly by the emergence and expansion of hubs. A node's likelihood to become a hub is further suggested to correlate to the time of its appearance in the network, as nodes which appear early on are more likely to become hubs due to increased likelihood of increasing their connectivity. has, however, suggested this notion to be accompanied with *fitness*, a measure of how likely a link will be made to a node once it has been found which over time generates competition in networks (2013, p.412-13).

Centrality in networks refers to the influence, or importance, of a node in a network based on factors such as number of connections, quality of connections, closeness to other nodes, quality and quantity of connections and ability to connect to many other nodes (Liu, Slotine & Barabási , 2013, p.2), and thus how much control of the network it has. Ferrell and Newman have suggested centrality of hubs making them "extremely difficult" to circumvent, which in turns creates interdependence and paves way for states which are in control of hubs to use them as "chokepoints" due to coercive leverage (2019, p.56). This affects financial inclusion and access (De Goede, 2020, p.161), and alters power dynamics between network participants as certain nodes are able to leverage their centrality.

5 | Method

This chapter presents an overview of the method used in this study along with research design in terms of empirical and analytical methods, discussion concerning validity and reliability, including my positionality as an author, and ethical considerations.

5.1 | Empirical method and material

It could be argued that financial fragmentation has accelerated since the sanctions on Russia in 2022. The disconnection of Russian banks from Swift demonstrated geopolitical risks of relying on the dollar and Western financial infrastructure and caused urgency and increased interest in establishing alternative systems of facilitating capital flows. Thus, it could also be argued that fragmentation practically still is in a relatively nascent state, which in turn could motivate existing data on the matter being insufficient. As an attempt to contribute to a still unmapped area, the research design of this paper is an inductive, exploratory thesis.

The study was conducted in a qualitative manner, an approach which emphasises the word rather than quantification and aims to gain understanding of individual perceptions (Bryman, 2013, p.340). I deemed this as particularly beneficial for my study, as I was able to discover nuances and complexities of perception of the research problem while gaining insight to ideas which might contribute to an extended understanding of the problem, as well as new perspectives on what might be a potential way to address it. The material was collected through anonymous semi-structured interviews with four respondents, all holding senior or executive positions in finance, fintech and investment. Given the particular focus of this study, the aim was to interview respondents with background and/or knowledge in my field of research as to ensure relevance to the paper and the research question. Thus, the respondents were selected on a basis of purposive sampling (Bryman, 2013, p.434). The purposive sampling was combined with "snowball" sampling (Bryman, 2013, p.434), as some of the respondents were either referred to me or I was put in contact with through other respondents. It should be noted that due to the nature of the subject, finding respondents willing to participate in the study was a lengthy process and several professionals operating in finance and fintech declined participation. This was most commonly motivated by limited knowledge in the area of fragmentation. All interviews were conducted in English, and took place either in person, online or by email. The different methods of conducting the interview can be explained due to logistical reasons, as the respondents were located in Europe and the Middle East along with availability and preference of the respondents. Upon contacting the respondents, they were provided a short summary of the purpose of the study along with a preview of the eight questions the interview consisted of. The nature of the interview (in person, online or

email) along with providing a summary of the study and the question beforehand are two separate factors which might have affected the answers. However, due to the specific nature of the subject I deemed it as necessary to provide, both in regard to providing the respondents an opportunity to think though the subject as fragmentation arguably is no small task to address, but also to ensure transparency from my side.

The semi-structured interview was designed on the basis of the main research question of the paper, "*How can financial fragmentation and clustering of global financial systems be addressed?*" and a holistic exploration thereof. To achieve this, an interview guide was designed, aiming to address three main points; Whether financial fragmentation is a problem, how it can be addressed, and what issues might arise addressing it. This design aimed to gain a comprehensive understanding of the (presumed) problem, its complexity, core characteristics of the solution and the stakeholders required, complications with implementing solutions and the answers to those, and - as this study takes an interest in fintech, the role of financial technology in addressing fragmentation. While the interview questions were formulated, the nature of their formulation in regard of not being too specific and not acting as a barrier to alternative ideas and perspectives was kept in mind (Bryman, 2013, p.419). To achieve this, eight questions were formulated for the interview guide. These were formulated in an open-ended manner to encourage the respondents to share their subjective insights and to promote flexibility while maintaining focus on key areas of interest and relevance to address the research question(s) (Bryman, 2013, p.415). During the process of conducting the actual interviews, the structure proposed in the interview guide was not necessarily followed as set. This was particularly the case during interviews conducted in person or over phone, and in the case of one interview which viewed fragmentation from a much different perspective compared to others. In turn, a number of thoughts and follow up questions which are not featured in the interview guide.

The respondents operate in finance, fintech and investment, and a common factor for all of them is insight into the fintech industry. One could argue that this might give rise to a certain bias, however, as my study takes interest in fintech and one of the research questions is formulated around it was deemed necessary for the respondents to be familiar with the field although the depth

of insight and engagement varies. However, based on the results I would argue that the interviews have been rather objective and holistic in the sense of addressing fragmentation. The holistic background and experience in various fields of finance of the respondents enabled for nuanced insights to the research topic and various opinions, thoughts and ideas were presented.

