PhD-FHSE-2023-021
The Faculty of Humanities, Education and Social Sciences (FHSE)

01715264
Department of Geography

DISSERTATION

Defence held on 06/06/2023 in Ghent

to obtain the degree of

DOCTEUR DE L'UNIVERSITÉ DU LUXEMBOURG EN GÉOGRAPHIE

AND

DOCTOR OF GHENT UNIVERSITY IN SCIENCE: GEOGRAPHY

by

Gary ROBINSON
Born on 14 July 1974 in Dublin (Ireland)

CORRESPONDENT BANKING, SWIFT, AND THE GEOGRAPHIES OF FINANCIAL INFRASTRUCTURE: TECHNOLOGICAL AND ORGANIZATIONAL CHANGE IN CROSS-BORDER PAYMENTS

Dissertation defence committee

Prof Dr Ben Derudder (Supervisor)
Urban Studies Institute, KU Leuven
Department of Geography, Ghent University

Dr Sabine Dörry (Supervisor)
Urban Development and Mobility (UDM), Luxembourg Institute of Socio-Economic Research (LISER)

Prof Dr Markus Hesse
Department of Geography and Spatial Planning, Université du Luxembourg

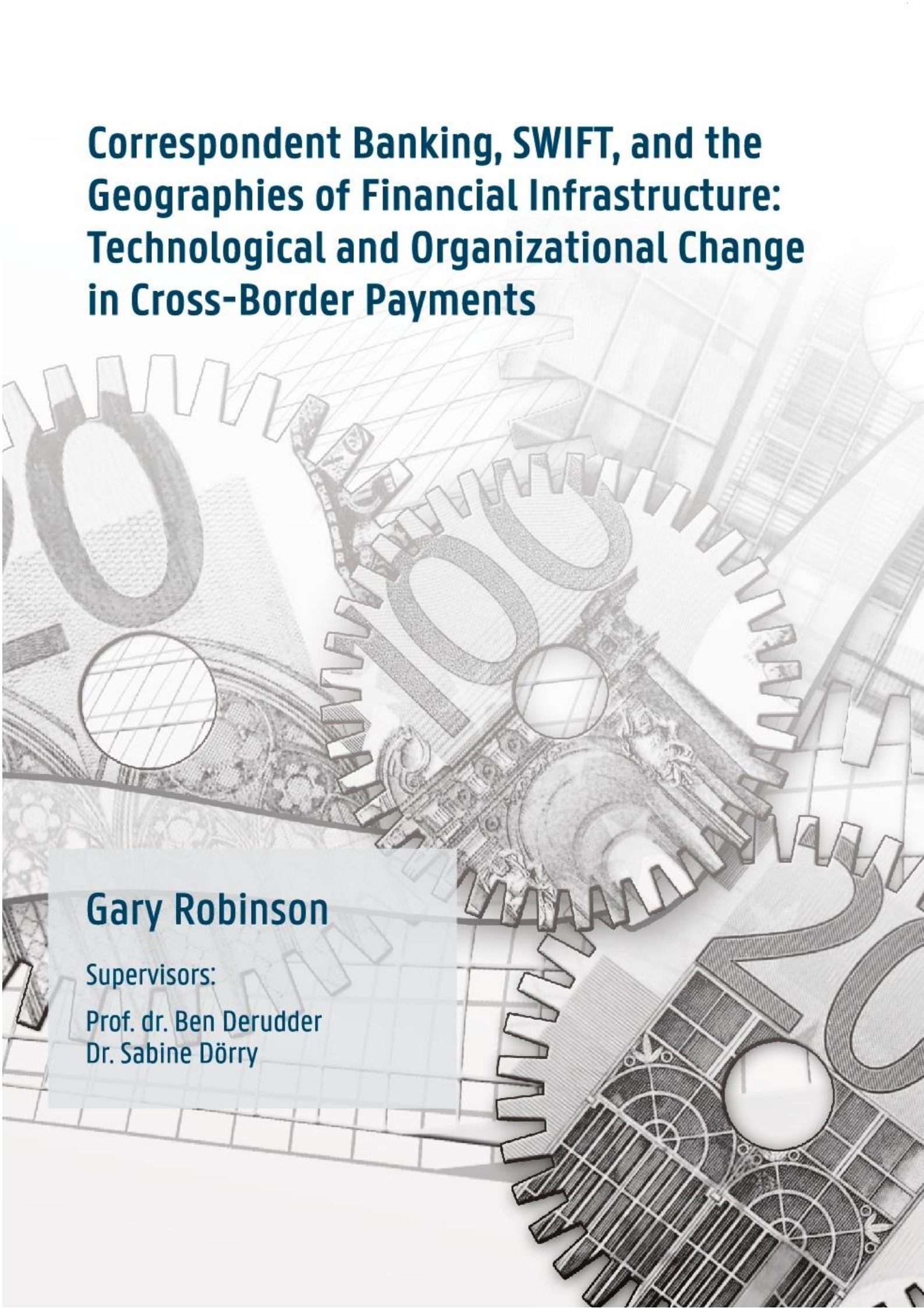
Prof Dr Christian Schulz (Thesis Committee)
Department of Geography and Spatial Planning, Université du Luxembourg

Dr Tom Storme (Thesis Committee)
Department of Geography, Ghent University

Prof Dr Nico Van de Weghe (Chair)
Department of Geography, Ghent University

Prof Dr Frank Witlox (Secretary)
Department of Geography, Ghent University

Correspondent Banking, SWIFT, and the Geographies of Financial Infrastructure: Technological and Organizational Change in Cross-Border Payments



Gary Robinson

Supervisors:

Prof. dr. Ben Derudder
Dr. Sabine Dörry

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Technological and organizational change in cross-border payments

Gary Robinson

Submitted in fulfilment of the requirements for:
Doctor of Science: Geography, Ghent University
Doctorat en Géographie, Université du Luxembourg

Defence held on 6th June 2023 in Ghent

Version: 6th June 2023
Cover design: Wim Van Roy
Referencing: American Psychological Association (APA) 7th edition
Font: Arial Nova Light

This doctoral thesis by publication was completed as a cotutelle between Ghent University and the University of Luxembourg as degree-awarding institutions, and the Luxembourg Institute of Socio-Economic Research (LISER) as employer institution. The thesis was submitted and defended under special status based on exceptional social or individual circumstances (disability). Defence held on 6th June 2023 at Ghent University (online).

This research is part of the FINWEBS project (INTER/FWO/16/11312037/FinWebs), which is funded by the Flanders Fonds Wetenschappelijk Onderzoek (FWO) and the Luxembourg Fonds National de la Recherche (FNR).

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Examination committee and candidate

Examination Committee

Prof Dr Ben Derudder (Supervisor)
Urban Studies Institute, KU Leuven
Department of Geography, Ghent University

Dr Sabine Dörry (Supervisor)
Urban Development and Mobility (UDM), Luxembourg Institute of Socio-Economic Research (LISER)

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Department of Geography and Spatial Planning, University of Luxembourg

Dr Tom Storme (Thesis Committee)
Department of Geography, Ghent University

Prof Dr Nico Van de Weghe (Chair)
Department of Geography, Ghent University

Prof Dr Frank Witlox (Secretary)
Department of Geography, Ghent University

Candidate

Gary Robinson
Department of Geography, Ghent University
Faculty of Humanities, Education and Social Sciences (FHSE), University of Luxembourg
Urban Development and Mobility (UDM), Luxembourg Institute of Socio-Economic Research (LISER)

Ghent University: 01715264
University of Luxembourg: PhD-FHSE-2023-021; 0171116040
0000-0002-7582-2557

Publications

Chapter 2 published as: Robinson, G., Dörry, S., & Derudder, B. (2023). Global networks of finance and information at the crossroads: Correspondent banking and SWIFT. *Global Networks*, *23*(2), 478–493. https://doi.org/10.1111/glob.12408

Chapter 3 published as: Robinson, G. (2021). Capturing a moving target: Interviewing fintech experts via LinkedIn. *Area*, *53*(4), 671–678. https://doi.org/10.1111/area.12726

Chapter 4 co-authored with Sabine Dörry and Ben Derudder. Submitted to and under review at *Geoforum*.

Chapter 5 co-authored with Sabine Dörry and Ben Derudder. Submitted for publication in the forthcoming (2024) volume by B. Brandl, M. Campbell-Verduyn, & C. Westermeier (Eds.), *The Cambridge Global Companion to Financial Infrastructures*.

Acknowledgments

This journey has taken a lot longer and with many more obstacles than expected, (no) thanks mainly to long COVID. The PhD would not have been completed without the support of many people.

Huge gratitude to my supervisors, Prof Dr Ben Derudder and Dr Sabine Dörry, firstly for hiring me for their FINWEBS project: I am surprised I managed to make a decent enough impression in the job interview despite having locked myself in the emergency staircase just beforehand and having to call LISER reception to come and rescue me. But I am also grateful to them for sharing their wisdom throughout the PhD, and for their patience, optimism, assistance, and accommodations in getting me over the finish line. Additionally, they were experienced co-authors from whom I learnt much, however, any errors in this thesis are mine alone. I was also glad to have worked with and enjoyed the company of the FINWEBS project advisory board members, Profs Jon Beaverstock and Britta Klagge, and team members, Jan Musschoot and Tom Storme.

I am fortunate that my three affiliated institutions, Ghent University, the University of Luxembourg, and the Luxembourg Institute of Socio-Economic Research (LISER), were very supportive, before but particularly after becoming ill. Their accommodations of my changed circumstances helped me to complete the PhD. I have heard of others in similar situations whose institutions were sadly not so supportive.

The thesis examination committee members were kind enough to not only read an entire thesis on the gripping topic of payments infrastructure, but to also provide constructive feedback and comments which helped to improve this work, and which gave me confidence. I acknowledge too the many nice people I met at conferences and events, both for the helpful feedback on this research, and for general good times and conversations. Thank you to Wim Van Roy for the great cover design.

To my LISER, University of Luxembourg, and Belval friends and colleagues, in office 5.214 and beyond: thanks for sharing the pleasure and pain of the PhD and life in beautiful Belval. There are too many to name, but you know who you are. I am also thankful for and humbled by the thoughtful wishes and extremely kind presents from LISER colleagues.

While the exact causes of long COVID are still only hypothetical and treatments are still lacking, I am grateful to the healthcare professionals in Luxembourg and elsewhere who continue to help me and other patients. I would not have been able to finish this thesis without the off-label use of medication that I was fortunate to get prescribed. I also acknowledge the long COVID and ME/CFS patient and researcher communities online: this is a lonely and at times hopeless illness, so the validation and support of others going through the same thing is invaluable, as is the sharing of research and potential treatments. The efforts of patients who keep going, who advocate, and who are involved in patient-led research, many in far worse condition than me, are inspirational.

I am not sure that doing a PhD later in life has been the smartest choice, but it is the most enjoyable job I have had, despite the setbacks. I am appreciative of past lecturers at BA and MA level who got me interested in political economy and finance, and who inspired me to do a PhD. I am also thankful to all interviewees, without whom this research would not have been possible.

Thank you to my family and friends for the support, especially during the last couple of years. Finally, to Te-Anne, a rare and unexpected great thing during an otherwise dark time: salamat, aking munting ardilya.

Abstract

This thesis examines the impacts of technical and organizational change on the geographies of finance via infrastructure for cross-border payments, employing a qualitative methodology of semi-structured expert interviews. The study finds that SWIFT's messaging system together with the correspondent banking system, a decentralized global network of bilateral contracts between banks, remain a geographically and historically foundational sociotechnical infrastructure connecting IFCs. To stave off fintech challengers and preserve banks' incumbency, SWIFT's system is platformizing with the aim of changing banks' business models from fee-extraction towards economic use of transaction data. Collaborative action in bringing about change across a global network is a key finance industry agency for maintaining its collective dominance. SWIFT's cooperative organizational form is a significant locus for this agency, engendering trust as a relational aspect of power to resolve tensions among actors and processes across scales. Specialized infrastructure is instrumental in how the geographies of finance are (re)shaped.

Nederlandse samenvatting

Dit proefschrift analyseert de effecten van technische en organisatorische veranderingen in de financiële sector op de geografie van de infrastructuur voor grensoverschrijdende betalingen, en dit door middel van semi-gestructureerde interviews met financiële experten. De studie stelt vast dat het berichtensysteem van SWIFT, samen met het systeem van bilaterale contracten tussen correspondentbanken, een fundamentele sociotechnische infrastructuur blijft die internationale financiële centra met elkaar verbindt. Om fintech-uitdagers af te weren en de gevestigde bancaire orde te behouden, wordt het SWIFT-systeem geplatformiseerd met als doel de bedrijfsmodellen van banken te veranderen naar het economisch gebruik van transactiegegevens. Samenwerken in een wereldwijd netwerk bij het tot stand brengen van regulatieveranderingen is een belangrijk middel van de financiële sector om zijn collectieve dominantie te behouden. De coöperatieve organisatievorm van SWIFT is een belangrijke locus voor deze samenwerking, waarbij vertrouwen als relationeel machtsaspect ontstaat om spanningen tussen actoren en processen op verschillende schaalniveaus op te lossen.

Summary

The infrastructure of technological networks is a taken for granted but vital foundation of modern life. The finance industry has its own specialist and critical infrastructure. This infrastructure, including for payment, is of geographical and historical significance, as a key driver of the concentration of financial activity in urban agglomerations, financial centres, and in interconnecting these centres. Infrastructure for cross-border payments, of crucial importance for global trade and wholesale interbank transactions, has largely worked the same way for hundreds of years via the correspondent banking system, supported since the 1970s by the SWIFT messaging system. Cross-border payments is undergoing technological upheaval, driven by the post-2008 global financial crisis fintech boom. This thesis by publication examines the impacts of change on the geographies of finance via infrastructure for cross-border payments.

I address four overarching and interrelated research questions: 1) how does financial infrastructure, particularly for cross-border payments, work? 2) how are the geographies of cross-border payments configured? 3) how does technological and related organizational change unfold, and how is it governed? 4) what are the impacts of this change on the geographies of money and finance, i.e., the constellation of financial actors, places and spaces? To answer these questions, I use a qualitative methodology based on two types of data: primary data from semi-structured expert interviews as well as from attending industry events; and secondary data from desk research consisting of analysis of interdisciplinary academic literature and of industry news, technical documents, and reports.

The questions are answered in four chapters/publications. Chapter 2 sets the context by providing an exploration of the historical and current workings of the combined correspondent banking and SWIFT system for cross-border payments. Chapter 3 examines this study's methodology of qualitative research via semi-structured interviews, and what conducting this research itself reveals about the actors and processes involved in the research topic. Chapter 4 focuses on the processes and outcomes of technological and organizational change in cross-border payments, showing how the collective agency of financial firms realised through SWIFT's cooperative organizational form. Chapter 5 outlines and conceptualises an understanding of financial infrastructure and its architecture, centring on SWIFT's cooperative organizational form and its messaging system, not just for cross-border payments but for other financial infrastructures.

This study has a number of findings: 1) The correspondent banking system is a geographically and historically foundational and critical means of financial expansion and remains so today. The correspondent banking combined with and supported by SWIFT's messaging network, comprises a dual sociotechnical infrastructure featuring separate but interdependent geographies of finance/settlement and information/messaging that are constituted across different scales. The system is therefore an instrumental part of activities and flows within and between IFCs. 2) SWIFT's messaging network is shifting towards platformization and increased centralization and mutualization of common bank functions. This brings a shift towards the economic use of data rather than reliance on high fees in correspondent banking. These changes are designed to maintain the correspondent banking system and banks' incumbency in cross-border payments by making banks competitive in the big data age. 3) Collaborative action in bringing about technological and organizational change across a huge global network of disparate and distributed actors is a significant finance industry agency for maintaining its collective dominance. SWIFT's cooperative organizational form is a key locus for this agency, enabling the resolution of tensions among diverse actors and processes across different scales. 4) An instrumental

role of SWIFT is as a provider of trust. Confidence in the reliability of SWIFT's technological messaging infrastructure is key to maintaining trust in money globally, bridging the various domestic currency zones in which central banks provide trust in national currencies. Additionally, SWIFT's governance role and position of authority is legitimized by the trust its members place in it, granting them collective agency. Trust is therefore an important binding element of infrastructure. 5) The money form is important as it determines the attendant financial infrastructure and its geographies. Consequently, an understanding of this is essential to understand how new money forms, such as those based on cryptocurrency, may engender new infrastructures and geographies.

Beyond the contribution of these findings to better understanding geographies of finance, the chapters/publications in this study are the first geography contributions to the nascent social sciences literature on financial infrastructures, shedding more light on the unique and opaque SWIFT organization, and additionally showing the importance of transaction banking activities like cross-border payments as a stable mainstay of global banking.

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List of acronyms and abbreviations

a/c	account
ACH	automated clearing house
AML	anti-money laundering
API	application programming interface
APS	advanced producer complex
B2B	business-to-business
BIC	business identifier code
BIS	Bank for International Settlements
BNY	Bank of New York
CB	correspondent banking
CBDC	central bank digital currency
CBPR+	Cross-border Payments & Reporting Plus (SWIFT)
CBR	correspondent banking relationship
CCP	central counterparty clearing
CEO	chief executive officer
CIPS	Cross-Border Inter-Bank Payments System
CLS	Continuous Linked Settlement (Bank)
CoP	Communities of Practice
COVID-19	coronavirus disease 2019
CPMI	Committee on Payments and Market Infrastructures
CPSS	Committee on Payment and Settlement Systems
CSD	central securities depository
DLT	distributed ledger technology
DNS	deferred net settlement
EBA	Euro Banking Association
ECB	European Central Bank
e-CNY	digital renminbi (currency)
EU	European Union
EUR	euro (currency)
FABS	financial and advanced services providers
FinGeo	The Global Network on Financial Geography
fintech	financial technology
FINWEBS	Stabilising an unstable industry. The role of agency in interconnecting international financial centres (project)
FMI	financial market infrastructure
FNCB	First National City Bank (now Citi)
FSB	Financial Stability Board
FX	foreign exchange
G-10	Group of Ten' countries that provide additional funds to the IMF: Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom, the United States
GDP	gross domestic product
GIB	global investment bank
GloCoBank	Global Correspondent Banking 1870-2000 project
gpi	global payment innovation

GPN	global production networks
GTB	global transaction bank
HQ	headquarters
ICSD	international central securities depository
ICT	information and communication technology
IFC	international financial centre
IMF	International Monetary Fund
IOSCO	International Organization of Securities Commissions
ISO	International Organization for Standardization
IT	information technology
JPY	Japanese yen
KYC	know your customer
long COVID	a condition characterized by long-term health problems affecting multiple organ systems persisting or appearing after the typical recovery period of acute COVID-19 infection
LVPS	large-value payments systems
MTO	money transfer operator
NBB	National Bank of Belgium
NDA	non-disclosure agreement
NY-LON	New York - London
OPC	(SWIFT) operating centre
OPP	obligatory passage point / obligatory point of passage
PEM	post-exertional malaise
PESE	post-exertional symptom exacerbation
PIN	personal identification number
PMI	Payment Market Infrastructure
PMPG	Payments Market Practice Group (SWIFT)
RTGS	real-time gross settlement
SDX	SIX Digital Exchange
SPFS	Sistema peredachi finansovykh soobscheniy (Russian: Система передачи финансовых сообщений (СПФС), English: System for Transfer of Financial Messages)
SSF	social studies of finance
SSI	standard settlement instructions
STP	straight-through-processing
STS	science and technology studies
SWIFT	Society for Worldwide Interbank Financial Telecommunication
T2S	Target2Securities
TM	transaction management
UK	United Kingdom
US	United States
USD	United States dollar

Chapter 1. Introduction

1.1. The fintech revolution … or the empire strikes back?

1.1.1. Research context and topic

Much of what we consider to be modern life runs on technological networks that we call infrastructure (Vinsel & Russell, 2020, p. 64). Hidden in plain sight, invisible by design, and providing essential background support for other work (Star, 1999), infrastructure is usually only noticed when it breaks (Burrington, 2016). While often conceived of materially, in terms of large technical systems like transport, electrical power or telecommunications (Joerges, 1998), a broader definition of infrastructure is as "matter that enable[s] the movement of other matter", distinctive in that is not merely a thing but simultaneously "the relation between things" (Larkin, 2013, p. 329). Infrastructures thus undergird and sustain everything from media and communication to cultures (Plantin & Punathambekar, 2019, p. 163).

Money and finance have been conceptualised as infrastructures for the economy and for society (Muellerleile, 2018; Ricks, 2018), or "the infrastructure of the infrastructure" (Cerny, 1994, p. 223). Financial intermediation involves the centralization of critical and interrelated functions, such as risk management, clearing, and settlement1, to enable more efficient transactions (Lin, 2015). Finance has its own specialized infrastructures in which some of these functions are centralized, defined as "the socio-technical systems enabling basic yet crucial financial functions to be carried out, but that tend to be taken for granted and assumed" (Campbell-Verduyn et al., 2019, p. 911). A fundamental economic function, payment in person using cash is a simple transaction, however, payment across distance requires a complex and invisible infrastructure of intermediaries, technologies, standards, and socioeconomic relationships.

The post-2008 financial crisis has seen the rise of the financial technology (fintech) trend, involving the novel application of old and new technologies to existing financial functions (Wójcik, 2021a). Technological change is nothing new in finance (see Appendix 3 for a depiction of its evolution) and innovations have frequently reconfigured its geographies, for example the introduction of ever-faster digital telecommunication links (Eichengreen et al., 2016; Langdale, 1985, 1989; Lewis, 2014; Malecki, 2002; Zook, 2018) and the shift from in-person to virtual trading activities (Engelen & Grote, 2009; Grote, 2009; Wójcik, 2007; Zaloom, 2010). Indeed, finance has sometimes been an early adopter of information and communications technology (ICT) (Beauchamp, 2000; Carré, 1993; Warf, 1989) but innovations are usually deployed by existing actors within the industry, with 'disruption' from outside a rarity.

Technological innovations do not stand alone but are deployed by actors in "complex social power struggles" (Graham, 1998, p. 181). As far back as the 1990s, banks used payments innovations as a defensive strategy to prevent the encroachment of non-financial firms, particularly technology firms, into this essential business domain (Bowers & Devine, 1995; Radecki, 1999). Now payments is again an area of major fintech-led change, for example from: neobanks who improve functionality in niche areas, e.g. Wise, Revolut; the centralized walled-gardens of payment platforms, e.g. PayPal; alternative monetary infrastructures

[1] See section 1.1.2 for an explanation of clearing and settlement.

based on blockchain and cryptocurrencies2 offering entirely novel ways of combining and performing financial infrastructure functions without the need for some currently entrenched systems, processes and actors, e.g. bitcoin, Ethereum, Ripple; and the big data capabilities and near-global reach of big tech firms, e.g. Apple, Google, Meta. Retail payments are generally fast and efficient, run mainly on card schemes and networks, such as those of Visa and Mastercard. Cross-border payments for business and wholesale interbank transactions, however, use a very different infrastructure. Of crucial importance for global trade and finance, these payments have worked largely the same way for hundreds of years via the correspondent banking system, supported since the 1970s by the messaging system run by the Society for Worldwide Interbank Financial Telecommunication (SWIFT), a cooperative owned and governed by banks that use it. The complexity of cross-border payments means that technological innovation in this domain has been comparatively limited (Caron, 2018), however, both the correspondent banking system and SWIFT are legacy systems, held to be finally "ripe for disruption" (Tett, 2021, para. 6).

How this technological and related organizational change is unfolding in financial infrastructure for cross-border payments is the topic of this research. The workings of this infrastructure are examined in detail throughout the thesis, with an initial overview provided in sub-section 1.1.3. Payments are inextricably bound up with the provision of money via both central banks and private commercial banks, and an explanation of this is provided next.

1.1.2. Money, payments, and banking

Payments cannot be considered in separation from money and from banks, and an understanding of their entanglement is important for grasping the existential nature of this core activity for banks. Anthropological and sociological studies emphasise the sociocultural basis and meaning of money (Dodd, 2016; Graeber, 2014; Zelizer, 1989). While agreeing that money's existence and value depends on social relations between those who use it (Dodd, 2016), in this thesis I consider money in more functional terms, as a function of finance. By this I do not mean purely in terms of its various functions of unit of account, store of value, and medium of exchange, but by the various contextually contingent forms and institutions which bear those functions (Kapadia, 2013; Leyshon & Thrift, 1997). Economists generally (and wrongly) hold that money emerged to replace barter, while the chartalist or state theory contends that it is a legal creation of the state (Graeber, 2014; Ingham, 2004). Beggs (2017) disputes the primacy of the state, holding that that both states and markets shape money, and money in turn shapes both of them, with the state's prime position a historical contingency.

This highlights two important aspects of money: the involvement of both public and private actors, or hybridity, and its inherent hierarchy. Money's hybridity is accounted for by it being part public in the form of central bank currency[3] (available as electronic reserves and as physical cash) and part private as bank deposits, which is not noticeable as the two trade at par value (Mehrling, 2017). The two types[4] have been conceptualized as public and private-public money respectively, as the latter is publicly guaranteed through state deposit schemes (Murau & van 't Klooster, 2022). This hybridity in money creation and supply has been likened to a "finance franchise" (Hockett & Omarova, 2016, p. 1150) and an

[2] A blockchain is a type of distributed ledger technology (DLT). For an in-depth explanation of how blockchain and cryptocurrencies work, see Greenfield (2018).

[3] However, not all central banks are publicly owned, e.g., the US Federal Reserve.

[4] Other kinds of 'private-private' or 'shadow' money may also count as money, with the decision politically contingent (Murau, 2017; Murau & Pforr, 2020), but for this study I consider the two main money types.

"outsourcing agreement" (Ricks, 2018, p. 801). Within this hybrid system, there is also a hierarchy: central bank money is "the only financial asset that is guaranteed to keep its nominal value" because "unlike private entities, states do not have a binding survival constraint" (Pistor, 2019, p. 77). Backed by governments' promises of future growth, central bank, or state, money is at the top of the hierarchy (Pistor, 2019). The money that the state creates comprises only a very small part of the money supply compared to the majority, which is credit money privately created by commercial banks[5] (Beggs, 2017). Rather than first collecting customer deposits which they then lend out, banks grant loans as new credit money created *ex nihilo* (Ryan-Collins et al., 2012).

Commercial bank money can require around 10 percent collateralization, which is held at the central bank as reserves[6] (SWIFT & Accenture, 2021). This money creation function of banks "is not explicitly stated in any law, statute, regulation, ordinance, directive or court judgement"; rather, it "is likely derived from the operational, that is, accounting conventions and regulations of banking", (Werner, 2014, p. 72). These arose historically from London goldsmith banking innovations (Kim, 2011). Money creation is the sole preserve of banks because they are the only firms that are allowed (via a banking licence) to hold customer deposits as bank liabilities, which they then reclassify as new customer deposits by granting loans (Werner, 2014). This accounts for "the distinctive function of the banker", as Bagehot (2011, p. 21) quoting Ricardo put it, which "begins as soon as he uses the money of others; as long as he uses his own money he is only a capitalist." Unless explicitly guided by central banks in credit creation and allocation[7], commercial banks are the arbiters of credit and therefore money creation. This business is very profitable for banks, allowing rent extraction in the form of seigniorage[8] (Bossone, 2021; Macfarlane et al., 2017). The accounts in which banks hold customer deposits "serve as the administrative and technological backbone of a complex network architecture that facilitates the transfer of funds", thus ensuring that banks have also traditionally been providers of core payment functions (Awrey & van Zwieten, 2019, p. 3).

Although discussed in general terms here, the contemporary fiat money system of tiers of private and public money was not designed from scratch and then implemented by central banks, but was rather a gradual and global change from commodity money and the gold standard (Beggs, 2017). This also implies that the franchising or outsourcing analogy may not be entirely accurate, as it implies a privatization of what was once public, while the reverse may be the case, as originally private and risky monies become public to maintain financial stability. Banks are therefore not merely passive intermediaries, funnelling money from unproductive savers to producers, as orthodox economics holds (Werner, 2016), but are active creators of money. This excursion into their crucial role in the creation and supply of money shows the importance of studying banks as key economic actors and is also relevant for understanding payment systems, and finance industry structure and governance. Given that "payment services are the entry gate for every other financial need", much is at stake for banks from potential disruption (Omarini, 2020, p. 5).

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[5] Although varying across countries, some report that commercial bank money often comprises around 80 percent of total fiat money (SWIFT & Accenture, 2021), while others report that physical cash in modern economies represents only around 3 percent of total money supply (Macfarlane et al., 2017).

[6] This system is sometimes referred to as fractional reserve banking, although this is not accurate as it implies there is a multiplier and limit to the amount of credit money that can be created depending on the reserve requirement, which is not the case (Werner, 2016).

[7] As, for example, the post-World War II Asian developmental states did using a practice known as 'window guidance' (Johnson, 1982; Werner, 2005).

[8] Commercial bank seigniorage profits in the UK have been calculated at £23 billion annually in the years 1998–2016, which is 73 percent of bank profits after taxes and provisions (Macfarlane et al., 2017).

Relatedly, money has different forms. As previously mentioned, state money exists in two forms: physical cash (object/token money), available to the general public, and reserves (account/book money), available only to banks in the accounts of the central bank. Commercial bank money exists as customer deposits in the accounts of those banks. The different money forms have profound impacts on the geographies of finance as they entail differences in proximity and information when transacting, and therefore require specific and contingent kinds of financial infrastructure. For this thesis, then, and borrowing from recent sociological scholarship highlighting the increasingly important *information/data*[9] component of money and payment (O'Dwyer, 2019; Westermeier, 2020), I note the importance of the account money form (chapter 2), with this form borne dually by banks together with, internationally, SWIFT.

1.1.3. Financial infrastructure for cross-border payments: A primer

Understanding how financial infrastructure for cross-border payments works involves first looking broadly at financial infrastructure and its processes of clearing and settlement, then examining domestic payments infrastructure, followed by that for cross-border payments.

Clearing and settlement describe the processes and associated infrastructures needed to finalize a financial transaction. These processes follow the execution of every transaction to ensure the efficient transfer of ownership of securities from seller to buyer and corresponding transfer of payment from buyer to seller. The precise process varies depending on the market, securities, parties, and infrastructures involved (see Lee (2011, p. 31) for the steps following a trade on an exchange). Due to huge increases in volume and value of transactions, and in financial and technological innovation, modern clearing and settlement arrangements are very complex, potentially giving rise to systemic risk. Generally, clearing refers to everything post-trade and before settlement, including establishing the parties' obligations to each other, and the potential transfer of obligations to a central counterparty (CCP) to mitigate risk. Settlement follows clearing, in which the agreed exchange of ownership for money happens (European Commission, n.d.; Milne, 2016). One way of distinguishing the two is that clearing is a series of processes, while settlement is an event (Rambure & Nacamuli, 2008). In this thesis, I sometimes use the single terms clearing or settlement to refer to both together.

Clearing and settlement are also key processes in payments transactions. Every non-barter transaction, whether for purchasing goods, services, or financial assets, involves delivery of the item purchased against funds transfer, i.e., payment using either cash or deposits (funds in accounts) held at banks. A payment, then, is "a transfer of funds that discharges an obligation on the part of a payer vis-à-vis a payee" (Kokkola, 2010, p. 25). An elemental economic act with significant social (Swartz, 2020) and legal (Nabilou, 2022) dimensions, it is a core financial and banking function that is somehow connected to everything banks do (Brudar, 2012) (see section 1.2.1). Payments can be classified in different ways. A common classification is wholesale payments, which are between financial institutions, and which tend to be relatively low frequency but time critical and of high value, and retail payments, which are between non-financial institutions, and which tend to be of lower value but high frequency (Kokkola 2010).

Different payments systems may be used for each type of payment. A payment system is "a set of technologies, laws, and contracts that allow payments to occur and determine

[9] While there is a distinction between data and information, with data becoming information through processes of distillation that add value and meaning (Kitchin, 2014), I use the two terms interchangeably.

when a payment constitutes settlement" (Boel, 2019, p. 51). For wholesale payments, a large-value payments systems (LVPS), often with real-time gross settlement (RTGS), is frequently used. Deferred net settlement (DNS)[10] is used in retail payments systems, and some non-urgent payments are batch-processed in automated clearing houses (ACH). Interbank payments were historically settled using netting at the end of the day but since the dramatic increase in the volume of interbank payments since the 1970s, RTGS systems have been adopted by most central banks to reduce settlement risks and systemic crises (Bech & Hobijn, 2006). A payment system is considered an essential part of national infrastructure (Nicolaisen, 2019), with the national payment system nowadays usually provided by the national central bank (CPSS, 2003). In some countries, there also exist alternative payment systems often owned and operated collectively by the banks that use them[11]. Throughout this thesis, the term 'payment system' is generally used to refer to that of the central bank. That the central bank operates the payment system is because payments have evolved to be settled in central bank money (Norman et al., 2011). As explained in the previous sub-section, the provision of money can be thought of as a public-private partnership, in which the state provides public money in the form of physical cash to the general public, and as electronic reserves to licensed banks, while commercial banks provide electronic money to the general public as customer bank deposits. The cornerstone of monetary and financial systems, payment systems thus "form the key linkage between the economic and financial systems, with the availability of dependable and efficient means of payment likewise being a public good, supporting monetary and financial stability" (Zetzsche et al., 2020, p. 2).

International financial centres (IFCs) are "both waveform and point" in flows of information (Leyshon & Thrift, 1997, p. 305). Financial infrastructure plays a geographically and historically important role in the urban agglomeration of financial activities, as well as in interconnecting these urban nodes in global networks. The activities of trading, clearing, settling, and transferring deposits historically required physical proximity, and the high costs of such infrastructure led to concentration in financial centres, with IFCs extending their activities beyond their local territory (Cassis, 2010). While securities trading infrastructure like stock exchanges are often held to be a national emblem essential for an IFC, payments clearing is also a core, if comparatively understated, function (Kindleberger, 1973). Historically, the physical proximity required in increased centralisation of clearing payments in particular places was one of the key drivers in constituting financial centres (Leyshon & Thrift, 1997). The advent of electronic accounts and money means that physical proximity is no longer a strict necessity for clearing and settling payments. However, access to a local payment system is a central reason for certain banks to operate in other jurisdictions. These correspondent banks, who specialise in inter-bank activities, still congregate in IFCs as that is where the business is (Tschoegl, 2000).

The previously mentioned public-private division of labour in the provision of money is also evident in payments provision. Figure 1.2 shows a map with a stylized depiction of domestic and cross-border payment links in and between the US and Japan. Because a central bank only has authority over its own currency, it only settles payments in that currency in its own domestic payments system (shown in blue in the figure). Cross-border payments have

[10] Payment netting means establishing each party's net position (the sum of payments sent and received) at a certain point in time, so that only the single net payment obligation or claim has to be settled. Real time gross settlement (RTGS) involves (almost) immediate settlement of payments, without netting, and payment at a later time. RTGS thus involves reduced risk that the counterparty might be later unable to settle, but involves larger (gross, rather than net) amounts, and therefore increased liquidity requirements (Kokkola, 2010).

[11] For example the Clearing House in the US (The Clearing House, n.d.) and EBA Clearing in the EU (EBA Clearing, n.d.) operate such payment systems.

historically been transmitted via the correspondent banking system, in which commercial banks in different locations have bilateral business relationships and hold accounts with each other (shown in red). A relatively small group of fewer than 20 mostly Western banks have access to payment systems in multiple global locations. Serving as important hubs for processing cross-border payments, these are known as global transaction banks (GTBs), as cross-border payment processing falls under the business area of transaction banking12. This has allowed these banks to build their own large correspondent networks, processing cross-border payments internally across their own branches, known as 'on us', 'in-house', or 'book-entry' payments (Kokkola, 2010; Rambure & Nacamuli, 2008).

Table 1.1 lists the top 10 GTBs and top 12 global investment banks (GIBs) for the financial year 2018, ordered by GTB ranking. Some interesting points to note are the overlap between the two lists, particularly the same banks occupying the top two spots in both lists, as well as the fact that every bank in the table is from either the US or Europe.

Table 1.1. Top 10 global transaction banks and top 12 global investment banks 2018

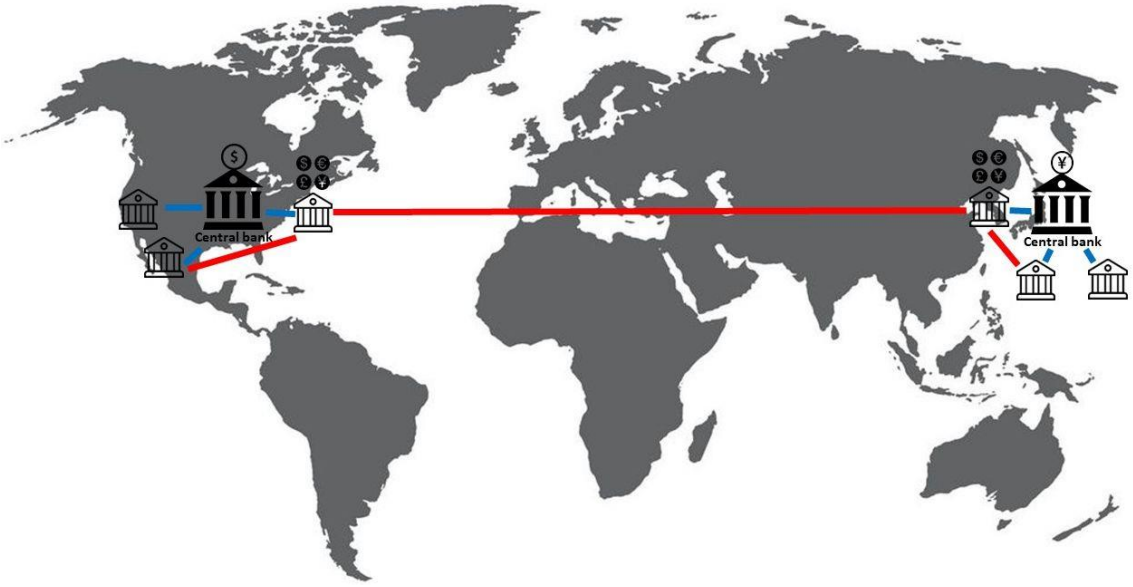
Bank	HQ	GTB 2018	GIB 2018
Citigroup	US	1	2
J.P. Morgan Chase	US	2	1
HSBC	UK	2	9
Bank of America Merrill Lynch	US	4	3
BNP Paribas	FR	5	12
Deutsche Bank	DE	6	6
Standard Chartered	UK	7	
Société Générale	FR	8	11
Wells Fargo	US	9	
Groupe Crédit Agricole	FR	10	
Goldman Sachs	US		2
Morgan Stanley	US		3
Barclays	UK		7
Credit Suisse	CH		8
UBS	CH		9

Source: (CRISIL Coalition, 2019; Damyanova, 2019)

The correspondent banking system is supported by the SWIFT financial messaging system, transmitting transaction information between banks. While domestic payments infrastructure can be thought of as publicly provided, infrastructure for cross-border payments is historically privately operated by commercial banks. The global payments system can thus be thought of as "a network of federated payment systems, where fiat currencies are settled in different jurisdictions, each with their local regulations and requirements – independent, yet interdependent on each other" - which are connected by correspondent banking "into a meaningful value transfer system" (SWIFT, 2019; see chapter 5).