The respondents are following:
Respondent A - Chief Executive Officer
Respondent B - Co-founder and director
Respondent C - Managing director
Respondent D - Senior investment advisor

5.2 | Analytical method

The aim of this paper along with the material has served as the basis for my choice of material. By following the six-phase framework by Braun and Clarke, I have conducted a thematic analysis with the analytical objective of identifying, analysing and reporting patterns found in the data while describing it (2006, p.79), along with interpretation of various aspects of the topic in question (Boyatzis, 1998. As cited in Braun & Clarke, 2006, p.79). Although deemed to not have set rules for how the analysis should be conducted, a thematic analysis is generally conducted by themes and subthemes being generated on the basis of material being read through several times (Bryman, 2013, p.528). The framework by Braun and Clarke (2006, p.78,87) is set on the following six steps:

1) Data familiarisation: As the data was collected through interviews, it was read through separately and several times after each interview.
2) Initial code generation: While reading the material, patterns or themes were noted and I started the process of initial coding.
3) Searching for themes: Initial codes were grouped together, and themes were formed.
4) Reviewing themes: During the process, both codes and themes were re-reviewed, adjusted and sorted in regard to relevance for the research questions.

5) Defining and naming of themes: Final sorting and adjustment of themes. After finalisation of the coding and results chapter, I analysed the results in relation to the theory framework, network theory and fintech.
6) Production of the report.

Some scholars have suggested themes are embedded in data, which makes it an important point to consider while conducting a thematic analysis (Singer & Hunter, 1999, Rubin & Rubin, 1995, as cited in Braun and Clarke, 2006, p.80). In the framework developed by Braun and Clarke, it is argued that themes do not emerge due to objective embeddedness in data. Instead, the active role of the researcher is emphasised, as he is subject to identifying patterns and themes and selecting which ones are of interest to report.

5.3 | Validity and reliability

In qualitative research, scholars are questioning the relevance of the terms "validity" and "reliability" as they per definition seem to refer to connotations which regard measurements. Effectively, as measurements are not the main interest of a qualitative research, researchers have suggested qualitative research to be assessed through a framework which assimilates validity and reliability to qualitative measures without changing the meaning of the concept. Instead, it is altered in a way that the focus is shifting away from numerical data (Bryman, 2013, p.351-2). In qualitative research, validity refers to accuracy and whether the researcher "observes, identifies or 'measures' what he is ought to measure" (Mason, 1996. As cited in Bryman, 2013, p.352). Other scholars have added that reliability refers to what extent a study can be reproduced, and in case of the study being conducted by a research team, the ability of the team to agree on the interpretation of the study and the results (LeCompte & Goetz, 1982. As cited in Bryman, 2013, p.352).

Other researchers have suggested that qualitative research should be assessed through completely different criteria than quantitative research. Lincoln and Guba have suggested "trustworthiness" and "authenticity", which are part of a framework built on four criteria which consists of several sub criteria. The framework highlights possibilities and shortcomings worth consideration in qualitative research, some of which I deem relevant to mention in regard to this study. As touched

upon previously, the researcher is an active part of the study rather than passive, and his pre-understanding will affect the validity. Keeping this in mind, the framework of Lincoln & Guba is critical towards the application of validity and reliability in qualitative research as there is not only one, objective, reality or truth - but many. In social sciences, constructivist theories suggest that validity is not limited to the research, but also applies to the researcher himself. As the researcher is part of constructing the research, how the research question will be answered and what the nature of the answer might be is determined by previous understanding and engagement in the field. Boréus and Bergström suggest that cultivation of the researcher in a broader sense about the field and in the social context the study is being conducted within increases the probability for high validity (2018, p.41-2).

As to maintain transparency of the paper, I would like to mention my personal positionality in relation to the research. Fintech is the industry I professionally operate within, with specific emphasis on payments. Such a fact could arguably open for a discussion around biasness, which I would like to counter. This paper is based on observations of a phenomenon which is taking place, and which has been recorded in media outlets, organisations and financial agencies globally. The solution is on one hand based on the hypothetical outcome of non-integrated financial systems and on the other hand an observation and a suggestion of a tool and a service which can facilitate such a solution.

5.4 | Ethical considerations

Ethics in this research concern issues relating to the study and the researcher's relationship with the study, and is built upon the principles prescribed by the Swedish Research Council - reliability, honesty, respect and responsibility (Vetenskapsrådet, 2024). To the best of my ability, the study is designed to provide the reader with openness and objectivity, which is demonstrated by transparency about not only the research process and shortcomings thereof, but also through transparency about my own positionality. The steps taken throughout the process of writing this paper have been recorded and are to review in detail in the chapter for "Method and methodology".

6 | Results

In this chapter, I present the results. The findings have been organised into three main themes, which are based on the interview questions, each one containing sub-themes which are based on the codes embedded in the results.

The findings suggest that the views on fragmentation and the way to address it range within a rather wide spectrum. Some of the respondents argued for the problematic nature of the current system and the importance of establishment of independent infrastructure to prevent (future) weaponization from taking place. Others did not see fragmentation as likely to take place on a wider scale, suggesting continuity of Swift hegemony and dependence on the USD remaining unchallenged for the foreseeable future.

6.1 | The solution

6.1.1 | Political will

Throughout particularly one of the interviews, a recurring and explicitly underlined point was political will. Every step of the process of addressing fragmentation, from the question whether it can be solved with ease or difficulty, what the difficulties are, examples of successful implementation of addressing fragmentation and what the solution is, is according to Respondent A intertwined with political will. "*The solution is to establish a new system...*" the Respondent gives BRICS Pay as an example, referring to it as "an initiative which failed but has turned and is about to succeed" because the initiative has been under development since 2018. "*Now because of the urgency, all the political will and the required alignment, it's developing well and at a high level. It means that it has to be done. They are overcoming all the challenges in a new system. You can see the problems being solved in BRICS, one after another, because the political will is there.*"

Respondent A further emphasises the significance of a solution being fair to all its participants, "*The solution is to establish a new system that interconnects the various fragments in an acceptable way to all the parties, otherwise it will cause more fragments in the future.*" The importance of a solution being inclusive is also emphasised by Respondent D, who argues that while a solution should be neutral in order for all parties involved to trust it, "*there needs to be clear and fair governance, so no*

one feels left out." Respondent A is further adding that "*Before there was no chance of negotiating but there is now. Before there was one system and you are either in it or not. A new system opens up for leverage of negotiation.*"

When discussing attempts of solving similar issues, Respondent A highlights two examples, the Single Euro Payments Area (SEPA) and Libra. SEPA is a payment integration initiative of the EU which standardised bank transfers denominated in Euro and facilitated real time transfers. Libra (later known as Diem) was a fintech project fueled by Facebook, aimed to provide a payment system and stablecoin. As of SEPA, respondent A credits its successful implementation due to "*It works because it was created under one organisation, a committee, responsible for integration rather than the individual countries*." While discussing characteristics which made SEPA successful, Respondent A suggests "*Interoperability, security, legal alignment, political will, trust, real-time processing, efficiency, cost, transparency and expandability. This is done in SEPA for example, trust, speed, same legal system, political will. All the stakeholders are participating. But again, the political will initiated it. Political will which was accepted by all participants. And good will. And the right environment.*" Looking towards the future, "*That is exactly what BRICS are doing now, by creating a committee...*". As for Libra, the respondent explains that "*There was no political will to participate in it and neither did anyone have the need to work with them. There was no motivation to be part of the network.*"

6.1.2 | Regulation

One of the most recurring themes among the respondents is regulation, both in the sense of generating difficulties in regard to addressing fragmentation, equal being the key to facilitating a solution to solve it. While some of the respondents had a clear idea about the solution, addressing it in terms of practicality is underlined as "*...extremely difficult, because of interoperability problems. Political and opinion based problems, different political opinions, different regulations, different currencies. Up to a certain extent geographical differences can interfere. And, the resistance from opposing fragments or the original fragment, the previous centralised system. And of course, the different interests.*" Respondent A explains that all actors have different interests and to harmonise all of them in a single system is no easy task, and that it is a different approach compared to earlier

when "*there was one system and one way, and those participating in the system had to accept it*", and that a new system opens up for leverage of negotiation, rather than actors finding themselves in a position of being either "in" or "out.

As earlier mentioned in this paper, there are protocols and standards regulating payments which ensures that participants of the system are able to communicate with one another. For the same reason, Respondent A suggests "*Technical difficulties require upgrade and alignment of infrastructure, and agree about common standards. Those are the biggest technical problems...*" and continues "*That is exactly what BRICS are doing now, by creating a committee responsible for initiatives and standards. So, it is not anymore political, it is technical.*"

To the question of whether fragmentation is easy or difficult to solve Respondent B answers "*Financial services are a very complex sector with regulations, standardization, international body and more aspects to be taken into account which make it hard to have a straight answer*." It is pointed out that regulation can work in both directions in the sense of both reducing and increasing fragmentation.

6.1.3 | Technology and financial technology

During the interviews, technology and fintech are touched upon several times by all respondents. As pointed out by Respondent D "*The technical side—like creating secure and fast payment systems—is manageable with today's technology*."

On the note of how similar issues have been solved, Respondent B gives an example of Central Bank Digital Currencies (CBDC), which is the digital equivalent of cash in the sense of being issued by central banks rather than commercial banks and thus the liability of the central bank. Respodant B points at "*There are many attempts and progress which in varies phase right now such as CBDC which almost all countries are in different phase (some of them are exploring, researching, developing, or implementing)*" and continues on the point of solutions that "*If we consider, Stablecoins as one of the potential solutions. There are some countries issued regulations for it others are drafting which can be accelerated. Stablecoins payment reduce the cost of moving money significantly*

since its peg to assets or fiat and the ledge is decentralized, but the majority of it is pegged to USD." A stablecoin is essentially a cryptocurrency which differentiates itself from other, free-floating currencies by being pegged to an asset or basket of assets. Regarding the significance of technology in addressing fragmentation, Respondent B explains that "*Technologies can play a significant role and its already there and is evolving. Technologies like Open Banking/Finance which is the digital transformation of the financial services, blockchain, Distributed Ledger Technology (DLT).*"