[12] Transaction banking addresses the day-to-day transactions and operational needs of banks' corporate and institutional customers. It involves services and terms like cash management, SWIFT, cross-border payments, trade finance, supply chain finance, corporate working capital and liquidity management, and securities services (Furió, 2018).

Figure 1.1. Domestic and cross-border payment links



Source: Author. Image sources: https://www.freepik.com/; https://www.flaticon.com/.

Correspondent banking is used for many things, such as trade services (SWIFT 2011) and central bank swap lines (Aldasoro et al. 2020), but is crucial for cross-border payments and has been an important means of bank internationalisation for centuries, allowing banks in one location to sell services to banks in other locations. For payments, it is profitable and flexible, with multiple paths to any bank account in the world. However, its distributed nature – split across thousands of banks all over the world – makes it inefficient, slow, opaque, and expensive. Costing about 0.04 US dollar (USD), a SWIFT messages comprises only a very small fraction of the cost of a payment charged by banks, which can be between 5 and 50 USD (Leibbrandt, 2015). The figure shows a stylized direct route between two prominent currencies, USD and Japanese yen (JPY). For currencies that are less commonly used and traded internationally, a payment route involves more 'hops' via intermediary banks, adding complexity, time, and cost to a payment. The distributed nature of the system makes upgrades complex and difficult: although the system as a whole would benefit from an individual bank upgrading its systems, individual banks themselves may have no incentive to do so and indeed may profit from the system's inefficiencies. While the messaging system is centralized in SWIFT, the correspondent banking relationships are bilateral and therefore decentralized, with no overall governance. This system is also geopolitically crucial: it is one of the main ways in which financial sanctions are enacted, as the system can be weaponized by powerful states (see chapter 2). Correspondent banking is therefore an extremely important business for banks and payments is a core activity: having customer relationships for payments allows them to cross-sell other products. The potential loss of the direct payment relationship could mean becoming just the underlying infrastructure for others who take over this relationship and thus also gain access to increasingly valuable payment transaction data. Technological change in this domain is therefore an existential issue for banks (see chapters 2 and 4).

Fintech boosters promote disruptive innovation, the theory of which holds that large powerful firms fail to maintain their incumbency when technologies or markets change radically, failing to recognize the potential of new technologies until it is too late (Bower & Christensen, 1995; Christensen et al., 2015). Individual banks are held to be notoriously slow at innovation, while fintech firms are lionized as quick and nimble upstarts. SWIFT's

messaging technology has been derided as “disco era” (Cate, 2018, para. 7) that will eventually be usurped (Qiu et al., 2019), and SWIFT itself a relic, as one of the few remaining financial cooperative infrastructures when others were long ago privatized. Yet, banks and SWIFT seem to have fought off the challengers for now and preserved their incumbency in cross-border payments, presenting the puzzle of how to explain the persistence of old, inefficient infrastructure in the face of ostensibly newer and better alternatives.

1.1.4. Aims, questions, and findings

This thesis is part of a larger research project and as such, its topic, aims, and research questions were derived to fit within that project’s objectives, which are discussed in section 1.3. This thesis aims to understand stability and change in global financial infrastructure interconnecting IFCs. It does so by analysing technological and organizational change in infrastructure for cross-border payments, namely the correspondent banking system and its supporting financial messaging system run by SWIFT. These twin systems and networks are separate but interdependent processes constituting a sociotechnical infrastructure. The thesis addresses four overarching and interrelated research questions: 1) how does financial infrastructure, particularly for cross-border payments, work? 2) how are the geographies of cross-border payments configured? 3) how does technological and related organizational change unfold, and how is it governed? 4) what are the impacts of this change on the geographies of money and finance, i.e., the constellation of financial actors, places, and spaces?

This study has a number of findings. First, the correspondent banking system is a geographically and historically foundational and critical means of financial expansion and remains so today. The correspondent banking system combined with and supported by SWIFT’s messaging network, comprises a dual sociotechnical infrastructure featuring separate but interdependent geographies of finance/settlement and information/messaging that are constituted across different scales. The system is therefore an instrumental part of activities and flows within and between IFCs. Second, SWIFT’s messaging network is shifting towards platformization and increased centralization and mutualization of common bank functions. This brings a shift towards the economic use of data rather than reliance on high fees in correspondent banking. These changes are designed to maintain the correspondent banking system and banks’ incumbency in cross-border payments by making banks competitive in the big data age. Third, collaborative action in bringing about technological and organizational change across a huge global network of disparate and distributed actors is a significant finance industry agency for maintaining its collective dominance. SWIFT’s cooperative organizational form is a key locus for this agency, enabling the resolution of tensions among diverse actors and processes across different scales. Fourth, an instrumental role of SWIFT is as a provider of trust. Confidence in the reliability of SWIFT's technological messaging infrastructure is key to maintaining trust in money globally, bridging the various domestic currency zones in which central banks provide trust in national currencies. Additionally, SWIFT's governance role and position of authority is legitimized by the trust its members place in it, granting them collective agency. Trust is therefore an important binding element of infrastructure and is engendered by the club-like nature of SWIFT. Fifth, the money form is important as it determines the attendant financial infrastructure and its geographies. Consequently, an understanding of this is essential to understand how new money forms, such as those based on cryptocurrency, may engender new infrastructures and geographies.

The following sub-section offers a review of some of the literature used to help answer these questions and arrive at the findings.

1.2. Literature review and contribution

1.2.1. Understanding change in cross-border payments

It became apparent while conducting the research that there is no oven-ready heuristic for tackling the analysis of the intricacies of infrastructure for cross-border payments. Because "no single theoretical perspective will enable us to explain everything about organizational interaction" (Cook, 1977, p. 77), the broad approach employed is one of bricolage, in which researchers "attempt to bring knowledge of something other than the literature of their own nominal disciplines to bear on the problems they address" (Turner, 2014, p. 144). This study therefore borrows from a variety of interdisciplinary scholarly literature for the task.

There has been a global infrastructure turn in recent years, with international frameworks calling for national and global infrastructure development (Dodson, 2017; IMF, 2015; United Nations, 2015). Alongside disciplines such as architecture, planning, engineering and the physical sciences, the social sciences and humanities have also taken an infrastructural turn (Appel et al., 2018; Dodson, 2009; Howe et al., 2016; Plantin & Punathambekar, 2019). Following from the definition of infrastructure at the beginning of this thesis, a common-sense understanding of it is "that which runs 'underneath' actual structures … that upon which something else rides, or works" (Star & Bowker, 2006, p. 230). Characterized as "the stuff of cities that only really gets noticed when it stops working" (Burrington, 2016, Chapter 1), geographers are frequently concerned with urban infrastructure and its politics (Amin & Thrift, 2016; Graham & Marvin, 2001; P. O'Neill, 2017, 2018; P. M. O'Neill, 2010, 2013), but have also examined logistics infrastructure (Gregson et al., 2017), telecommunications and internet infrastructure (Tranos, 2012; Tranos & Gillespie, 2009, 2011; Warf, 1989, 1995, 2013), and digital and data infrastructures (Ash et al., 2018; Furlong, 2021; Kitchin, 2014). While this research captures the materialities underlying social and economic activity, other research understands infrastructure as having wider non-anthropocentric applications and implications (Barua, 2021). Congruent with this wider application, but confining our analysis to human life, to analyse the materialities of infrastructure underlying finance, I also borrow from those works in science and technology studies (STS) characterizing infrastructure as *sociotechnical* configurations, comprising combinations of social and technical systems (Bernards & Campbell-Verduyn, 2019; Edwards, 2003). This means not just physical networks, but also things like ideas and standards (Easterling, 2016), because technology is embedded "within shifting networks of people, practices, and power" (Warf, 2017, p. 4). Avoiding technological determinism, technological change is not seen as inevitable but as "the result of specific social interests, conflicts, and group mobilization" (Preda, 2008, p. 910). Conceptualising infrastructure as sociotechnical, captures not just the social nature of correspondent banking's contractual business relationships and SWIFT's technical messaging infrastructure, but also that both of these are themselves comprised of social and technical elements, for example, individual banks' internal payment systems, or rulebooks governing usage of technical systems.

Among the characteristics of traditional infrastructures, such as transportation, (tele)communications, and utilities like energy, are geographic scope and scale, economies of scale, and regularity of cooperation (Brennan, 2009; Evans & Schmalensee, 2005). Because of their defining characteristic of network effects, infrastructures are also known as *network industries* (Economides, 1996; Montero & Finger, 2021). The "inherent interconnected nature of finance" (Lin, 2015, p. 644) in general and of financial infrastructure like payments in particular, also makes it a network industry (Brennan, 2009; Kemppainen, 2015). Lacking an inherent geography (Glückler, 2007), networks, as one of the "distinct spatial lexicons" (Jessop et al., 2008, p. 390), are thus an apt way to analyse

and conceptualise infrastructures with regard to other spatial components, such as nodes, hierarchies, movement, place, territory, and scale (K. R. Cox, 2014; Jessop et al., 2008). Comprising not just the material aspects of physical cabling and equipment but also social relationships connecting network nodes (Gulati, 1998), infrastructure networks are instrumental in interconnecting, (re)creating and crystallizing particular geographies because they are both structures *and* flows (Parkhe et al., 2006, p. 561).

One of the purposes of infrastructure is to provide ubiquitousness and sameness across space, such as the provision of electricity in a national territory. However, this does not necessarily imply a complete flattening of scale (Marston et al., 2005): by forging paths through and around the lumpiness and unevenness of space, connecting actors in places/territories in multiple ways, infrastructures both bridge and create scale. For example, as seen earlier, a cross-border payment, is composed of multiple interactions between financial institutions embedded in diverse places and territories, subject to different regulatory regimes, operating at different scales, whether locally, regionally or globally, demonstrating the "mutually constitutive and relationally intertwined dimensions of sociospatial relations" (Jessop et al., 2008, p. 389). SWIFT's messaging network and its cooperative organizational form provide the 'glue' of common and ubiquitous standards, rules, and equipment, the continued provision of which is contingent and a process of continued (re)negotiation. However, rather than ensuring complete sameness, the SWIFT infrastructure also accommodates difference and incorporates hierarchies across space, both of which are necessary for the smoothing of friction. Itself comprising multiple geographies, infrastructure is a means of resolving tensions across space and is fundamental to other spatial concepts, such as the world city network (Taylor & Derudder, 2016). The technological is always embedded in the social (Proskurovska & Dörry, 2022) and this means that rather than privileging the sociotechnical infrastructure itself, I focus also on its organizational form, and through this, on the relations that constitute the infrastructure across space. I return to the relational aspect later in this section.

The infrastructure turn has also awakened scholarly interest in financial infrastructure, which in some cases incorporates aspects of infrastructure studies just mentioned. There is ample extant literature on infrastructure for trading securities, especially exchanges, (Handel, 2022; MacKenzie, 2018; MacKenzie et al., 2012, 2020; Pardo-Guerra, 2019; Petry, 2020a, 2020b, 2021, 2020c; Petry et al., 2019; Zaloom, 2010), with geographers mainly focusing on their role within IFCs (Engelen & Grote, 2009; Grote, 2009; Wójcik, 2007, 2011). More recent scholarship, especially from political economists, has focused on other financial infrastructures, including for payment (Bernards & Campbell-Verduyn, 2019; Brandl & Dieterich, 2021; Campbell-Verduyn et al., 2019; Clarke, 2019; Genito, 2019; Jeffs, 2008; Rodima-Taylor & Grimes, 2019; Westermeier, 2020), with anthropologists in particular examining the act and changing technologies of payment (Maurer, 2012a, 2012b, 2015, 2014; Maurer & Swartz, 2015; Nelms et al., 2018).

Academic literature on SWIFT is relatively thin and comes mainly from the domains of business history (Scott & Zachariadis, 2010, 2012, 2014), security studies (de Goede, 2012, 2020; de Goede & Westermeier, 2022), and law (Fuster et al., 2008; Kaunert et al., 2012), with a recent political economy study also building on some of the work in this thesis (Nölke, 2023). Although useful, with one notable exception from geography scholarship noting the contribution of electronic funds transfer in the internationalisation of banking and the then relatively new role of SWIFT (Langdale, 1985), the literature says little about the geographies of finance. It must be noted that the relative paucity in number of publications on SWIFT is made up for by the impressive depth of the aforementioned work by Scott and Zachariadis. Their study, which had unparalleled access to archive data and former and

contemporary SWIFT employees, including CEOs, provides a detailed account of SWIFT's history and operations, and forms a strong bedrock for subsequent research, such as this thesis, to build on. A notable omission from the entire social sciences literature on financial infrastructure and payments is correspondent banking. With a few exceptions (Brown et al., 2002; Cassis, 2010; Christophers, 2013), it is barely known outside of studies of business and finance (e.g. Buhl-Freiherr von und zu Guttenberg, 2018; Chan, 2014; James & Weiman, 2010, pp. 1850–1914; Lawrence & Lougee, 1970; Merrett, 1995, pp. 1830–1960; Naughton & Chan, 1998; Panza & Merrett, 2019) and the payment industry (e.g. Brudar, 2012; Lyddon, 2012).

Ongoing technological change in payments infrastructure is germane to geography because "innovations of money forms and infrastructures have always been bound-up with space and movement" (Swartz, 2013, p. 5). While money is held to flow like mercury (Clark, 2005), it does so along well-worn paths (Taylor et al., 2021; Taylor & Derudder, 2022) that need to be secure and reliable at scale, namely via infrastructures. These infrastructures "don't just exist by themselves – they are embedded in organizations of many kinds" (Star & Bowker, 2006, p. 233) and are constructed by social actors. Economic geography focuses principally on firms as the prime economic organizations and actors (Aoyama et al., 2010) but a distinctive feature of finance and its infrastructure, past and present, is *cooperative ownership* by its users: financial institutions. Financial infrastructures like exchanges (Aggarwal, 2002; Geranio, 2016; Movsesyan, 2007) and the card payment networks of Visa and Mastercard (Benner, 2008; Dow Jones Newswires, 2001), have mostly long-ago changed from mutually- to privately-owned; however SWIFT remains a cooperative and a uniquely large one, with a global network of 11,000 members. This, and its infrastructural characteristics and functions, influence how technological change occurs.

Organizational form, place, and space with respect to technological change are a core concern of geographers, who have eagerly embraced analysis of fintech (Knight & Wójcik, 2020; Lai & Samers, 2020; Wójcik, 2021a, 2021b). While there has been as yet no studies of the application of fintech to financial infrastructure, research examining the application of *platformization*, or "socio-technical practices to create a new intermediary logic of data-rich accumulation" (Langley & Leyshon, 2020, p. 121; see also Srnicek, 2016), to finance is relevant. As per table 1.2, infrastructures and platforms differ in some key respects but also overlap (Plantin et al., 2018; Star & Ruhleder, 1996), e.g., platforms can enhance infrastructure for payments (Westermeier, 2020), although a key characteristic overlooked in the table is the importance of the economic use of data by platforms. Platforms can resolve the tension between *innovation and stability* (Hendrikse et al., 2018) but specificities of the finance industry mean that platformization there proceeds differently to in other industries (Haberly et al., 2019).

Table 1.2. Summary of infrastructure and platform properties

	Infrastructure	Platform
Architecture	Heterogeneous systems and networks connected via sociotechnical gateways	Programmable, stable core system; modular, variable complementary components
Relation between components	Interoperability through standards	Programmability within affordances, application programming interfaces (APIs)
Market structure	Administratively regulated in public interest; sometimes private or public monopoly	Private, competitive, sometimes regulated via antitrust and intellectual property
Focal interest	Public value; essential services	Private profit, user benefits
Standardization	Negotiated or de facto	Unilaterally imposed by platforms
Temporality	Long-term sustainability, reliability	Frequent updating for competitive environment
Scale	Large to very large; ubiquitous, widely accessible	Small to very large; may grow to become ubiquitous
Funding	Government, subscription, lifeline services for indigent customers, pay-per-use (e.g. tickets)	Platform purchase (device), subscription (online), pay-per-use (e.g., TV shows), advertising
Agency of users	"Opt out," for example, going off the grid	"Opt in," for example, choosing one platform instead of another; creating mashups

Source: Plantin et al. (2018).

Geographers have devised useful frameworks for understanding innovation, change, and governance. Systems of innovation approaches focus on the creation and diffusion of knowledge and innovation but usually in terms of clusters in particular locations and at particular scales, such as the local or regional (Asheim et al., 2018; Fernandes et al., 2021), or within national territories/polities (Lundvall et al., 2007). Sectoral innovation systems stress a specific industry or group of related industries (Cooke, 2002) but lack a geographical emphasis (Robertson, 2017). These approaches are often concerned with regional rather than global relations, and are less apt for the study of networks (Glückler, 2007; Stuck et al., 2016). As its name suggests, the global production networks (GPN) approach (Coe & Yeung, 2015) is a useful heuristic that has been fruitfully employed to analyse how some financial activities are performed across places and space (Dörry, 2014, 2015, 2016). However, the coordination of activities via a lead firm in a GPN does not adequately account for the cooperative organizational form and agency of SWIFT. Additionally, the *industry characteristics* of infrastructures, which differ from products and services, make the GPN approach an imprecise fit for this thesis (see Appendix 2 for an early application of the GPN framework to the case at hand).

These questions of organizational form, agency, and industry structure and characteristics are key with respect to technological change. It is common when discussing innovation and fintech to employ the dichotomy of *incumbents and challengers*, which is used in literature ranging from business studies (Bower & Christensen, 1995) to sociology (Fligstein & McAdam, 2012), to examine social change. Although a useful distinction, and one which I employ in this thesis, it does not fully capture the complex realities of finance industry structure. We saw earlier that banks are key and distinctive actors as they are the only firms that can create money. However, it is not just banks' *individual* actions that are strategically

significant. Archetypically, finance has been characterised by oligopolies whose quintessential feature is interdependence and cooperation between firms and their strategic actions (Christophers, 2016; Clark, 2002). This interdependence is evidenced by *concurrent cooperation and competition* (also dubbed 'co-opetition'; see Brandenburger & Nalebuff, 1996) among actors, both insiders and innovator outsiders (Laven & Bruggink, 2016), who may be simultaneously rivals, partners, and customers of each other. As mentioned earlier, finance, and its infrastructure like payments, is a *network industry*. Financial incumbents may also "serve as gatekeepers to the financial network—deciding who gets in and how they get in" (Lin, 2015, p. 667). Alongside the network industry, therefore, another useful way of characterizing some of the organizational forms in which this kind of industry structure is embedded, and one particularly pertinent for SWIFT, is that of a *club*, with exclusive benefits for members (Buchanan, 1965; Potoski & Prakash, 2009; Tsingou, 2015).

These considerations are intimately tied to questions of *agency and structure* when analysing change and its governance in an infrastructure network that must be stable and durable at scale. As indicated in section 1.1.2, this requires *coordination* across thousands of heterogenous actors with different capacities across a variety of places and scales. Network effects, while powerful, are insufficient to maintain stability: networks still require *governance*. The duality between agency and structure is intrinsic to networks, which are both structures and flows (Parkhe et al., 2006). Examining networks allows the identification of governance structures (Boggs & Rantisi, 2003) as well as actors, ongoing relations, and structural outcomes of those relations (Dicken et al., 2001). Trust is an important factor in governance and authority, particularly in inter-firm cooperation (Nooteboom, 1999, 2003; Nooteboom & Six, 2003), as well as in the creation of economic spaces, including networks (Murphy, 2006). Financial governance is usually rooted in the powerful authority of national state actors, like central banks and a regulatory/supervisory apparatus. However, private actors have also been granted private authority over important areas, both nationally and internationally. This authority is considered legitimate because it is delegated by public authorities, and rests not on coercion but on trust or persuasion (Hall & Biersteker, 2004; Pauly, 2004).

There are different aspects to agency, such as its purpose and its operationalization. An oft-assumed *purpose* of technological innovation is disruptive change, but this overlooks the more common act of *maintenance*. This can mean repair and keeping something in good condition, but also has a related meaning of ensuring the continuation of something. Maintenance involves refurbishment, overhaul, improvement, and often radical change over time (Edgerton, 2019). Such change also entails preservation, with maintenance the work that is done to preserve orders, accentuating stability and continuity (Russell & Vinsel, 2018; Vinsel & Russell, 2020) through *maintenance agency* (Baumgartinger-Seiringer, 2022; Jolly et al., 2020). Structures "are not 'givens'…, they are 'mades'" (R. W. Cox, 1987, p. 395) and the reason for their creation is "to create agency (for some), not simply to close it off (for others)" (Knafo, 2010, p. 510). Hence, platformization in cross-border payments allows for some infrastructural features, like stability at scale, while gradually introducing new features and allowing for easier future upgrades. At the same time, this is intended to preserve the dominance of financial incumbents as, in Callon's terms (1986), an "obligatory passage point" (OPP) (Allen, 2010, p. 2898). Therefore, while payments infrastructure is in some respects an essential utility (Kay, 2015), it is not neutral.

As for the *operationalization* of agency, the notion of *power geometries* captures how different social actors are differentially placed and have different power vis-à-vis flows and interconnections (Massey, 1993). Power is an emergent effect of *tensions* in relationality:

sets of power relations between and among structures and actors and scales that bring about change (Yeung, 2005). The ability to mobilize sufficient resources in order to have an effect, even over space, is one meaning of what it means to be powerful, because although resources are located in specific places, they can also be marshalled via networked relationships (Allen, 2003). Based upon trust, another type of power is the ability to shape these relationships and their combined interactions in particular ways accepted by the multiple social actors involved (Bachmann, 2003). Among a variety of social actors with shifting and conflicting interests, therefore, the outcome of processes of change is contingent (Robinson, 2017) and depends on how tensions are resolved: SWIFT's cooperative organizational form is a key locus for this.

I finish this sub-section by joining the relational considerations of agency and structure above with the discussion of infrastructure at the beginning of this sub-section. Congruent with sociotechnical understandings of infrastructure as comprising both social and technical artefacts, *relational* conceptualizations of infrastructure hold that an infrastructure's material properties matter less than whether it fulfils the function of an infrastructure for its users (Read, 2019; Star & Ruhleder, 1996). However, as this risks ascribing equal importance to all infrastructural components, human or otherwise (Read, 2019), I focus on the actors, networks and organizations in which these components are embedded and how they are relationally deployed to enable specific paths of action, while closing off others.

1.2.2. Contribution

This thesis broadly contributes to further opening up the 'black box' of finance and its opaque infrastructure (MacKenzie, 2005; Wesseling et al., 2012) by getting deep into the weeds of its workings and how it produces, changes, and reinforces the geographies of finance. It provides a first geography contribution to the nascent financial infrastructure literature mentioned previously. Specifically, it makes important and novel contributions in elucidating the architecture of financial infrastructure based on its money form, and in illustrating correspondent banking as a crucial global banking infrastructure and means of financial expansion across space. Payments has long been a defining and profitable yet overlooked banking characteristic (Radecki, 1999). To this end, this study highlights transaction banking, of which cross-border payments is part, as an important and unsung family of bread-and-butter banking activities that complement other functions, and that root banks in IFCs. Relatedly, the thesis builds on the work of Scott and Zachariadis (Scott & Zachariadis, 2010, 2012, 2014) to shed further light on SWIFT as a unique and key infrastructure and organization. It shows SWIFT's role as an inimitable locus of relational agency in assuring the continued global collective dominance of established financial actors by defending their interests and marshalling collective action in different places and across different scales. Additionally, it highlights SWIFT's role as trust provider in global payments and among its member banks, enabling them to act collectively. The thesis also contributes to the study of infrastructure by demonstrating trust as an important binding social element of infrastructure. For economic geographers, "business organization does matter" (Dicken & Thrift, 1992, p. 279). To this end, the focus on SWIFT contributes to moving "beyond the usual suspects" of enquiry (Robinson, 2018) by studying non-firm organizational forms, such as cooperatives, and by paying close attention to finance industry structure, where network and club-like characteristics strongly influence the configuration of its geographies. In so doing, it enhances our understanding of how technological innovation and change occurs, and contributes to both the study of fintech by focusing on incumbents and infrastructures, rather than on disrupters and products/services, and to studies of platformization by elucidating the specificities of this process in the finance industry.

1.3. Research strategy

1.3.1. Case selection

The thesis is part of a larger research project, entitled *FINWEBS – Stabilising an unstable industry. The role of agency in interconnecting international financial centres*[13]. The FINWEBS project aims to add an agency perspective to interpretations of how international financial centres come into being and jockey for position within the global financial system. Its overarching objective is to

> enhance our understanding of the global architecture of IFC networks through an analysis of how interacting fields of social practices between financial firms, influential financial professionals and regulatory authorities shape and stabilise it (Derudder & Dörry, 2016).

Case studies using interviews are the most common methodology in financial geography (Wójcik, 2022) and are also apposite for this research. Semi-structured interviews with industry professionals contribute to adding an agency perspective while addressing some of the stated objectives and questions of the FINWEBS project. Those objectives and questions of the FINWEBS project that guide the research topic, questions and aims of this thesis are: 1) to explore the most significant global networks of financial centres, firms, and agency; 2) to look at some of the more disruptive innovations in finance, such as fintech; and 3) to examine the influence of an IFC's strategic infrastructure for global finance (Derudder & Dörry, 2016). The choice of the research topic, technical and organizational change in infrastructure for cross-border payments, thus meets two important criteria. Firstly, it addresses a number of objectives of the FINWEBS project. Secondly, and importantly for the successful completion of a long-term research project, it satisfies my own intrinsic intellectual curiosity and interests. This includes an innate desire to answer "a call to study boring things", as some scholars have characterized the study of infrastructure (Star, 1999, p. 377): counter to the suggestion that geographers should not focus on the complexity of finance to avoid ratifying it (Christophers, 2009), I advocate for a focus on its complexity in order to demystify it. Curiosity about how cross-border payments work comes partly from personal experience: while living in South Korea, I pondered the different time and expense involved in using banks and SWIFT to send money back to Europe versus using cryptocurrency to do the same. The thesis is by publication, rather than a monograph. Because publishability is a major criterion by which doctoral work is judged (Badley, 2009), it can be advantageous that those chapters already published have already gone through peer-review. Additionally, in light of the 'publish or perish' imperative for early career researchers pursuing an academic career, having at least some of the chapters published and others submitted or ready to submit is valuable if such a career path is chosen.

Case selection depends on the kind of case study. Although the term case study is itself ambiguous, referring to a variegated set of research designs, it has been defined as "the intensive (qualitative or quantitative) analysis of a single unit or a small number of units (the cases), where the researcher's goal is to understand a larger class of similar units (a population of cases)" (Seawright & Gerring, 2008, p. 296). This thesis is best understood as a different type of case study, namely a *single-outcome study*, which instead aims to explain particular aspects of a specific case, and in this kind of study, the problem of case selection is either minimized or non-existent (Gerring, 2006; Seawright & Gerring, 2008). In this thesis, the individual cases/chapters aim to together elucidate technological and

[13] https://liser.elsevierpure.com/en/projects/stabilising-an-unstable-industry-the-role-of-agency-in-interconne

organizational change in a single case: cross-border payments. Insights from this study help us to better understand the workings of financial infrastructure broadly. However, the importance, scale, and singular nature of both the correspondent banking system and SWIFT mean that there are no other directly comparable realistic alternatives, and mean that gaining an in-depth understand of their operations is itself key to understanding some of the most fundamental workings of finance. Because this study is focused on a single outcome, case selection is *within-case analysis* (Gerring, 2006).

It was not clear from the outset that the research would be a single-outcome study, but this was to some extent determined by how events unfolded. Chapter 3 outlines some of the methodological challenges in trying to nail down a constantly changing research area. It became apparent as I learnt more during research what an important, unique, and entrenched infrastructure the combined correspondent banking system and SWIFT is. Various potential alternatives that had been much hyped, fell by the wayside and the incumbents appeared to consolidate their position. Thus, the story became less one of change/disruption from outside and more one of preservation of the status quo, in some respects, and how this happened. One of the assumptions guiding the research from quite early on, before it became overtly clear from SWIFT's actions, was that change would proceed via a process of platformization. Guided by the overarching FINWEBS research project and by assumptions shaped by the iterative process of researching a constantly changing research topic, the four main intertwined research questions addressed in this thesis, and as mentioned above, are: 1) how does financial infrastructure, particularly for cross-border payments, work? 2) how are the geographies of cross-border payments configured? 3) how does technological and related organizational change unfold, and how is it governed? 4) what are the impacts of this change on the geographies of money and finance, i.e., the constellation of financial actors, places, and spaces? These are answered over four chapters and further fleshed out in the conclusion. Chapter 2 mainly sets the context and background, showing the system's current workings. Chapter 3 critically reflects on the methodology and reveals the obscure and opaque nature of this area of finance, contributing to our understanding of how it works. Chapter 4 investigates how the geographies of cross-border payments are changing and the governance of this change via SWIFT as a key collective agency. Chapter 5 demonstrates the wider importance of SWIFT and correspondent relationships for other financial infrastructure and shows SWIFT's importance in attempting to direct change to the benefit of its member banks.

1.3.2. Methods, ethics, and data

This study engaged in qualitative research, continuing in "the longstanding tradition of using human experience as an empirical source of evidence" (Montgomerie, 2017, p. 129). Contrary to the search for objective and general laws in quantitative research, qualitative research "searches for meanings in social and cultural contexts" (McFarlane-Morris, 2020, p. 394). Describing the world from the perspective of the actors concerned contributes to a better understanding of social reality while highlighting processes, interpretations and structural characteristics (Flick et al., 2009). This serves to help the researcher analyse socioeconomic agents' practices, defined as "stabilized, routinized, or improvised social actions that constitute and reproduce economic space" (Jones & Murphy, 2011, p. 366). To this end, interviews are an appropriate methodological tool. In applying pre-existing ideas to interview data, the project tested their suitability for grappling with the research problem and therefore engaged in deductive reasoning. However, in wishing to remain open to unexpected findings from the data, the research also applied an inductive approach (Peters, 2017, pp. 168–169) influenced by grounded theory, or "the discovery of theory from data systematically obtained from social research" (Glaser & Strauss, 1967, p.

2). This contributed to trying out different approaches and frameworks during the research, discarding some wholesale while retaining elements of others, in a process of "bricolage and borrowing" (Larner, 2012, p. 159).

Primary research data is composed mainly of answers to semi-structured interview questions. The organizations and individuals involved were identified from secondary data analysis, including lists of speakers at industry events, as well as from attendance at such events, and via word of mouth or snowballing. Amongst others, the interviewees included participants from: fintech firms and consortia; fintech incubators/accelerators; SWIFT; and banks of different sizes (see appendix 1 for a full list of all interviewees). Attending industry events, both in person and online, was another source of primary data, as well as a means of finding potential interviewees. In this respect, the onset of the COVID-19 pandemic and its wholesale shift to virtual events was in one respect advantageous[14], as it allowed attendance at events that would not previously have been possible in person. An example of this is one of the largest annual finance industry conferences, Sibos[15]. Organized by SWIFT, this is an important "field configuring event" for the finance industry, or an event important for social action as a space for "introducing, structuring, maintaining and configuring new products, industrial standards, cultural artefacts and knowledge categories" (Lange et al., 2014, p. 187). Attendance in-person at this event normally costs thousands of euros and the event is held on different continents each year, making it an expensive exercise. However, the pandemic saw it held online for the first time and I was kindly allowed to attend for free as a researcher for two years following a request to the SWIFT Institute[16]. In total, 130 potential participants were contacted, of which 30 consented to being interviewed, a success rate of 23 percent. Chapter 3 contains a critical reflection on the interview process, including the perennial problem of gaining access, and on the elite versus expert interviews.

Following Creswell (2015), the interview protocol was prepared in advance, did not exceed two pages in length, and did not contain more than 10 questions. Although consistent use of the protocol is advised for all interviews, this was not always possible and was not always the case in this research. Because only 30 interviews could be conducted, it was not always possible to interview multiple people with the exact same role and expertise. Despite this, it was still possible to triangulate by confirming information from one interview in others and using desk research. This was also in part because of the wide range of organizations and roles involved and because the main organization being researched, SWIFT, is unique and tends to be secretive. Another reason for this was the constantly changing nature of the topic under investigation, where some initially interesting firms and information faded in relevance as events unfolded. To encourage interviewees to converse, semi-structured open-ended content questions were used (Creswell, 2015). Because of the freedom this affords the interviewee to talk, interview questions were not followed in strict order: interviewees sometimes brought up question topics unprompted and naturally, allowing the conservation to flow. This provided affirmation that I was on the right track with the interview topics I had planned to cover. Additionally, the freeform nature of semi-structured interviewees allowed interesting new avenues to arise that I had not considered or been aware of beforehand and this also sometimes subsequently changed the research in some ways, for example, in terms of questions to ask future interviewees.

[14] The COVID-19 pandemic also brought a massive obstacle to the completion of this thesis in the form of chronic illness and disability from long COVID, addressed in section 1.3.3.

[15] https://www.sibos.com/

[16] Set up by SWIFT, this organization funds research by finance practitioners and academics: https://swiftinstitute.org/

Informed consent was obtained in advance from those interviewees who agreed to be recorded, and anonymity was guaranteed. Not all interviewees agreed to being recorded and one required me to sign a form disallowing usage of any quotes from the interviewee without prior consent. For those who did not consent to being recorded, I took handwritten notes during the conversation, which I typed up after while they were fresh in my mind. The notes therefore also helped remind me of the interview. Sometimes, depending on the disposition of the interviewee, I did not even ask to record the conversation and just relied on taking notes. I transcribed most interviews myself. This was to gain familiarity with the content and to hence better interpret meaning by noting new themes and by noticing moments which might not be captured otherwise, such as tone of voice and non-verbal cues like hesitation and pauses (Peters, 2017, pp. 170–171).

To aid with analysis, MAXQDA was used for archiving, indexing, management and retrieval of interview data. Data about potential interview participants along with interview notes and transcript data were encrypted and stored on non-internet facing computer drives, with access limited only to the research authors. Thus, research ethics and data management practices follow EU guidelines for researchers (European Commission, 2018b, 2018a). Coding, or analysis of interview data to find and assign meaning, was done with the assistance of MAXQDA, rather than by hand. Similarly coded groups of text were assigned to broader themes (Creswell, 2015). Coding was done following both explorative design, in which new codes are inductively formed from the empirical material (similar to grounded theory), and descriptive design, where a code system is deductively formed from the research question and the theoretical approach (Mayring, 2014). Because "coding is not a precise science" but "primarily an interpretive act" (Saldaña, 2009, p. 4), data were sometimes coded multiple times, in light of new insights that arose during the research process.

The research also involved consultation and critical evaluation of different kinds of secondary data. Reflecting the figuratively "ever-more promiscuous" nature of economic geographers (Barnes & Christophers, 2018, p. 82), who are particularly prone to borrowing from a plurality of approaches (Hassink et al., 2023; Larner, 2012; Marchionni & Oinas, 2023), academic literature used in this study is not just from the areas of economic/financial geography but also from the areas of: political economy; organisational studies; business history; law; history of technology; sociology of technology; social studies of finance (SSF); and STS, amongst others. Secondary data used additionally consists of: industry reports by consultancy firms; blogs by finance industry professionals with perspectives and explainers of industry practices; financial, technology, fintech, and cryptocurrency news websites and blogs; and reports, speeches, and technical documents by central banks, national and supra-national financial supervisory and regulatory agencies, payments and financial market infrastructure providers, and financial technology providers. Inspired by the 'follow the thing/follow the money' methodology (Christophers, 2011; Hughes-McLure, 2022; Peck & Theodore, 2012), industry reports, technical documents and events allowed me to get deep into the "nitty gritty" (Christophers et al., 2017, p. 27) of how financial practices work. Some have argued that critical researchers need to "be careful not to adopt too readily the depoliticising lens of economists in their rightful eagerness to delve into the technicalities of finance" (Knafo, 2020, p. 92). However, as finance has become "a 'scientized' and 'technologized' domain", industry resources can be invaluable in discovering how organizations and practices are kept opaque, and ultimately in holding finance's power to account (MacKenzie, 2005, p. 556).

Lastly, there were some mixed and other kinds of data used while conducting this research. I participated in a training course for finance professionals run by SWIFT called 'Introduction

to SWIFT in the payments market'[17]. While very useful secondary data in terms of in-depth technicalities of payments messaging, the course was also valuable primary data, as I heard first-hand from the other course participants about some of the day-to-day banking processes and activities around payments messaging. A final observation is to note the value of a particular kind of data: dissertations by past doctoral students. These are useful, not only as examples of best practice for thesis content and structure, but also as a source of inspiration (e.g. those by Balmas, 2022; Coremans, 2019; Genito, 2018; Hendrikse, 2015; Robles, 2019; Storme, 2014).

1.3.3. Limitations and problems

There are inevitable trade-offs between specificity and the application of a general theory (Knafo, 2017) and in the case at hand, this becomes a problem of how to generalize about an infrastructure and organization, SWIFT, that is *sui generis*. Because SWIFT fulfils a uniquely global infrastructural role and has a unique organizational form, and because there is a limited number of types of financial infrastructures (see figure 2.1), the aim of this study is not necessarily to generalize from it but instead to interpret and to offer in-depth scrutiny of SWIFT's operation and of certain dynamics and processes in which it is involved. In spite of this, there are certain findings that can be applied to learn more about the workings of financial infrastructures, such as their governance, their interconnection with SWIFT, and the impact of the account money form on determining this. Additionally, the relatively small number of interviews conducted could be seen to present a problem for validity, particularly when compared to the large sample sizes of quantitative research. SWIFT's unique role, the generally opaque nature of the finance industry, and the complexities of the workings of financial infrastructure all make finding and accessing appropriate interviewees difficult (see Chapter 3). However, within qualitative approaches, validity is not usually an issue because such approaches "seek to be subject centred, close to everyday life" (Mayring, 2014, p. 14).

A further issue concerns publication of chapters/papers in a PhD by publication. Difficulties could have been caused where later chapters/papers relied on earlier ones being already published in order to refer to information in them. This problem was exacerbated by the general prolonging of review and publication times during the COVID-19 pandemic and the broader problems associated with the peer review and publication process that make it difficult for journal editors to find reviewers, all of whom are overworked. While I managed to get two papers published and a further two submitted before submission of the thesis, there was an element of luck as this was to some extent out of my hands. There are valuable, if sometimes unpleasant and stressful, lessons in terms of journal selection and dealing with inevitable rejection for doctoral students in this process.

A massive and unforeseen problem while doing this thesis, was becoming chronically ill and disabled with long COVID in March 2021, following infection in December 2020. This was about six months before the planned PhD finish date. Long COVID's etiopathology is to date only hypothesised and it has no confirmed treatment. My remaining symptoms are mainly neurocognitive and fatigue. The former features tinnitus, headache, and cognitive impairment (colloquially known as 'brain fog'), which involves problems with concentration, memory, thinking, and executive function. Fatigue includes post-exertional malaise (PEM)/post-exertional symptom exacerbation (PESE), which is a significant worsening of symptoms for an extended period following even very small amounts of physical or cognitive exertion (Choutka et al., 2022; Davis et al., 2023). This condition has affected my life in very

[17] This course was held on 9th October 2019 at the Luxembourg House of Training.

profound ways, including seriously impacting my ability to work. I am no longer able to read long-form or complex texts or to write or concentrate for more than very short periods, which must be followed by long periods of rest in silence. With such limited energy, I sometimes struggle with basic care activities, as well as trying to advocate for medical diagnosis and treatment for myself, while occasionally trying to do small amounts of work on this thesis, and I am frequently unable to work at all for weeks or months. This has significantly prolonged the time to complete this thesis. I am fortunate that this happened close to the finish of the PhD when I had already completed the fieldwork. I have had to rely on my notes and memory of what I read to be able to write. I could not have completed the thesis without the patience, understanding, and assistance of my supervisors and my affiliated institutions in accommodating my severely curbed ability to work due to illness.

1.4. Structure of the thesis

The remainder of the thesis comprises four chapters and the conclusion. At the time of submission, chapters 2 and 3 have been published, and chapters 4 and 5 have been submitted. These chapters are reproduced here in their original form with only minor adaptations, such as replacing the words 'article' or 'paper' with the word chapter, and renumbering headings, tables, figures, and footnotes. In those chapters that are co-authored, I have retained references to 'we'. Some of the figures in this thesis appeared in multiple papers or are slightly updated versions: to help with readability, I have left these duplicate figures in each thesis chapter. The different chapters display slightly different methodologies and data, relying variously on secondary data from desk research and on primary data.

Chapter 2 sets the context for the thesis in providing an exploration of the historical and current workings of the combined correspondent banking and SWIFT system for cross-border payments. It does this by noting the importance of the account money form in determining the architecture of current financial infrastructure, which is composed of twin financial and information processes and geographies of settlement, via the correspondent banking system, and messaging, via SWIFT. It conceptualises this combined infrastructure as a sociotechnical configuration, comprising both technical elements like SWIFT's messaging network, banks' internal payment systems, and national payment systems, with social elements such as rules for the use of technical systems and contractual business relationships and arrangements. In so doing, it shows the composition and distribution of this infrastructure across different scales and actors, and how international payments are thus composed of multiple interconnected global, regional and local activities. The significance of non-firm forms of organization in financial infrastructure, namely SWIFT's cooperative form, is highlighted. Finally, it further demonstrates the geoeconomic and geopolitical salience of correspondent banking and SWIFT by outlining their weaponization in imposing sanctions during the Russo-Ukrainian war. This contributes to answering the first two main research questions of this thesis. Chapter 2 was co-authored with Sabine Dörry and Ben Derudder, and was published in *Global Networks* in 2023. An early version of this paper, which was published as a FinGeo[18] working paper, appears in Appendix 2.

Chapter 3 serves two purposes; the first is examining the methodology of qualitative research via semi-structured interviews, and the second is what the pursuit of this methodology itself reveals about the actors and processes involved in the research topic. Namely, it demonstrates the opaque, arcane, and sometimes secretive nature of financial infrastructures and the organizations through which it operates, while also shedding more light on actors engaged in transaction banking. Additionally, this chapter demonstrates the

[18] The Global Network on Financial Geography: https://www.fingeo.net/

reach of the platformization trend, which I show in chapter 4 is a strategic response by SWIFT to upgrade financial messaging, as it also increasingly intermediates between researchers and interviewees. This augments the answers found in chapter 2 to the first two research questions of this thesis, as well as adding some initial colour to the third research question about the actors governing financial infrastructure. This chapter was published as a single-authored paper in *Area* in 2021.

The processes and outcomes of technological and organizational change in cross-border payments are covered in chapter 4. This chapter address research questions 3 and 4 and finds that SWIFT's cooperative organizational form is a crucial relational mode of mediation between the thousands of SWIFT's member users in maintaining the stability and structure of heavily entrenched global financial infrastructure and the agency required to simultaneously upgrade this infrastructure to be competitive in the big data era. The aim of this is to maintain correspondent banking as the prime channel for cross-border payments and to preserve bank's incumbency. This is enabled by a step changing in SWIFT messaging from inefficient serial chains to partial platformization via a new transaction management system, gently forcing banks into painful change by shifting from reliance on fee extraction to the economic use of data. This change was complex and its coordination across thousands of banks around the globe impossible to simply centrally order. It was rather a result of the resolution of many tensions inherent in the relational geometries of power, in which SWIFT is instrumental in a variety of ways. The impact of this platformization is to maintain the financial geographies of settlement of cross-border payments via the correspondent banking system, preserving banks' collective position and particularly the dominance of the GTBs anchored in financial centres around the world. The information geography of messaging, however, is reconfigured and features increased centralization of messaging data in SWIFT as an orchestrator of transactions. This lays the foundation for increased mutualization of even more common banking services in SWIFT as a collective banking platform. Chapter 4 was co-authored with Sabine Dörry and Ben Derudder and was submitted to *Geoforum* for inclusion in a special issue on the impact of fintech on the advanced producer complex (APS) complex, where it is currently under review.

Chapter 5 builds upon the previous chapters to expand our understanding of financial infrastructure beyond payments and into securities transactions, thereby further illuminating the answers to all four of this thesis' research question. It shows the wider reach of SWIFT as an infrastructure for other financial infrastructures and its extension of platformization into securities messaging. With this understanding, it investigates how the two main things that constitute SWIFT, the cooperative organization and its messaging network, are instrumental in extending various forms of trust across space and among thousands of banks in different places. Trust is a club good that SWIFT's members benefit from, a crucial ingredient in engendering cooperation between competitors, and a key element of how power is collectively and relationally operationalized to maintain the joint dominance of financial incumbents. Alongside things like physical equipment and networks, ideas and standards, trust is therefore an important component of infrastructure. SWIFT aims to cement and future-proof its role as a bringer of trust in global finance and the continued role of banks as financial intermediaries by providing interoperability with new digitally tokenized forms of money and securities, their financial infrastructures, and their potentially new institutionalized forms of trust. However, it faces challenges maintaining its self-proclaimed neutrality and the trust on which this is based. On the strength of the work in this thesis, I was invited to contribute a chapter on SWIFT to the section 'Organizations and Actors of Contemporary Financial Infrastructures' in the forthcoming (2024) volume, *The Cambridge Global Companion to Financial Infrastructures,* edited by Barbara Brandl, Malcolm

Campbell-Verduyn, and Carola Westermeier. Chapter 5, co-authored with Sabine Dörry and Ben Derudder, will be the submitted chapter.

The thesis concludes with a summary of the research outcomes, findings, and implications. In the spirit of aspiring to "intellectual humility" (Hoekstra & Vazire, 2021, p. 1602), it includes some limitations of the research and avenues for future research.

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Chapter 2. Global networks of money and information at the crossroads: correspondent banking and SWIFT

Co-authored with Sabine Dörry and Ben Derudder. Published in *Global Networks*:

Robinson, G., Dörry, S., & Derudder, B. (2023). Global networks of finance and information at the crossroads: Correspondent banking and SWIFT. *Global Networks*, *23*(2), 478–493. https://doi.org/10.1111/glob.12408

Abstract

This chapter explores how transaction information is a fundamental element enabling and fostering global flows of money. Financial systems, constructed around account-based money require infrastructure, which is separated into two parts: messaging and settlement, performed via trusted agents. This separation has allowed the geographical expansion of banking, and to this day constitutes a key architecture of increasingly global networks of money. Focusing on the correspondent banking system and SWIFT, the chapter demonstrates the workings of this infrastructure in cross-border payments and in enacting economic sanctions. This sociotechnical infrastructure is a crucial yet overlooked area of global banking, which makes global economic and financial activity possible in the first place. Importantly, by analysing the organizational architecture of the global payments system and including the actors and agencies within it, we elucidate the (changing) relationships between data/information, geographies, and power, contributing to the formation of a literature that conceptualises financial infrastructure.

Keywords

correspondent banking and SWIFT; cross-border payments; financial infrastructure; geopolitics; financial geographies; information networks

2.1. Introduction

This paper elaborates on the generic observation that finance is 'essentially an information business where most processes may be IT-supported' (Alt & Puschmann, 2012, p. 204) by exploring how transaction information is a fundamental element enabling and fostering global flows of money. The importance and justification for this elaboration is reflected in the uniqueness of an infrastructure comprised of the tightly intertwined interplay of the *Society for Worldwide Interbank Financial Telecommunication (SWIFT)* and correspondent banking (CB), whose geopolitical and geo-economic significance require forensic examination and a thorough understanding of their workings. Information is a critical building block of this global architecture. Information is interwoven through banking relationships that form specific geographies and link financial centres around the world (while excluding other places), thereby exerting financial power that is transformed into geopolitical power. The continued production of infrastructure by public and/or private actors is necessary for the reproduction of capitalism.

The social sciences have seen a turn towards new and more nuanced understandings of infrastructure, recognizing that both its material and immaterial forms set the rules and standards that shape the rhythms and flows of social life (Appel et al., 2018; Easterling, 2016). The importance of infrastructure as critical to modern life is often thought of in terms of national, physical and public infrastructure (Church et al., 2004). However, private global network infrastructure as a bridge between disparate jurisdictions in the world economy has a vital coordinating intermediary role. The specialized infrastructure of finance is crucial in enabling global economic activity but is often characterized as the 'plumbing' of the global financial system, and perceived as "boring, low margin and not strategic" (Lord et al., 2015, p. 6). We prove otherwise in this paper.

The financial sector has clearly been a pioneer in the adoption of information and telecommunications technologies. For example, the wave of digitalization that started emerging in the 1960s (Arner et al., 2015) has led to now almost all financial markets being digital, while the industry is currently undergoing unprecedented change due to a variety of fintech actors, innovations and trends, including the ever-increasing digitalization of payments (Wójcik, 2021). Information in finance is referred to in terms of market data, such indices and prices, crucial for trading and investment decisions (Petry, 2021). Additionally, knowledge creation and information flows are key variables in configuring global economic geographies, for example the information asymmetries providing the underlying logic for financial firms to cluster in specific places (Kindleberger, 1973) and allowing advantages in high frequency trading (Zook & Grote, 2017). Recent research has also drawn attention to previously less explored forms of financial information, which has gained in importance in light of the rise of fintech and digital platforms: payment transaction data (O'Dwyer, 2019; Westermeier, 2020).

Taken together, transaction information is a crucial building block on which the backbone of global networks of money runs, yet the geographies of financial information remain relatively recondite in terms of their organizational structure, potential power, and geographical impact (Zook, 2018).

A complex global architecture undergirds the mechanics of financial flows. For example, account-based flows in cross-border payments involve myriad chains of actors, intermediaries and specialized infrastructures collecting, transmitting, storing and ordering information – messages with transaction instructions – as they connect places. Accounts are siloed at trusted institutions, whose ledgers are subsequently reconciled, or settled, based on this information, realizing the movement of money. The informational and financial

components have different business models and congruent but different geographies. Payments is one of the core banking areas targeted by fintech entities, and efforts to rewire this could have far-reaching implications for the geographical organization of global networks of money, e.g., in terms of who engages in which financial activities and where.

Against this backdrop, the overarching aim of this paper is to shed light on how informational (messaging) and financial (settlement) geographies structure global flows of money. Financial infrastructures have been somewhat of an analytical blind spot, but recent contributions have begun to (in-)form a more coherent conceptual embrace (Brandl & Dieterich, 2021; Campbell-Verduyn & Goguen, 2019; de Goede & Westermeier, 2022; Dörry et al., 2018). We build on these contributions by: (1) examining evolutions in account-based money to highlight the separation of information and settlement processes, and to show the contingency of the architecture of global banking on this money form; and (2) examining these dual intertwined processes and geographies in the correspondent banking infrastructure for cross-border payments, which helps to tease out the 'social fabric' and its organization that define the working of financial infrastructure.

We thus highlight the pivotal role of SWIFT as a global financial *information* infrastructure that does not itself touch money, and show the importance of the CB system as a historically central banking infrastructure with a continued crucial role. Probing the workings of this system in its use for cross-border payments and in enacting sanctions allows us to more precisely grasp how funds cross borders as transaction information that moves across space through unevenly networked places. In doing so, we illustrate how informational and financial geographies, while closely linked and sometimes matching, are distinct elements of global networks of money, and suggest that disentangling them is crucial. Therefore, this article employs a qualitative analysis of multidisciplinary secondary data, including literature from economic and financial geography, business studies, political economy, critical data studies, and science and technology studies, as well as industry reports and insights from 30 expert interviews across the banking and payments industry (Robinson, 2021).

The remainder of this paper is organized as follows. Section 2 examines the historical evolution of deposit banking and financial flows from being predominantly token-based to account-based. This precondition facilitated the spatial expansion of finance by dividing financial transactions and flows into two separate processes: transmission of transaction information (messaging) and reconciliation of transactions across accounts (settlement). Section 3 conceptualizes both the terminologies and use of data and information in finance. Section 4 introduces financial infrastructure as a distinct category of actors built around the architecture of account-based money. It focuses on the CB system as a pivotal global banking infrastructure, highlighting its dependence on a crucial financial actor that handles information rather than money: SWIFT. Section 5 uses the examples of cross-border payments and of economic sanctions to demonstrate the workings of the system of account-based flows and its twin informational and financial geographies, shaped by the interactions of more than 11,000 banks worldwide. The paper concludes with reflections on the significance of transaction information flows in global banking, and on technological innovations that seek to rewire informational and financial geographies.

2.2. Two sides of the same coin: Information and settlement

As Maurer (2012, p. 20) points out, "you can't have finance without the act of value transfer – the seemingly small, mundane little technicality that sets the world of finance, high and low, in motion". Every day across every economy, a huge number of transactions takes place across a range of economic actors. Excluding barter, whether for the purchase of goods, services or financial assets, each transaction has two settlement components: 1)

the delivery of goods or services; and 2) the transfer of funds or payment. There are two basic types of payment mechanism or money form: objects, or *tokens* (for example, cash), and claims, or *accounts* (for example, deposits at commercial banks) (Abrazhevich, 2001; Green, 2008). Discussing banking and payments invites a brief reflection on the relationship between money and finance. Proponents of cultural economy, for example, argue that a purely utilitarian approach to money, i.e., "market money", would disregard the "extraeconomic, social basis of modern money" (Zelizer, 1989, p. 342). While we agree, here, we define money as a distinct function of finance, with money and finance being functionally and metaphorically close. The latter notion therefore guides the choice of our terminology and meaning of money throughout the article.

Money is both information and infrastructure (Maurer, 2014). Banknotes must be designed and printed in ways to make it difficult to forge, and need to be securely transported, stored and accounted for. With token or object-based payments, settlement is immediate; there is no other exchange of information needed. However, most payments today are account-based. Although they simplify transactions, they need a complex supporting infrastructure (Adrian & Mancini-Griffoli, 2019). Digital payments rely on, amongst other things, chip and PIN cards, point of sales terminals, mobile phones and telecommunications networks. On top of this, there are centralized settlement systems, agreements and rules governing the use of systems and networks, as well as a legal framework. With account-based payments, payment takes the form of transferring ownership of a claim on value held elsewhere. For example, payment with a debit card sends instructions to transfer ownership of one person's claim on bank assets to another person. The act of payment in account-based money therefore comprises two parts: transmission of transaction information (or: instructions) and subsequent settlement (or: reconciliation) of accounts. Thus, in funds transfer, what is actually transferred is information. This separation has its origins in the Middle Ages and is essential to understand when considering previous and current efforts to change how global networks of money are organized.

Deposit banks evolved from moneychangers' original function as custodians of physical specie in medieval Europe. The quality and quantity of coinage was ill-suited to commerce. Rather than constantly counting and transferring *physical* coin as payment, they instead allowed transfer of title to, and ownership of, coin deposited with them. This immobilized the coin and instead strengthened the recording of ownership transfer and the creation of a kind of *book-entry* or *account* money. Account-based money comprises debt/credit claims on a party, which are dematerialized as they are recorded in accounts or books. Payment thus evolved from physical transfer of an object (token) to book (account) transfer. Using bank deposits for payments allowed netting, that is, using one debt to extinguish another, resulting in the mediation of a large volume of transactions without the need for much final settlement in cash. Payment was executed by transferring debts between strangers, with the bank as trusted intermediary. Banks' distinctiveness lay in centralizing these operations across many parties in their books. While deposit banks were a local affair, trade and finance expanded further across geographical distance with the bill of exchange. Merchants sent goods and remittance instructions to agents to accept payment in one location's local coin and to repay in another location's coin, with a delay of up to several months between receipt and repayment (Kohn, 1999, 2001).

For most of history, information moved with people: tokens and information about them moved at the same speed. This changed, however, in the 19th century, when the telegraph brought the dematerialization of telecommunication, allowing information to travel faster than physical objects (Wenzlhuemer, 2007). Digitalization of accounts from the 1960s greatly enhanced accounting and settlement (Bátiz-Lazo et al., 2011) but technological

improvements to information flows impacted hugely on the geographies of banking. The Euromarkets from the late 1950s and the end of the dollar gold standard in 1971 increased cross-border flows of money (Burn, 2006). The subsequent advent of electronic funds transfer from the 1970s further intensified the speed of flows and the globalization of the banking sector (Langdale, 1985). Importantly, this digital transition did not change financial intermediation patterns based on the account-money form but rather optimized them. The separation of information and settlement in the account money form is one reason why communications advances have been so impactful in finance. Fintech innovations and actors target both processes in novel ways, making it important to understand the nature of these building blocks that shape global money's current and future architecture.

2.3. Financial data and information

As an information business, finance has long been data-driven (Hussain & Prieto, 2016). Data, information and knowledge can be understood as different hierarchical layers (Kitchin, 2014), in which each layer is differentiated by distilling it through reduction, abstraction, processing, organizing, analysis, and interpretation, to reveal relationships and truth, thus adding meaning and value. Finance is not only an information business in terms of price and market information and associated asymmetries, but also in terms of account and transaction details. The distinction between *types* of financial information is vital in the context of the heightened importance of data. Computing advances have greatly expanded the volume of data that can be processed and transmitted, thereby placing more emphasis on innovation (Thrift, 2005). Unlike physical commodities, the value of data does not lie in its materiality. It can exist simultaneously in multiple places, and is not lying around waiting to be dug up – it must be appropriated (Couldry & Mejias, 2019). Conceptualizations of data as a crucial element in modes of capitalist accumulation and monetization capture the moments and processes at and through which this happens (Sadowski, 2019).

Some consider banks the accounting centers and system of the economy (Stiglitz & Weiss, 1988). Building on this, global finance has been posited as "a system for keeping track (and profiting from the manipulation) of information on ownership claims, debts, revenue streams, exposure to or protection from risk" (Campbell-Verduyn et al., 2019, p. 914). However, transaction data and information have been thus far underutilized for reputational and regulatory reasons (Omarini, 2020), meaning that "until now, banks have thrived on money, not data" (Westermeier, 2020, p. 2). Payment data and information, such as transaction history and payment instruction information, for both retail and corporate customers, nonetheless constitutes an increasingly important data source, becoming more valuable than payment fees (O'Dwyer, 2019; TechCrunch, 2012). As the former CEO of Citigroup, Walter Wriston, put it, 'information about money has become almost as important as money itself' (Bass, 1996).

Although information flows and knowledge creation are key variables in the production of a broad range of economic geographies, the geographies of financial information have often remained somewhat obscure (Zook, 2018). A key exception is the literature that considers how information asymmetries lead to spatial proximity, which in the case of finance translates into the coordination of capital flows at the global level being concentrated in just a few places: international financial centers (IFCs) (Dörry, 2015; Grote, 2009; Kindleberger, 1973; Meyer, 2009). However, this centralized global financial infrastructure links globally dispersed financial actors through collecting, storing, and communicating information via a financial messaging network.

One fundamental function of finance is the transfer of (exchange) value, more simply known as payment. The payments industry in itself is an enormous economic sector, without which

global production and exchange as we know it would be impossible. This is echoed in one of the financial system's core economic functions: to provide a payments system that facilitates the exchange of money necessary in the purchase of all goods and services (Dixon, 2011). As we saw in the previous discussion of the origins of account-based money in deposit banking, settlement is performed in the books of trusted intermediaries, that is, banks, and payment settlement instructions are transmitted separately. The interdependent geographies of information (messaging) and finance (settlement) are therefore different but intersecting. Having examined the history of this separation, we now turn to an analysis of cross-border payment flows via the CB system to demonstrate the inseparability of their organizational interplay and resulting geographies.

2.4. A global infrastructure: Correspondent banking for payments

2.4.1. Correspondent arrangements

Except for currency unions like the euro, currencies are mostly national. National payment settlement systems have become crucial financial infrastructures with public utility. Essential to everyday life, they are a vital part of a country's basic infrastructure to the extent that "if you wanted to cripple the U.S. economy, you'd take out the payment systems" (Greenspan, 2007, p. 2). Central banks usually operate payment settlement systems within a jurisdiction where payments in that currency are ultimately settled. Direct access to a national payment system is typically granted only to financial institutions regulated in that jurisdiction. Payments in that currency are relatively straightforward: they are settled across the banks' accounts at the payment system. However, payments made in different currencies, or cross-border payments, are more complex, conducted via a global network of decentralized contractual agreements between banks, known as correspondent arrangements, supplemented since the 1970s with a financial messaging network centralized in SWIFT (Dörry et al., 2018).

In its most basic guise, a correspondent arrangement, or correspondent banking relationship (CBR), involves an entity (usually a bank) in one location, the respondent, engaging an independent entity (usually a bank) in another location, the correspondent, to conduct services there for it and its customers. The parties usually agree on the ongoing purchase and sale of products and services by exchanging contracts to establish a CBR (Naughton & Chan, 1998). CB is intrinsically geographical: its key element and indeed *raison d'être* is overcoming distance, and the term dates from when banks sent instructions in letters by ship (Leibbrandt & De Terán, 2021).

There are two main ways that financial institutions operate overseas. One way is by establishing an overseas presence as part of the parent firm, such as a branch, subsidiary, agency, or representative office (Derudder & Taylor, 2020). The other way is via a correspondent arrangement, akin to exporting activities of manufacturing firms, where the correspondent is independent of the respondent (Cho, 1986). Most banks do not have a physical overseas presence and instead use correspondent arrangements for international business. While such arrangements may also be between banks within a local market, for example historically underpinning the U.S. banking system (James & Weiman, 2010), they are far more common internationally and have been a bulwark of the internationalization of finance for centuries (Merrett, 1995).

CBRs are, first, an integral way that banks sell services to each other. Maintaining a network of global relationships is part of banks' back office operations, supporting other activities within a bank and allowing the cross-selling of various department's products to other banks

(Chan, 2014). Purchasing products and services from correspondents is often cheaper than producing them in-house as large, vertically-integrated correspondents can exploit economies of scale and network effects to lower prices (Osterberg & Thomson, 1999). CBRs are the cheapest way to do transaction banking across borders, including payments, trade finance, account and liquidity management, and securities services (Naughton & Chan, 1998). It makes transaction banking services "the bread and butter of international banking" (Merrett, 1995, p. 70), providing over 40 percent of global banking revenues (McKinsey & Company, 2019). Second, CBRs were also the means of settling foreign exchange (FX) transactions prior to the formation of the centralized Continuous Linked Settlement (CLS) infrastructure in 2002 (Lindley, 2008) (Figure 2.1), and are the means by which central bank swap lines operate (Aldasoro et al., 2020).

Banks often hold reciprocal accounts with each other, known as nostro/vostro accounts, and while this is not a necessary condition of a correspondent arrangement, doing so allows access to a wider range of correspondent services, such as cross-border payments. The ability to conduct such payments without legal domicile or physical presence in another jurisdiction supports myriad other global networks in trade and investment by providing "a flexible and regulated channel with a potentially worldwide reach" (Coelho et al., 2020, p. 4). The geographies and business models of CB have not remained static. The telegraph was among the reasons for the development of CBRs into global interbank networks between the late 1800s and the early 1900s (Battilossi, 2006). Ease of communication aided banks in more easily expanding abroad without a direct presence via CBRs. The advent of electronic funds transfer, such as SWIFT, in the 1970s allowed the intensification of financial flows by greatly increasing the speed of information transfer. Reflecting SWIFT's foundation by Western banks, most payment flows then were between Europe and the United States. We examine SWIFT in more detail in the next section but for now it is important to note that its introduction brought about a marked increase in the scale and complexity of CBRs (Rice et al., 2020; SWIFT, 2011).

Since the financial crisis of 2008, despite a rise in the number of banks, the number of CBRs has declined by between 20 and 25 percent. The reasons for this include reduced profitability, partly because of high costs of due diligence, and 'derisking' because of increased regulatory compliance responsibilities and the high costs and reputational damage from transgressions, mainly by U.S. and European banks (Accuity, 2017; Rice et al., 2020). Reciprocity is fading due to price and competition pressures and a decline in trust among banks post-global financial crisis with regard to credit and compliance risk (Langley, 2004; Lyddon, 2012). Trust is still essential, however, as participants' high interdependence through extending credit lines to each other, holding balances and exposure to operational failures, creates potential for systemic risk (Wandhöfer & Casu, 2018). The decline in CBRs has uneven regional impacts, for example affecting the Pacific Islands and Sub-Saharan Africa, where fewer direct and more nested CBRs have lengthened payment chains and increased costs (IMF, 2017; World Bank Group, 2018). New technologies bring more choice in payment channels, some of which support and others which substitute for CB (Rice et al., 2020). The demise of CB has been predicted many times (Hawser, 2015), but the system is geoeconomically, geopolitically, and technologically key, because banks still need correspondents in places where they have no direct presence.

Other financial institutions also use correspondent arrangements, including central banks, financial infrastructures, and non-bank financial institutions such as remittance operators (Buhl-Freiherr von und zu Guttenberg, 2018). Thus, correspondent arrangements are also a mode of international operation and expansion allowing the relational exercise of power

across space. Central banks, for example, used correspondents to intervene in foreign exchange markets in other jurisdictions (Eichengreen, 2019), also acting as correspondents for other central and commercial banks, both in the past (Cassis, 2010) and today (Deutsche Bundesbank, n.d.). With an estimated 1.3 million contractual relationships (Zschieschang, 2018), the CB system forms a decentralized and global infrastructure network for the flow of funds and the provision of other banking services. Although reaching all corners of the world, the uneven concentration of global networks captured by CBRs is influenced by currency hierarchies and trade volumes (Kaltenbrunner & Lysandrou, 2017). Large correspondent banks in IFCs are the key nodes and nexus. Particularly for payments, CBRs have facilitated the geographical expansion of banking via the updating of reciprocal accounts (settlement) held at partner banks in distant locations. Of crucial importance in determining the extent of expansion is the communication of transaction information, in which SWIFT's network is pivotal.

2.4.2. SWIFT: Messaging infrastructure within and for infrastructures

SWIFT was established in 1973 by banks to create a standardized, secure and reliable digital messaging system. This is still a mainstay of its operations today. Holding no actual funds, SWIFT instead transmits instructions for the transfer of funds, which members act upon by updating their accounts. Payment instructions is one example. The SWIFT network encompasses both hard (e.g. network cables and equipment) and soft (e.g. standards, and rulebooks) infrastructure, thus determining how users act for the system to function efficiently. During the 1960s, U.S. and European banks' needs for reliable computer and telecommunications systems increased with the expansion of global operations. They began to innovate by developing their own private networks (Scott & Zachariadis, 2014). Although domestic payments had become standardized, international payments were not yet automated because of different languages and procedures, relying on telex to communicate transactions.

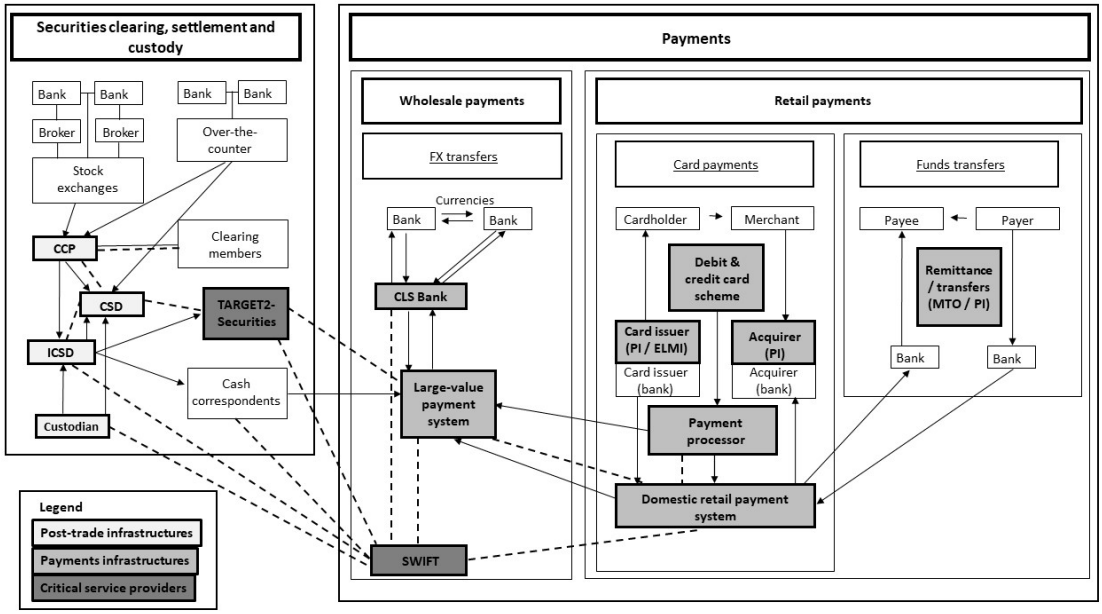
European banks had begun to co-operate around the 1960s to prepare for the possibility of a monetary union, to react to competition from U.S. banks, and to take advantage of opportunities presented by the Euromarkets. Europeans spearheaded the initiative to examine the feasibility, costs and specifications of a communications network for international payments and related messages. Some U.S. banks came on board by 1971 and SWIFT was founded as a non-profit co-operative in 1973 with 239 banks from 15 countries. The choice of Brussels for SWIFT's headquarters – a jurisdiction of high political relevance today – was a political compromise in the rivalry between London and New York (Scott & Zachariadis, 2014; cf. Taylor & Derudder, 2022). The eventual decision to adopt SWIFT was taken partly in reaction to attempts by First National City Bank (now Citi) to have its proprietary messaging system imposed in 1975: fear of being locked into a competitor's system was a crucial factor in driving the adoption of a collective solution. More banks signed up for the cooperative and collaborative SWIFT option instead. This gave it critical mass, with the first SWIFT message sent in 1977 (Scott & Zachariadis, 2014). SWIFT's cooperative form is a key element engendering institutional trust among rivals, mediating between the world's banks and financial infrastructures within and across borders.

Incorporating features of both a public good and a private cooperative organization run on a not-for-profit-maximization basis, SWIFT's profits are recycled as rebates to its (today) over 11,000 member-owners. However, it is not ownership by equals. Board membership is determined according to network usage: the six countries with the largest messaging volume appoint two directors each and the next 10 countries appoint one each. This favors large global Western banks, who send most SWIFT messages, granting them more control

over SWIFT (Bergin, 2016). Hailed as a model of co-opetition, SWIFT is classified as a critical financial service provider (National Bank of Belgium, 2017).

Figure 2.1 depicts the multiple interlinkages of national and international financial infrastructure for the example of Belgium, where SWIFT is headquartered. These core components of the financial system provide interconnection and manage risk. They comprise functions and systems for payments and securities trading, clearing and settlement, and have typically evolved into centralized infrastructures, many privately operated. Because the consequences of infrastructure failure are far-reaching, many have been designated systemically important by financial authorities (CPMI & IOSCO, 2012). The architecture of this infrastructure is structured by the account money form. Each payment and securities infrastructure is a trusted curator of accounts, which must be reconciled with other infrastructures and actors for each transaction, with transaction information transmitted separately. SWIFT's financial messaging system links not only member banks but also these infrastructures, making it literally an *infrastructure for infrastructures*, but also "a monopoly used by an oligopoly of participants" (Rambure & Nacamuli, 2008, p. 73).

Figure 2.1. Interlinkages between financial market infrastructures and SWIFT



Source: National Bank of Belgium (2017), amended by the authors

Figure 2.1 shows the existence of multiple centralized infrastructures based on the account money form, as well as the importance of SWIFT in interconnecting these infrastructures. CB is not represented in figure 2.1 because it shows centralized financial infrastructure in a single country (although some infrastructures are global, e.g. SWIFT, ICSD), but CB is decentralized cross-border (social) arrangements between banks in different jurisdictions and depicted in Figure 2.2.

2.4.3. Cross-border payments: A sociotechnical infrastructure

The correspondent arrangements for settlement do not constitute one centralized infrastructure, but rather a fragmented, decentralized global network of over a million bilateral contracts. While supposedly invisible, *technical* data infrastructure in reality has a very material geography (Furlong, 2021): its distributed and ubiquitous *social* dimension of

over a million distributed bilateral relations is "hidden in plain sight" (Panza & Merrett, 2019), but requires efficient coordination and control. For example, network participants need to know counterparty names and account numbers for different kinds of transactions and currencies. Known as standard settlement instructions (SSI), this information used to be available in printed directories like *Banker's Almanac*, first published in 1851 (Sylla, 1976) and still providing SSI today, albeit now online, while SWIFT also has such a directory.

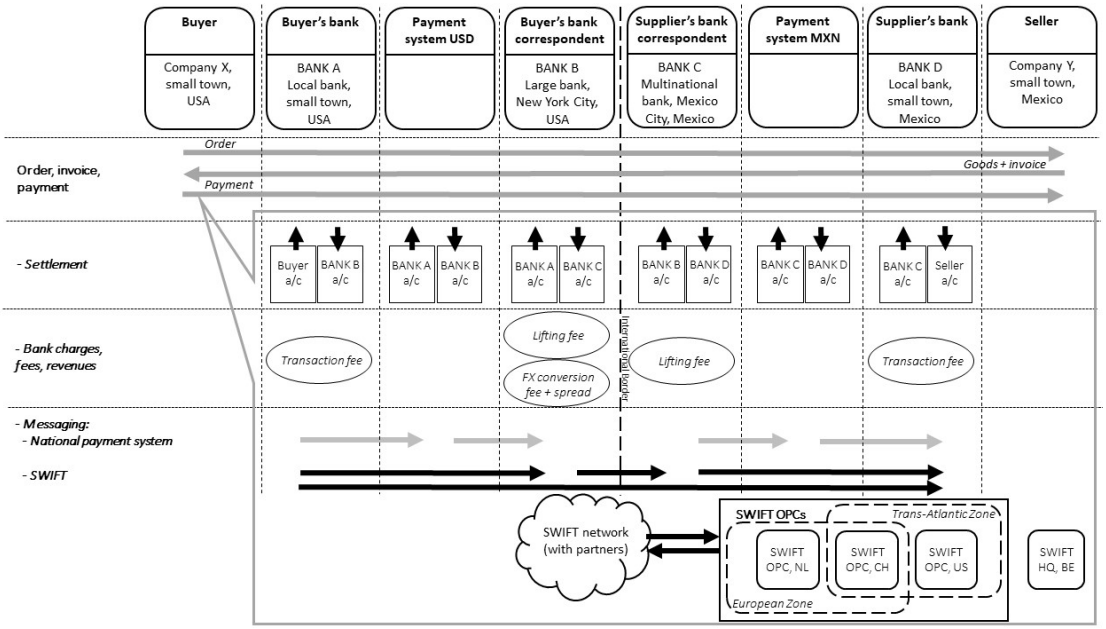
Additionally, the efficient communication of financial information requires interoperability, standardization, and security. This is the role of SWIFT, one of the advanced telecommunications services underpinning organizational networks and interconnecting powerful economic actors concentrated in cities (Langdale, 1989). CB predates SWIFT by centuries, but together, the two constitute an infrastructure as an assemblage of artefacts, or sociotechnical configuration. SWIFT's genesis is inseparable from CB; it has become synonymous with it, the more visible technological counterpart to the distributed invisible social network of contractual arrangements it supports. If correspondent arrangements are the lifeblood of global payments, SWIFT's messaging network is the blood vessels and its financial messages the blood cells. Other messaging networks exist, but the basic architecture is the same, with the separation of information and settlement inherent in account-based money.

Especially in the area of payments, the financial messaging information and infrastructure has gained in importance, alongside a shift from perceiving payments as a technical back office matter to a sector of new strategic interest (Villeroy de Galhau, 2018). 'Long chains' of financial information (Campbell-Verduyn et al., 2019), however, can be slow and inefficient, but incumbents profit from inefficiencies, while at the same time spending enormously on mitigating their negative impacts. This presents opportunities for 'disruption', which we discuss in the final section. We now turn to demonstrating the intertwined geographies of messaging and settlement by unpacking the mechanism of a cross-border payment.