Respondents A and D also touch upon the subject of technology and fintech being part of the solution, as Respondent D points to "*For example, regional systems could work together under shared rules and technology.*" Going into the question concerning fintech, Respondent D suggests that it can be implemented in multiple ways and demonstrates through examples of "*Blockchain and other technologies can help connect systems, reduce costs, and make everything faster. AI can improve security and reduce fraud. Fintech is also great for financial inclusion...*" Respondent A equally points at the various ways fintech can be implemented, but also underlines that rather being only a tool, it is a crucial such. "*It has a critical role as innovative advanced technology solutions like blockchain, open banking are required to fill in the gaps and interconnect the various fragments or various clusters. But, as fintech also can be used to cause fragmentation it can cause interconnectivity if it's maintained in a suitable environment.*" Respondent A further emphasises the importance of fintech being implemented not only in a suitable environment, but that "good will" also is present "*good will, meaning it's intended for a good purpose. As I said, it can fragment (further) and it can connect. As Swift was built on a bad intent to control the financial system in the hands of a few entities, good will is required to solve this problem and not to repeat the same problem again. That will only cause further fragmentation and clustering.*" Respondent A continues by highlighting that fintech has been utilised before and solved similar problems by blockchain and cryptocurrencies, and that fintech possesses the technology required for a (new) system which is fast, transparent, trustworthy and "gills the gap". Respondent A suggests "*A solution that contains blockchain and e-wallet can provide the means to hold, receive and send money in a digital manner that is efficient, real time, cost effective, and trusted. The difference between an e-wallet and every other solution is that a wallet can hold the money, but in a digital form*". Although lifting it in a slightly different

perspective, Respondent D also points to wallets as an example of how fintech can be utilised, as "*...mobile wallets and apps can bring more people into the system, especially in developing countries*."

As for fintech and addressing fragmentation, Respondent A suggests that a fintech solution requires a "*proper and correct network topology such as star topology to interconnect all parties into a centralised hub that provides transparency and trust and efficiency.*" This is motivated by a star topology being the most efficient way of interconnecting nodes, as a failed node won't cause the failure of everyone else. Respondent A continues by lifting BRICS Pay as an example and suggests that BRICS has reached a state where the initiative is strong enough for others (states) to seek connectivity rather than the other way around. Another example of successful systems powered by fintech in the manner Respondent A suggests being the solution is blockchain, where the respondent explains that "*Blockchain is an unique example of a decentralised and uncontrolled system. The problem of the fragments will be alignment, so you always need a system to interconnect them in an uncontrolled way*."

6.2 | Challenges to proposed solutions

6.2.1 | Regulation

Like one of the main components for a way forward is regulation, so is it a component which can prevent solutions to be implemented.

Respondent D points to challenges including "*...political mistrust, different rules in different countries, and technology gaps in less developed regions. In richer countries, the problem might be more about regulation, while in poorer ones, it could be about lacking the right infrastructure.*" Respondent B seems to be in agreement as "*The challenge is regulation...*" motivated by it being able to work in both directions. It is argued that regulation in fact is the main challenge to any solution, as it is able to either reduce fragmentation or increase it, despite technologies such as DLT being available. In relation to technology, Respondent B further suggests it being "enablers". The difficulties concerning regulation are further agreed about by Respondent A who adds that "*There is difficulty to align across various stakeholders, like the legal system, technological infrastructure gaps, the interests*

of participating parties, aligning interoperability, and finding a compatible system between them..." and that "*having all these different variables will be challenging for participants to agree about*".

As suggested, the technology is already available and Respondent D is touching upon this point in regard to the systems already existing. However, while SEPA has eased the process of conducting payments in the Eurozone and China's CIPS offers an alternative to Swift for transactions denominated in RMB are successful in their respective regions, they don't solve the global problem of fragmentation due to lack of interconnectivity.

6.3 | Solutions to challenges

In terms of how difficulties in addressing fragmentation should be countered, it seems like the Respondents, although highlighting different aspects, are in consensus about collaboration being the way forward. As political will and regulation arguably have gone hand in hand in the section for solutions, it seems like the same can be applied in regard to facing difficulties.

6.3.1 | Collaboration

Respondent B points to "*The solutions should come from the regulatory body, regional regulator and international to coordinate among others since technology is already out there*". Respondent D who suggests that "*The key is collaboration.*" continues "*Countries need to agree on shared standards...*" and suggests "*...wealthier nations or organizations can help poorer regions build the right technology*". In turn, "*Making the systems transparent and fair will also help build trust.*"

Respondent A highlights collaboration from a different perspective, and points at benefit and cost in relation to not overcoming difficulties. With BRICS Pay as an example, Respondent A highlights how it "*...turned from failure to success, when they overcame the challenges and when understanding the benefit and cost, the benefit of doing it and the cost of not doing it.* As a recurring theme throughout the interview, Respondent A highlights collaboration as a solution to face challenges rooted in political will, and points at "*The political will is the most important, everything else can be managed. Political will to push though, align and agree upon all the various differentiation I mentioned*."

So, who are the main stakeholders for this collaboration to be successful? The respondents seem to be in consensus. As explained by Respondent D "*It's a big list: governments, central banks, international organizations like the IMF, fintech companies, banks, businesses, and even regular people. Everyone has a role because it affects all levels of the economy*" and filled in by Respondent A "*...consumer organisations which cater for consumer rights and NGO*".