2.5. Currency corridors: Unpacking the geographies of cross-border payments

Banks typically negotiate an arrangement with a correspondent for each currency they wish to transact in, creating 'currency corridors' (Figure 2.2). Contracts between correspondents specify how they want to handle various aspects of payments (e.g. different currencies, types of payments from private individuals or businesses); when to settle transactions; pre-funding accounts and extending credit; and fees, balances, and who performs foreign exchange (FX) transactions. Approximately two-thirds of international payments are conducted this way, with 13 percent conducted 'on-us', that is, within a bank's own branches, and the remaining 20 percent using cross-border retail (e.g. credit card) and high-value payment systems (IMF, 2017, p. 44). The payments industry in general is growing and provided 34 percent of banking revenues in 2016 (McKinsey & Company, 2017). Revenue from cross-border payments, FX transactions and trade services amounted to USD 145 billion (Boston Consulting Group & SWIFT, 2017). Cross-border payments made up 2.5 percent of payments volume but 10 percent of revenue in 2010 (SWIFT, 2011). Payment revenues come from fees charged to the originator and the beneficiary, interest on 'float' (value difference between debiting the originator and crediting the beneficiary), and FX fees and spreads (Rambure & Nacamuli, 2008), which is the most profitable part (Collinson, 2017). Although CB is a crucially important infrastructure, it has been mostly overlooked outside of business and industry literature.

Figure 2.2. The anatomy of an international payment via correspondent banking



Source: own illustration, based on ECB (2017); Gifford & Cheng (2016); McCune (2014); SWIFT (2016, n.d.b).

Figure 2.2 shows how CBR transfer funds in a particular currency corridor, here for a payment from US dollar to Mexican Peso. This currency corridor is composed of the correspondent banking relationships between the banks in the boxes along the top of the figure: payer and payee, their banks, correspondent banks, and national payment systems. There is a series of domestic transactions with the two banks ending up with more and less money in their respective correspondent accounts, shown in the settlement layer (McCune, 2014).

The flow of funds is concentrated in large banks in IFCs. Large banks settle the payments between each other across borders by debiting and crediting their correspondent accounts. These accounts are prefunded in anticipation of making payments. This is done in response to financial messages, as shown in the messaging layer at the bottom of the figure. Messages are stored with SWIFT but relayed serially between banks in a payment chain, with no overall central transaction visibility. At each stage, banks charge a transaction or lifting fee, effectively a toll for passing funds through their books by changing account entries and for passing financial messages to the next participant in the payment chain. Thus, there are two key pillars at the heart of this process, that is, messaging and settlement, which define global flows of money. Via double-entry bookkeeping, the acts of changing account and ledger entries and balances involved in settlement make money move across borders. Mediating between all banks as the monopoly provider of the messaging network, SWIFT is both intermediary and infrastructure within the CB infrastructure.

Following Callon's (1986) terminology, the places in which correspondent banks, SWIFT, and its data centers are anchored (Figure 2.2) can be characterized as 'obligatory passage points' in the global financial system (cf. Bassens & van Meeteren, 2015). SWIFT's significance stems from its quasi-monopoly intermediary position in global finance, a position of geopolitical consequence. Infrastructure is territorially grounded and thus subject to the regulations of a respective jurisdiction. Headquartered in Belgium, SWIFT has offices all over

the world. Its operating centers (OPCs), in which every message is processed and stored for up to 124 days, are embedded in select institutional environments: the Netherlands, Switzerland, and the United States. While many data providers and users consider the importance of the jurisdiction and potential legal consequences when storing data, SWIFT data can carry geopolitically sensitive information, as revealed by SWIFT's involvement in international political controversies that highlight the intricate interplay of its governance, oversight and territorial embeddedness.

In what became known as the 'SWIFT affair', following the 9/11 terrorist attacks in the United States, SWIFT supplied data to U.S. authorities to allow them to analyse financial flows and thereby identify and thwart terrorist activity (de Goede, 2012). Due to having a branch in the U.S., SWIFT was legally compelled to comply with U.S. subpoenas to provide access to the data. However, despite wanting to preserve its neutral and trusted position, the nationally focused and unequal nature of SWIFT's internal governance and oversight also played a part (Zarate, 2013). Having made confidentiality agreements with the U.S. regarding the data transfer and not informed EU data protection authorities, SWIFT subsequently found itself under investigation by the Belgian Privacy Commission when knowledge of the program became public in 2006. Incorporated in Belgium, SWIFT is subject to Belgian data protection law, which implements the EU Data Protection Directive (Fuster et al., 2008). This prompted SWIFT to re-design its OPC architecture to that depicted in Figure 2.2, so that intra-EU transaction data is no longer stored outside the EU. Messages are always stored in two OPCs for resilience in case of disaster-recovery (SWIFT, 2016), but given its footprint, data residing in both the Dutch and Swiss OPCs ensures intra-EU messages within the European Zone.

SWIFT stresses its apolitical nature and has created "a 'grand narrative' about itself as the world's foremost secure trusted third party" (Scott & Zachariadis, 2014, p. 138). However, it has been unable to avoid being further used as a geopolitical tool, as interdependence on it has been weaponized (Farrell & Newman, 2019) and has disconnected banks from particular countries, such as Iran and most recently Russia, as part of sanctions imposed by the EU and the U.S. (Milne, 2022). Disconnection from SWIFT makes it very difficult to conduct cross-border financial transactions but not impossible: information can still be transmitted using less efficient means, such as telephone, fax, or email. Targeting the information leg of financial transactions is thus one means of enacting sanctions, but targeting the settlement leg of CB is another.

Power is crucially connected to money, but not all currencies are equal. The dollar is at the apex of the currency hierarchy (Kaltenbrunner & Lysandrou, 2017) due to its dominance in financial markets, central bank reserves and trade. This grants the U.S. autonomy, and the potential to exert influence, e.g. through sanctions (Cohen, 2013). As dollar transactions must ultimately be cleared in the U.S. payment system, access is through U.S. correspondent banks (Robertson, 2021) whose processing of large amounts of dollar flows means they are large users of SWIFT messages and subsequently also maintain a dominant role in its governance. Under the current sanction regime following Russia's invasion of Ukraine, the U.S. has leveraged SWIFT for sanctions against Russian banks but has also denied them correspondent relationships in the U.S. This effectively means that they cannot conduct dollar transactions, a massive blow given the dollar's supremacy (Tooze, 2022). As a consequence, infrastructural assemblages allow the circulation of power (Pickren, 2018), in which the location of the financial institution performing settlement is important. Both the messaging and settlement legs of SWIFT and CB are thus key ways in which financial power is exercised across space.

2.6. Conclusion and outlook

This paper has analysed the organizational architecture of the global payments system and highlighted the actors and agencies within it, thereby elucidating the (changing) relationships between data/information, global geographies, and geopolitical power. In combining these different dimensions, we foregrounded the global payment system – and its distinct twin organization of SWIFT (messaging) and CB (settlement) – as a key infrastructure that makes global economic and financial activity possible in the first place. The paper began by showing the importance and historical contingency of separate processes of information transmission and account settlement in account-based money. Allowing finance to transcend geographical distance through the formation of myriad global networks, these principles underpin the operations and architecture of financial infrastructure today. We showed that financial messaging flows are the lifeblood of the global banking system, constituting how money moves across borders. Bound up with the hierarchy of international currency usage, both settlement (financial) and messaging (information) components feature distinct geographies of territorial embeddedness that differ in some ways but in others match and intersect.

By condensing important functions in finance to information, it becomes clear that unpacking financial function-cum-location is a valuable exercise that helps better comprehend the global networks of money. The insights from this study have consequences for future research. First, scrutinizing both financial infrastructure and information in their joint relationship as 'glue' that binds together economic and financial activity allows for a deeper and broader understanding of not only what constitutes financial activity around the globe, but also how and why specific information-based financial activity is embedded and linked to and between specific places. Second, financial infrastructure is a vital precondition, and this paper appeals for forensic, mechanisms-based analysis to help develop in-depth comprehension of the changing geographies underpinning the global networks and to help inform a growing body of literature on financial infrastructures.

Signposting at least two large shifts placing cross-border payments at a crossroads, there is much at stake for future research: (i) information as a basic component has evolved into a strategic resource, with data as a new, exploitable asset class, often by centralized digital platforms; and (ii) given the technological ambitions and regulatory sandboxes around the globe, the financial infrastructure architecture revolving around CB and account-based money may change. Addressing the first of these, while CB was the basis for earlier financial globalization, the contemporary phase is based more on big data arrangements (Derudder & Taylor, 2020). Digital platforms, like Apple Pay, seek to allow non-bank actors to insert themselves in payment chains and monetize transaction information, while actors like PayPal have created successful 'closed loop' payment networks atop banks' infrastructure, and the fintech firm Ripple has created improved financial messaging using blockchain. SWIFT has been driven to platformize, centralizing financial transaction management and big data analysis, to retain but also optimize CB (SWIFT, n.d.-a).

However, the second shift above arguably heralds greater change. The weaponization of SWIFT has driven Iran and Russia to develop their own messaging systems (Nölke, 2022). Network effects mean that it is difficult to avoid using SWIFT for global payments but regional payment blocs can be formed around alternatives. Thus far, however, Russia's system, SPFS, processes only a small proportion of domestic payments, has struggled to attract foreign members, and lags operationally behind SWIFT (Shagina, 2021). As we saw earlier, avoiding sanctions means not just replacing SWIFT but also the dollar, and a shift towards a multipolar monetary system is already underway (Eichengreen, 2022). China is building alternative financial infrastructure, with its Cross-Border Inter-Bank Payments System

(CIPS) designed to facilitate cross-border payments in renminbi and therefore to promote that currency's internationalization. CIPS uses the architecture of CB, but with Chinese correspondents directly connected to it, and for now still uses SWIFT messaging, although this may eventually be replaced (Wong & Nelson, 2021). Until then, China has formed a 'defensive' joint venture with SWIFT (called Finance Gateway Information Service Co.) to locally store and monitor financial messages (Yeung, 2021). Other initiatives could replace the correspondent banking model by directly connecting national payment systems regionally (BIS Innovation Hub, 2021), but more radical change could come from new money forms, which involve changing the fundamental roles of some established actors, markets, networks, and trust relationships (with)in networks. Based on cryptocurrency, digital tokens are a money form combining the separate messaging and settlement processes in one atomic peer-to-peer transaction on a shared distributed ledger, obviating the needs for settlement across accounts at different intermediaries and for separate messaging. Central bank digital currencies (CBDC) are being actively explored by states, with China's e-CNY in the vanguard. This new money form could provide real-time peer-to-peer settlement, including for cross-border payments, without current payments infrastructure (Auer & Böhme, 2020).

These are all challenges, not only to SWIFT's historical core missions, but also for other financial infrastructures, banks and the centuries-old model of correspondent arrangements and their current geographies. Research to further explore and address these exciting challenges is well under way.

Acknowledgments

The authors wish to thank two reviewers for their comments.

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Chapter 3. Capturing a moving target: Interviewing fintech experts via LinkedIn

Published in *Area*:

Robinson, G. (2021). Capturing a moving target: Interviewing fintech experts via LinkedIn. *Area*, *53*(4), 671–678. https://doi.org/10.1111/area.12726

Abstract

This chapter explores possible responses to some of the main challenges associated with conducting elite and expert interviews as part of qualitative research in human geography. Drawing on the example of the dynamic fintech industry, the chapter outlines some similarities and differences between elite and expert interviews, and uses this to identify and discuss possible responses. Against this backdrop, the chapter also reflects on advantages and disadvantages of using the professional social networking site LinkedIn as a research aid for sampling and contacting interviewees as well as for interview preparation. The chapter is anticipated to be of interest to those conducting qualitative research involving limited subject sample sizes who are potentially difficult to find.

Keywords

elite and expert interviews; qualitative research methods; financial geography; fintech; LinkedIn; social networking service

3.1. Introduction

The paper reflects on some methodological challenges experienced while conducting elite and expert interviews as part of qualitative research in human geography and on the practical responses to these challenges. The importance of interviews as a key qualitative research method has been long recognised across different disciplines, such as political science (Richards, 1996), sociology (Ostrander, 1993), and business studies (Yeung, 1995) and there is a wealth of work by geographers (Desmond, 2004; Harvey, 2011; Herod, 1999; James, 2006; McDowell, 1998; Schoenberger, 1991; Smith, 2006). Much literature provides guidance on the factors, skills and preparation necessary to successfully obtain and analyse data from such interviews. Qualitative researchers continually adapt and reflect on their methods in specific fields and environments (McFarlane-Morris, 2020) and on their use of new technological tools (Adams-Hutcheson & Longhurst, 2017; Truong et al., 2020). However, despite the benefits of such tools for conducting and analysing interviews, as well as for sampling and preparation, some perennial problems persist, perhaps the most enduring of which is gaining access to interviewees.

Previous research shows that although elites may in fact often be willing to share their experiences, reaching them is the key problem (Delaney, 2007; Mikecz, 2012; Useem, 1995). While some feel that difficulties gaining access are exaggerated (Ostrander, 1993), many researchers have provided valuable practical information on their experiences of 'getting in the door' (Goldstein, 2002, p. 669). Pre-interview preparation is paramount, as is gaining trust and building rapport (Mikecz, 2012), which researchers can achieve through being honest and transparent about themselves, their research goals, research dissemination, the interview process, and information attribution and interviewee anonymity (Goldstein, 2002; Harvey, 2011; Lilleker, 2003). To gain access, scholars are recommended to make use of their institutional affiliation, to leverage personal networks, and to consider getting project endorsement from an influential sponsor (Aberbach & Rockman, 2002). Others have noted specificities of gaining access to elites in different cultural contexts (Liu, 2018; Mikecz, 2012) as well as the impact of gender differences when conducting interviews (Desmond, 2004; Herod, 1993; McDowell, 1998) in the 'indelibly male-dominated habitats' of industry and institutional elites (Wong, 2018, p. 13). However, gaining access is often contingent upon opportunism, fortune, circumstance and personal connections (McDowell, 1998; Ostrander, 1993; Parry, 1998; Yeung, 1995).

Although researchers can still draw upon insights in the extant literature, recommendations to contact interviewees by post, fax or cold calling by telephone (Delaney, 2007; Thomas, 1995; Useem, 1995; Yeung, 1995) now seem dated. More recent literature replaces letters with emails, and some research mentions the use of public online directories for locating interviewees (e.g. Lilleker, 2003). Professional social networking platforms like LinkedIn are overlooked in recent work on the topic of social media in qualitative research (McKenna et al., 2017; Sloan & Quan-Haase, 2017; Snelson, 2016). Offering a corporate directory with granular search, user profiles, and a channel to contact many professionals across multiple geographies, LinkedIn presents a potentially useful avenue for qualitative researchers to deal with the abiding problems of sampling, gaining access and interview preparation (Dicce & Ewers, 2020). This may be even more salient when researching industries and organisations that present particular access difficulties.

3.2. Researching finance

3.2.1. The research project

The context for this paper is a doctoral research project on innovation in financial technology (fintech). The finance industry projects a dual aura of 'sexy and arcane' (Leyshon & Thrift, 1997, p. 191). Some investment banking and trading activities have been simultaneously glamorised and made notorious in popular media such as films like *The Wolf of Wall Street* and the books of Michael Lewis. However, most financial workers are employed in more ordinary middle- and back-office support roles or in retail and commercial banking, some of whom are paid comparatively much less than front-office workers.

One such area is that of financial infrastructure, including payment systems, which is essential for economic activity and involves specialist technological and organisational knowledge. The area of payments seldom saw change, until technological innovation after the financial crisis of 2008 brought a rare opportunity for disruption by non-financial actors using novel technologies such as blockchain. The project explores how change materialises in and between organisations, and in the global network of international financial centres. The methodology is one of semi-structured interviews with people working mainly in financial institutions and financial technology firms. The research revolved mainly around a financial infrastructure cooperative but also involved other organisations, including: innovation and payments departments at banks; finance industry consortia; financial technology system integrators; fintech firms; and payments departments at non-bank firms.

Quantitative methods dominate and define research into finance in fields specialising in the area (Kaczynski et al., 2014), with qualitative research considered rare and of unproven credibility by some within those fields (Gippel, 2012). However, social scientists from fields such as anthropology (e.g. Ho, 2009; Luyendijk, 2016; Zaloom, 2010) and geography (e.g. Dörry, 2015; Hall, 2009; McDowell, 1997), have long used qualitative methods, including interviews, to provide rich insights into finance, in which as an information industry, 'close dialogue is an essential ingredient' (Clark, 1998, p. 82).

3.2.2. A secretive and complex industry

Both the finance industry and the research project present some methodological challenges as objects of qualitative research. Researchers have noted difficulties finding and gaining access to potential interviewees because 'the world of finance is governed by a code of silence' (Luyendijk, 2016, p. 13). This may be partly because of negative publicity and suspicion of the industry, for example because of cases of corporate misconduct, the perceived role in causing financial crises, and sometimes very high remuneration.

The case at hand involves studying a relatively small number of key organisations operating in the area of payments. Gaining access to interviewees at all organisations proved to be difficult. This could be because of the aforementioned characteristics of the financial industry but also because co-operative ownership and governance of some financial organisations in some respects functions like a club in providing exclusive rules and benefits to members (Potoski & Prakash, 2009) and in serving as a private forum (Tsingou, 2015). Informants' desire and ability to respond to requests for interview may have been limited by the sensitive nature of the technology and collaborations, in some cases involving national central banks and large systemically important financial institutions, and perhaps also because of some firms' sensitivity about public image. Additionally, increasing requests from researchers for interviews demands more of interviewees' time for little in return.

A further problem is the industry's complexity. Banks can be large organisations, with many different departments and functions, which may be siloed, with little connection to each other, and staffed by individuals with distinct personalities, dispositions, interests and experiences. Some departments may be more or less collaborative with other internal departments and external organisations, and therefore more knowledgeable and open, and this may condition how employees respond to interview requests. Additionally, some of the new technologies and actors exist since just 2008, only beginning to achieve widespread consciousness in mainstream finance around 2015. The pace of change since then has been dizzying, presenting challenges in keeping up with change, delimiting the research, and understanding the technologies' workings.

3.3. Elite and expert interviews

Mirroring the duality of the finance industry mentioned above, there is a distinction between elite and expert interviews. Anglo-American literature focuses almost exclusively on elite interviews, while German-language literature talks mostly about expert interviews (Littig, 2009). This has an interesting historical parallel in Landes' (1969) distinction between the 'pecuniary rationality' of British business and the 'technological rationality' of German business.

Because elites are often only vaguely specified in methodology literature, Welch et al.'s (2002, p. 613) precise definition of a corporate elite interviewee is worth quoting in full:

> an informant (usually male) who occupies a senior or middle management position; has functional responsibility in an area which enjoys high status in accordance with corporate values; has considerable industry experience and frequently also long tenure with the company; possesses a broad network of personal relationships; and has considerable international exposure.

While this interpretation is notably not limited to senior management, the defining points of elites generally concern power, authority and status, with a presumption that their access to high level knowledge makes them suitable for interview (Van Audenhove & Donders, 2019). Experts have been broadly defined as those responsible for the implementation or control of problem solving, and those with privileged access to information about people or decision-making processes (Littig, 2009). Experts thus hold knowledge not otherwise available to researchers and are often also in positions of power but not necessarily top leadership. While big shots, or visible elites, may seem like the first and most obvious interviewees, as well as being shielded and very busy, they may not have the specific knowledge needed (Van Audenhove & Donders, 2019). Elites' and experts' different roles and responsibilities, generalisable as more strategic for the former and operational for the latter, yield different kinds of information for different purposes. Elites' social capital could be more likely to result in other interviews via snowballing. In a context where technology is driving change and banks are becoming more like tech firms, particular experts may also have strategic knowledge, while the increased "technicalisation" of finance as an information industry elevates the importance of expert knowledge. The conception of expert can reasonably be decoupled from hierarchical occupational status position (Meuser & Nagel, 2009) and this consequently widens the pool of people considered to be useful informants beyond elites. Corporate elites may be 'visible but not accessible' (Thomas, 1995, p. 4), with deliberate barriers making them hard to study (Hertz & Imber, 1995, p. viii), however experts can be both invisible and inaccessible.

3.4. Gaining access: The song remains the same

3.4.1. Sampling

Gaining access is a perennial problem comprising multiple overlapping processes, such as sampling, pitching, and interviewing. Focussed recruitment methods are needed for select populations. These include tried and trusted methods like: leveraging personal connections (Welch et al., 2002); industry conference programmes, even if not actually attending the event; snowballing; and desk research (Van Audenhove & Donders, 2019). Professional networking websites are a compelling tool for sampling. Apart from some location- and industry-specific sites, LinkedIn offers global, cross-industry coverage and serves as a powerful way of finding interviewees, featuring granular search by industry, current and previous employer, geographic location and skill (Dicce & Ewers, 2020). More refined sample inclusion criteria can be gleaned from career biographies, also useful during interview preparation, while job titles, roles and tasks can assist with learning more about the organisation structure of firms and with identifying experts with cross-domain knowledge. Searching for profiles also sometimes shows other related and interesting profiles. The platform's refined search options allow external sampling, or 'the inclusion of interviewees outside the focal organisation but with knowledge of it' (Welch et al., 2002, p. 624), such as customers and former employees of target organisations. I conducted twice as many interviews with experts compared to elites. Elites are obviously fewer in number and were less likely to respond to requests for interview. LinkedIn's granular search allowed targeting of an expanded pool of potential respondents while also learning about organisation structures and the wider array of roles in work areas.

Methods for identifying **elite** subjects interviewed were fairly evenly spread across personal network, desk research, and in-person introduction at a conference. The most successful method was conference and event programmes, including online events. Interestingly, not one of the elite subjects interviewed was initially identified on LinkedIn, nor were any found through snowballing. While many elite *potential* interviewees were found on LinkedIn, none replied to interview requests. Of the **expert** interviews conducted, LinkedIn was the avenue via which almost half of the participants were found. The next most successful method was conference and event programmes, both live and online, with the remainder fairly evenly split between personal networks, snowballing and desk research. While snowballing, or asking interviewees to recommend others, is acknowledged as a good way to find participants, it has limits (Waters, 2015). Certain organisations may present particular challenges and even a personal referral by email from another interviewee did not guarantee a response. I eventually interviewed two elite and one expert subjects at the organisation in question, introduced via personal network, snowballing, and LinkedIn message mentioning an online conference which the recipient had taken part in. Just as certain organisations may present challenges, certain roles may be more amenable to snowballing. This I found to be the case among some tech employees, who are used to collaborating and sharing online with other tech enthusiasts outside of work, and who collaborate with fintech and other partners in work. In sum, LinkedIn complements established sampling methods and is especially useful for finding expert and less visible participants, but the serendipity of introductions via personal networks remains important.

3.4.2. Pitching and relying on gatekeepers

Having identified potential interviewees, contacting and gaining access is the next challenge. Reliance on gatekeepers when accessing elite interviewees is well documented (Campbell et al., 2006), however experts' relative anonymity within large organisations is also a barrier, one which LinkedIn, as explained above, is useful for surmounting. LinkedIn

is now an alternative to corporate directories and it has become practically the only game in town for contacting people. Corporate websites rarely list professionals' email addresses and some even link directly to employees' LinkedIn profile pages. Practically all subjects are on LinkedIn and contact requests are thus necessarily also pitched via the platform. The same content and caveats as when sending emails apply (Delaney, 2007), however, LinkedIn's character limits forces brevity. Replies and subsequent messages may be very short, more akin to a messaging app, given users often use it on phones, rather than solely on computers. Just over half of the total successful contact requests I sent were via LinkedIn, with the remainder via email. Of those sent by email, none of the email addresses were publicly available, found instead via personal network or snowballing referral, obtained at a conference, or in reply to a contact request submitted via a webform. LinkedIn's importance as a contact medium is thus enhanced when contact information is almost never public.

On one hand LinkedIn democratises access by allowing direct connection with a wider network of potential interviewees, circumventing human gatekeepers and a lack of publicly available contact information (Dicce & Ewers, 2020). However, in some respects, LinkedIn has become an electronic gatekeeper, one whose mercy cannot be appealed to. Assuming that users manage their own profiles, they can ignore messages and connection requests, and can choose not to receive messages from unknown people. Initial contact on LinkedIn sometimes results in being asked to contact the participant via email, however this is still no guarantee of actually getting an interview, as such emails may then go unanswered. An additional barrier is that of cost. Free LinkedIn membership allows sending only very few messages per month, has limitations on searching and viewing profiles, and does not allow a user to hide from users that they viewed a profile. Effective use of LinkedIn's features, such as the ability to send more messages, unlimited profile search, and "invisible" profile browsing, depends on premium membership, which is free for the first month, with subsequent varying levels of premium membership costing non-inconsiderate monthly or annual fees. As with other digital platforms, LinkedIn may be more reintermediation than disintermediation (Langley & Leyshon, 2020).

3.4.3. Interviewing

LinkedIn's gatekeeper role is also important with respect to user profiles and positionality. Researcher positionality is both elastic and dynamic, changing depending on the interviewee and over the course of research (Mason-Bish, 2018; Mikecz, 2012; Rice, 2010), with both interviewer and interviewee constructing distinct versions of themselves in interviews (Clark, 1998; McDowell, 1992). Social media platforms 'are not neutral stages of self-performance' (van Dijck, 2013, p. 213) but are one way in which interviewers can 'construct themselves as certain types-of-people in relation to the topic of the interview and reflexively the interview itself' (Rapley, 2016, p. 303). Some scholars recommend an "insider" business-like approach to reduce the professional gap between the researcher and elite interviewees (Welch et al., 2002; Yeung, 1995), while others have found that using LinkedIn often changed their positionality by 'blurring the insider/outsider industry dynamic' (Dicce & Ewers, 2020, p. 7). However, without industry experience and expertise, and given the club-like nature of finance, it is unclear how a researcher might be able to feel like an insider. LinkedIn profile visibility works both ways. Researchers can unobtrusively scan potential interviewees' profiles but the researcher's profile may be decisive in whether a respondent, particularly if unaccustomed to receiving interview requests, decides whether to participate (Dicce & Ewers, 2020). For the researcher, having an adequate level of knowledge of a specialist research topic is important to avoid not being taken seriously, but also to avoid wasting valuable interview time on basic concepts. The profile can at least be

a place to signal a certain level or area of knowledge. There are LinkedIn groups for those interested in particular speciality areas, and membership may demonstrate interest in or knowledge of the area to a potential interviewee. Additionally, LinkedIn premium membership may also send a positive and professional signal for other site users, while visibility of common contacts may generate trust and influence interviewees' decisions to respond to an interview request.

Certain interviews yield more useful information than others, and for my research, I classified interviews as being useful in strategic terms or operational terms, roughly corresponding to the distinction between elites and experts. While I interviewed twice as many experts as elites, expert interviews were around four times more likely to be useful, compared to elite interviews, in terms of both strategy *and* operations. For elites, the most useful were found via desk research, where they had been interviewed for industry news articles, and were contacted via LinkedIn. These interviews were conducted via phone or video, and the interviewees currently or previously worked in finance. Among the most useful expert interviews, introductions via personal network and snowballing accounted for a quarter, while the remainder were found by searching on LinkedIn. Despite being classed as expert interviews, most of these were also useful in terms of strategy. Just over half of these were conducted by phone and the remainder in person. Almost half of them were either former employees of organisations key for the research or former employees of customers of those organisations, while another worked at a smaller firm that worked closely with key organisations. I was fortunate to have finished fieldwork just before the COVID-19 pandemic of early 2020, but over half of the most useful interviews were not conducted in-person. Although considered suspect, phone interviews provide researchers with the benefits of flexibility and access unavailable in other ways (Block & Erskine, 2012). Neither elite/expert status nor LinkedIn may provide an advantage when it comes to repeated interactions as part of close dialogue. Most respondents provided an email address following initial contact on LinkedIn and the likelihood of responses to subsequent communication seemed more related to the kind of respondent (Clark, 1998).

Elites know they are elites and are therefore used to receiving interview requests from both media and academia, and may be adept at "performing" interviews, for example giving evasive answers to difficult questions. They may also be bound by internal organisation policies regarding giving interviews. Having successfully navigated the LinkedIn gatekeeper, researchers must still be prepared to deal with human gatekeepers, such as public relations representatives and staff, and conditions like NDAs or seeking approval prior to publication of any interview insights used. On the other hand, experts may not even realise they are experts. They may therefore be less accustomed to being approached for interview and may be surprised that someone is interested in what they do and in their specialised knowledge. LinkedIn's search features help to render experts more visible, and to conduct targeted searches by employment history, skills and expertise. This is a very powerful tool for researchers, especially for finding informants who are perhaps no longer bound by commitments to a current employer. The realities of trying to access elites can prompt a pragmatic decision to enlarge the pool of research participants, but some experts have what might be considered more elite-level knowledge, as well as being willing and able to share it. Considering experts as valuable research participants helps move beyond privileging elites as the main sources of insider knowledge.

3.5. Conclusion

There are far more similarities than differences between elite and expert interviews. Being mindful of both can help with sampling and with interview preparation and execution, and may also help with "demystifying" elites and perceived power differentials. Ultimately,

the researcher is the arbiter of sample size and of what is an elite or expert interview. The LinkedIn platform combines multiple elements: a searchable corporate directory, user profiles, and messaging medium. For qualitative research into the corporate world, it is a valuable resource for finding, contacting and preparing to meet with more visible elite and especially with less visible expert interviewees. However, alongside newer digital tools, longstanding techniques remain crucial. While LinkedIn offers potential access to a larger pool of interviewees, there is still no guarantee that they will agree to participate. In the absence of personal connections and apart from industry and organisation-specific factors, this leaves researchers largely still reliant on elements like luck, timing and respondent disposition, to get in the (sometimes virtual) door, making it still 'more art than science' (Goldstein, 2002, p. 669). Having certain things in common with interviewees, for example gender (Desmond, 2004; McDowell, 1998), cannot be taken for granted as a way to build rapport but surprising elements of a researcher's background and profile can be persuasive. A useful empirical project, alongside "actual" research, would be to try to understand the elements of a researcher's LinkedIn profile that induce interviewees to participate, for example, affiliation, connections to other platform users, skills, endorsements, group membership, or indeed how much attention was even paid to the researcher's profile. Frustration, failures and mishaps are as much part and parcel of fieldwork as its joys of connections and moments of intellectual insight (McSweeney & WinklerPrins, 2020). While there is still sometimes a trade-off between who you want and who you can get, the above insights could help researchers to better use both traditional and newer avenues artfully to try to create good fortune.

Acknowledgments

I wish to thank Sabine Dörry, Ben Derudder and two reviewers for their comments. I am grateful to all research participants.

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Chapter 4. Reform that you may preserve: SWIFT's directed change towards platformisation of global payments

Co-authored with Sabine Dörry and Ben Derudder. Submitted to and under review at *Geoforum*.

Abstract

Crucial for international trade, cross-border payments are conducted via the *correspondent banking* (CB) system. This CB system is a decentralised network of bilateral agreements between more than 11,000 banks in different jurisdictions nested in a range of monetary spaces, and supported by a centralised *messaging network* (SWIFT). This global twin infrastructure consists of complex socio-technical and socio-spatial arrangements resistant to change. The global payment infrastructure is constituted by and for key members in cross-border payments, in which transaction banking is a key service. Analytical frameworks of innovation and change fail to grasp the essence of financial infrastructures that feature simultaneous cooperation and competition between and among challengers and incumbents, and lack overall central governance organised across scales. The new wave of digital technologies that are challenging business models roughly denoted by the rise of fintech, however, makes change inevitable. Beset by inefficiencies, from which the gatekeeper incumbent banks profit, the international payments system lacked alternatives until the recent tech threat of *dis*intermediation and *re*organisation of legacy serial messaging chains to big data arrangements and centralising platformization. We show that the CB/SWIFT nexus is an integral part of the financial and advanced services providers (FABS) complex and as such also a specific part of obligatory passage points (OPPs) argued to create (and defend the creation of) difference to arbitrate and extract monopoly rents. Challenged by new technology, it makes understanding and conceptualising change in and of OPPs vital. Methodologically, the chapter draws on insights from an explorative research design, including 30 semi-structured expert interviews. Capturing the complex relationships between the intermediaries of the FABS complex in order to gain a better analytical understanding of change at system level, we argue that shifting rent extraction to new, forward-looking sources of profit is necessary to preserve incumbency.

Keywords

financial infrastructure; SWIFT/correspondent banks; change; obligatory passage point; platformization; FABS

"Shame on us. We repeatedly allow ourselves to be disintermediated. By the time we have barely gotten ourselves organized, nimble new competitors have staked out their superior claims."
Heidi Miller (JP Morgan), Sibos conference, 2004

4.1. Introduction

Payments are a fundamental banking function and essential utility for the economy. Each transaction, such as purchasing large supplies for corporations, involves payment. Most international payments rely on the same underlying twin payment infrastructure of (1) correspondent banking (CB) – performed by more than 11,000 correspondent banks – *and* (2) messaging – operated by the Society for Worldwide Interbank Financial Telecommunication (SWIFT). SWIFT is an organisation formed in the 1970s by banks to set up a secure, private digital messaging system, initially for payments messages. Our study aims to contribute to the recent wave of interest in the area of financial infrastructures (Bernards & Campbell-Verduyn, 2019; de Goede, 2020; de Goede & Westermeier, 2022; Robinson et al., 2023) such as those for payments, "on whose continuous functioning the modern economy depends" (Kay, 2015, p. 281; cf. Muellerleile, 2018). The complexity of global financial infrastructure, as well as its misguided perception as boring 'plumbing', have contributed to belated conceptual and empirical analysis. Its importance requires global financial infrastructure, and global payments in particular, to be *immune to failure*, also in the event of change. This fundamental requirement of stability frames the argument we seek to develop in this paper.

Global financial infrastructure is not only key in shaping the functioning of our economies and societies. It also forms a vital part of the advanced producer services (APS) or financial and advanced business services (FABS) complex (Hanssens et al., 2014; Taylor et al., 2014). The services firms in this complex are mainly banks and other (para)*financial* firms (Dörry, 2015; Jones, 2005; Wójcik, 2013b), which together can be referred to as a specific, spatially clustered and highly relational, type of economic organisation integral to the global economy. Not least due to their structural positioning in global cities and financial centres (Sassen, 2001), their functional relationships within and between cities/regions (Hoyler et al., 2008), and their specific agency in facilitating and orchestrating constituent mechanisms of a globalised financial capitalism (Dörry, 2023), the FABS complex exerts increasing leverage in and over particular economic activities, with important functional, organisational, and spatial consequences.

These and other similar observations have prompted scholars to conceptualise the FABS complex – centred on *inter alia* finance, law, and accountancy firms – as an obligatory passage point (OPP) (Allen, 2010; Bassens & van Meeteren, 2015; see previous conceptualisations by Callon, 1984) with channels set up to realise rent extraction. Comprised of cogent formal and informal interdependencies within and between (para)financial industries and networks, and characterised as an indispensable hinge between global production and financial spaces, the FABS complex is proposed to have the capacity to recurrently create new opportunity spaces, e.g. through 'qualifying' space/place to arbitrate (monopolistic) access to rent extraction (Dörry, 2022; Pažitka et al., 2022). Scholars have located the OPP in a single component of the FABS complex, i.e., investment banks at the perceived core of the complex (Pažitka et al., 2022; Wójcik, 2018), stressing that the FABS complex is collectively able to corner the market. Firms within the FABS complex also jockey for leading position, but the complex' internal hierarchy remains contested and dependent on the *source creation of rent* (Dörry, 2022; Wójcik, 2021a). Consequently, the question arises to what extent the incumbent system of the CB/SWIFT

infrastructure aligns within the FABS complex, and how such a conceptualisation can help understand how (much) its relationships alter under pressure to change.

The emergence of new technical applications in and for global payments, such as in transaction banking, provides an apt example for exploring these questions and our assumption that the FABS complex' banks and other financial firms are central to the emergence and maintenance of financial infrastructure. The question of how this particular function of the FABS complex is undergoing restructuration under the pressure of new technologies, and how this change can best be conceptualised, is the analytical guidance for our argument. Payment, one of the key services of banking, *is* also an infrastructure. Like a public utility, without it the economy could not function, but it is provided by private firms on a for-profit basis, often through co-operatively owned and governed financial infrastructures. On the one hand, domestic payments are comparatively simple and centred on national payment systems, usually operated by national central banks.[19] Cross-border payments, on the other hand, are provided as a business service by private commercial banks via the CB system. They pass through multiple hops across ledgers of commercial banks *and* national domestic payment systems (Dörry et al., 2019). This, in turn, makes the payment infrastructure of CB/SWIFT itself an OPP that (otherwise competing) banks have to *maintain*. The purpose of this paper, therefore, is to analyse how the reform dynamics of the CB/SWIFT infrastructure attempts to preserve itself, and how (successfully) it is doing this. The dilemma here is preserving the stability of old yet critical infrastructure to shore up incumbency while also upgrading it to successfully compete with 'the new', i.e., to preserve the collective power of the global transaction banks (GTBs) to collaborate against 'outsiders', as explained below.

The need for both stability and change for the CB/SWIFT infrastructure cannot be understood without making reference to processes of innovation. Studies of innovation usually imply a preoccupation with 'the new' and overlook the important, yet underappreciated, aspect of technology-in-use and its maintenance (Russell & Vinsel, 2018). The concept of *maintenance* involves overhaul, improvement, preservation, and keeping something in good condition. This can be best captured by ensuring the continuation of something through "the crucial but mundane work of keeping things going" (Edgerton, 2019, p. ix), thereby preserving orders, as well as accentuating stability *and* continuity (Russell & Vinsel, 2018; Vinsel & Russell, 2020). The flipside of innovation is taken to be resistance to change, or stagnation. Actions that contribute to reproducing the status quo are referred to as *maintenance agency* (Jolly et al., 2020). Here, we focus on how "change agendas may actually be directed at least as much at the reproduction of existing organizational and economic orders as at their transformation" (Suchman & Bishop, 2000, p. 331).

Incremental change, then, is more about 'artful integrations' of prior experience and new, imaginative solutions (Suchman, 1993), akin to *bricolage* in finance (Dörry & Schulz, 2018; Engelen et al., 2010). This is particularly true for infrastructure, which is not just built and then left standing, but requires constant repair, extension, adaptation, and redefinition. We thus focus on the incumbent system of the CB/SWIFT infrastructure, especially on transaction banks, that seek to maintain their OPP position in times of pressure to change via maintenance action and agency. Complex adaptive systems composed of multiple continuously changing, yet interacting parts, infrastructure is "also embedded in and overlaid across cultures, organizations, governments, and other social forms, which interpret, alter, and erode them" (Edwards et al., 2011, p. 1409). Tech-driven innovation,

[19] Not all central banks are public, however. For example, the US and Japan still have private central banks.

then, affects the organisation of what is serviced and produced, and how, but factors such as industry structure also determine the kind of technological change that is possible.