6.4 | Western hegemony

One respondent had views very different to the others, and does as a start not see fragmentation taking place. As suggested by Respondent C "*When you say fragmentation, I don't actually see fragmentation because everybody is relying on Swift and Western infrastructure right now. Yes, there are initiatives to avoid these systems but I don't think they are avoidable at the moment. I don't see how other countries can deal with currencies other than USD*". The respondent suggests that while there are initiatives and other systems can be developed, they are not going to either replace nor constitute a threat to Swift anytime soon. This can partly be explained due to the reliance on Swift, but also on the USD and the hegemony of the US. Respondent C argues that "*You can see other alternatives, you can see alternatives that could actually work, take the position of the current infrastructure. It's complicated because it's not only Swift. The currency reconciliation, these are other things. Most of the trade in the world is based on USD, I believe it's more than 80-90%, so it's not that easy to skip the current... and convince the people who are used to different systems to change*." The USD is further discussed and Respondent C explains that initiatives of de-dollarisation have been spoken about for a long time. However, a lot of countries have their currencies pegged to the USD. "*...take Kuwait for instance. A couple of decades ago they announced that they would replace the reserves, or change the reserves from usd to a basket of different currencies. And in reality 90-95% of the reserves are still in usd so these initiatives are easier said than done because most of the commerce and businesses are related to, or dollarised, for one reason or another*." Respondent C continues that one of the reasons people want dollars is because they want to save value, or that they believe that it is the right value to keep and that it is stable, and because other currencies are pegged to the dollar. Respondent C gives an example of China pushing for yuan-based oil trade with Saudi Arabia, but believes that while it could be done as a "signal" or "political message", reality is that "*Saudi needs dollars to buy from the US and from others - not Chinese yuan. Saudi is pegged to the dollar so if you*

get the chinese yuan fluctuation the stability of value will alter. So, as I mentioned, it's easier said than done. It could be done as a "compliment" or as political "give and take" but the backbone is still based on dollars." Respondent C shares that "*I also had the leisure of talking to some of my friends at the Central Bank and they don't foresee that using another currency or another infrastructure as eminent, although there are... BRICS and other efforts. But they can't see these replacing the infrastructure which is in existence. At least not anytime soon.*"

Respondent C also argues that while fintech can "bring some extra layers", it will not be able to circumvent western infrastructure. As for BRICS Pay, "*It could be regional, but I don't see it having global coverage*". It's suggested that while some fintech innovations can be implemented to help and to improve systems, Respondent C does not see it as a component which will have any major effect.

7 | Analysis

In this chapter, the reader is invited for an analysis of the results. Keeping how financial fragmentation can be addressed in mind, we are analysing the material in the context of fintech and networks. The chapter has further been organised in two parts, addressing my two research questions one at a time.

7.1 | How can financial fragmentation and clustering of global financial systems be addressed?

As the literature review has suggested, fragmentation can occur due to various reasons. Sometimes because an actor is excluded from a network, and others because actors(s) choose to not participate in, move away from, or attempt to establish parallel networks. Regardless of the reason, this study largely suggests that fragmentation in regard to payment systems is "complex" and "very difficult" to solve. We have, however, been provided several suggestions on what the way forward might be.

One of the most underlined themes in the material is "political will". The current global payments landscape is, namely through Swift, highly centralised. Establishment of alternative payment systems and leveling of the playing field could challenge existing, centralised nodes, particularly in regard to emergence of new, decentralised players. De-fi solutions such as stablecoins which are

built on DLT which were suggested as an example of technology which could address fragmentation might alter distribution and topology of the current system in regard to reducing reliance on incumbents equal financial intermediaries. Shifting, or distributing the centrality might by introducing a new system based on DLT may result in reconcentration in a different part of the network. However, as suggested by Zetzsche, Arner, Buckley, the main obstacle for De-Fi is regulation (Zetzsche, Arner, Buckley, 2020, 173-4). Depending on one's positionality on the matter, this could be both favourable and the very factor preventing such a solution from being implemented on a large scale. As De-Fi only relatively recently has been implemented to finance as we know it today, many cases of decentralised finance are not regulated yet. This means that it might, for the time being and in certain jurisdictions, be able bypass supervision of authorities and regulation. However, simultaneously as public interest for the area, i.e. through cryptocurrencies, has grown, FI's and authorities have grown increasingly keen to implement regulatory measures, which is easier said than done (Zetzsche, Arner, Buckley, 2020, p.184) as De-Fi's decentralised nature raises difficulties in regard to determining jurisdiction of courts and applicable laws thereof, resulting in uncertainty regarding which legislative framework(s) apply (Lehmann, 2019, as cited in (Zetzsche, Arner, Buckley, 2020, p.185).