Incumbent GTBs are a defining part of the FABS complex at hand. In 2018, most of the top 10 GTBs were also among the top 12 biggest investment banks (CRISIL Coalition, 2019)[20], thereby putting the 'hidden' workings of the CB/SWIFT network in the spotlight (Panza & Merrett, 2019). Transaction banking is "the side of banking that addresses the operational needs and day-to-day transactions of business, corporate and institutional customers" and involves such services and terms as cash management, SWIFT, trade finance, supply chain finance, corporate working capital and liquidity management, and securities services (Furió, 2018). It allows banks to maintain close relationships with corporate clients (Camerinelli, 2013). Providing over 40% of global banking revenues, the core products are trade finance and cash management, which includes domestic and cross-border payments (McKinsey & Company, 2019). Since the financial crisis of 2007-8, there has been a shift by traditional investment banks towards the provision of 'less sexy' transaction services and its provision of steady income, with JP Morgan aiming to become global leader and Goldman Sachs entering the segment (Bippart, 2018). Another reason for the shift from investment towards transaction banking activities is that post-2008, restructuring as bank holding companies and commercial banks allowed investment banks to be eligible for federal crisis loans in the U.S. (Wong, 2019). While investment banking is better known, its exorbitant profits are more volatile than those of transaction banking. OPP in transaction banking is thus an important counterpart to investment banking.

The GTBs are important for another reason than governing SWIFT. Banks' internal payments systems are important for national and cross-border payments. By profiting from built-in system inefficiencies that evolved over time, banks had little incentive to improve their own internal systems and processes. Bringing about industry-wide technology and business model shifts are no easy feat and can be expected to be painful for large and traditionally conservative banks. Banks have accumulated many fragmented, outdated and non-interoperable IT systems over decades, particularly after mergers and acquisitions of other banks, and sometimes no longer know exactly how this all works and interconnects (Thompson, 2020). Yet, these GTBs are *key* for system-wide change. A change of their systems would also encourage other member banks to invest in change, not least because other, lower-ranked, banks are not only also SWIFT members but also the GTBs' customers. How, then, does one get turkeys to vote for Christmas?

Methodologically, the article draws on insights from an explorative research design, including 30 semi-structured interviews conducted between 2018 and 2020 with professionals from the payment industry, as well as from industry reports, conferences and webinars. As well as economic and financial geography, the article draws on literature from organization studies, political economy, history and sociology of technology, economic sociology, and business history. We derived structure, relationships and caesuras in our endeavour to gain a better analytical understanding of change at system level. Researching an industry based on fast-changing technology is like trying to hit (but failing to ever fully nail) a "moving target" (Robinson, 2021). As the field constantly evolves, many empirical insights gained early in the research process turned out to be useful later as background information. Some of the identified and interviewed challengers, be they projects, start-ups or new business fields of established firms, had vanished after being on the market for a short time only. However, three interviews with SWIFT employees in total, as well as the

[20] They include Bank of America Merrill Lynch (HQ US), Barclays (HQ UK), Citigroup (HQ US), Credit Suisse (HQ CH), Deutsche Bank (HQ DE), Goldman Sachs (HQ US), HSBC (HQ UK), J.P. Morgan Chase (HQ US), Société Générale (HQ FR), UBS (HQ CH), BNP Paribas (HQ FR), and Morgan Stanley (HQ US).

other interviews combined with in-depth desk research and data triangulation still provided valuable insights into (challenges of) the CB/SWIFT's transformation.

In the remainder of this article, section 2 examines the extent to which the CB/SWIFT nexus is an OPP for global finance, and how this can be reasoned and conceptualised in cross-border payments as (part of the) FABS complex. It sheds light on CB to understand the nature of one leg of the twin infrastructure, before it identifies fintech-driven challenges to bank incumbents. Section 3 discusses empirically how tech threatens the multiple relationships in the CB/SWIFT nexus and therefore the OPP of the CB/SWIFT nexus. Section 4 employs the empirical results to study change processes at and across the interlacing institutional, organisational and structural dimensions of the CB/SWIFT nexus as part of the FABS complex in order to secure its future OPP position. The article concludes by summarising and critically reflecting on the main findings.

4.2. The CB/SWIFT nexus as an obligatory passage point for rent extraction in global payments

4.2.1. Anatomy of the CB/SWIFT OPP

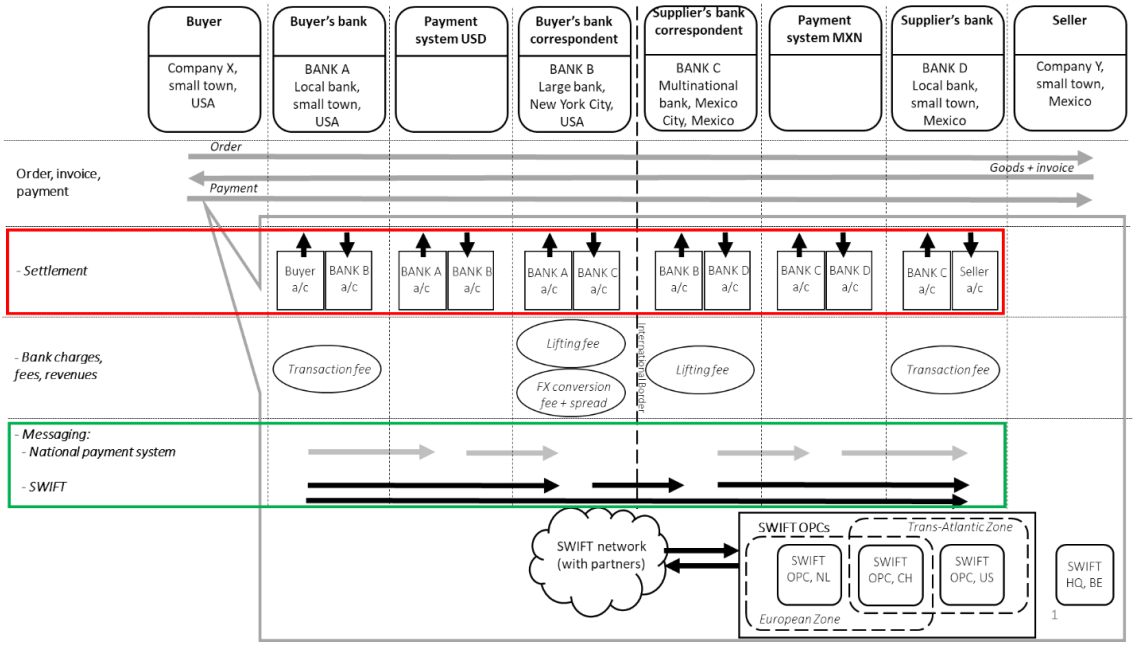
Payments can be classified in different ways, such as according to currency, value, priority or purpose. A common feature of all payments is that nobody sets out to purchase a payment in and of itself: a payment is always connected with another aim or transaction and is therefore expected to be invisible and inexpensive. Some transactions are higher value, lower frequency payments (e.g. for large interbank transactions); others are lower value, higher frequency (e.g. remittances and B2B and trade transactions in prominent currencies). While retail (B2C) payments are often conducted using card networks, like Visa and MasterCard, B2B (business) payments are usually conducted via banks. Domestic, or rather, single currency payments are industrialised, simple and moving to real-time (interview fw021). Cross-border, inter-currency payments, however, are more complex than intra-currency ones. They cross multiple time zones and jurisdictions with different opening hours, regulations, compliance checks and currency controls. Because there is no global currency or central bank, they lack central governance and are therefore not settled on a central platform; rather, cross-border payments are settled across the books of a chain of commercial banks and national payment systems.

This system works via CB arrangements, in which banks in different jurisdictions – correspondents and respondents – hold reciprocal accounts for each other, which they pre-fund and use to settle payments in the other jurisdiction. Banks negotiate the terms of these arrangements in bilateral contracts, and funds can reach any country in the world via serial hops from one bank to the next in this complex, decentralised global network of bilateral contractual arrangements. Messages conveying the information about account changes at each bank in the payment chain are transmitted via the private secure SWIFT messaging network, cooperatively owned by the over 11,000 financial institutions that use it (Robinson et al., 2023). CB is used for many things, such as trade services (SWIFT, 2011) and central bank swap lines (Aldasoro et al., 2020), but is crucial for cross-border payments and has been the means of financial expansion across distance for centuries. Heavily concentrated in an oligopoly of large global clearing banks (ECB, 2015), and with smaller banks also taking a cut of each payment that passes through their systems, cross-border payments via CB are a source of substantial and easy profit (Janczuk-Gorywoda, 2013). With a 12% margin on CB (interview fw020), cross-border payments "punch well above their weight" in terms of profitability (SWIFT, 2011, p. 2). It is also flexible: if a particular path between two

banks stops working, another path between others can be found; it allows banks to choose which other banks to connect to (interview fw030).

However, this organisational model is criticised as inefficient, slow, opaque and expensive (FSB, 2020). Some inefficiencies arise from the non-granular nature of the original SWIFT MT message format. Based on the previous legacy technology *telex*, these messages contain many free text fields. This means information cannot always be relayed in consistently structured format, which would make them more easily machine-readable. This means that STP (straight-through-processing) breaks and requires human intervention to sort out, adding to cost and taking much time to fix errors. Mismatches in messaging standards at different banks in a payment chain mean that transaction data is sometimes truncated, further breaking STP (Figure 4.1, messaging part). Compounding this, messages are passed serially back and forth, from one participant to another along the chain, with no overall payment visibility. There are multiple points of failure in a payment chain at which delays can occur as local regulation compliance checks must be performed at each hop (Figure 4.1, settlement part). For example, a payment from London/UK to Vietnam undergoes 16 stages of compliance checks (Amin et al., 2020); every party in a payment chain is liable for a violation (interviews fw018, fw020). Recent resulting de-risking strategies of banks have contributed to a reduction and concentration in the number of CB arrangements, in turn leading to higher costs and increased difficulties for payments to and from some jurisdictions.

Figure 4.1. Cross-border payments as a combined process of settlements (red) and messaging (green)



Source: Robinson et al. (2022: 9)

Not all delays are because of compliance checks: banks have internal processes regarding how promptly to forward payments and may profit from delays, known as 'float'.[21] Established payment hops are a series of bilateral agreements: there is no upfront overall

[21] Interestingly, while this was not much of an issue when interest rates were zero or even negative (as banks were not incentivized to keep funds overnight at the central bank), this could again become important as interest rates rise.

visibility on fees or payment processing time, nor is there progress visibility, with payments sometimes taking 3-5 days to arrive. Each bank in the message chain charges a fee for handling the payment. Often, the customer knows the entire fee only at the end when they receive an amount that is less than they expected by whatever the fees were. Fees can be considerable, e.g. 20 EUR to transfer 100 EUR, which in part represents rent-seeking by banks that profit from these inefficiencies. These technical and organisational details are vital and define points of intervention to which we refer in section 3.

There are a number of factors driving recognition of the need for change in cross-border payments. While international payments used to be relatively rare outside of remittances and some business (usually for larger amounts), globalisation and e-commerce drives the need for and expectation of low-value, frequent, user-friendly and cheaper global payments, available 24/7/365. Additionally, the 2030 Sustainable Development Agenda aimed to significantly decrease the cost of remittances, some of which use CB/SWIFT (United Nations, 2015). Regulatory change has opened up certain payments functions to a wider array of non-bank institutions to induce competition, and national retail payment systems are broadly moving towards near-instant settlement, normalising cheaper and faster payments. The entire payments domain has been undergoing upheaval, bringing about a convergence of previously fixed payment segments (FIS, 2020) alongside a fragmentation of payments services across multiple actors who seek to consolidate and expand into different payments areas in a payments "land grab" (Armstrong, 2019). Together, these factors put pressure on banks' legacy infrastructure and fee-based business models.

4.2.2. The tech challenge and incumbent response

Digital technologies transform businesses, work patterns and divisions of labour. Payments, an existential matter for banks, are no exception. Payments are also a key customer interface function, allowing banks to have customer relationships and to sell other products to customers, such as accounts and loans. Losing the direct customer relationship could mean that banks are relegated to the role of a "dumb pipe" (Maurer & Swartz, 2015), thus losing much profit-generating potential elsewhere.

In the age of digital platforms, payments also potentially provide access to valuable transaction data, something that has thus far remained underutilised by banks. Fintech innovations are argued to bring about the disruption and disintermediation of financial incumbents and the potential unbundling of banking's core functions that do not require a banking license to be performed by different actors (Wójcik, 2021b). Various alternatives have emerged in the payments sector. New infrastructure based on blockchain and digital asset solutions offers a complete reconfiguration of cross-border payment, based on a decentralised peer-to-peer architecture without established financial intermediaries (Rodima-Taylor & Grimes, 2019). Firms like Ripple target remittances, B2B payments and payments messaging (cf. Dörry et al., 2019), thereby focussing particularly on the inefficiencies of CB/SWIFT. Digital platforms and wallets like PayPal, overlay services like ApplePay, and neobanks specialising in foreign exchange (FX) like Wise (formerly TransferWise) and Revolut still run *atop* existing bank infrastructure. Unhindered by internal legacy technology, they use new technology to improve particular niches and provide a better customer experience. (Some) fintechs would like to have the accounts, data, and products, but care little about the infrastructure underneath: they do not need a banking license as long as the customer deposits are ultimately held with a bank and payments ultimately processed between banks via payment systems. There is still value for some banks in providing just the underlying banking infrastructure. Goldman Sachs, for example, underlies Apple's foray into retail finance, however it does not have a large retail or commercial banking business to lose in the first place.

To ward off various threats and preserve banks' incumbency, therefore, cross-border payments need to be made *fast*, or near instant; *transparent*, in terms of price and payment progress; *predictable*, in terms of price and speed; and *cheap* to compete with the new fintech solutions. As well as defending the domain of mid- and high-value B2B and interbank payments, banks must additionally try to take on other growing payment segments, such as lower-value and consumer payments. This involves competing with the superior, more user-friendly wallet-experience of digital platforms and fintechs, and greatly reducing payment fees. Put differently, the FABS complex at hand needs both fundamental changes in order to shift the locus of rent generation from an increasingly outdated source, i.e., its (lucrative) fee-based business, and secure future rent generation by monopolising access to the future source of rent, that is, big data. The SWIFT/CB nexus must reform, e.g. by keeping customer relationships and offering new services, in order to preserve CB. It means that this part of the FABS complex is shifting an entire business model in order to preserve the conditions for maintaining control of gatekeeping to futures source of rent-extraction, and to remain a valuable OPP in the future.

The urgency of the task becomes tacit with the opening quote from a former JP Morgan executive speaking at the annual SIBOS industry conference (organised by SWIFT) in 2004, in which she criticised banks' (in)ability to collectively innovate. Specifically, she called on SWIFT to step up when she elaborated:

> Wouldn't you think that banks should be facilitating payments transactions for e-Bay? We have the customer relationships. We have the accounts. We have the clearing and settlement systems. In fact, Pay Pal transactions ride on the very same systems we banks have spent billions of dollars building. And yet the banks lost the deal, despite our natural advantages. (Miller, 2004)

Almost two decades later, banks' business, including cross-border payments, is being threatened to an even larger extent. Inertia may be a consequence of economies of scale and increased reporting pressure due to compliance measures. However, despite this and while conceding that challengers have superior technology, banks have thus far retained their incumbency in cross-border payments. Challengers have made little overall impression yet, with blockchain firm Ripple, for example, having to adapt its solutions, in some part replicating the CB structure on its own network, and mainly providing only improved messaging (interviews fw015, fw017). Indeed, the role of Ripple – once a celebrated start-up – so far seems to have been mainly a catalyst for change by spurring banks and SWIFT into action (interview fw012).

Some SWIFT initiatives exemplify some of these shifts and are discussed in detail in section 3.2: The first shift is a move to **better structure or rationalize data**, mainly revolving around the introduction of a new electronic data standard, *ISO 20022*. There is also the addition of a unique reference number to each payment message, trackable via a cloud-based application called *global payment innovation (gpi)* launched in 2017. Based on this, a low-value payment offering for payments called *SWIFT Go* was launched in 2021. A second broad shift is towards **centralization and partial platformization**, which enacts a step change from serial messaging to central transaction orchestration in SWIFT's *transaction management platform*, launched in November 2022. These technological changes are complemented with contemporaneous **social** shifts is involving **changes to banks' business processes and practices** around payment processing and using the technology, such as agreeing to new 'rulebooks' with new service level agreements (SLAs) and lowering fees. The overall aim is to cement the incumbency of banks as OPP in cross-border payments by upgrading the CB/SWIFT system for the big data era. Potentially painful for banks, this also

entails embracing new data-centric business and profit models; the shift that symbolises turkeys' proverbial voting for Christmas. The overall effect of these changes is to tweak banks' own capacity to arbitrate access to the *rent heavy*-infrastructure controlled through gatekeeping by the quasi-monopoly power, or 'rentier' (Pažitka et al., 2022), here the CB/SWIFT complex.

4.3. Analysing change/maintenance and stability/change in cross-border payments

4.3.1. Tensions in maintaining/changing the CB/SWIFT system

The decentralised nature of parts of the combined CB/SWIFT system means SWIFT cannot simply order and unilaterally change but rather co-creates and coordinates change with and among its competing members while maintaining organisational (and therefore geo-economic and geopolitical) stability. Thus, the mere fact of multiple actors being embedded in a cooperative network does not explain outcomes in itself, but requires accounting for power. Attributing change to SWIFT alone overstates its agency and overlooks the nuanced work involved in coordinating cooperative action among competitors. Avoiding over-attributing causality to either individual actors or structures, we operationalise power through *relational geometries* (Yeung, 2005), that is, the spatial configurations of relations among and between dynamic actors and structures constituted by interaction, interconnection, practices and tensions at different scales. Power, then, is not a resource in itself but produced by the mobilisation through networked relationships of resources and abilities, which are territorially embedded and unevenly distributed, thereby influencing outcomes in particular ways (Allen, 2003). Different forms of power emerge from the inherent tension in relationality. This necessitates examining the qualitative nature of relations between actors and the key power shifts as practiced through relationality that work between/among actors and structure, global-local scales, the social and the spatial. Three tensions in particular frame the CB/SWIFT challenge for change: industry structure, innovation and technology, and governance and coordination.

Starting with the industry structure, as with other infrastructures, payments is a network industry (Brennan, 2009; Kemppainen, 2015), in which competing finance firms must also communicate and collaborate. For example, one bank cannot normally refuse to transmit a payment to an account held at another bank. This leads to interesting organisational constellations: some challengers, e.g. neobanks, are members of SWIFT; other challengers, e.g. digital asset firms like Ripple, must collaborate with SWIFT members (banks) to compete with SWIFT. Thus, many industry actors are simultaneously competitors, clients and service providers to each other, resulting in *co-opetition*. Furthermore, not all banks are the same, embedded in different and multiple territories, operating at different scales and with widely varying resources and technology. Co-opetition involves cooperation in important efficiency-generating areas, such as interoperability via shared infrastructure and common standards and in some aspects of product development, but competition in practically every other way, such as fees, interest rates and services (Evans & Schmalensee, 2005). SWIFT's distinctive cooperative organisational form is just one example. Distinct from ownership by investors, the public or an entrepreneur, member-owned co-operatives are owned by those who directly benefit from its activities. Cooperatives centralise some decision-making, distribute shared profits, and can entail some investments which create exit barriers (Nooteboom, 1999). Ownership is important for a number of reasons: which stakeholders benefit, which stakeholders have control, which stakeholders bear transaction and governance costs, and also has wider systemic effects in terms of customer protection, monopoly, innovation, profit-seeking and risk-taking (Birchall, 2011). While the few bigtech firms are giants in their own fields with no or minimal

regulation, banking is a heavily regulated industry in which no one bank is allowed to be a monopoly. Hence, it is an oligopoly that competes in some areas but also heavily collaborates in others, e.g. in their common payments infrastructure; this was the original *raison d'être* of SWIFT.

According to Jessop (2018), capitalism operates "through an unstable mix of co-operation and competition", which causes tension during cooperation for two reasons: the tendency for co-operation to create conditions for self-interested behaviour that damage trust and therefore undermine the initial reasons for co-operation, and its potential to inhibit innovation by blocking creative tension. SWIFT's role now extends far beyond what it was originally created to do and its membership has accordingly expanded since its inception. As well as running the network, SWIFT takes care of governance and of defining and agreeing on common rules and standards for data and processes (Macknight, 2018). While banks were the original members, this has since been expanded to include securities firms, market infrastructures and some corporate customers (Scott & Zachariadis, 2014). Although SWIFT is cooperatively owned by over 11,000 banks, it is not governance by equals, with board membership determined according to usage and therefore favouring large global Western banks, who originally built the network and who drive SWIFT's revenues by processing most payments and therefore sending most SWIFT messages. This grants these banks more control over SWIFT's strategy and operations. Although SWIFT operates in over 200 territories, in the decade to 2011, 90% of its messaging revenue came from banks in only 25 most developed nations. These banks encouraged smaller banks to join because they considered SWIFT more secure and cost effective than other means of communication about financial transactions (Bergin, 2016).

Although large banks operate their own payments networks and would sometimes prefer to use these, other banks may prefer to use SWIFT because everyone is on it (interview fw020). For smaller banks, SWIFT may be the only payments network they have (interview fw022). Thus, the focus on SWIFT as incumbent masks the fact that while it has some autonomy, it is also a *class alliance* and the *combined agency* of its members, particularly its most powerful ones. It is an *oligopoly dressed as monopoly*. SWIFT refers to itself and its members as a community, but it can also be thought of as a club: membership is a club good, providing exclusive benefits for members (Potoski & Prakash, 2009). While not wishing to overstate SWIFT's role as an elite club based on intellectual agreement around governance and instrumental in global financial regulation (Tsingou, 2014), it serves an important role as thought leader in the banking community (Allison, 2015).

This has implications for innovation and technology. In a critical infrastructure like payments, *stability* is paramount, further complicating technological change. Payments systems, critical to the workings of a bank and to the economy, are highly interconnected within individual banks. Even short outages may attract the attention of politicians, making working on them akin to "performing open heart surgery" (interview fw015): to be avoided unless necessary. Centrally-controlled platforms can be relatively quickly upgraded for all users, but the same cannot be said for a distributed infrastructure like the CB/SWIFT system. While there are similarities between platforms and infrastructures, there are also important differences (Plantin et al., 2018). In a closed-loop system, a single company manages the platform, with all users connected to it as members. Digital platforms profit from lock-in of users to their closed-loop systems. In an open-loop system, the members are intermediaries between the platform and end-users (Verdier, 2006). PayPal is an example of the former, in which users can pay each other directly if both are members. CB/SWIFT, on the other hand, is an open-loop system because banking is an infrastructure-like network industry in which

no one bank has a monopoly. Quick technological upgrade may be desirable but is impossible: it requires adequate arrangements of governance and coordination.

Cooperative governance and action, then, is a key agency in the maintenance of financial infrastructure networks and in preserving the incumbency of financial institutions. Banks are stand-alone entities with their own competitive interests. However, they are, at the same time, members of a larger entity, SWIFT, which considers banks' collective interests, but also has its own franchise to protect. The destiny of each member is thus entangled in the other. Above, we conceptualised SWIFT (and by extension the banking industry) as a club, but clubs too need governance. Just because SWIFT 'owns' the network does not mean that it calls all the shots and can easily order changes and new rules. Change rather needs to be more consensual, or at least, members need to be persuaded of the club's continued benefits. The need for coordination is vital when considering the distributed nature of the CB system. Despite its limitations, efficient and automated payments transactions have long been technologically possible. SWIFT is "one of the fastest networks in the world", but it is banks that are slow (interview fw008). This is mainly for reasons of culture and practise, although regulation is non-negligible (interview fw023). The main barriers to change have to do with business and economics (Milne, 2007), which, as an interviewee put it, are "bad reasons" (interview fw021). These include rent-seeking and costs of change/upgrade of a single banks' internal system, which might be of no benefit to a single bank but could improve cross-border payments as a whole.

Firstly, therefore, incumbent banks must make coordinated, difficult, and unwanted change (technological and social, e.g. business terms) across a huge global network in order to stay relevant. Secondly, the importance lies with the role of SWIFT in bringing about such change, both directly and indirectly. SWIFT 'looks' after member banks' collective interests and governs it since global collaboration in co-opetition requires coordination. It tries to get banks to do things they do not want to do. This is understandably difficult because "turkeys don't vote for Christmas" (interview fw023). However, SWIFT is adept at and used to absorbing such tension (interview fw012). How incumbents' defensive actions happened is explained next.

4.3.2. Upgrading CB/SWIFT for the big data era: getting turkeys to vote for Christmas

The global payments system based on CB evolved organically over hundreds of years. If starting from scratch, it could be designed differently (interviews fw012, fw023). However, the critical nature of banks' ageing internal payment systems, along with their lack of agility in process change means that change must be incremental and based on the existing system (interview fw012). Understanding payments as a *collective problem* and the CB system as a *legacy infrastructure* with strong socio-economic and technical components allows us to see that overcoming these barriers requires changing interwoven technological objects and social rules, conventions and practices. SWIFT (SWIFT, 2021) calls the process of collaborative innovation with its members 'co-creation'. However, this elides the nuances of maintenance agency in getting many parties to do things that are necessary but difficult and uncomfortable through a kind of nudging to resolve tensions. In this section we examine the key areas outlined in section 2.2.

First, the ISO 20022 standard for electronic data: Financial messages, like specially formatted emails, may seem like a mundane technicality but are the lifeblood of financial flows. Different parts of the financial system run on different messaging standards. Key to fixing cross-border payments and in banks making better use of transaction data is the 'unsexy' work of data harmonisation (Buitenhek et al., 2020). SWIFT's original MT messages

are still widely used today but, based on the legacy technology they replaced (telex), contain lots of freeform text that make computerized STP difficult. To improve this, SWIFT developed a new MX message format, containing many structured fields for granular and richer message data. This is based on ISO 20022, a new methodology, or 'data dictionary' for creating consistent and interoperable financial standards across the industry. SWIFT wrote the original ISO 20022 specification in 2000 as part of an ISO working group (The SWIFT Standards Team, 2020). The benefits of this new messaging standard and format are mainly in terms of cost, efficiency and risk mitigation, by better structuring payment data to remove friction, and the collection of richer data associated with transactions As discussed earlier, STP breaks require human intervention, and unstructured message data makes precise compliance checks (e.g., sanctions screening) more difficult, potentially leading to fines from regulators (interview fw030).

The global roll-out of ISO 20022 for payments messages was supposed to happen between November 2022 and November 2025, during which time old and new SWIFT message formats would co-exist. This was delayed until March 2023 to coincide with the delayed upgrade of the Eurosystem's payment system to the new standard (SWIFT, 2022). This highlights the difficulty in implementing a new standard globally, as standards usually evolve over time. It is not just thousands of banks, but also critical national/regional payment infrastructures, such as FEDWire in the US and TARGET2 in the EU, that must be upgraded. Upgrades need to be tested and coordinated to avoid any break in payment service that would immediately halt economic activity. Some channels via which this occurs are SWIFT's Cross-border Payments & Reporting Plus (CBPR+) and Payments Market Practice Group (PMPG), forums for the financial industry to liaise with organisations like industry organisations and payment system operators across the globe, thus ensuring alignment and interoperability across actors operating at different scales (Muir & Roels, 2020; SWIFT, 2019b). SWIFT's three-year roll-out is designed to nudge its own members to make the shift within a specific timeframe. Software already exists for translating between different message formats, but ISO 20022 will make this easier (The SWIFT Standards Team, 2020), while SWIFT's transaction management platform (see below) further assists by accommodating multiple message formats.

Second, global payment innovation (gpi) and SWIFT Go: The launch of *gpi* in 2017 enabled banks and SWIFT to fix some longstanding problems in cross-border payments and demonstrates the difficult intertwined technological and social changes required, with SWIFT again integral. Although competitors like Ripple made a lot of noise about problems in global payments, SWIFT was already long aware of inherent inefficiencies (interview fw012). It published a number of potential future upgrade scenarios based on in-depth interviews with banks as far back as 2011 (SWIFT, 2011). These nascent ideas that became *gpi* were too early for the industry (interview fw028). However, they wanted *gpi* when SWIFT offered it later (interview fw020). The 2013 Sibos conference with much talk about fintech and DLT served as a wake-up call for the banking industry (interview fw030). At Sibos a few years later, a group of banks decided that something needed to be done. Those banks became the ones who implemented *gpi* (interview fw028).

The main feature of *gpi* is the addition of a unique identifier to each message in a payment transaction to connect and be able to track previously separate messages. Connecting messages allowed end-to-end payment visibility, visualised on a new cloud platform in the style of a metro line. Accompanying these technological changes was a multilateral agreement (rulebook) between banks of new rules and SLAs for timely processing of payments and upfront transparency of payment fees. Key to implementation is getting the fewer-than-20 truly GTBs on-board, as they are "the piece in the middle" of all transactions

(interview fw030). Some of SWIFT's corporate customers were involved in piloting; SWIFT was able to leverage corporate customers by educating them of its benefits and encouraging them to ask their banks to sign up. Enforcement of the new SLAs is via penalties for misbehaviour: public naming and shaming in the *gpi* observer and the potential of having the bank's name published. Because "no bank wants to be on the wall of shame", this has not had to be used (interview fw012). The *gpi* rulebook did not, however, directly reduce payment fees, as these are negotiated bilaterally between banks. Instead, the *gpi* observer allowed customers to compare and subsequently question payment performance and price across banks, thereby indirectly pressuring banks to improve performance and lower fees. SWIFT thus used technological change to bring about difficult social change among its member banks. The general move by payment infrastructures across jurisdictions towards instant payments and ISO 20022 helps SWIFT by speeding up payments. By 2020, over 90% of payments were delivered in under 24 hours and almost 40% within 30 minutes, fees were reported upfront, and payments were tracked (SWIFT, 2020).

The *gpi* implementation demonstrates that banks ultimately guide SWIFT, but SWIFT provides a forum for discussion and dialogue by bringing people together, putting problems on the table (interview fw030) and getting agreement across different banks (interview fw020). SWIFT has not been constrained by its board in what it proposes, although there may sometimes be limits to what it can deploy as it is a co-operative as it lacks direct access to funding (interview fw020). Implementing *gpi* was "a really big deal for some banks" and required a mind-set shift: if adding a tracking number was hard, implementing a totally new system would have been unimaginably harder (interview fw012). Lower-value cross-border payments are almost "nuisance level" for CB/SWIFT, given the low value, friction and costs in changing currencies and crossing borders (interview fw023). SWIFT already did a surprising amount of low-value payments but wants to do more, given this is a growing area (interview fw020). Building on the socio-technical changes in *gpi,* a low-value cross-border payments initiative called *SWIFT Go* launched in late 2020, in which a core group of banks agreed to charge lower fees on payments below 10,000 USD and to process them within tighter service levels. This allows CB/SWIFT to compete in that segment.

Third, transaction management (TM): gpi has been described as a marginal improvement (Bermingham, 2018) and a "practical optimization" rather than an innovation (interview fw023). Others have questioned whether it is "the last gasp of the old order" or "the first step in the new direction" (CurrencyCloud, 2021). The importance of data in the digital economy is well established (Chenou, 2019; Sadowski, 2019). While looser CB arrangements originally facilitated globalisation, today it centres on big data strategies (Derudder & Taylor, 2020) with digital platforms being the organisational mode of data accumulation and monetisation (Langley & Leyshon, 2017; Srnicek, 2016; Zuboff, 2019). Consequently, the CB/SWIFT model needs to adapt for the big data and platform era, while maintaining CBs' incumbency. In November 2022, SWIFT launched a new strategy based on TM with the aim of leveraging its trove of financial data to provide mutual services to its members and aid a shift towards a business model based on data rather than extracting gatekeeper fees.

TM is not a new technology. It is, however, new for SWIFT and a step change, moving for the first time away from serial messaging chains and towards orchestrating transactions fully end-to-end: a first step in the *platform* direction. A new central SWIFT platform will maintain full transaction data, to which authorised parties can connect via multiple methods, including older and new messaging standards as well as application programming interface (API). The shift towards API is indicative of a cultural change at SWIFT towards more openness of connectivity (interview fw008), allowing banks and fintechs to create new products (SWIFT,

2019a). The platform will translate between message standards, thus fixing data truncation issues and accommodating all member banks, including small ones for whom upgrading is very difficult. TM workflow involves creation of a data object on the platform by either API or message that can then be interrogated by users. This indicates that the movement of platformised money is not so much a flow as an update (Westermeier, 2022). This allows the creation of new centralised services on the platform that can mutualise costs and processes for banks. Examples are using artificial intelligence (AI) to perform compliance checking of payments once, rather than by all parties in the chain, or to performing *payment pre-validation* to check for errors in transactions that can be fixed before being sent. Such mutual services are examples of things that nobody else but SWIFT will do because they do not make money (interview fw028). TM therefore incrementally builds on ISO 20022 and the improvements in *gpi*, providing rich data and reporting for financial institutions to leverage and build new data-centred products for clients (Buitenhek et al., 2020).

Data-centred products are intended to make up for the loss of fee revenue while mutual services will lower costs. Additionally, a central platform will make future CB/SWIFT technological upgrade easier, thereby resolving the tension of having to coordinate change across thousands of technologically heterogeneous members worldwide, and the tension between stability and change inherent in a critical infrastructure. The outcome of the above is incremental upgrade and maintenance to preserve the CB/SWIFT system's relevance as OPP – and thus a continued source of profits for banks, albeit less reliant on rent in the form of a toll for passing payments through their books in favour of providing data-centred products. A unique and irreplaceable part of this maintenance agency is SWIFT's friendly pressure of nudging, persuading and cajoling banks to collectively change for their own good. In so doing, SWIFT resolves tensions across space and scales, essential for preserving trust and stability of a global network industry and ensuring continued profitable cooperation between competitors.

4.4. Discussion, conclusion and outlook

We ask to what extent the incumbent system of the CB/SWIFT infrastructure aligns within the FABS complex, and how such a conceptualisation can help understand how (much) its relationships alter under pressure to change to preserve rent-extraction through an OPP. Using the example of transaction banking as key component of the FABS complex, we showed that, given the imperative to respond to challenges posed by tech challengers, the FABS complex itself is subject to both change and preservation/maintenance to sustain CB and its business model in the (near) future. Transaction banking can thus be summarised to be in the process of 'qualifying' new space/place to arbitrate (monopolistic) access to (new) rent extraction by employing an underutilised, yet powerful data (re)source: SWIFT, its collectively owned messaging network. The importance of transaction data as a potential strategic business resource has not been all that long recognised or possible to exploit. Yet, the spatio-organisational qualification strategies of the GTBs aim at preserving their collective power to collaborate against 'outsiders' and defend the domain of mid- and high-value B2B and interbank payments, while better competing in the growing lower-value payment segment.

Such new qualification processes, however, could also be argued to initiate a shift from rent-extraction towards more genuine profit generation, therefore serving the FABS complex as an OPP with changing attributes. Although cross-border payment fees were/are a form of rent-extraction as they rely mainly on a bank's position in the payments chain, shifting to providing products/services based on data may not be rent extraction in the sense defined by the OPP concept, as the latter may provide valuable and measurable services to customers. Yet, while a functional shift may indeed suggest a rent-to-profit shift, the defence

of GTBs' organisational gatekeeping position to utilise their OPP and levy a toll on payments passing through may prevail. These changes also seek to avoid that banks lose out on cheaper alternatives.

Such organisational and functional shift are, however, embedded in a larger – spatial – context and defined by a range of hierarchies among actors; their agency composed of overlaying and intersecting – or nested – relationalities. In a sense, the change imperative faces multiple hierarchical super-type—sub-type relationships, forged together through a range of nested relationalities and power geometries that re-define and re-design the 'new' OPP's spatial and organisational architecture, through which the CB/SWIFT nexus articulates. First, SWIFT members are not all equal. There are hierarchies in SWIFT user types, with three different levels of access to services. The first tier is supervised financial institutions (such as banks and securities broker-dealers), who can send and receive all SWIFT message types and can become shareholders. The second, non-supervised financial entities, can send all messages to first tier users but not to other non-supervised entities. The third tier is closed user groups and corporate entities, who can access specific defined services, e.g. specific types of messages for particular business requirements. Although less powerful, corporate members of the third type, at the bottom of the hierarchy, play an important role in demanding services from their banks, who are SWIFT members, and thus driving change. SWIFT can encourage them to pressure their banks to implement changes for the clients' benefit. In this process, the fewer-than-20 GTBs are key for system-wide change. Changing their own systems would nudge other member banks to invest in change, not least because other, lower-ranked, banks are not only also SWIFT members but also the GTBs' customers. There are also ownership/governance and regional/spatial hierarchies. While all banks are owners, SWIFT usage proportionally determines member share allocation and influence. GTBs, who process most transactions and are mostly Western, have most say in election of the board of SWIFT's directors, power to change bylaws and influence over strategy (cf. Scott & Zachariadis, 2014). There is also a country-level element of governance stemming from the stipulated geographical composition of the 25-member board, as well as national user groups of SWIFT members who ensure communication between users and the organisation. There are individuals working at different banks are committed to SWIFT's products and its success (interview fw013, fw028). The cooperative model provides the opportunity for representation, involvement and influence within SWIFT for smaller markets and institutions through their community representatives, which might not be possible in a purely commercial model (interview fw030).

Second, financial flows in CB relationships are concentrated in systematically important banks located in financial centres that themselves form the apex of the global financial hierarchy. The growth of the financial and business services sector has unmistakeably been one of the key economic trends of the last thirty years. Both the world's leading wholesale and investment banks as well as shadow banks and large investment managing firms are in practice part of a broader ecology of firms active in law, accountancy, marketing, etc. that feed on each other's business. The net result in geographical terms is that hierarchical tendencies among specialised international financial centres (IFCs) have been established, with New York and (pre-Brexit) London at the apex of the IFC pyramid. Recent world city literature and IFC analysis suggests that Asian cities/IFCs are still being highly dependent to the IFC axis NY-LON (Taylor et al., 2021; Wójcik, 2013a). This ties in with the fact that most GTBs are still Western-based, and most cross-border flows are concentrated in key currency corridors, e.g. USD-EUR. Many smaller currencies are exchanged using USD as a vehicle currency between them, although the currency corridors with most-used currencies were already the most efficient; hence change there brought moderate gains.

London remains the key place for FX, the largest financial market, and important for cross-currency payments. Together, GTBs have formed a global pattern of competition and complementarity supplemented by a myriad of small, more local, and highly specialised financial firms. A third 'nested' monetary space is shaped through central banking and the governing of currency spaces. Correspondent banks are aligned with and co-defined/co-designed through their "physical and functional notions of space", i.e. policy space (defined by interest rates), regulatory space (defined by GDP) and currency spaces (defined by FX rates). Monetary space is a field of forces in terms of a (mathematical) 'network' of payments or monetary flows emanating from and returning to a 'centre', which itself is complex aggregate of monetary and financial organisms (Perroux, 1950). As a result, monetary space is simultaneously delocalised and yet inherently hierarchical, operating at multiple regional, national and global spatial dimensions (Bieri, 2020, pp. 8–10).

Following on from the foregoing, we suggest some avenues for future research. Banks capture tremendous amounts of data and recognise that this is evolving towards being a strategic enabler (Claeys et al., 2020). However, they are still just scratching the surface of this shift and, among other things, need to figure out how to reconcile the potentially more liberal treatment of data with their traditional sensitivity to client information (interview fw030). Some have suggested that SWIFT's increased data-centricity highlights a pivot towards 'surveillance capitalism' (Arauz, 2019), however, so far it is difficult to see how the mainly corporate data from CB would be monetised via advertising as end-user data is by bigtech platforms. Payments industry members recognise that payment data is a potential comparative advantage, particularly against threats from new entrants, which banks will definitely be able to monetize and add value to, but the question is how and in partnership with whom, as this capability is not inherent to banks (Lumley et al., 2022). Therefore, the content and impact of data-centric products and profit models by FABS firms should be examined.

This paper has also shown that fintech is not just a phenomenon of outside disrupters but can also be wielded by incumbents to maintain their dominant position. Therefore, research into how other actors with large networks, such as the card payments schemes Visa and Mastercard, are harnessing fintech to bolster their positions and expand into new areas is apposite. Following on from this, the trend in recent decades has been towards privatisation of once mutually owned financial infrastructures, such as stock exchanges and the aforementioned card networks. As we have shown, CB/SWIFT's continued relevance is in no small part due to SWIFT's cooperative organisational form, and the unique agency that emerges. Indeed, in contrast to the decentralisation aspiration of some fintech, we suggest exploring how SWIFT's gradual platformisation lays the foundation for potential further centralisation of common bank processes, as well as interoperability with new disruptive money forms such as tokenised digital assets and central bank digital currencies (CBDC) (SWIFT & Capgemini, 2022a, 2022b).

In light of the findings in this paper, we consider tech-induced transformations in well-established, economically sensitive and often complex socio-technical systems as part of the FABS nexus with infrastructure-like traits to be an important avenue for future research – not least with regard to the (future) importance of OPP.

Annex 1. List of interview partners

fw008	Vice President, financial technology company. Interview in Brussels, Belgium, June 6th 2019.
fw012	SWIFT employee. Phone interview, 30th July 2019.
fw013	Blockchain Solution Owner, European bank. Interview in Brussels, Belgium, 14th August 2019.
fw015	Sales Director, financial technology company. Phone interview, 7th Sep 2019.
fw017	Global Head of Banking, blockchain payments company. Phone interview, 13th November 2019.
fw018	Head of Operations & International Expansion, European payments fintech. Phone interview, 30th Sep 2019.
fw020	SWIFT employee. Interview in La Hulpe, Belgium, 31st Jan 2020.
fw021	Global Head of Payments, European global transaction bank. Phone interview, 3rd Feb 2020.
fw022	Head of Operations and Outsourcing, European neobank. Phone interview, 14th Feb 2020.
fw023	Vice President of Global Payments, online travel agency. Video interview, 20th Feb 2020.
fw028	SWIFT employee. Video interview, 18th November 2020.
fw030	Head of Direct Clearing, US global transaction bank. Video interview, 24th November 2020.

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Chapter 5. SWIFT: Trusted infrastructure for infrastructures

Co-authored with Sabine Dörry and Ben Derudder. Submitted for publication in the forthcoming (2024) volume by B. Brandl, M. Campbell-Verduyn, & C. Westermeier (Eds.), *The Cambridge Global Companion to Financial Infrastructures*.

5.1. Introduction

Money and finance have been conceptualised as an infrastructure for the economy and for society (Barnes & Christophers, 2018; Muellerleile, 2018; Ricks, 2018), or "the infrastructure of the infrastructure" (Cerny, 1994, p. 223). Finance has developed its own infrastructures, defined as "the socio-technical systems enabling basic yet crucial financial functions to be carried out, but that tend to be taken for granted and assumed" (Campbell-Verduyn et al., 2019, p. 911). As financial activities have become more complex and speculative, centralised ordering institutions such as central banks and financial infrastructures have evolved (Norman et al., 2011) to smooth the conduct of finance and commerce across space and time.

Within the finance industry, what constitutes financial infrastructure is not exactly defined. It broadly includes organisations that conduct the core financial markets processes and functions of risk mitigation, trading, clearing, and settlement[22]. Exchanges take care of securities trading activities and have evolved into large groups, whose activities and market data shape financial markets (Petry, 2021). Post-trade activities, like clearing and settlement, are performed across a variety of actors, namely central counterparty clearinghouses (CCPs), national central securities depositories (CSDs), the two international CSDs (ICSDs) Euroclear and Clearstream, and custodian banks, which, while not directly considered infrastructures, perform essential infrastructural functions (Lee, 2011). Every economic and financial transaction necessitates payment, with clearing and settlement of payments performed by a number of infrastructures: national large value payment systems[23] (LVPS) for wholesale payments; fast/instant and retail payment systems; automated clearinghouses (ACHs) for batch and non-urgent payments; and CLS (Continuous Linked Settlement) Bank for foreign exchange (FX) transactions in certain key currencies. Post-trade and payment infrastructures are collectively referred to as financial market infrastructures (FMI), although it is sometimes differentiated between post-trade infrastructures as FMI, and payment systems as payment market infrastructures (PMI).

SWIFT, however, does not fit into the above categories of financial infrastructure. While many infrastructures store and transfer value, whether as money or as securities, the Society for Worldwide Interbank Financial Telecommunication (SWIFT) transfers

[22] Clearing and settlement describe the processes needed to finalize a financial transaction. These processes follow the execution of every transaction to ensure the efficient transfer of ownership of securities from seller to buyer and corresponding transfer of payment from buyer to seller. Generally, clearing refers to everything post-trade and before settlement, including establishing the parties' obligations to each other, and the potential transfer of obligations to a central counterparty (CCP) to mitigate risk. Settlement follows clearing, in which the agreed exchange of ownership for money happens (European Commission, n.d.; Milne, 2016). Clearing is a series of processes, while settlement is an event (Rambure & Nacamuli, 2008).

[23] Here, we use the term 'payment system' to refer to an interbank payment system "incorporating a particular set of payment instruments, technical standards for the transmission of payment messages and an agreed means of settling claims among system members, including use of a nominated settlement institution" (CPSS, 2003, p. 9).

data/information about value[24] between banks and financial infrastructures internationally. SWIFT's original role and *raison d'être* was in providing a secure, digital, international financial messaging system for international payments for a small group of Western banks in the 1970s. Since then, it has expanded into messaging for post-trade securities transactions. It now accounts for more of its messages than payments (SWIFT, 2021a), expanded its membership globally and membership to other financial actors beyond banks, and provides more shared services to its members. In so doing, it has become a critical "infrastructure for infrastructures" (Robinson et al., 2023, p. 485).

This chapter unravels SWIFT's role as trust provider by examining its workings, technologically and organisationally. Trust is integral to money and finance. Much of the sector's growth has come from scaling trust (Rubinstein, 2022); financial infrastructure is a key method of doing so. Styling itself as "the most secure trusted third party" (S. V. Scott & Zachariadis, 2014, p. 38), SWIFT refers to two dimensions: the financial messaging infrastructure network (SWIFTNet) and the organisation, a cooperative, in which SWIFTNet is embedded. Viewing SWIFT as a 'club', its purpose is not messaging specifically but connectivity generally, allowing it to extend trust among its members and more broadly to financial flows. To this end, we combine different strands of literature on clubs to study the relationship between SWIFT's organisational design and its effectiveness in bringing about strategic change to retain its pre-eminence (see chapter 4). Both SWIFT's messaging network and organisational form are integral to the workings of global finance as a sociotechnical infrastructure by extending different forms of trust across space, an essential prerequisite for continued collaboration between financial competitors. Alongside physical networks, ideas and standards, trust is an important component of "the binding medium" (Easterling, 2016, p. 6) that is infrastructure.

The next section explores and defines the concept of trust in finance and explains the architecture of global financial infrastructure as based on the account money form. The third section demonstrates the significance of SWIFT's organisational form in engendering trust among competitors and as a key relational form of agency that fosters collective action to mediate technology, geopolitical and market challenges. The fourth section engages with new dynamics of trust facilitation in cross-border payments in response to a variety of challenges, before this chapter closes with a critical reflection and outlook.

5.2. Trust in money and finance

Trust is foundational to money and finance. It requires "social, geographical, and discursive nodal points of trust and authority" (de Goede, 2005, p. 185) to buttress the banking business, which is likened to "a massive, complicated and delicate confidence trick" (Arnold, 2023). A definition of trust, which is "a slippery and complex notion" (Nooteboom, 2003a, p. 111), encompasses several reasons and motivations for broadly having confidence or reliance that actors or things will not fail us. This can be based on control in the form of incentives or contracts; on self-interest or assurance, such as dependence or legal coercion; or it could be a strong sense of 'real' trust based on motives beyond self-interest. As this brief list shows, the sources of trust can be distinct, thus lying in individuals or in a system (e.g., organisation) as a clear rule provider and enforcer to (better) calculate others' behaviour and action. Central bankers, for example, consider trust to be confidence that "authorities will act predictably in the pursuit of predefined objectives and that they will

[24] Other payment infrastructures include debit and credit card schemes (e.g. Visa, Mastercard), payment processors (e.g. Worldpay, Stripe), and money transfer operators (MTOs) for remittances (e.g. Western Union, MoneyGram). Some also handle data rather than value and are mainly for specific, e.g., retail, transactions.

succeed in their task" (Carstens, 2023, p. 6) of maintaining trust in the monetary system as a public good and foundation of an economy. Trust, however, can take forms such as behavioural, competence, intentional, and informational in people, institutions and organisations, but is not limitless: "someone has trust in something, in some respect, and under some conditions" (Nooteboom, 2003b, p. 8).

Representations of trust as radiating down from central banks to lower-order financial actors as well as residing in networked groups of financial experts neglect the role of the financial 'plumbing' in providing trust (Campbell-Verduyn & Goguen, 2019). Finance is a network industry, in which competitor firms must necessarily collaborate to a certain extent. This has been evident historically in financial infrastructures, from exchanges and clearinghouses up to credit card schemes, which have been mutually owned by the financial actors that use them. Trust is thus also important between organisations in enabling relations: it reduces relational risk, or the risk of something going wrong in a relationship; it is economically relevant because it reduces uncertainty, bringing material benefits for cooperation, and savings on search, contracts, and monitoring because it reduces fear of opportunism; and it involves an acceptance of more influence from partners. This is the purpose of governance, which acts with other governmental instruments like contracts, incentives, reputation, and via structure of networks (Nooteboom, 2003b).

Through governance, trust is related to authority and power. The financial system comprises the combined interactions, competitive and cooperative, of its participants. Authorities and financial institutions are not the only components of the financial system. Financial infrastructures are both key nodes themselves but also the sociotechnical mesh (both material, like cables and network equipment, as well as immaterial, like rules and conventions for using this equipment and executing processes and functions) interlinking nodes. Trust is the reliable working of such large, impersonal social structures at societal level, or *system trust*, is a crucial phenomenon in modern times, which builds on both "the authority attributed to formal social positions as well as on the reliability of technical systems, standards and procedures" (Bachmann, 2003, p. 64). Private actors have been granted forms of legitimate or private authority over important domains, both domestically and internationally, usually associated exclusively with the state (Hall & Biersteker, 2004). Such authority is deemed legitimate because it is ultimately delegated by interdependent public authorities (Pauly, 2004), such as those with regulatory supervisory oversight over financial institutions and infrastructures. Legitimacy implies that those governed consent to or recognise authority, which they do without coercion, but rather for reasons like persuasion or trust (Hall & Biersteker, 2004); legitimacy is invoked in the ability to mould relationships by bundling and shaping the interactions of multiple social actors in generally accepted ways (Bachmann, 2003).

As an essential infrastructural component of international funds transfers, SWIFT's technological messaging infrastructure plays a crucial role in scaling trust in money and finance globally. This goes beyond the national jurisdictions, within which central banks and national financial regulators/supervisors nominally can only maintain trust in the value of their own currency. While in recent decades many financial infrastructures have been privatised, SWIFT remains a not-for-profit-maximisation cooperative, co-owned by its member banks. We argue that the cooperative organisational form is a key enabler of trust among financial institutions and aids their collective strategic agency to change.

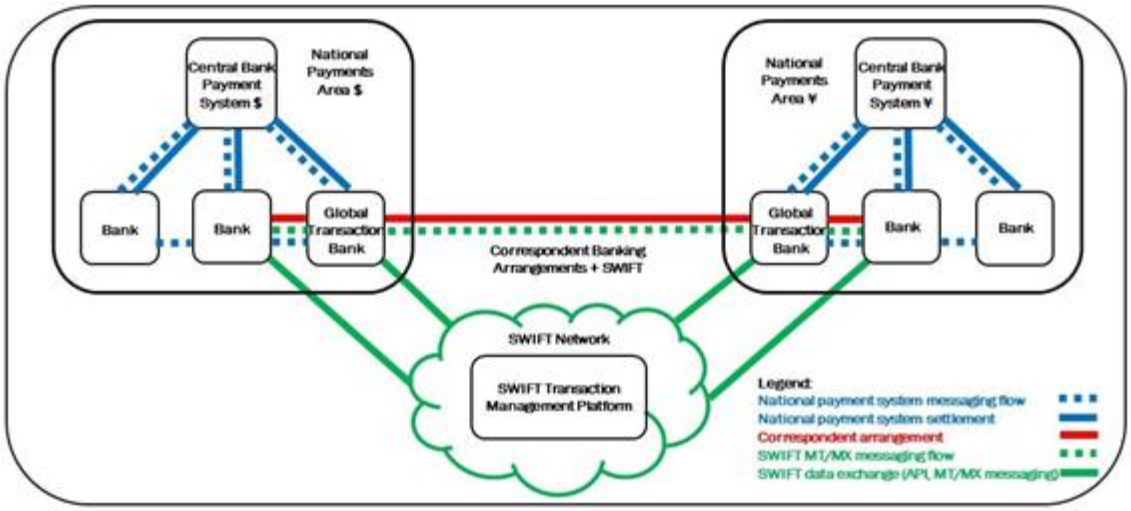
5.3. SWIFT and financial messaging

The architecture of financial infrastructure is contingent upon the *money form* that it supports. The two money forms for payment are physical objects/tokens, such as cash, and

accounts/claims, such as commercial bank deposits. Token money transactions feature immediate settlement and no information exchange once the token is deemed valid (Adrian & Mancini-Griffoli, 2019), however such transactions generally require physical proximity. Account money evolved from token money in medieval Europe when moneychangers transformed from custodians of physical coin to deposit banks. Instead of physically transferring coin as payment, they logged ownership of coin deposited with them in books, and then transferred ownership, thereby immobilising coin and creating account or book-entry money. This also allowed netting, or extinguishing one debt with another, leading to banks becoming trusted central intermediaries. As such, banks conduct transactions for many parties across their books, with only minimal final settlement in physical money. Account money thus has two components: *value*, residing in and cleared/settled across the ledgers of financial institutions, and *data/information* about that value, requiring transmission via trusted channels. Value, also a kind of data, can be considered money at rest and is a representation of value inherent in and created by our ecology and societies (B. Scott, 2022). Data is more accurately transaction information, such as payment instructions, and manifests money in motion. Account money payments do not need physical proximity or immediate settlement; rather, they require information to verify account holder identities. Account money nowadays resides in electronic accounts/ledgers of various silo-ed financial institutions, e.g., banks. Effecting payment means changing these accounts (settlement) in response to instructions. Instructions are communicated electronically across distance in email-like messages. This secure transmission of financial information is the purview of SWIFT and of particular significance for cross-border payments, in which SWIFT's origins lie.

There are important differences between domestic and international payments. SWIFT (2019) describes the global payments system as "a network of federated payment systems, where fiat currencies are settled in different jurisdictions, each with their local regulations and requirements – independent, yet interdependent on each other", which are connected by correspondent banking "into a meaningful value transfer system". This is depicted in a stylised manner in figure 5.1. Domestic payments (or payments in one currency) are centralised in a national payment system, to which member banks are directly connected or indirectly via a member bank. The payment system is generally publicly run by the central bank, which has responsibility for that currency. Interbank payments are settled in the payment system in central bank money, and payment information is communicated via the payment system's messaging system. However, the lack of a global currency and central bank means that there is no single global payment system and this "banal" fact makes cross-border payments more complex (Brandl & Dieterich, 2021, p. 10).

Figure 5.1. Federated global payments system



Sources: CPSS (2005); SWIFT (2021c); Robinson et al. (2023).

As per the above description, the various national payment systems are connected to each other via correspondent banking. This is a decentralised system of bilateral contractual agreements, called correspondent arrangements or correspondent relationships, between commercial banks operating in different locations. Most banks lack a physical presence overseas and so engage the services of banks elsewhere for international business. For cross-border payments, banks in different locations hold reciprocal ('nostro'/'vostro') accounts with each other, which they prefund and then use to make payments. Banks have an arrangement for each currency they make payments in ('currency corridors'). This system has become concentrated in a small number of mainly Western banks called global transaction banks (GTBs). GTBs have a physical presence in many jurisdictions and direct access to payment systems there[25]. Correspondent banking has existed for centuries and remains a mainstay of bank internationalisation as well as a critically important mode of cross-border funds transfer, both for trade and for interbank payments, such as central bank swap lines.

SWIFT's function here, and the reason for its foundation, is providing secure transmission of payment information for correspondent arrangements between over 11,000 banks in more than 200 (para)sovereign territories. A massive rise in cross-border funds transfers from the 1960s led to Western banks needing standardised, digital, and secure communication for the increased volume of transaction information. The digitisation of banks accounts was important, but the digitisation of standard payments messages was revolutionary (Stearns, 2011). SWIFT's messages have become the standard for parts of the finance industry[26] and these, as well as its network and systems, have gone through various upgrades. As correspondent banking and SWIFT have been derided as legacy systems, ripe for technological disruption, SWIFT has transitioned from serial transmission of messages along the correspondent banking payment chain, towards partial platformization via a new transaction management platform, aimed at helping banks to make economic use of transaction data (see chapter 4). While cross-border payments messaging is SWIFT's raison

[25] This has also allowed these banks to build their own large correspondent networks, processing cross-border payments internally across their own branches and books, known as 'on us', 'in-house', or 'book-entry' payments (Kokkola, 2010; Rambure & Nacamuli, 2008).

[26] Different parts of the industry use different messaging standards and protocols (S. V. Scott & Zachariadis, 2014).

d'être and still what it is mostly associated with, SWIFT now processes more messages for securities transactions (SWIFT, 2021a). Securities used to be physical instruments until inefficiencies in paper-based systems of trading and settlement were exposed by a paperwork crisis on Wall Street in the late 1960s, following a rise in trading volumes. This led to immobilization and dematerialization of securities, with electronic issuing, custody, and recording and transfer of ownership in accounts at CSDs and custodian banks. The account money form of separate value and information components thus also underpins financial asset custody (Chan et al., 2007; Milne, 2016), allowing SWIFT to further extend trust beyond payments, and serve as an essential infrastructural component of international financial flows.

5.4. Facilitating trust in cross-border payments

5.4.1. The message is the medium

Payment settlement has evolved over time to become centralised in public central banks (Norman et al., 2011). States guarantee the stability of their money's value across space and time, and the perceived credibility of this promise makes money "essentially a relationship of trust" (Brandl & Dieterich, 2021, p. 4). Central bank money is at the top of the monetary hierarchy (Mehrling, 2013) and is the safest settlement asset as it is "the only financial asset that is guaranteed to keep its nominal value" because "unlike private entities, states do not have a binding survival constraint" (Pistor, 2019, p. 77). Beneath central bank money, the majority of money in use is credit money created by commercial banks in a kind of monetary public-private partnership (Ingham, 2020; Murau & van 't Klooster, 2022). Private commercial banks have accounts with the central bank where payments are settled: the payment system links public and private money (CPSS, 2003). Lack of trust in fiat money would mean a loss of ability to reliably and confidently conduct everyday social and economic activities that we take for granted, e.g., to safely effect payment and to exchange cash for the same amount of money at different commercial banks.

Trust in *domestic* payments is anchored in the central bank as the provider of the unit of account, the final means of settlement, and the guarantor of the smooth operation of the payment system (BIS, 2021). *Cross-border* payments, that can include multiple "long chains" of correspondent arrangements (Campbell-Verduyn et al., 2019, p. 911), are different. In this tightly intertwined network, banks are interdependent by reciprocally holding balances and extending credit (Wandhöfer & Casu, 2018). In the past, based more on reciprocity (Molteni, 2021), trust in the intentions and behaviour of partner banks is now more transactional and controlled via contracts (Lyddon, 2012). Only those banks directly connected to each other 'trust' each other with payment in commercial bank money by pre-funding their nostro/vostro accounts. Trust, for example, erodes when regulatory violations in a payment chain, e.g., anti-money laundering (AML), mean that all parties in the chain are liable. The reputational and financial costs of entering into a 'bad' correspondent relationship has led to a decrease in correspondent banking services in a process of de-risking (Prentice, 2019) in recent years. In light of this and other challenges, SWIFT has spearheaded efforts to reorganise its network and correspondent banking to maintain trust in both.

Trust in the information/data component, integral to money's movement, reinforces trust in its value. SWIFT's standing is based not on asset transfer, but on security, reliability, integrity, and confidentiality in proprietary financial data, a non-trivial undertaking with the technology available when it was founded. Only the parties to a transaction are able to read messages about it, which SWIFT provides for via authentication and encryption with latest

generation IT security. Continuous network uptime and availability for fast and assured message deliver is assured via multiple layers of data-centre resilience, redundancy, physical security, and processes for implementing critical changes, while SWIFT also accepts some liability for its messages (S. V. Scott & Zachariadis, 2014). The quasi-monopoly international payments messaging system, SWIFT also relays domestic payments messages for some central banks (CPSS, 2003, 2005) and offers them a shared backup generic payment settlement system, the Market Infrastructure Resiliency Service (MIRS), in case of a failure of their own systems, e.g., due to natural disaster, cyber-attack, or hardware failure (SWIFT, 2014).

Trust also comes from the rules that an infrastructure's users abide by, which "instil diligence in the effective use of the electronic medium" (Kozolchyk, 1992, p. 55). For example, correspondent banking payment messages are only sent once relevant account balances have been updated, meaning that the previous leg of the payment has already been settled (Wandhöfer & Casu, 2018). While types of some messages convey promises, both binding and non-binding, others "are the very performance promised in the previously or concomitantly issued message" (Kozolchyk, 1992, p. 47). Through this, banks trust that the content of SWIFT messages is correct and untampered with, that the message is genuinely from the sender, and that transactions within have been settled. Trust in account-based money is thus inextricably bound up with the medium of communication. Via SWIFT's competence, security, reliability, and the performativity of its messages, trust is mediated systemically.

5.4.2. Cooperative, community, club

SWIFT's organisational form is pivotal in co-constituting trust. Not a firm, but a not-for-profit-maximization cooperative which is collectively owned by thousands of member-banks who use it, SWIFT styles itself as a trusted community for its members and communicates "a strong organizational narrative of neutrality" (S. V. Scott & Zachariadis, 2014, p. 132). A way to conceptualise SWIFT is as a club. This has some interrelated features and implications that can help us get an analytical grasp on this complex singular organisation and its relation to trust, power, and governance, but also its ability to bring about and shape change.

The *first* feature is that of club goods. Economics posits the theory of clubs as arrangements for the consumption of goods shared by owner-members. While adding members to share usage of a club good eventually leads to reduced utility through congestion, it has the benefit of reducing the cost for a single member (Buchanan, 1965). Such goods are widespread in financial infrastructure where the necessity of communication technologies gives rise to network effects of shared benefits and costs among many users (Lacker, 2006), such as in cross-border payments. The provision of club goods creates trust as the following exemplifies:

A central driver in SWIFT's creation as a cooperative was a lack of trust among competitor banks. At the time that banks needed a secure, digital communications system, First National City Bank (now Citi) had a messaging system that it proposed all banks use. However, other banks' mistrust of competitor's intentions and of becoming reliant on that competitor's proprietary system was a key reason for the decision to go for a cooperative solution. Perhaps the banks were right not to trust a competitor. In the 1980s, Citi envisioned broader usage of its private electronic funds transfer system, which other banks could use, "but only for a fee and only on Citibank's terms" (Bátiz-Lazo et al., 2014, p. 121). SWIFT's cooperative form engendered organisational trust in its motives and intentions beyond any

individual bank's self-interest, while its ability to provide a secure messaging infrastructure created confidence in its *competence* – an important dimension of trust in the system rather than in individual member banks. Shared ownership-usage of SWIFT's messaging system in return for membership fees makes it a club good, while SWIFT's profits are returned to members in the form of cheaper services. For example, the cost of sending a letter of credit by telex in the 1980s was 10 to 25 USD, compared to 0.50 USD by SWIFT (Kozolchyk, 1992). SWIFT's messages have continuously dropped in price, allowing member banks to make large profits (Leibbrandt, 2015). SWIFT also provides other shared non-messaging services to its members, such as for financial crime compliance, like for sanctions, fraud, and AML. Overall, SWIFT creates benefits for its members by doing things that nobody else will do, such as common provision of unprofitable activities, saving duplicate work and cost. And although SWIFT is not responsible for its members' security, it has introduced a security control framework for its users, recognising that, for example, hacking incidents are a significant security and reputational problem for the cooperative (Bergin, 2016).

Trust, then, is itself a club good, which can lead to further benefits, and this takes us to the *second*, social and cultural meaning of clubs as distinct and powerful communities of practice (CoP) (Wenger, 1998), also involving aspects like branding, status, reputation, meaning, purpose, and other non-economic benefits (Pak, 2013; Potoski & Prakash, 2009). Trust building is very much a cultural issue, also between banks that operate in their own institutional and cultural environments. Affiliation ties granted by club admission allow the assessment of members' trustworthiness, community commitment and adherence to norms, even without personal ties or direct interaction as members (Pak, 2013). A specific benefit is collective learning, such as in CoP, which, via an organisation's simultaneous presence in many places, allows the connection of decentralised knowledge, both tacit and codified, and local and nonlocal (Malecki, 2000). Headquartered in Brussels, SWIFT also has offices around the world, including innovation labs, as well as local country user groups consisting of member bank employees with direct connections to the organisation, allowing SWIFT to 'co-create' with its members (SWIFT, 2021b).

SWIFT's reputation also adds value to its annual Sibos conference, which is an important community hub (S. V. Scott & Zachariadis, 2014) and serves as a field configuring event (Lange et al., 2014), at which like-minded individuals from competitor banks can discuss common problems. Collective learning and community fora are thus milieu-specific forms of relational and social capital (Maennig & Ölschläger, 2011) that help to build interpersonal, and by extension inter-firm, trust among SWIFT members and their employees. However, SWIFT's trusted reputation may not extend evenly within its member banks, but only among those familiar with it. Financial institutions are not monoliths, with some operating across many different segments, perhaps with some internal rivalry. SWIFT's primarily services is transaction banking, encompassing areas such as payments and post-trade. Investment banking activities, for example, may use different infrastructures and services.

Third, gatekeeping as a specific form of access control is central to clubs. Club goods are not only about inclusion and availability to members. They necessarily involve exclusion to discourage free riding. While inclusion and exclusion are normal features of all kinds of groups and organisations, the club notion helps to illuminate these features with regard to SWIFT in particular and finance in general. SWIFT has three main user categories with different levels of access to SWIFT services:

- supervised financial institutions are entitled to full usage of SWIFT services;
- non-supervised financial industry entities may use almost the full suite of services; and

- closed user groups and corporate entities (including some non-financial firms) are restricted to using messaging only within certain closed groups.

SWIFT users who are involved in the same business as the other shareholders and who send financial messages are eligible to become SWIFT shareholders, who in practice are mainly licensed/supervised financial institutions such as banks, securities broker/dealers, and investment managers (SWIFT, 2020). Unsurprisingly, there are restrictions on full SWIFT membership and access, given that banking itself functions as a club, with restricted access: state-imposed entry requirements guard the reputation and trust in members, and regulations guide behaviour in a way that benefits all members (Goodhart, 1988). However, at times, powerful members defend existing club boundaries to preserve advantages they enjoy (Stearns, 2011). SWIFT's original member banks were not always keen on allowing new kinds of members to join. While securities firms and infrastructures were admitted in 1987, international fund managers' efforts to join were originally blocked until 1992, while non-financial firms were allowed access in 2002 via closed user groups (S. V. Scott & Zachariadis, 2014).

There are always limits to trust, however. While, for example, SWIFT has thousands of member banks, most only own a tiny sliver. Board membership is partly composed according to network usage. This favours the large, mostly Western, global transaction banks who process most transactions, send most SWIFT messages, and drive SWIFT's revenue.

A *fourth* aspect of clubs relates to governance. Clubs are a model of multilateral cooperation where negotiations and bargaining that produce compromise, decisions, and actions, are obscured by being taken in a private setting (Keohane & Nye Jr, 2000). Sheltered from outside influences, the club is a private forum allowing room for competition for influence and ideas, while avoiding conflict and ironing out differences. While this model is usually associated with elites, it is also connected with private authority, in which trust in expertise, experience, and competence, leads to legitimate governance based on delegation of technical issues (Tsingou, 2014, 2015). SWIFT's legitimacy as a private authority stems from regulatory oversight by central banks, its co-operative ownership by regulated financial institutions, and from a variety of sources and roles, some of which it has performed for over 40 years. These include:

- its function as standards developer/repository and role as ISO registration authority;
- its status as an accredited market infrastructure; and
- its capacity as community hub and conference organiser for the global finance community.

SWIFT's development and diffusion of its messaging standards has enabled the industrialisation of financial services on a global scale. SWIFT's governance structure is partly organised to grant a country-level voice, from national user groups, ensuring communication between users and SWIFT to keep a global focus, to national member groups of shareholders, to the director voting formula (S. V. Scott & Zachariadis, 2014). It is not unusual, however, that the common direction the organisation forges is likely to suit the interests of its most powerful members, in this case the very few global transaction banks, which may not always be the same as other members. While SWIFT is therefore a class alliance, it represents the hegemony of a particular transnationally oriented class fraction (Bieler & Morton, 2018).

5.5. Conclusions

In summary, financial infrastructure provides communication, spatial integration,

and fundamental functions of capitalism, such as the smooth functioning of exchange, and upholding property rights by keeping records and transfer of ownership. Sometimes co-operatively owned, this infrastructure demonstrates that the very core of financial markets is itself not always market-based. This chapter sought to provide an ordering mechanism to grasp the essences of SWIFT as a monopolistic infrastructure for infrastructures, by mobilising the concept of trust.

Trust among club members is an essential precondition in mobilising collective strategic action to preserve dominance. Since 2017, in response to fintech challengers targeting inefficiencies in correspondent banking and in SWIFT's legacy messaging system, SWIFT has coordinated and rolled out changes across its network worldwide, thereby building on collective learning among its members. These changes have meant inducing banks to change their business models from fee extraction to the economic use of transaction data, a painful but necessary change if banks are to remain competitive in cross-border payments. Coordinating such change across thousands of heterogeneous, interest-driven actors is a mammoth task and enormous challenge for club members. The organisational trust placed in SWIFT, however, grants it the power to resolve tensions and to shape its members' collective behaviour in ways that benefit the club as a whole. SWIFT's ability to provide a secure and reliable financial messaging infrastructure between banks has bolstered systemic trust in money internationally over time as it moves within and between sovereign monetary jurisdictions, thereby scaling trust globally. As demonstrated in this chapter, systemic trust is a key part of the connective tissue of (a changing) infrastructure.

SWIFT has also been reluctantly involved in geopolitical controversies. In 'the SWIFT Affair', there was uproar that prompted a reconfiguration of SWIFT's data centre locations (Dörry et al., 2018) after SWIFT allowed US authorities access to transaction data, including of EU parties, following the 9/11 terrorist attacks in New York (de Goede, 2012). Financial sanctions on cross-border payments can be enacted in two ways: one involves targeting the information component, SWIFT, while the other involves targeting the settlement component by banning correspondent banks from processing currency transactions on behalf of particular nationality banks in the issuer country (Robinson et al., 2023). SWIFT has been forced by the US and EU to disconnect banks in, amongst others, Iran on two occasions and Russia in 2022. While SWIFT wishes to remain neutral and to avoid disconnecting members and countries, its near-monopoly messaging infrastructure is a choke point that can be leveraged as a political tool.

Money's data component is thus subordinate to its value component and the private authority of financial infrastructures is subordinate to the monetary and political power of states. Due to the possibility of future sanctions, certain countries are reducing USD dependence, for which they use alternative currencies and clearing/settlement systems, as well as alternative financial messaging systems to SWIFT (Nölke, 2023). Established in the 1970s, SWIFT is a child of the post-1945 Bretton Woods cementing of USD hegemony, cross-Atlantic Eurodollar flows, the beginnings of financial globalisation, and the attendant dominance of Western banks, who crafted their private financial infrastructure according to their needs. A shift towards a multipolar monetary order will see attendant new financial infrastructures and shifts in existing infrastructure.

Challenges to SWIFT's primacy in financial communications come not only from geopolitics/geoeconomics. While SWIFT has recently upgraded its messaging infrastructure to compete in the digital platform era, other fintech challenges remain, mainly from central banks and financial incumbents. The first is a nascent trend towards direct bilateral and multilateral interlinking of national payment systems with the aim of improving cross-border

payments efficiency. Doing so bypasses correspondent banking arrangements and possibly also SWIFT. A further challenge is from a new money form based on cryptocurrency, namely digital tokens on distributed ledger technology (DLT)/blockchain. Incumbent banks, infrastructures, and central banks have incorporated the technology to make financial transactions more efficient through 'tokenization' of money and securities. This money form features 'atomic' instant combined communication and settlement of transactions, without the separate processes inherent in account-based money. It may thus replace existing financial infrastructures, including SWFT, with entirely new DLT-based infrastructures. While new technologies like blockchain have raised questions about trust in finance, they have not yet succeeded in their aim of removing trust entirely (Campbell-Verduyn & Goguen, 2019).

Infrastructure consists of both technical 'hardware' and social 'software', including organisations in which it is embedded. SWIFT's centrality as an infrastructure for infrastructures is not neutral but contingent on and enrolled in larger power struggles, which inform attempts to change it. Examining the money form(s) that financial infrastructures support allows us to speculate about potential infrastructural futures of new money forms. Change is inevitable, and understanding how this complex twin infrastructure will navigate these challenges remains an exciting task for the future.

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Chapter 6. Conclusion

6.1. Summary

This thesis looked at the impacts of technological and organizational change on financial infrastructure for cross-border payments. It did so by employing a range of analytical tools from interdisciplinary literature (see section 1.2.1) to address four overarching and interrelated research questions: 1) how does financial infrastructure, particularly for cross-border payments, work? 2) how are the geographies of cross-border payments configured? 3) what is the impact of technological change on this infrastructure, how does this change unfold, and how is it governed? 4) what are the implications for the geographies of money and finance, i.e., for the constellation of financial organizations and actors located in specific places and interconnected across space? In so doing, it made a number of contributions (see section 1.2.2).

This study's findings are as follows. *First*, the correspondent banking system is a geographically and historically foundational and critical means of financial expansion and remains so today. Supported by SWIFT's messaging network, this dual sociotechnical infrastructure features separate but interdependent geographies of finance/settlement and information/messaging that are constituted across different scales. The system is therefore an instrumental part of activities and flows within and between IFCs. *Second*, SWIFT's messaging network is shifting towards platformization and increased centralization and mutualization of common bank functions. This brings a shift towards the economic use of data rather than reliance on high fees in correspondent banking. These changes are designed to maintain the correspondent banking system and banks' incumbency in cross-border payments by making banks competitive in the big data age. *Third*, collaborative action in bringing about technological and organizational change across a huge global network of disparate and distributed actors is a significant manifestation of finance industry agency for maintaining its collective dominance. SWIFT's cooperative organizational form is a key locus for this agency, enabling the resolution of tensions among diverse actors and processes across different scales. *Fourth*, an instrumental role of SWIFT is as a provider of trust. Confidence in the reliability of SWIFT's technological messaging infrastructure is key to maintaining trust in money globally, bridging the various domestic currency zones in which central banks provide trust in national currencies. Additionally, SWIFT's governance role and position of authority is legitimized by the trust its members place in it, granting them collective agency. Trust is therefore an important binding element of infrastructure. *Fifth*, the money form is important as it determines the attendant financial infrastructure and its geographies. Consequently, an understanding of this is essential to understand how new money forms, such as those based on cryptocurrency, may engender new infrastructures and geographies.

Chapter 2 set the context for the thesis in providing an exploration of the historical and current workings of the combined correspondent banking and SWIFT system for cross-border payments. It did this by noting the importance of the account money form in determining the architecture of current financial infrastructure, which is composed of twin financial and information processes and geographies of settlement, via the correspondent banking system, and messaging, via SWIFT. It conceptualised this combined infrastructure as a sociotechnical configuration, comprising both technical elements like SWIFT's messaging network, banks' internal payment systems, and national payment systems, with social elements such as rules for the use of technical systems and contractual business relationships and arrangements. In so doing, it showed the composition and distribution of this infrastructure across different scales and actors, and how international payments are

thus composed of multiple interconnected global, regional, and local activities. The significance of non-firm forms of organization in financial infrastructure, namely SWIFT's cooperative form, were highlighted. Finally, it further demonstrated the geoeconomic and geopolitical salience of correspondent banking and SWIFT by outlining their weaponization in imposing sanctions during the Russo-Ukrainian war. This contributed to answering the first two main research questions of this thesis.