Continuing on the topic of political will, during one of the interviews successful and failed solutions of similar issues were discussed, the case of Libra was mentioned. The respondent argued that "*There was no political will to participate in it and neither did anyone have the need to work with them. There was no motivation to be part of the network.*" Arslanian and Fischer provided us a comparison between phones and networks, "a phone isn't a useful innovation until someone you want to call also has a phone" and "a payment network isn't useful until someone you want to pay also uses that network" (2019, p.33). As of network theory, isolated nodes usually occur when a node is unable to connect to a centralised and/or another node. In the case of Libra, the opposite seems to have taken place as other nodes' interest in connecting was not sufficient enough. As a result, the stablecoin never reached a momentum, which could suggest that technology alone does not suffice. The case of Libra serves as an example of an initiative having everything at hand (given it was initiated and funded by Facebook), except political will - which gives rise to another question. May the case be such that the single most important factor in facilitating and successfully

implementing solutions to address financial fragmentation is political will? The results in this study suggest that the utter solution to address fragmentation, including the challenges following such initiatives, is subject to the right environment. Indeed, I would propose the themes presented in the results chapter to be incorporated under one umbrella term, "environment", due to the interconnectivity uniting them. Political will determines the course of regulation, which in turn establishes the framework in which technology and innovation can be implemented - while safeguarding financial stability. Equally, regulation might shape political will in regard to defining the scope in which it can be implemented, as well as acting as a tool for political gain. This can be either in the context of moving forward and being open to, in the context of this study, change of structure in payment networks, or refrain from participating in those changes. Over time, this might lead to challenges of implementing new technology in its system, in a similar sense as banks which rely on legacy systems (Arslanian & Fischer, 2019, p.28). In network theory, such a node risks isolation and poor distribution, which could force interdependence and facilitate other nodes and those in control of them with coercive leverage to weaponize such. If the particular node is part of a cluster, be it smaller or bigger, it further alters the topology of that cluster in regard to distribution, interconnectivity and centrality, favouring nodes which are *fit* (Barabási, 2013, p.412-13).

While discussing the characteristics of a solution for a similar issue of fragmentation, the answer was, exemplified by SEPA, collaboration. Trust, a shared legal framework, participation by all stakeholders, good will and the right environment constitute characteristics which ultimately are required to be embedded in a solution. This obviously goes hand in hand with regulation, but that a driving factor in uniting the differences which will follow integration of not only different jurisdictions, but also political interests and geographical differences is the chance to participate in the creation of a network, and for the possibility of negotiation. One of the results argues "*The solution is to establish a new system that interconnects the various fragments in an acceptable way to all the parties, otherwise it will cause more fragments in the future.*" Indeed, a solution which does not consider all its participants may lead to further fragmentation in the term, which could be argued is manifested in the case of the sanctions on Russia and the aftermath thereof. It could further be argued that the conditions of a network which nodes have to accept vary depending on

the role of the node and the stage of the network. According to Barabási, nodes which appear early in the network are more likely to become hubs in a scale-free network (2013, p.412-13). However, results of this study also suggest that "founding" nodes of a new network may find themselves in a position of being subject to a higher level of compromise and/or ensuring that the new network is "acceptable" to other founding nodes, given the results pointing at "*...key is collaboration.*" Further, the nature of founding nodes is of interest to consider, as it will affect the topology of the new network. Thus, we need to ask ourselves *who* are the founding nodes? State actors, central banks, FI's, international organisations, big techs - or a variation of all? In a new system developed by BRICS, given the states themselves will represent the founding nodes, will geopolitical factors affect the distribution across the network? What will the distribution for nodes connecting from outside of the network, or nodes which are not a part of BRICS but nonetheless wish to participate in the network look like? We have already established that timing is one of the variables increasing the likelihood for a node to become a hub. The other variable is fitness, which implies the likelihood of a link being made to a node once it has been found (Barabási, 2013, p.412-13). Now, we need to establish what *fitness* means. States which share a larger percentage of interdependency or are keeping "friendly" ties with another, are they deemed to connect to that very node? While governments, as demonstrated i.e. through BRICS Pay, agree about the need for alternative systems, we must emphasise the reason motivating a new system in the first place. The results suggest that BRICS Pay, which has been under development for several years, turned from a "failure" to "success" when its members came to mutual understanding about cost and benefit, as of the benefits a new system could provide and the cost of remaining dependent on Western infrastructure. This in turn emphasises the importance of collaboration, which is emphasised in several ways. One respondent suggests that instead of one new system, several regional systems could work together under shared rules and technology. If stakeholders succeed in agreeing about a common regulatory framework and supervision, it might give rise to scale networks which are characterised by most nodes having an average distribution of degrees rather than a network with an uneven distribution and a few, central hubs (Barabási, 2013, p.1-2). Such a topology could indicate the dynamics of the new system adapting centralised elements with specific regards to centrality of certain nodes (Liu, Slotine & Barabási , 2013, p.2), which in the long term might result in fragmentation and interdependence. Hence, it could be argued that decentralisation, which can

be demonstrated in various manners, is an important element to keep in mind when establishing a new financial system. At the same time, it should be noted that decentralisation is embedded with risk. While solving the problem of centralisation potentially resulting in fragmentation, the lack of regulation of decentralisation might result in lack of transparency (Zetzsche, Arner, Buckley, 2020, p.173-4). Further, and arguably even more importantly is the fact that a decentralised element would be applied to *finance*, and to leave it uncontrolled in a sphere so crucial and embedded in every aspect of society would might be disastrous. Financial services require, for the sake of safeguarding the operationality thereof trust, transparency, security, and safeguarding. Which arguably is provided through regulation and supervision. Further, decentralised systems would be of scale-free nature, meaning they are at risk of being unevenly distributed (Barabási, 2013, p.1-2) and subject to preferential attachment (Barabási, 2013, p.412-13).