Chapter 3 served two purposes: the first was examining the methodology of qualitative research via semi-structured interviews, and the second was what the pursuit of this methodology itself revealed about the actors and processes involved in the research topic. Namely, it demonstrated the opaque, arcane, and sometimes secretive nature of financial infrastructures and the organizations through which it operates, while also shedding more light on actors engaged in transaction banking. Additionally, this chapter demonstrated the reach of the platformization trend, which I showed in chapter 4 is a strategic response by SWIFT to upgrade financial messaging, as it also increasingly intermediates between researchers and interviewees. This augmented the answers found in chapter 2 to the first two research questions of this thesis, as well as adding some initial colour to the third research question about the actors governing financial infrastructure.

The processes and outcomes of technological and organizational change in cross-border payments were covered in chapter 4. This chapter addressed research questions 3 and 4 and found that SWIFT's cooperative organizational form is a crucial relational mode of mediation between the thousands of SWIFT's member users in maintaining the stability and structure of heavily entrenched global financial infrastructure and the agency required to simultaneously upgrade this infrastructure to be competitive in the big data era. The aim of this is to maintain correspondent banking as the prime channel for cross-border payments and to preserve bank's incumbency. This is enabled by a step change in SWIFT messaging from inefficient serial chains to partial platformization via a new transaction management system, gently forcing banks into painful change by shifting from reliance on fee extraction to the economic use of data. This change was complex and made its coordination across thousands of banks around the globe impossible to simply centrally order. It was rather a result of the resolution of many tensions inherent in the relational geometries of power, in which SWIFT is instrumental in a variety of ways. The impact of this platformization is to maintain the financial geographies of settlement of cross-border payments via the correspondent banking system, preserving banks' collective position, and particularly the dominance of the GTBs anchored in financial centres around the world. The information geography of messaging, however, is reconfigured and features increased centralization of messaging data in SWIFT as an orchestrator of transactions. This lays the foundation for increased mutualization of even more common banking services in SWIFT as a collective banking platform.

Chapter 5 built upon the previous chapters to expand our understanding of financial infrastructure beyond payments and into securities transactions, thereby further illuminating the answers to all four of this thesis' research questions. It showed the wider reach of SWIFT as an infrastructure for other financial infrastructures and its extension of platformization into securities messaging. With this understanding, it investigated how the two main things that constitute SWIFT, the cooperative organization and its messaging network, are instrumental in extending various forms of trust across space and among thousands of banks in different places. Trust is a club good that SWIFT's members benefit from, a crucial ingredient in engendering cooperation between competitors, and a key element of how power is collectively and relationally operationalized to maintain the joint dominance of financial incumbents. Alongside things like physical equipment and networks, ideas, and standards,

trust is therefore an important immaterial component of infrastructure. SWIFT aims to cement and future-proof its role as a bringer of trust in global finance and the continued role of banks as financial intermediaries by providing interoperability with new digitally tokenized forms of money and securities, their financial infrastructures, and their potentially new institutionalized forms of trust. However, it faces challenges maintaining its self-proclaimed neutrality and the trust on which this is based.

6.2. Implications and future research

Research into financial geographies, defined in this thesis' fourth research question as the constellation of financial actors, places, and spaces, covers a number of interrelated aspects, including: the hierarchical tendency of IFCs; finance as an oligopoly of interdependence featuring competition and complementarity; financial elites; and the impact of fintech (Derudder & Dörry, 2016). This section discusses some of the implications of this thesis and its findings for the geographies of finance, suggesting some avenues for future research.

As networks are embedded in the global division of labour, they have a tendency "to organize space hierarchically and lead to an ever-widening gap between power centers and peripheral loci" (Mattelart, 2000, p. 98). Financial geography research has highlighted the relative stability and hierarchical organization of the network of IFCs, with functional specialization of some lesser nodes (Musschoot et al., 2023; Poon, 2003) and the continued dominance of two key nodes, namely New York and London (Taylor et al., 2021; Taylor & Derudder, 2022; Wójcik, 2013). The importance of New York and London can in part be explained by the former's current salience as the clearing centre for the world's key currency, the US dollar, and by the latter's equivalent role in the past, when the pound's monetary hegemony was built on the expansion of the British Empire. This highlights the banal fact that the payment system is perhaps the key strategic infrastructure of a financial centre (Kindleberger, 1973), with direct access to the payment system a main reason for banks to locate there. This also provides the basis for some correspondent banking services, such as cross-border payments provision, as shown in this study. It also partly explains how and why certain banks are global: they have a physical presence with local access to many payment systems and sell this access as a service to other banks.

A foundational and longstanding mode of financial intermediation across space, the correspondent banking model also bridges local specialized banking functions in an IFC with cross-border functions connecting to other IFCs. The routine, regularized, and interconnecting characteristics and function of correspondent banking, along with its flexible and distributed nature in allowing multiple different paths between any two banks in the world, makes it a fundamental underlying infrastructure providing for the continued stability and structure of the IFC network. The number of correspondent relationships is in decline, at least in some geographies, as banks are cutting back on them, mainly as a process of "de-risking" (FSB, 2018a; IMF, 2017; World Bank Group, 2018). As these relationships retreat, some places may not get completely cut off but rather see a reduced number of routes via longer paths, consequently becoming slower and more expensive. Those peripheral geographies that are increasingly less well serviced may see early adoption of new financial technology out of necessity, thus a kind of small, gradual adoption at the edges.

However, it is not yet the case that correspondent banking's loose and ad-hoc arrangements are being supplanted by big data arrangements (Derudder & Taylor, 2020), although as chapter 4 shows, such arrangements may help to optimize and organize them differently. It is currently difficult to imagine an alternative to correspondent banking. The

idea of direct peer-to-peer relationships between every bank is seductive but unfeasible: even if every bank wanted to be connected to every other bank, which they do not, it would be unmanageable to negotiate and maintain such a vast number of bilateral relationships. On the main axes between those IFCs at the top of the hierarchy, correspondent banking's 'currency corridors', rooted in the oligopoly of GTBs, are efficient, and thus may remain the dominant relational mode for some time yet. While SWIFT faces threats from new money forms and infrastructures, it too is likely to persist: although financial messaging infrastructure in its current form may in the longer term become obsolete, this study has shown that SWIFT's value to its member extends far beyond this as a trust provider and cooperative form of agency.

Examining banking functions with regard to financial infrastructure shows the nature of finance as an industry featuring **oligopolistic interdependence with cooperation and competition** (Christophers, 2016; Clark, 2002). The definition of banks as "speculative investment funds grafted on top of critical infrastructure" (Klein, 2023, para. 1), while a pithy simplification, is not entirely inaccurate. Financial activities like payments and custody are infrastructural but are provided competitively on a for-profit basis. They serve to reinforce the stability and hierarchy of the IFC network on one hand, while aiding with functional specialization of individual IFCs on the other. Each aspect is bound up differently with financial infrastructures. Payments is an essential utility (Greenspan, 2007; Ingves, 2018; Kay, 2015; R. Lee, 2011), and, as noted earlier in this section, national *payments infrastructures* are an infrastructural cornerstone of IFCs. They simultaneously play an explicitly integral domestic role as the kernel around which an ecosystem of connected banks gathers, but also an international role, because global payments are composed of multiple local transactions. As this thesis has shown, the combined correspondent banking system and SWIFT infrastructure for cross-border payments is a cohesive element reinforcing the stability of global financial networks by binding these disparate transactions together into a coherent system.

National and international *securities infrastructures*, however, contribute more towards IFCs' competitive differentiation. Although each jurisdiction has its own securities infrastructures, these can also be oriented towards cross-border activities, for example, by attracting certain activities and financial instruments. The presence of the few international securities infrastructures, i.e., the ICSDs Euroclear and Clearstream, may provide synergies with national infrastructures but is not necessarily a determinant of an IFCs orientation. For example, Luxembourg is a major international centre for securities custody, hosting many of the global custodian banks (Musschoot et al., 2023), and is home to Clearstream, while Brussels is home to Euroclear but does not have the same profile, instead projecting a neutral image (home to EU institutions, it is a major political centre, however) where organizations like SWIFT and Visa are headquartered (Hendrikse et al., 2019). Further research could shed light on the role of connections between national and international financial infrastructures, private firms, and the state in the differential configuration of particular IFCs.

Although this thesis has made the case for expanding economic geography research to include non-firms, such as cooperatives, **individual firms** are still important agents in shaping financial geographies (Balmas, 2022). There is not always a neat separation between different kinds of financial activities and infrastructures. Securities custody services and cross-border payments/SWIFT use some different infrastructures, but both fall under the category of transaction banking. Different activities can be synergistic, further explaining the pivotal position in financial networks of some banks. An example of this is Bank of New York (BNY) Mellon, which does not provide commercial banking services, such as cross-border

payments, to corporate customers, but as the largest global custodian bank its worldwide presence allows it to offer correspondent banking services to other banks. Chapter 4 explained the heightened importance of transaction banking since the 2007-8 financial crisis. Compared to the exorbitant but volatile profits of investment banking, the quietly reliable income from transaction banking has seen it variously described as "not the sexiest segment of banking" (Bippart, 2018, p. 52), and the "workhorse of the banking world" with a "sleepy image" (McKinsey & Company, 2019, p. 2). Profits from one segment can support banks through relatively leaner times in the other, with table 1.1 showing the particular dominance of JP Morgan and Citi in both areas. Financial geographers have shown the importance of *individual* segments (e.g., securities services, investment banking) for IFCs' functional specialization (Musschoot et al., 2023), for connections within and between IFCs (Pažitka et al., 2021), and for the power of large banks (Pažitka et al., 2022). Research on the GPNs of finance provides insights into the composition of financial activities across space/places (Dörry, 2016) and further investigation could shed light on synergies between different segments and activities that bolster banks' presence in specific locations and influence connections between and within places.

The case of Goldman Sachs presents an interesting research opportunity. Already the topic of scholarly research into its resilience (Urban et al., 2022), the notorious investment bank lost ground after the 2007-8 financial crisis on rivals like JP Morgan who expanded their transaction banking operations. A main point of this thesis is that financial incumbents must preserve their role in payments to avoid becoming just the underlying infrastructure for non-bank payments firms, and that even the largest banks cannot operate globally in the same way that big tech firms can. However, acting as financial infrastructure for non-banks can be strategically successful and profitable for Goldman Sachs, at least in the short term. With its retail bank, Marcus, less successful than planned (Natarajan, 2022), and lacking a transaction banking business, Goldman Sachs has partnered with Apple on the big tech firm's foray into financial services, facilitating Apple's Buy Now Pay Later, savings account, and payments cards offerings via its banking licenses. Apple's increased incursion into the domain of finance demonstrates that global technology firms can use banks' presence and access to financial networks and infrastructures but without having a banking license and the supervisory regulatory burden that it entails (Foroohar, 2023; Franklin & McGee, 2023; McGee, 2023). Future research could therefore examine the ways in which non-FABS firms reconfigure extant FABS geographies.

SWIFT's platformization (described in chapter 4) may also have an impact on "**IFCs' ability to imitate and innovate** - i.e., to create new work and extract more value from it" (Derudder & Dörry, 2016, p. 5), as well as on existing work. The provision of more shared services centrally by SWIFT is intended to save duplication of certain tasks across individual banks, while the updated ISO 20022 messaging standard and messaging tracking functionality for payments and securities will improve end-to-end automated processing of transactions. While not creating new work, this will remove existing work and possibly involve the loss of jobs. Finance in popular culture is mostly portrayed as the notoriously speculative, cut-throat, and macho world of front office jobs in investment banking, deal-making, and trading, where extreme profits (and losses) are realized, exorbitant bonuses paid, and where price discovery, essential to capitalism, happens. However, given the utility-like nature of some banking activities, many jobs are in supporting middle and back office roles, relatively normally paid, and looked down upon by front office workers (Luyendijk, 2016). Such roles are not exactly innovative but rather necessary because finance is an information industry, one increasingly concentrated in an oligopoly of huge banking groups, swollen by constant acquisitions, and thus constantly incorporating more inefficient legacy technology and processes requiring manual intervention. While fintech may increasingly do away with such

work, platformization of financial services may bring new work in areas like data analysis that will be necessary to make economic use of data. Traditionally, this is not an area in which banks have in-house expertise and so provides opportunities for partnerships with outside firms (Lumley et al., 2022), potentially forming new ecologies.

This study complements research on **the spatial organization of elites** and their role in configuring the IFC network. The notion of elites is more often than not taken to mean power elites, namely, those in positions to take consequential decisions in society's political, military, and economic institutions (Mills, 2000). In business, these are the owners and executives of large corporations. While the power elite is sometimes associated with inherited positions, functional elites ascend to positions of power necessary for the running of complex organizations. The mastery and management of complexity requires expertise, thus as shown in chapter 3, this study expands the category of corporate elites to include (some) experts. Elites are held to occupy particular elite spaces, usually major cities as sites where business and politics intersect, and influence can be sought and exerted. This research highlights SWIFT as a global community of practice, club, and trusted elite/expert network where like-minded competitors can meet, both physically and virtually, to hammer out common strategic action and to innovate collectively based on shared learning among geographically distributed members.

With regard to finance, **the state** in geography research is sometimes narrowly perceived in terms of governance, or considered to play a somewhat passive role in providing less or more attractive regulatory environments for private actors (although recent interventions have explored a more active role for the state in the rise of particular fintech ecosystems (Hendrikse et al., 2019; Migozzi et al., 2023)). The recent empirical and academic resurgence of state capitalism (Alami et al., 2023; Babic et al., 2019; Whiteside et al., 2022) has reawakened interest in the state-finance nexus as an object of research for financial geographers (Lai, 2023). This thesis has focused mainly on the technological drivers of change and on privately provided financial infrastructure. However regulation, legislation, and politics also shape technological systems in important ways (Stearns, 2011), and this thesis also emphasized the crucial role of the state in the provision of money and domestic payments infrastructure. Deeper engagement could examine how state financial actors, such as central banks, are actively involved in economic development, technological innovation, and in creating and configuring financial geographies.

Central banks are "an arm of the state, albeit not of the government" (Honohan 2019, 10) and they impact upon economic geographies as development actors via monetary policy and other means (Epstein, 2005; Khatkate, 1991; Mann, 2010). While sometimes responsible for the supervision of financial institutions and infrastructures, another critical role in providing national payments infrastructure also has a development impact. In deciding who is allowed access to its payment system (and therefore to its reserves, the safest settlement asset) (Bossone et al., 2020), the central bank can influence how attractive its jurisdiction and therefore an IFC is, thereby serving a local, regional, or national development function. For example, allowing new participants direct access to a national payment system rather than indirectly via correspondent banks, can encourage new institutions to apply for a license and locate and begin operations there. This also potentially allows a greater array of financial institutions to provide correspondent services between that financial centre and others. Both the EU and the UK have sought to foster greater competition in payments within their respective jurisdictions (Zachariadis & Ozcan, 2017), in part by opening up direct access to payment systems to non-banks. This is also related to geoeconomic/geopolitical shifts away from the unipolar dollar hegemony and towards a more multipolar world, which may also bring about changes in the hierarchy of IFCs. A rise

in usage of other jurisdictions' currencies could see increased importance of national payment infrastructures for clearing transactions in those currencies, and a concomitant rise in importance of those IFCs as more banks seek to locate there for direct connection to those infrastructures and to provide correspondent services for other banks to connect.

The state legally delineates the boundaries of capitalism (Pistor, 2019) and so can also decide to renegotiate the terms of the public-private partnership with commercial banks. Indeed, the types of institutions included in the definition of a bank in the US has changed several times since the 1950s (Omarova & Tahyar, 2011). This research has shown that SWIFT can be thought of as a club, with exclusive benefits for members. The top tier of membership of SWIFT, which includes ownership, is available only to licensed financial institutions and is thus strictly limited. Banking itself, therefore, can also be considered a club, membership of which is controlled by state-issued licenses (see chapter 5). While there are onerous conditions and responsibilities for receipt of a banking license granting membership of the club, the exclusive benefits and privileges include: access to the safest settlement asset, central banks reserves; the ability to quite literally make money, which banks do every time they grant a loan (Ryan-Collins et al., 2012; Werner, 2014b, 2014a); and regulatory leeway, despite being heavily regulated, especially if considered too big to fail (Christophers, 2016; Dymski, 2011). The club could be a helpful heuristic for analysing dynamics of exclusion and power in finance more broadly, beyond private actors.

Another way in which central banks could potentially influence the geography of financial infrastructure is by setting up multilateral payment platforms which would directly connect payment systems in different jurisdictions. The Bank for International Settlements (BIS), which serves as a forum[27] for central banks (Germain, 1997), has been very active in investigating the technologies and potential of fintech, distributed ledger technology (DLT)/blockchain, and cryptocurrency (Auer et al., 2023). It has set up its own innovation hubs in recent years in different locations, and has been exploring multilateral payment platforms with several central banks (BIS et al., 2023). This could see the replacement of the current privately-run payments infrastructure of correspondent banking replaced by direct links between publicly run national payment systems, raising normative questions about the provision and (geo)politics of critical financial infrastructure. Related to this, the previously mentioned reluctant weaponization of SWIFT by the US in particular but also the EU is because of the power of their currencies, especially the USD (Cohen, 2015; Wheatley, 2013). As Nölke (2023) has shown, this leads to a loss of trust in the supposed neutrality of SWIFT and the building of alternative monetary and information infrastructures to support rival currencies. The future impacts on monetary and financial geographies remains to be seen, perhaps with a splintering into different zones of currency interoperability, which may empower certain private financial actors in particular places as conduits between zones, for example.

Central banks and other actors could also reconfigure the geographies of financial infrastructure via new money forms. I have shown (chapter 2) that the current architecture of financial infrastructures is hundreds of years old and based on the account money form, comprising separate but interdependent processes of settlement (performed by reconciling the ledgers of trusted institutions, banks) and messaging (communication of settlement instructions, or payment transaction data via SWIFT). Cryptocurrency blockchains like Bitcoin and Ethereum have not succeeded in large-scale replacement of the existing financial system and intermediaries. However, the cryptocurrency money form of digital

[27] Originally an informal body lacking legal force but possessing the authoritativeness and technical expertise of a small number of members (Giannini, 2011), it has been characterized as a club for central banks (Douglas-Bowers, 2015; LeBor, 2013).

tokens which, like cash, is a bearer instrument, but which also 'lives' in accounts on shared distributed ledgers (Grym, 2018), is being actively explored by central banks. This CBDC, does not necessarily have to be implemented as a digital token and can also have an account form (A. Lee et al., 2020), however it is the token form that has the most disruptive potential for correspondent banking and for SWIFT. This is because with digital tokens on DLT, there is no separation between information and settlement; rather there is an atomic and instant peer-to-peer combined process of information and settlement. This clearly entirely replaces and disintermediates SWIFT and the chain of correspondents in a payment transaction. This may in part portend a 'publicization' of cross-border payments infrastructure, wherein central banks compete with and take over financial functions that were previously provided by private actors.

Much of the increased involvement of state bodies in finance is in **fintech**, an area of research in which financial geographers are keenly interested (see chapter 1). The discussion of new money forms above shows that the state and financial incumbents have diverted the "radical technologies" of cryptocurrency and blockchain/DLT (Greenfield, 2018) from their intended revolutionary aims of subverting the traditional financial system (Nakamoto, 2008), and appropriated and subsumed them under the fintech category where they are deployed to reinforce this system. New money forms based on digital tokens, require appropriate new financial infrastructure. As previously mentioned, for digital tokens, such infrastructure can be shared ledgers in which settlement and messaging are combined. Blockchain has failed to live up to the earlier hype surrounding it and some of the more prominent projects have already failed to launch or have shut down (Fildes, 2022; Muir, 2022). However, central banks and some financial institutions and infrastructures are pressing with the technology and the number of DLT infrastructure providers has already coalesced around a small number, among them IBM's Hyperledger, Consensys' Quorum (based on the Ethereum blockchain and originally developed by JP Morgan), and most prominently, R3's Corda. Like SWIFT and other financial infrastructures, R3[28] began as a consortium of financial institutions. It is therefore worth examining new financial infrastructures to ascertain the extent to which history repeats itself through the creation of a 'new SWIFT' as a vector for collective incumbent agency.

Implementation of new money forms is likely to be only in specific use cases, at least at first, such as in wholesale payments and for settling securities transactions. The implementation of digital tokens, a process known of tokenization, is not only happening with money but also with securities, the infrastructural architecture of which is also currently based on the account money form, i.e., with separate settlement and messaging. Some financial infrastructure providers are already heavily involved in investigating this, with SIX Digital Exchange (SDX)[29] in Switzerland very far advanced. SDX is part of SIX Group[30], which operates all of the financial infrastructure within Switzerland, including running the national payment system for the Swiss central bank. Apart from investigating the impact of tokenization, the role of vertically integrated financial infrastructure groups in the development of particular national IFCs and their expansion into other IFCs, potentially creating new inter-IFC connections, is an interesting area of research.

As discussed in chapter 1, fintech innovation is mainly conceived of as happening in financial centres, where incubators and innovation hubs are the kernels of ecosystems that allow startups to cluster, flourish, and potentially partner with incumbents. SWIFT fosters bank-friendly technological innovation with outside fintech firms through its Innotribe subsidiary

[28] https://r3.com/
[29] https://www.sdx.com/
[30] https://www.six-group.com/

(Hendrikse et al., 2019). This thesis has highlighted SWIFT, styled by one of its employees during an interview as the original fintech firm, as a transnational community of practice and innovative milieu (Malecki, 2000), in which trust enables the sharing of decentralized knowledge and subsequent innovation across multiple places and organizations. Central banks are engaging in similar collective innovation under the aegis of the BIS Innovation Hub, with hub centres so far established in the financial centres of Hong Kong, Switzerland, London, Stockholm, and New York (BIS, 2021). Incumbent and state involvement in fintech shows that technology is not necessarily disruptive, demonstrating the importance of investigating the innovation as change vs stability/maintenance dichotomy. This supports the prediction that fintech "might ultimately reaffirm the hierarchy of established sectors, firms, and cities" (Derudder & Taylor, 2020, p. 4; cf. Cassis & Wójcik, 2018; Hendrikse et al., 2018; Langley, 2016). The tendency of the IFC network towards relatively stable hierarchy, then, is not merely attributable to the telos of structure, but is in part the outcome of the agency of powerful actors pursuing the strategic design of the network's sociotechnical infrastructure. While this research sheds some light on how these agents achieve this, a compelling further area for research could be a more detailed examination of SWIFT's or the BIS' internal processes of innovation or of governance, for example applying the concept of habitus to innovation culture (Hudson, 2004; Spigel, 2013, 2018). However, this would require extended ethnographic research and access, likely proving very difficult to arrange given these organizations' club-like characteristics.

A final point is that examining infrastructure in depth helps us to add specificity to sometimes abstract conceptualisations of the geographies of infrastructure and finance. Abstraction is both necessary and useful in trying to understand and communicate complex phenomena but can omit or elide important detail. Castells (2007, 2010) sees the informational society as working through the "space of flows", organized in three layers, the first of which is a material and strategically important "circuit of electronic exchanges" (Castells, 2010, p. 442), corresponding to information infrastructure. This conceptualization has received scholarly accusations of reductionism (Cox, 2014) and "'flowsterism': the idea that people, phenomena and processes somehow fly above the stickiness of space in an atmosphere of frictionless fluidity" (Jones et al., 2007, p. 265). While Castells' idea of "networked connection between the local and the global" (Castells, 2010, p. xxxv) captures nicely how cross-border payments are produced at and across different places and scales, the above critiques imply a deterministic reification of technology that attributes agency to it rather than to human actors. Similarly, Clark's (2005) mellifluous metaphor, "money flows like mercury", conjures up images of money's figurative liquidity, as well as some of its more toxic attributes. Those tendencies to run at speed, to pool and re-pool, and to flow evenly over surfaces are not due to any intrinsic property of money, nor do electronic circuits and exchanges exist or route flows by themselves. A lot of contingent and contested work is involved in fashioning and maintaining infrastructure's specific architecture, meaning that money more accurately "hops, nearly skipping over most of what lies in between" (Ferguson, 2005, p. 379), deliberately connecting specific points rather than covering the globe.

The geographies of data/cloud infrastructure forming the basis of the space of flows are important but can neglect the social in favour of the technical. As cloud computing becomes ever more ubiquitous, many organizations will share a similar underlying technical geography. This features oligopolies of submarine internet cable firms, internet services providers, and cloud and data centre providers, situated not in the urban nodes where the symbolic business HQs and workers are, but in more nondescript peri-urban hinterlands and places that are meant to be obscure (Blum, 2013; Burrington, 2016; Eichengreen et al., 2016; Furlong, 2021; Hu, 2015). Technological and social structures influence each

other (Easterling, 2016). Consequently, this study suggests an extra social or relational infrastructure layer, for example comprising contractual business relationships, standards, and rules for the use of physical infrastructure, that is embedded in specific organizations, via which agency is exerted to overcome frictions for some, while sometimes purposefully creating barriers for others. Despite continued attempts to automate some financial flows, all kinds of frictions remain, some of which create work in specific places. Merely examining the 'hardware' alone can show possible connections but cannot tell us much about how the way in which social relations conducted over these connections are organized.

To explore the social/relational layer of correspondent banking relationships in more depth and to gain new insights into changing correspondent relations between banks in IFCs and the implications for geographies of finance, findings from this research could be combined with those of the Global Correspondent Banking 1870-2000 (GloCoBank)[31] historical project. Complementing approaches that quantify and visualize city/firm relations (Storme et al., 2019; Taylor & Derudder, 2016), with access to appropriate data, there is potential for more mixed-method or quantitative research into correspondent banking relations between actors/places (e.g., Brown et al., 2002; Cook & Soramäki, 2014; Grolleman & Jutrsa, 2017). Additionally, this research has shed light on money forms and the composition of often abstractly defined and discussed financial flows (namely, changes to ledgers in particular places in response to electronically transmitted transaction instructions). In light of this and of the observation that the cryptocurrency money form has the potential to reshuffle contemporary financial geographies, (Muellerleile, 2020), further research should examine new money forms to gain a more concrete comprehension of their figurative flows and an understanding of their attendant impact.

Apart from those discussed above, this penultimate paragraph discusses some remaining limitations and potential research topics. Human geography is not immune to debates about the replicability of its research (Wainwright, 2020). A potential limitation of this thesis is that the specificity and relatively small number of types of financial infrastructures in general (there is little real competition, and they fulfil very specific functions) and of SWIFT in particular (both functionally and organizationally) mean that it may be difficult to generalize from this study. This is not necessarily a problem, given the scale and centrality of SWIFT to global finance. However, a related future research topic could be how other large incumbent networks/infrastructures retain their dominance, for example the card payment network duopoly of Visa and Mastercard, and as mentioned above, new financial infrastructures for new money forms. Relatedly, while national financial infrastructures have been demutualized, and consolidated into an ever small number of profit-driven global groups (Petry, 2021), their shareholders typically remain the financial institutions who use them, for example SIX Group is owned by 120 international and domestic financial institutions, with no single absolute majority owner (SIX, n.d.). Cooperative ownership of SWIFT is a key agency maintaining the stability of incumbent and IFC networks, but collective ownership of infrastructure embedded in for-profit firms is another potential vector for achieving these ends. Thus, while FABS firms are important actors in shaping global financial networks (Balmas, 2022), it is not solely their individual agency that shapes financial space but also their collective action through shared ownership of strategic infrastructure. The ways in which this translates into specific geographies, e.g., the specialization of IFCs, merits further investigation. This research has examined the introduction of the economic use of payment transaction data by banks via SWIFT's platformization. While SWIFT's message data has already been exploited by particular states (see appendix 2) for reasons of security and geopolitics, future research could examine the impacts of this newly platformized data,

[31] https://glocobank.web.ox.ac.uk/

particular if interoperable with new money forms like CBDC that have easy surveillance baked in (Westermeier, 2022). In cross-border payments, following increased awareness of problems with the correspondent banking system for cross-border payments, a roadmap for change was proposed by the G20 (FSB, 2018b; IMF, 2017; World Bank Group, 2018). Future research could investigate how such global change is coordinated and implemented across multiple governance actors, national and transnational, public and private.

The research object and outcomes of this thesis present multiple intertwined potential scenarios and avenues for research. Long considered the domain of mere plumbers, financial infrastructure is set to have a profound impact on the geographies of finance, proving it is anything but boring.

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Appendix 1. Full list of interview partners

fw001	European bankers' association employee. Interview in Luxembourg, 19th December 2018.
fw002	Program Director Distributed Ledger Technology, European bank. Interview in Amsterdam, 27th June 2019.
fw003	Senior Research Fellow, European research institute. Phone interview, 13th February 2019.
fw004	Head of Innovation, European bank. Interview in Luxembourg, 10th April 2019.
fw005	Head of Distributed Ledger Technology Lab, European bank. Interview in Amsterdam, 24th May 2019.
fw006	Senior Research Scientist, University of Luxembourg. Interview in Luxembourg, 26th April 2019.
fw007	Blockchain & Digital Transformation, European bank. Interview in Brussels, Belgium, 28th May 2019.
fw008	Vice President, financial technology company. Interview in Brussels, Belgium, June 6th 2019.
fw009	Deputy Head of Digital Banking Division, European bank. Interview in Luxembourg, 14th June 2019.
fw010	Business Development Manager, blockchain trade company. Interview in Dublin, Ireland, 1st July 2019.
fw011	Innovation Catalyst and Blockchain Lead, US global transaction bank. Interview in Dublin, Ireland, 31st July 2019.
fw012	SWIFT employee. Phone interview, 30th July 2019.
fw013	Blockchain Solution Owner, European bank. Interview in Brussels, Belgium, 14th August 2019.
fw014	IT Analyst, European bank. Text chat via messaging app, 20th August 2019.
fw015	Sales Director, financial technology company. Phone interview, 7th Sep 2019.
fw017	Global Head of Banking, blockchain payments company. Phone interview, 13th November 2019.
fw018	Head of Operations & International Expansion, European payments fintech. Phone interview, 30th Sep 2019.
fw019	Head of Growth, European neobroker. Phone interview, 16th October 2019.
fw020	SWIFT employee. Interview in La Hulpe, Belgium, 31st Jan 2020.
fw021	Global Head of Payments, European global transaction bank. Phone interview, 3rd Feb 2020.
fw022	Head of Operations and Outsourcing, European neobank. Phone interview, 14th Feb 2020.
fw023	Vice President of Global Payments, online travel agency. Video interview, 20th Feb 2020.
fw024	Pricing and portfolio manager, European insurance market. Phone interview, 10th March, 2020.
fw025	Business Development, cryptocurrency news website. Phone interview, 17th July 2020.
fw026	Principal Consultant, web3 consulting company. Phone interview, 22nd July 2020.

fw027 Key Account Manager, global payments resource. Phone interview, 30th September 2020.

fw028 SWIFT employee. Video interview, 18th November 2020.

fw029 Director, Financial Sciences and Digital Assets, US technology company. Video interview, 19th November 2020.

fw030 Head of Direct Clearing, US global transaction bank. Video interview, 24th November 2020.

fw031 Director, Global Custody Product Management, US global transaction bank. Video interview, 16th February 2021.

Appendix 2. There is no Alternative: SWIFT as Infrastructure Intermediary in Global Financial Markets

Co-authored with Sabine Dörry and Ben Derudder. FinGeo working paper: Dörry, S., Robinson, G., & Derudder, B. (2018). *There is no Alternative: SWIFT as Infrastructure Intermediary in Global Financial Markets* (Financial Geography Working Paper #22). FinGeo. http://www.fingeo.net/wordpress/wp-content/uploads/2019/02/FinGeoWP22_Doerry_Robinson_Derudder_SwiftGPN.pdf

Abstract

This article explores the changing infrastructural architecture of global finance through the lens of Global Production Networks (GPNs). Financial markets infrastructure (FMI) for international payments and securities trading form the backbone of global finance. However, this FMI is typically hidden from observation, debate, and analysis, partly because international payments have functioned in broadly the same way for almost 50 years, governed by large global banks and the co-operative Society for Worldwide Interbank Financial Telecommunication (SWIFT). A global monopoly sensitive to geo-political upheavals, SWIFT is increasingly influential in acting to the benefit of the world's most powerful financial and political players. Thus, more than a mere passive facilitator of global economic activity, we argue in this paper that FMI forms a carefully crafted socio-economic system of geo-political relevance, whose core components 'power' and 'embeddedness' we seek to comprehend with the GPN framework. We introduce SWIFT as a key player in global FMI and establish a conceptual dialogue between the recently introduced notion of the GPNs of finance and the newly developed idea of the GPNs of financial infrastructure. Incorporating Allen's (1997) power dimensions, we demonstrate their coexistence and complementarity in their carefully orchestrated, tightly intertwined global organizational arrangements. We show that SWIFT's proneness to technological and organizational change threatens to reconfigure long-established actors, processes and relationships in and beyond finance, and argue that this makes an in-depth understanding of FMI vital.

Keywords

SWIFT; financial markets infrastructure; correspondent banking; GPNs of finance; intermediaries

A2.1. Introduction

It has been a decade since the financial crisis prompted a closer examination of financial institutions, with regulatory responses designating some of them as too-big-to-fail and/or systemically important (Dymski, 2011). Yet, alongside the focus on these prominent actors, another group of systemically important financial actors has also come under increased scrutiny post-crisis: financial markets infrastructure (FMI). Also known as financial market utilities, FMI comprises functions and services such as stock exchanges, clearinghouses and securities depositories, as well as processes and systems for payments, clearing and settlement that are core components of the global financial system. FMI links and enables global economic activity, trade, and finance between international financial centers (IFCs), which themselves are "embedded in highly competitive regulatory environments" (Dörry & Dymski, 2018, p. 2). This grants FMI geo-political significance, which has been visible in a number of recent events, for example the Brexit-induced struggle to relocate euro clearing from London within the Eurozone (The Economist, 2017), the blocking of the proposed merger of Deutsche Börse and the London Stock Exchange on the same day that the United Kingdom formally triggered Brexit (Ruddick, 2017), and the striking down of the proposed acquisition of the Chicago Stock Exchange by a Chinese-owned company in the United States (Flitter, 2018). Outages of the US-owned VISA and MasterCard networks in Europe have emphasized reliance on non-EU schemes for cross-border card payments (Mersch, 2018). Protectionist responses to an increasingly technologically self-sufficient China and opposition to US sanctions on Iran have further intensified EU politicians' awareness of the strategic significance of payment systems (Horobin & Jennen, 2018). Based on this, we argue that FMI as an industry as well as the key actors involved in FMI deserve more analytical attention than they have hitherto received. Disentangling the socio-economic structures of governance and coordination helps to develop a more profound and holistic understanding of this 'hidden' backbone of global finance and to extend insights into global finance's power relations, degrees of territorial embeddedness and connectivity, sources of financial risk, and proneness to technological and organizational change. As the latter change threatens to upset and reshuffle long-established actors, processes and relationships in and beyond finance, an in-depth understanding of FMI is of the utmost importance.

In economic geography, the literature often preconditions regional economic development upon there being 'effective' and 'reliable' infrastructure (Munnell & Cook, 1990; Ottaviano, 2008), even though the nature and functioning of that infrastructure often remains somewhat of a black box. Examples range from standard setting of agricultural products (Ouma, 2010), to end-to-end cooling chains and global payment arrangements in tourism (Dörry, 2008), and to the built environment, like transport and housing infrastructure (O'Neill, 2010). This strand of literature, however, remains largely silent on the key character of infrastructures as carefully crafted socio-economic systems of geo-economic and – in the case at hand – geo-political relevance, which this article seeks to highlight. The continued production of infrastructure by public and/or private actors is necessary for the reproduction of capitalism (Appel et al., 2018), but the infrastructure of *finance*, despite its crucial economic role in enabling global trade and finance, its political significance and the current technological upheaval, has largely been neglected in economic geography. Often characterized as the 'plumbing' of the global financial system, and perceived as "boring, low margin and not strategic" (Lord et al., 2015, p. 6), it is poorly understood beyond its well-known intermediary 'facilitating' role. A fundamental function of FMI is the transfer of (exchange) value, more simply known as payment. This "seemingly small, mundane little technicality that sets the world of finance, high and low, in motion" (Maurer, 2012, p. 20) is in fact a huge industry, yet has attracted little academic attention outside of law and business schools (Nelms et al., 2018).

This article seeks to help with rectifying this by means of an analysis of the changing world of the Society for Worldwide Interbank Financial Telecommunication (SWIFT). We try to illustrate the key role of this monopolistic FMI actor that is a long-established, integral part of the global financial system. SWIFT is a financial messaging provider for cross-border payments in the correspondent banking (CB) system. A helpful lens to analyze SWIFT's geo-economic and geo-political power constellations is the tried-and-tested global production networks (GPN) framework. The reason for invoking the GPN framework is that it stresses the significance of the institutional-cum-territorial logics with a strong focus on firm agency that is indeed central to SWIFT's (changing) operation. The recently minted GPN 2.0 approach (Coe & Yeung, 2015) also showcases the critical importance of *intermediaries* as essential lubricants and knowledge providers in today's fragmented global economy. Thus, by invoking a GPN perspective on SWIFT this article seeks to clarify why and how FMI matters. Conducive to accomplishing this is the incorporation of Allen's power dimensions (1997), which we introduce to refine GPN's power aspect. To this end, we examine the CB system: the fragmented and hierarchical network of relationships that has developed over centuries and is concentrated in large, powerful banks geographically embedded in IFCs (Taylor et al., 2014; Wójcik & Burger, 2010). Key to the efficient functioning and globalization of this network is SWIFT, an ostensibly 'neutral' and trusted third party within global finance, whose function, exposure, and ownership and governance structures nonetheless render it geo-politically strategic. We propose the GPN concept as an apt framework for the analysis of the above by extending its notion of intermediaries to include those with infrastructure characteristics. Such actors are crucial in shaping the geography of global finance and a key resource in the relational exercise of power.

Following this introduction, the next section positions the payments industry and SWIFT within the global financial system. We discuss the few academic contributions on this topic, mainly published in business studies, alongside some contributions in law and science and technology. As the activities of finance have become more complex and speculative, the system has developed powerful ordering intermediaries. In this regard, SWIFT itself makes a fascinating case as it is composed of unique actor constellations and ownership structures that add an important geo-political dimension to the debate on global finance. The following section moves on to conceptualize FMI as a key intermediary in organizing international economic and financial activity with the help of the GPN framework and its distinct focus on intermediaries. This aids in assessing SWIFT differently from merely being a facilitator and extends the literature on FMI with its predominant focuses on the technicalities of smoothing its operations to allow uninterrupted financial activities and to minimize financial risk for the trading parties and the financial system as a whole. The penultimate section scrutinizes these patterns through the lens of the GPNs of finance, and adds the FMI's strategic geo-political role, followed by the conclusions in which we discuss the implications for a range of literatures.