Finally, I would like to address the anomaly this study generated. One of the interviews suggested fragmentation not being an actual matter of fact, and that although there are initiatives for alternatives to be developed, reliance of Swift and the dollar is too great for a change to take place anytime soon. Reliance on Swift and the dollar, along with inability for alternatives to constitute a threat to Swift (anytime soon) can be understood as an effort to establish an alternative to a scale-free network whose distribution indeed is subject to Power Law. Applied to the financial system of today, this could suggest that current infrastructure, with Swift acting as a central node, indeed is a scale-free network whose distribution is subject to power law. The centrality of Swift, along with the dependence on the USD, could further suggest that preferential attachment is based not only on the number of degrees of a node, but also the fitness of the node in regard to being able to settle in dollars. On the other hand, this might serve as a demonstration of a suggestively problematic nature of the global financial system, where the centrality of Swift and global dependence of dollars as a currency of settlement makes Swift in regard to a hub "extremely difficult" to circumvent (2019, p.56). This in turn might suggest that nodes are forced to a "selective" attachment in the favour of being able to settle transactions in dollars and increasing their own centrality, as centrality can be measured in both quality and quantity of connections to other nodes, together and separately (Liu, Slotine & Barabási , 2013, p.2). Indeed, it might suggest an interdependent state of the global financial system.

7.2 | How can fintech be applied to these solutions?

Now, let's turn to our second research question. How fintech can be applied to suggested solutions has been serving as a sub-question in this paper. Through the material which has been generated, we have gained an insight to what the role of technology might be. Majority of the results suggest fintech solutions of considerable weight and scale, while one interview suggests that they might provide an "extra layer" and be used regionally, they will not be able to circumvent Western infrastructure. Other results did not explicitly suggest circumvention, but rather the ability of fintech to bridge gaps between clustered systems. Both scenarios suggest a scale-free network structure, but in the latter case an arguably clear indication of different power dynamics. Bridging a gap can be understood as establishment of a new system, and facilitation of interconnectivity between the two without preferential attachment. The results suggest that the technology required to establish new payment systems is available, and that similar issues have been addressed through technology, and that the potential of fintech as connecting systems will result in reduced costs and increased speed of transactions. By facilitating such interconnectivity, for example by DLT such as Blockchain, the amount of time it takes for a transaction to move from A to B and the cost thereof would increase, as the intermediary no longer is needed. All participants of the network would be required to agree about the validity of the transaction, and once the transaction is added to the blockchain - it would not be able to alter it (Arslanian & Fischer, 2019, p.115). This could, paradoxically as De-Fi is suggested, undermine transparency (Zetzsche, Arner, Buckley, 2020, p.174), in fact increase it. In turn, in addition to reducing a centralised risk, the overall stability of the network might improve which in the long term can prevent fragmentation.

Fintech is also appealing as a tool of addressing fragmentation on the basis of its ability to promote financial inclusion by increasing accessibility of financial services to segments which, for example, are unbanked. Both cost, speed and accessibility can be incorporated through digital payment systems, through services such as digital wallets, and e-wallets, or as discussed above, through decentralised services. This might generate "network effect" which refers to the value of a service increasing in relation to the number of users (Arslanian & Fischer, 2019, p.33) (in that very network).

Addressing financial fragmentation by adoption of fintech gives rise to an array of possible solutions and use cases, as well as it does to potential issues. As suggested by the empirical findings, regulation is crucial to consider due to its potential of overlapping both solutions and difficulties.

One of the main questions, and potential difficulties, regulators will have to face in a scenario of implementing fintech is the nature of the very solution and the regulation of such. Will regulation be specific for fintech, or will it be regulated according to the principle of "same activity, same regulation"? If so, we need to ask ourselves what effects such an approach might hold for long term stability of the financial system. Indeed, implementation of innovative and disruptive technologies on financial services and especially in a case as critical as financial fragmentation might urge regulators to rethink the future of financial regulation and the implications thereof. This leads us to another question; what is the most important component in addressing financial fragmentation?

8 | Concluding discussion

This study has aimed to explore how financial fragmentation can be addressed and what role fintech might play. While it is difficult to address financial fragmentation, and mainly so due to regulatory aspects, results have overwhelmingly not only suggested that it *can* be addressed, but also *how*. Results suggest that addressing financial fragmentation requires a solution of four components. I; political will, which includes the political incentive to take action, II; regulation, which refers to a favourable regulatory environment along with standardisation alignment of technical nature. III; technology, referring to the technical ability to develop a solution or have it at hand. Results point at technology able to bridge gaps between clusters, such as digital wallets and various segments of DLT. IIII; collaboration, which incorporates the presence of regulatory bodies which provide international coordination, agreement between stakeholders, fairness and willingness to help poorer nations to build the right technology and collaboration on every level of society, ranging from governments, to central banks, to NGOs and policy makers, to individuals. Given the seemingly high interconnectivity between these components, I suggest incorporating into one - environment - as politics, jurisdiction and technology go hand in hand, and shape one another. I would, however, further propose that the determining factor of the environment goes back to political will. How come? Because political will is the starting point which all incentives, supervision and executions, ranging from review and revision of regulations, to development of

technology, to collaboration with others exceed from. Political will as in the urge to change and move forward, is the variable on which all others rely on. Without political will and an agenda, it is irrelevant how favourable the regulatory environment is, how advanced the technology at hand is, and how much incentive potential partners have in regard to establishing ties and promoting collaboration.

As for my second research question, *How can fintech be applied to these solutions?* , various forms of fintech can be utilised and in certain regard already is. The most common results pointed at segments of De-Fi, technology which bridges the gap between clusters, and technology which facilitates transactions and promotes financial inclusion, such as digital wallets and e-wallets. Depending on the nature of the fintech solution, it might further shape and/or alter the network it's operating in, which in turn can either increase or decrease fragmentation. This demonstrates the both powerful and vulnerable nature of both the network which the solution is being applied to, and the significance of the solution itself.

By utilising concepts and methods of network theory and network science, the study revealed the significance of acknowledging financial networks as *networks,* and that they should be regarded as such when proposing a solution to address fragmentation. This conclusion can be drawn on the basis that network-based theories provide insights to the structural nature of existing networks by revealing their embedded power dynamics. Indeed, previous literature has suggested that infrastructure, including financial such, is embedded with inequality and power (De Goede, 2020, p.359), which I suggest has been demonstrated in this study through exploration of network dynamics. This in turn provides us with tools to analyse the structure which establishes functionality and interaction of networks. Combined with insight to variables of importance in addressing fragmentation, we can establish a holistic understanding of financial fragmentation and consciously design solutions to address it and to connect clusters.

Besides the purpose, the aim of the study was to contribute to fill a literary gap concerning fragmentation and clustered systems. For further research, I suggest extensive study on how financial fragmentation can be addressed, based on a larger sample than that of this study to gain

further, in-depth insight and perspectives. I further suggest exploring the network properties and behaviour of the financial system and payments infrastructure by utilising network theory and network science. Both the study of the financial system and payments infrastructure can moreover be related to concepts of security and sustainability.

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Appendix

Interview guide

Is financial fragmentation a real problem, and if so what is the solution?

Is it easy or difficult to solve, and why?

Has there been any attempts, successful or unsuccessful, of solving similar issues?

What are the key characteristics of potential solutions?

What stakeholders are involved in the solution?

What are the challenges the proposed solutions might encounter and will these vary across regions?

What is the solution to these challenges?

What role can financial technology and innovation play in addressing financial fragmentation and clustered financial systems?

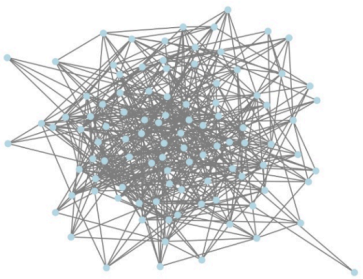

Figure 1. *Scale network.*

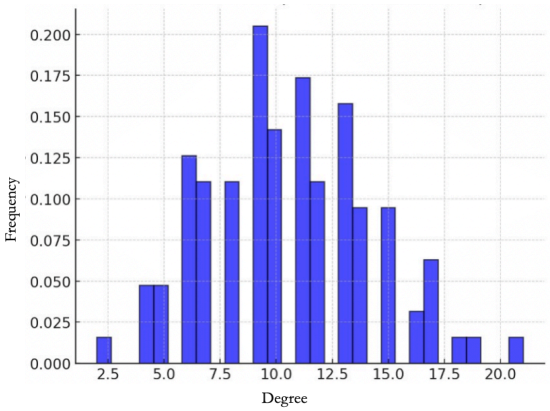

Figure 2. *Poissons curve.*

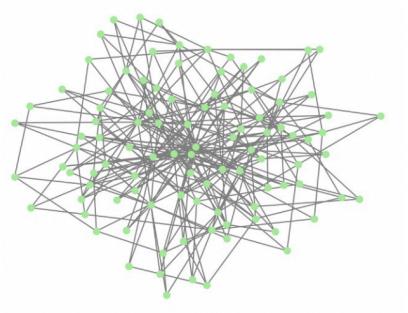

Figure 3. *Scale-free network.*

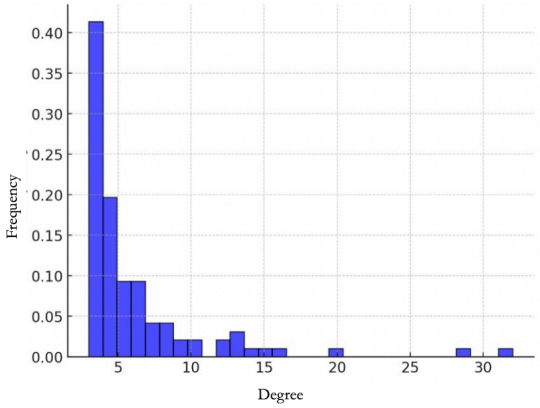

Figure 4. *Power Law.*