A2.2. SWIFT as a powerful intermediary in global trade and finance

Without a payments system, global production and exchange would be impossible. This is echoed in one of the financial system's core economic functions: to provide a payments system that facilitates the exchange of money necessary in the purchase of all goods and services (Dixon, 2011). As access to the payments system is essential to everyday life, it has become an essential part of a country's basic infrastructure (Ingves, 2018). The former governor of the US Federal Reserve (the Fed) observed that "if you wanted to cripple the U.S. economy, you'd take out the payment systems" (Greenspan, 2007, p. 2). While in the past payments were considered a technical back office matter, hidden and obscure in nature, this is no longer the case, with the sector now acknowledged

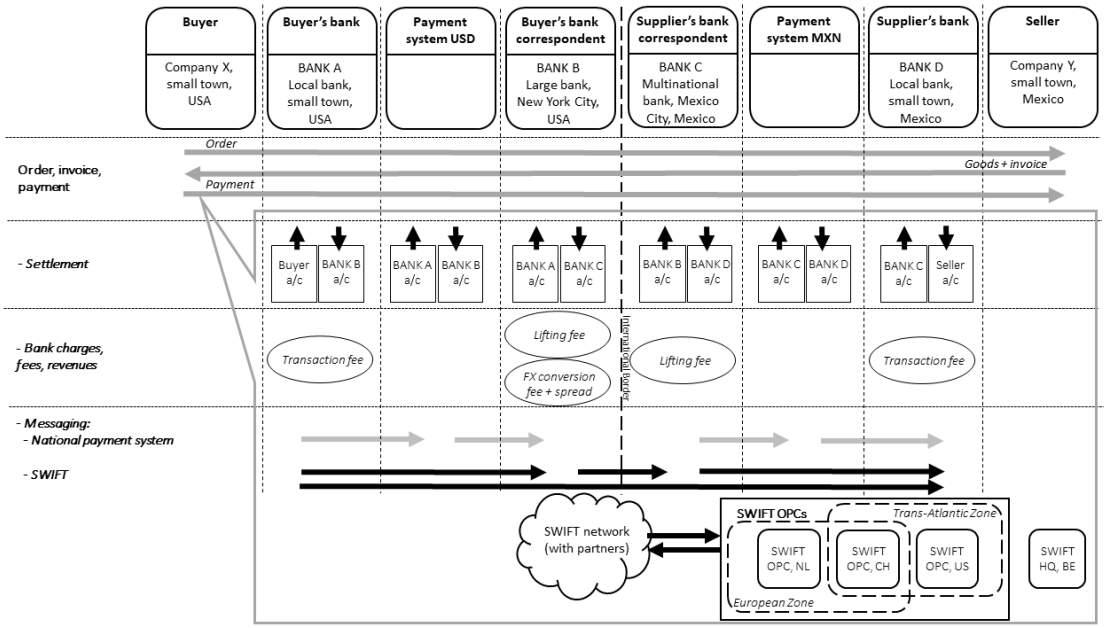
to be of strategic interest (Villeroy de Galhau, 2018). Regulatory and supervisory bodies have designated some FMI actors as systemically important for their role in reducing and managing risk and maintaining stability (Bank of England, 2013; European Commission, n.d.; Financial Stability Oversight Council, 2012). For example, the Committee on Payments and Market Infrastructures (CPMI) is the supranational body for advancing the safety and efficiency of payments, clearing and settlement. Composed of central banks, the CPMI has no formal supranational authority and relies fully on its members' own commitment to carry out its mandate, which is largely concerned with the technicalities of FMI operations to reduce risk and promote financial stability through safe and efficient arrangements for payment, clearing and settlement (CPMI & IOSCO, 2012). While the CPMI provides a framework for managing various kinds of risk, and indeed favors market disciplines for achieving efficiency, FMI in some cases runs counter to this aim by being "a monopoly used by an oligopoly of participants" (Rambure & Nacamuli, 2008, p. 73). We therefore call them 'strategic intermediaries' (on which we will expand in section 4).

Over 500 years old, the CB system evolved to support long-distance trade (Norman et al., 2011) and can be considered to be the foundation of the international financial network. In this system, two banks – the respondent and the correspondent – hold reciprocal accounts with each other in a correspondent banking relationship (CBR): a formalized bi-lateral arrangement between trusted partners. Over centuries, this system has gradually built up to form today's decentralized payment network of siloed national systems. While in the past, domestic payments used CB, the advent of electronic payment systems in the early 1970s brought the centralization of settlement for domestic banking largely via central banks. Centralization has resulted in cost savings and decreased liquidity requirements for banks (Rambure & Nacamuli, 2008). Usually only banks licensed and regulated in that jurisdiction have access to its payments system. As international payments take place ***across*** different currencies and borders, there is no central payment system for such transactions. Instead, banks in one country access another country's payments system via a CBR with a partner bank in that country. Such relationships quickly become hierarchical and nested when smaller banks in one country rely on larger banks in the same country to carry out international transactions. There are an estimated 1.3 million of such contractual (though not transactional) relationships across the banking industry (Zschieschang, 2018). Based on their contracts, both banks negotiate the details of their revenue-based cooperation: *how* they want to handle various aspects of the payments (e.g. different currencies and countries, types of payments from private individuals or businesses); *when* to settle their transactions; *whether* to pre-fund accounts or extend credit; and fees, balances and *who* performs foreign exchange (FX) conversion.

Approximately two-thirds of international payments are conducted via CBRs, with 13 percent conducted "on-us", that is, within a bank's own branches, and the remaining 20 percent using cross-border retail and high-value payment systems (IMF, 2017, p. 44). Thus, for local economies, CBRs provide a crucial connection to the international financial system (World Bank Group, 2018). However, while this system is distributed across the globe, flows end up being concentrated in systemically important banks located in IFCs who form the apex of this hierarchical banking system (Grolleman & Jutrsa, 2017). Since the 2008 crisis, CB has been the subject of reports with concerns about increased concentration among large banks who are withdrawing from the provision of services in some geographic areas due to low profitability and risk compliance concerns. Some of the effects are reduced access to the international financial system and halted economic growth (IMF, 2017; World Bank Group, 2018). In one example, withdrawal of CBRs denominated in US dollar (USD) in Angola, whose economy is heavily dependent on international trade, led to a rebalancing of trade from USD to euro. The subsequent USD shortage, however, affected all sectors of

the economy, including the supply of food and medicine, and subsequently caused inflation. In the case of Belize, the loss of CBRs there greatly increased transaction fees, lengthened payment times, and reduced deposits in banks. Figure A2.1 depicts how the CB system works. Its sound understanding is important, as SWIFT's genesis is inseparable from the CB system.

Figure A2.1. The anatomy of an international payment via correspondent banking



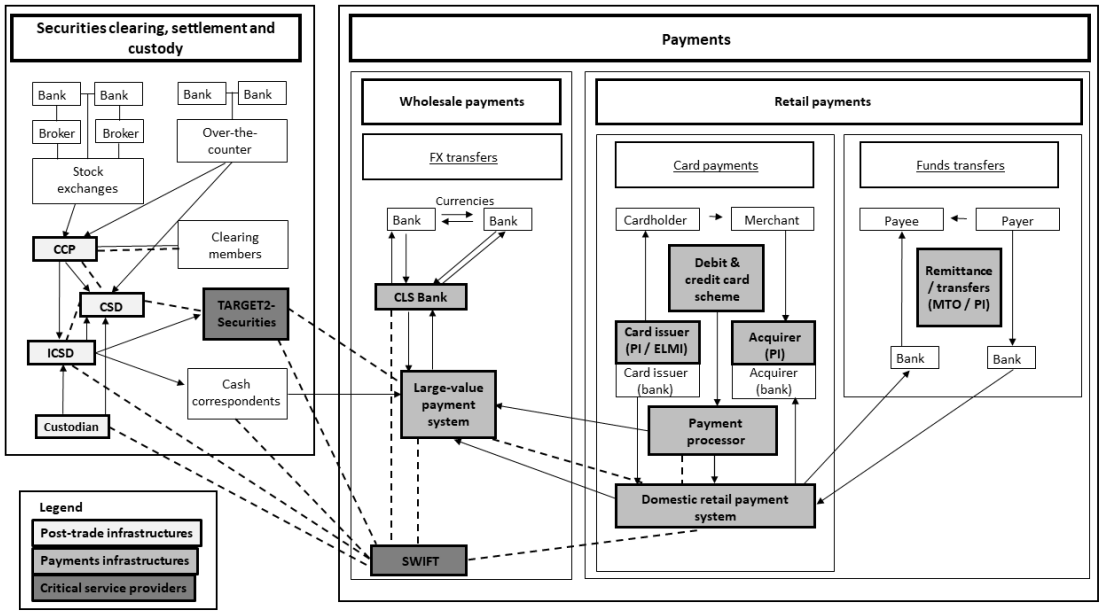
Source: own illustration, based on European Central Bank (2017); Gifford and Cheng (2016); McCune (2014); SWIFT (2016, n.d.b).

Figure A2.1 shows how correspondent banking relationships between the two correspondent banks transfer funds in a particular currency corridor; it also illustrates that messages but not money cross borders. There is a series of domestic transactions with the two banks ending up with more and less money in their respective correspondent accounts (McCune, 2014). Accounts (a/c) are debited and credited (settled) in response to messages transmitted between banks, all this via the SWIFT system. Until the 1970s, freeform messages were transmitted via telex, which was inefficient and costly. SWIFT was established in 1973 by banks to create a standardized, secure and reliable messaging system that would overcome the inefficiencies of telex, and this is still a mainstay of its operations today. Thus, while the flow of funds in CB is concentrated among large banks who settle the payments between each other, a key component and in practice the primary way of communicating payment messages is the global messaging network centralized in SWIFT. Messaging and settlement are the two key pillars at the heart of the CB process. The main actors in the settlement pillar are banks, and settlement occurs in their accounts. As portrayed in figure A2.1, this is not one centralized system, but rather a fragmented, distributed network of over a million bilateral contracts. Via double entry bookkeeping, the acts of changing account and ledger entries and balances involved in settlement make it appear that money has moved across borders. These changes are communicated in the messaging pillar via SWIFT: the single main actor, or lead entity in this pillar. Mediating between all banks as the monopoly provider of the messaging network to all banks, SWIFT is *both intermediary and infrastructure*.

The SWIFT network encompasses both hard and soft infrastructure, such as cables, hardware, software as well as their encoded standards, thus determining how users act for the system to function efficiently. It is precisely for this reason that SWIFT was created, yet its foundation was a contested affair. During the 1960s, US and European banks' needs for reliable computer and telecommunications systems increased with the expansion of global operations, and they began to innovate by developing their own private networks (Scott & Zachariadis, 2014). Although domestic payments had become standardized, international payments were not yet automated because of different languages and procedures and still relied on telex. European banks had begun to co-operate around the 1960s for a number of reasons, amongst them to prepare for the possibility of a monetary union, to react to competition from US banks, and to take advantage of opportunities presented by the Euromarkets. Europeans spearheaded the initiative to examine the feasibility, costs and specifications of a communications network for international payments and related messages. Some US banks came on board by 1971 and SWIFT was eventually founded as a non-profit co-operative in 1973. The choice of Brussels for SWIFT's headquarters – a jurisdiction of high relevance today – was a political compromise in the rivalry between London and New York. The eventual decision to adopt SWIFT was taken in reaction to attempts by First National City Bank (FNCB, now Citi) to have its proprietary messaging system imposed in 1975. Balking at the prospect of being captive to one correspondent bank and using its commercially developed standards in which they had no say, more banks signed up for the cooperative and collaborative SWIFT option instead, thereby giving it critical mass, with the first SWIFT message sent in 1977 (Scott & Zachariadis, 2014). SWIFT today comprises over 11,000 members and is hailed as a model of co-opetition (i.e. cooperative competition), yet its foundation was contested, with fear of being locked into a competitor's system being a crucial factor in driving the adoption of a collective solution by capitalists.

SWIFT's financial messaging system links global securities and payment systems (figure A2.2) making it literally an infrastructure for infrastructures classified as a "critical service provider" by its overseeing central bank (National Bank of Belgium, 2017). National payments systems, and, alternatively, payments systems within a currency union like the euro, are supervised and often also run by a national (or in the case of the euro, the European) central bank. Since no centralized international payments system exists, one of the basic means by which money moves across borders is via the CB system. The bilateral, hierarchical CBRs are a crucial financial conduit. They support trade and provide domestic and cross-border payments, including remittances. As banks extend credit lines and hold balances with each other in the inter-bank market, their interdependency contains systemic risk potential (Wandhöfer & Casu, 2018). SWIFT's financial messaging service transmits the instructions between all participants in this system; SWIFT's network is therefore essential in allowing banks to manage liquidity and risk. The payments industry in general has been growing and provided 34 percent of banking revenues in 2016 (McKinsey & Company, 2017) with revenue from cross-border payments, FX transactions (figure A2.2) and trade services amounting to USD 145 billion (Boston Consulting Group & SWIFT, 2017). While it can be difficult to estimate exact revenues from CB specifically, it is also difficult for customers to obtain exact fees until after the payment transaction (Money Mover & Accourt, 2016). Banks' revenues come from various sources: processing fees charged to the originator and the beneficiary (figure A2.1), interest on 'float' (value difference between debiting the originator and crediting the beneficiary), and FX spreads (Rambure & Nacamuli, 2008). The majority of bank profits comes from FX margin, rather than fees (Collinson, 2017; Money Mover & Accourt, 2016).

Figure A2.2. Interlinkages between financial market infrastructures and the critical service providers T2S (unique within the European Union) and SWIFT



Source: National Bank of Belgium (2017, p. 12), amended by the authors

Financial messaging products and services remain SWIFT's core operations, in which it has a monopoly position for payments; yet, it also handles ever-increasing numbers of messages about securities. However, SWIFT's dominant position and its model of 'co-opetition' do not lead to market power per se: SWIFT's customers (banks) are also its co-owners, and profits are used to subsidize service costs. SWIFT generates its revenues from a variety of sources, including traffic revenues for each message sent, members' initial joining fees and annual support charges, interface revenue from sales of software to connect to its network, software maintenance fees, recurring revenue from charges for connectivity, documentation, directory services, conferences, consulting and training. Profits are returned to members in the form of rebates on SWIFT services (C24 Technologies, 2015; SWIFT, 2018). While banks earn huge profits from their intermediary positions at various points in the settlement process, SWIFT's monopoly intermediary position is attenuated by its infrastructure function and co-operative form: it does not earn *excess* profits from its users as they are also its owners, acting as a "not-for-profit *maximization*" (Scott & Zachariadis, 2014, p. 30 emphasis in original) organization.

This ownership model allows SWIFT to act with some autonomy relative to its owners but can also allow them to profit from an inability or unwillingness to implement costly but efficient process and technology innovations. Indeed, while SWIFT's role has expanded since its inception, its messaging system has changed comparatively little and still incorporates basic elements of the legacy technology that it replaced. The area of CB exemplifies this: its logic has not changed for hundreds of years, and the current technology is still largely the same as in the 1970s. With the aim of disentangling the interwoven complexities of SWIFT's technical role as monopoly provider of essential global financial infrastructure, its co-operative ownership by banks, and its intermediary position between these same actors, in the following section we explore extant research on SWIFT and on infrastructure. We suggest specifically that the GPN framework would be useful for appraising questions of embeddedness and power that arise from this confluence.

A2.3. The GPNs of finance and financial markets infrastructure

A2.3.1. Framing FMI

The academic literature on FMI is thin, and mainly covers SWIFT from the perspective of business studies, law, and science and technology. In the process, SWIFT is often cast as a "medium for the transmission of financial messages" (Kozolchyk, 1992, p. 46) as it does not perform settlement of transactions itself. The reading of SWIFT as a rather passive facilitator is echoed by Kaunert et al. (2012), although the main object of their analysis is to explain the socio-economic composition of SWIFT. From a business history perspective, Scott and Zachariadis (2014) aim to dispel the view of SWIFT as merely financial plumbing and provide a nuanced, empirical examination of its history and development. While contextualizing this in the historic juncture at which SWIFT was created, the focus is on SWIFT's co-operative status in assuming its ever-growing importance as a standards, technology and community hub for global finance. The authors see it as part of a generation of private organizations performing global governance, which is susceptible to being used as a political tool through its unavoidable entanglement with external influences. However, despite asserting that SWIFT is far from a passive actor, the role of its complex governance structure, including the "national or country-level voice" principle (Scott & Zachariadis, 2014, p. 32), is not really discussed with regard to controversies in which SWIFT has been involved. While SWIFT may self-present as a neutral global organization providing a crucial economic and financial infrastructure, powerful private financial institutions own and govern SWIFT and clearly bias its governance towards the heaviest users of the network. Of all of SWIFT's member organizations only banks can actually own shares, which favors US banks as SWIFT's heaviest users (Cowan, 2017) (see also FX transfers, mainly denominated in USD, in figure A2.2). We return to this notion of unbalanced power in section 4 where the multiple controversies of SWIFT demonstrate the complexities of this intermediary organization.

The social sciences have seen a turn towards new and more nuanced understandings of infrastructure, recognizing that not just its material but also its immaterial forms set the rules and standards shaping the rhythms and flows of social life (Appel et al., 2018; Easterling, 2016). Work such as that on the foundational economy (Bentham et al., 2013) recognizes the importance and politics of national infrastructure, broadly defined as providing territorially distributed goods and services that are often taken for granted and which are either directly or indirectly authorized by the state. However, the crucial coordinating intermediary role of *inter*national infrastructure as a bridge between disparate jurisdictions in the global economy has been much less explored from this vantage point. Featuring characteristics of public goods but largely provided and controlled by private actors, the governance of *financial* infrastructure has been analyzed in terms of market power (Lee, 2011). Depending primarily on whether there is competition in the provision of services in a particular area, market power's economic effects enable firms enjoying a (near) monopolistic position to engage in abusive or anticompetitive behavior, yet this insufficiently captures the more nuanced ways in which infrastructure is related to power. Neither a thing that moves across space nor a blanket force emitted from a center and experienced uniformly within its range, power is relational; the effect of social interaction and resources mobilized over space. The various modes of power, ranging from the more overt domination and authority to subtler techniques such as seduction and inducement, are modulated and experienced differently due to geography and actors' varying abilities to deploy resources effectively. Thus, a relational understanding of power as exercised across space via "a succession of mediated relations or through the establishment of a simultaneous presence" (Allen, 2003, p. 2) allows us to consider how the characteristics of infrastructure, particularly

its embeddedness in and intermediary role between territories, make it a potent resource and medium. The location of a resource influences and is influenced by its mobilization in the exercise of power. However, merely controlling a resource does not automatically infer power upon an actor: as power is enacted relationally, resource governance is key. Building on this notion of relational power, we apply this to SWIFT as a distinctive infrastructure and intermediary whose singularity of function, governance and ownership grant it a powerful role, not just within networks of global financial activity, but also without.

A2.3.2. Linking FMI with the GPNs of finance

Starting from the observation that today's global economy does not only rely on trade between national economies but on "the tightly coordinated global … networks of firms that … are the key organizational form" (Coe & Yeung, 2015, p. 9), leading GPN scholars have forged a new focus on *intermediaries*. The GPN 2.0 framework (Coe & Yeung, 2015) stresses the importance of the 'connecting' economic and non-economic actors that help to produce goods and services across various geographic locations for the world's markets. GPN 2.0 is a useful heuristic for capturing the logic and workings of SWIFT's network for the following reasons, thereby also addressing some of its blind spots.

First, the GPN framework is well suited to grasp the underlying logics of financial *infrastructure* that weaves firms and places into the global networks that make up the financial bloodstream. It therefore helps to shed light on the (distinct) workings of infrastructure as a neglected yet indispensable backbone of global economic activity. International finance is broadly concerned with national economies and their monetary and macroeconomic interrelations. Recent applications of the GPN framework have focused on finance with two distinct directions. *First*, the global financial network (GFN) agenda (Coe et al., 2014) seeks to shed light on the triadic entanglement between the financial and advanced business services (FABS) intermediaries who link the territories of world cities and offshore jurisdictions and, in so doing, mediate relations between global economic activity and its anchorage in specific regions (Coe et al., 2014). In spite of its analytical power, the GFN fails to fully recognize intermediaries in the globalized processes of connecting and embedding, that is, entities responsible for designing and running the mediating infrastructure in addition to providing the mediating services. Infrastructure is, however, not just a given technical device. Rather, infrastructure itself forms a carefully crafted socio-economic system. Hence, second, the literature on the GPNs of finance (Dörry, 2015, 2016) is particularly useful to comprehend "the GPNs of financial products, instruments and practices, themselves …, i.e. the global organization of financial intermediaries of all kinds, and their interplay with specialized production sites, i.e. financial centres" (Dörry, 2016, p. 4). In this spirit, we make a plea to broaden and deepen the notion of intermediaries in the GPN framework. This includes firms but also forms of inter-firm collaboration responsible for building, organizing and running the infrastructure and services, as presented with SWIFT and CB.

Second, the GPN 2.0 approach seeks to strengthen our understanding of agency. Acknowledging that "the under-theorization of … intermediaries in global production networks … represents a missing link in our existing knowledge base" (Coe & Yeung, 2015, p. 51), it introduces intermediaries as a largely ignored group of powerful actors in the organization of GPNs. Coe and Yeung distinguish three discrete groups of strategic – and often powerful – intermediaries that help to facilitate international trade and financial flows across sectors: financial intermediaries, logistics intermediaries, and standards intermediaries. However, building on the introduction of SWIFT as a key player in the global FMI, we seek to broaden Coe and Yeung's "endeavour to offer greater analytical purchase on the processes of network formation, coordination, and configuration" (2015, p. 24) and

introduce *infrastructure intermediaries* as a missing, yet essential group of intermediaries to the debate. We thereby specifically focus on the financial links that build the GPNs' vital connections and underpin their flows. SWIFT and the places in which it is anchored can therefore be defined, following Callon's terminology (1986, p. 204), as "obligatory passage points" in the global financial system (e.g. Bassens & van Meeteren, 2015). More than a mere passive facilitator of economic activity and a neutral provider of a level playing field, today SWIFT is a global monopoly highly sensitive to geo-political upheavals in the world. At the same time, it is increasingly influential and seemingly prone to act to the benefit of the world's most powerful financial and political players. Not just a market actor, SWIFT has also become a market maker: its actions can significantly influence the payment industry and thereby make it bigger or smaller. SWIFT's geo-political and geo-economic significance stems from its intermediary position within global financial networks: it mediates between the world's banks and FMIs, but it incorporates features of both a public good and a private co-operative organization run on a profit-making basis, with profits recycled into SWIFT's system. In its role and function of a key infrastructure provider of global geo-political and geo-economic importance, we argue that SWIFT forms a carefully crafted socio-economic system in itself.

Third, the GPN framework helps draw attention to FMI's particular power structures both within and outside FMI (Coe et al., 2008). Considering the cooperatively run SWIFT as a *private monopoly* with a distinct public good character in the CB system (see figure A2.1), the observation of relational and structural power constellations between SWIFT's member banks, the materialization of power structures and dependencies 'imported' from the outside geo-political environment, as well as the mutual interest combining the network actors are noteworthy. FMI, however, shares further characteristics with GPN arrangements, dubbed 'embeddedness' (Hess, 2004). SWIFT's historic emergence is closely linked with the geo-political situation in the 1970s. Although the geo-economic and geo-political environments have significantly changed since, its historic origins still shape SWIFT's internal organization, its power structures and the degree of functional connectivity, whilst its institutional-cum-territorial logic is echoed in the specific national anchoring of SWIFT's operating centers (OPCs; see section 4). The GPN framework has mainly dealt with forms of firm competition and oligopolies; monopoly constellations, however, challenge the concept and its notion of lead firm-based governance in particular. Yet, we show that both the GPNs of financial products and services and the GPNs of financial infrastructure coexist and complement each other in their carefully orchestrated, tightly intertwined global organizational arrangements, in which *financial risk* (management) features prominently (Clark et al., 2009).

Large banks' locations are significant, often with symbolically ostentatious offices in IFCs; the nodes which international payment flows are concentrated in and channeled through. SWIFT's presence is spatially significant in a different way. As an *intermediary*, SWIFT is interposed as a connecting medium between the nodes in a payment and a bridge between national currencies, while as an *infrastructure*, SWIFT is always and everywhere present throughout the flow. Both roles are fulfilled not only via SWIFT's software and hardware, but by setting and enforcing the standards and rules that govern international payment flows, for example via the Business Identifier Code (BIC) essential for making a payment. The geographies of both the intermediary and the infrastructure concepts are powerful, though largely veiled, as discussed in the following sections.

A2.4. Powerful infrastructure intermediary: SWIFT's geo-economics and geo-politics

Drawing on John Allen's (1997) conception of power – power as a capacity, as a medium, and as a technology – this section engages with the interplay within and between

the different authorities of SWIFT's governance and oversight, and its embeddedness in particular regulatory jurisdictions, from which SWIFT's geo-economic and geo-political significance originates. A slight difference with Allen's original power typology, however, is that we deal with a monopoly with command and control over key aspects of a social system that defines the core of the world's global economy and "mediate[s] relationships which involve different modes of power in overlapping and coexisting spatial arrangements" (Allen, 1997, p. 65). Nonetheless, Allen's basic concepts of power provide a useful sorting mechanism of SWIFT's geo-economic and geo-political power dimensions: *power as a capacity* essentially inscribes agents' power over others through inherent social (and material) relationships of domination and subordination, thus ultimately controlling economic space. Meanwhile, *power as a (fluid) medium* stresses the 'power to', the way in which agents generate and deploy power by strategically mobilizing (own and collective) resources. Finally, *power as a technology* highlights "that power works on subjects, not over them or simply as a resource" (Allen, 1997, p. 63). Anchored in institutional spaces, the exercise of power includes arrays of strategies, techniques and practices, for example strategic location choices that (indirectly) enable/control other agents' flexibility.

Table A2.1. Suggested SWIFT power dimensions

Power as a…	SWIFT's geo-economic power structures	SWIFT's geo-political sensitivities
…capacity ('power over')	HQ location as part of SWIFT's (legal) infrastructure; OPCs locations to regulate data protection	Oversight by a range of differently powerful regulators (Belgium, EU, US); global reach of USD as key reserve currency
…medium ('power to')	Defending position as the gatekeeping intermediary in global finance (access control to the entire system)	Defending position as monopolistic infrastructure in global finance (concerted action by co-opetition of SWIFT's member banks)
...technology (power anchored in institutional space)	Monopoly; established network externalities; unequal ownership structure	Influence of national powers on SWIFT's individual board members over sanctions imposed on, e.g. Russia, Iran

Source: authors, based on Allen's (1997) power dimensions.

Below, we discuss how identified power dimensions link and materialize with SWIFT's socio-economic compositions. We start with SWIFT's 'power as capacity' before touching each of the identified power dimensions in no particular order. Infrastructure – both hard- and software – is territorially grounded and thus subject to the regulations of a respective jurisdiction. Headquartered in Belgium, SWIFT has offices all over the world. Its operating centers, in which every message is processed and stored for up to 124 days, are, however, located in the Netherlands, Switzerland, and the United States, thus, being embedded in carefully chosen institutional environments (Hess, 2004; Yeung, 2009). Messages are always stored in two OPCs for resilience in case of disaster-recovery (SWIFT, 2016). The location of OPCs is not merely a technical consideration: data has a footprint and always resides in particular jurisdictions. The Dutch and Swiss OPCs comprise the European Zone, and the Swiss and US OPCs the Trans-Atlantic Zone. Intra-EU messages remain within the European Zone.

SWIFT's involvement in a number of international political events echoes some fundamental controversies, in which the intricate interplay of SWIFT's governance, oversight and territorial embeddedness are apparent. The highest-profile example was what became known as the 'SWIFT affair' when, following the 9/11 terrorist attacks in the United States, SWIFT supplied financial data to US authorities to allow them to analyze financial flows and thereby identify and thwart terrorist activity (de Goede, 2012). Due to having a branch in the United States, SWIFT was legally compelled to comply with US subpoenas to provide access to the data. However, despite wanting to preserve its neutral and trusted position, the nationally focused and unequal nature of SWIFT's internal governance and oversight also played a part. The CEO at the time, Leonard Schrank, was "there to cooperate [with US authorities] seeing himself first and foremost as an American" (Zarate, 2013, p. 52). He persuaded the board to co-operate with the US authorities, despite potential criticism from member banks, European politicians and a privacy-conscious European Union. When the SWIFT board grew uneasy about the continuation of the data access program, Alan Greenspan, the then-chairman of the Fed and one of the members of the SWIFT Oversight Group, exerted influence on the other central bankers involved in SWIFT oversight to persuade them to maintain co-operation. High-ranking figures from US national security and politics also persuaded SWIFT board members during visits to Washington (Zarate, 2013). Having made confidentiality agreements with the United States regarding the data transfer and not informed EU data protection authorities, SWIFT subsequently found itself under investigation by the Belgian Privacy Commission when knowledge of the program became public in 2006. Incorporated in Belgium, SWIFT is subject to Belgian data protection law, which implements the EU Data Protection Directive (Fuster et al., 2008). This prompted SWIFT to re-design its OPC architecture to that depicted in figure A2.1.

SWIFT has since been unable to avoid further politicization as it has made actors both aware and wary of its potential as a geopolitical tool. In 2012, SWIFT disconnected Iranian banks from its network in response to sanctions imposed by the European Council (SWIFT, 2012). The apparent success of this in persuading Iran to negotiate over its nuclear program, also led to calls from some in the United States and the European Union to disconnect Russia in response to its invasion of Ukraine (The Economist, 2014). China and Russia's view of SWIFT use as a political weapon of the West, has seen both voice the need to develop an alternative (Tett & Farchy, 2015; Wildau, 2015). Since the election of President Trump, US and EU views are increasingly divergent. As the United States has reactivated sanctions, SWIFT may once again have to disconnect Iran or face US punishment of its board members and their employers, such as US travel bans and restricted ability for banks to conduct business in the United States (Peel & Brunsden, 2018). This has ironically led to some calls in the European Union for SWIFT to be made more independent from the United States (Horobin & Jennen, 2018). The USD is the overwhelmingly dominant currency in FX trading (Wójcik et al., 2017) and in world trade, with the currency channeled through the US payment system and banks, overseen by the Fed. USD CBRs are thus critical for trading countries to access the global financial system (IMF, 2017). This notion of external power configurations imported to FMI's internal operations goes far beyond the GPN's explanation and power terminology of inter-firm control and lead firms (e.g. Gibbon, 2008; Hamilton & Gereffi, 2008; Ponte et al., 2011).

The organization of the global payment network has benefitted from increasing external network effects as – with the increasing importance of finance and financial institutions in society – cross-currency payments along with the new demand for these fundamental payment services has risen sharply. Both the setting and enforcement of standards upon network users mean that SWIFT shares some of the characteristics of a "lead firm" (Coe et al., 2004; Gereffi & Korzeniewicz, 1994), although we might perhaps call it more accurately

"lead entity", given its co-operative corporate form and ownership structure. This also ties in with SWIFT's unique governance structure. While SWIFT is governed by a board composed of individuals from some of its member banks, it is not ownership by equals. Since banks control access to the payments system via CB, access to the provision of these payment services is via a fragmented, hierarchical network of 'equal' banks, who act as gatekeepers. The infrastructure and standards underpinning this system is provided by the SWIFT co-operative owned by these same banks and overseen by national financial authorities. This governance structure at times refracts or concentrates control in unequal ways, and sometimes allows SWIFT to operate with relative autonomy. Diverging from Gereffi et al.'s (2005) governance concept of lead firms, the defining factors for SWIFT's governance model are not product and process complexity, transaction codification, and supplier capability, but rather streamlining inefficient processes and thereby enhancing global expansion while managing financial risk that has evolved over time.

Although SWIFT's membership has expanded in recent times to include other members of the finance sector and even some non-finance firms, its original members – banks – were at first opposed to such an expansion. Only supervised financial institutions are eligible to own shares in SWIFT while other members have access to fewer SWIFT services and are not eligible to be shareholders. There is also an uneven distribution of voting rights among members, with national usage of SWIFT messaging determining shareholding allocation, which in turn determines composition of the board of directors (SWIFT, n.d.a). Ownership and control are disproportionally allocated according to national usage of SWIFT's basic services; and this determines influence over matters such as the election of the board of directors, power to change bylaws, and votes at general meetings to influence strategy. The composition of the board is weighted proportionally by national shareholding (using a formula), and the board then chooses a chairperson and the deputy from among its members. Thus, the national or country-level voice is a key feature of SWIFT's governance.

Neither a payment nor a settlement system, SWIFT is not regulated by financial supervisors. Since 1998 it has been subject to oversight (focusing mainly on maintaining stability) by the G-10 central banks and the ECB, with the National Bank of Belgium (NBB) acting as lead overseer, as SWIFT is incorporated in Belgium (SWIFT, n.d.a). The NBB and SWIFT maintain "a continuous relationship, with regular ad hoc meetings" (National Bank of Belgium, 2017, p. 70). Cooperative oversight is conducted through the Oversight Group, which includes the chairperson of the CPMI as well as the central banks. Within this, the Executive Group is composed of representatives of the Bank of Japan, the Federal Reserve Board, the Bank of England, the ECB and the NBB; this group meets with SWIFT's board and management. With only one non-Western country involved in oversight, this reflects global financial power at the time of SWIFT's creation. The post-crisis loss of moral authority and slow shift of power away from the West is reflected in the 2012 creation of the SWIFT Oversight Forum, in which the G-10 shares information on SWIFT oversight with a further 10 central banks (SWIFT, n.d.a). The latter, however, are not members of the core Oversight Group. SWIFT is thus a child of its time, born of the Euromarkets-enabled globalization of US and European financial firms.

Although stressing its apolitical nature and creating "a 'grand narrative' about itself as the world's foremost secure trusted third party" (Scott & Zachariadis, 2014, p. 138), SWIFTs governance structure and internal politics still reflect these roots. SWIFT's historic origins have set a path difficult to alter as its institutional embeddedness ties in with its intricate internal power relationships that cannot be separated from the external geo-political environments. These complexities are typical for international infrastructures, which are

beyond the control of individual states and economic actors, thus, influencing SWIFT's own geo-economic actions and strategic decisions with effects on the entire world economy.

A2.5. Conclusion

This analysis has sought to shed light on FMI as much more than a mere technical matter of facilitation. It has done so by focusing on the mundane yet fundamental and profitable area of payments. Within this, we examined the CB system, a core function of the global financial system underpinning the network of IFCs going back centuries, and the role of SWIFT as a crucial messaging infrastructure enabling this. CB therefore reinforces the power of a rather exclusive network of IFCs, which defines a vital, but generally neglected dimension of centralized financial power. SWIFT is variously perceived as an intermediary and a crucial infrastructure but also characterized as an entity of global governance which somewhat glosses over its creation, ownership and governance by powerful private institutions. Far from being the self-proclaimed neutral actor, we illustrated how the economic intermediary SWIFT is also highly political through its function and exposure, and consists of a politically sensitive ownership structure, which itself adds yet another layer of complexity. This notion points to another aspect that makes the investigation and empirical scrutiny of financial markets infrastructure so timely and apt for economic and financial geographers. Literature on infrastructure largely focuses on domestic infrastructure. International infrastructure by its nature, however, does not fall under the remit of any one state. In the case of SWIFT, it is thus likely to be provided by private actors to meet their own needs. Yet it is still located between and within distinct territorialities and is as such a crucial resource in the relational exercise of control and power over firms and space.

For these reasons, this article engages with and further develops the emerging literatures on both international infrastructure and intermediaries. The GPN 2.0 concept has more strongly placed the spotlight on intermediaries in its analysis of important shapers of the global economy, and we have sought to extend and complement the suggested three groups of intermediaries in GPN 2.0 by introducing the CB-cum-SWIFT organization as an infrastructure intermediary. This new group helps to understand a kind of intermediary not yet covered in the typology but vital at many different levels and dimensions for the global political economy, as we illustrated in several examples in the article. We reflected the manifold, overlapping power intricacies with the help of John Allen's apt conceptualizations of power, which enabled us to develop a more nuanced though holistic understanding of this 'hidden' backbone of global finance and to elucidate the geo-economic dimension of SWIFT. We highlighted the ways in which complex governance structures and territorial embeddedness feed back on each other in a politicized process, which influences the geography of global finance.

Our analysis shows that privately governed international infrastructure intermediaries are significant actors, both in maintaining banks' profitable position within the global financial system and in shaping access to this system. In order to deepen our comprehension of FMI's geo-political dimension in global finance, both as controlling and controlled social entities, further analytical and empirical attention should be paid to the complexities and interaction of corporate form, ownership, governance and politics in the exercise of power. To this end we incorporate the GPN framework, although we are wary not to overstretch the concept.

Thus, the crucial function of FMI processes and actors in reproducing the international financial system mean that they should be of interest to economic geographers. This is particularly salient at a time when financial technological (FinTech) innovations may instill rare political and topological reconfigurations of the established order. A brief review of the

current SWIFT-CB system shows that although the system is secure and global, it suffers from drawbacks. Increasingly concentrated among fewer large banks, it is also slow, expensive, opaque, and carries risks for banks. On top of FX spreads, for example, a payment can cost up to 60 EUR and can take between three and five working days, with transparency in pricing, timing and tracking significantly lacking. A lack of standardization means payments are error-prone, often requiring costly and time-consuming manual intervention, while anti-money laundering (AML) and know your customer (KYC) regulatory compliance is also costly (McKinsey & Company, 2015). Maintaining correspondent accounts impacts the treasury, liquidity and risk positions of both banks' positions (Rambure & Nacamuli, 2008) and makes it increasingly expensive for even large banks to preserve. Some early FinTech challenger firms are about to launch their new businesses and threaten the established order. Yet, change seems to come about only slowly. Empirical scrutiny of the technological capabilities of these FinTech challengers and their potential barriers to disruption by the well-integrated SWIFT-CB intermediary infrastructure is well under way.

Acknowledgments

The authors thank Paolo Balmas, Hossein Nabilou, and the participants at the seminar on 'The Future of Fintech: The Politics of Technological Innovation in Finance', University of Luxembourg, 22 October 2018, for thoughtful comments that helped much to improve this manuscript.

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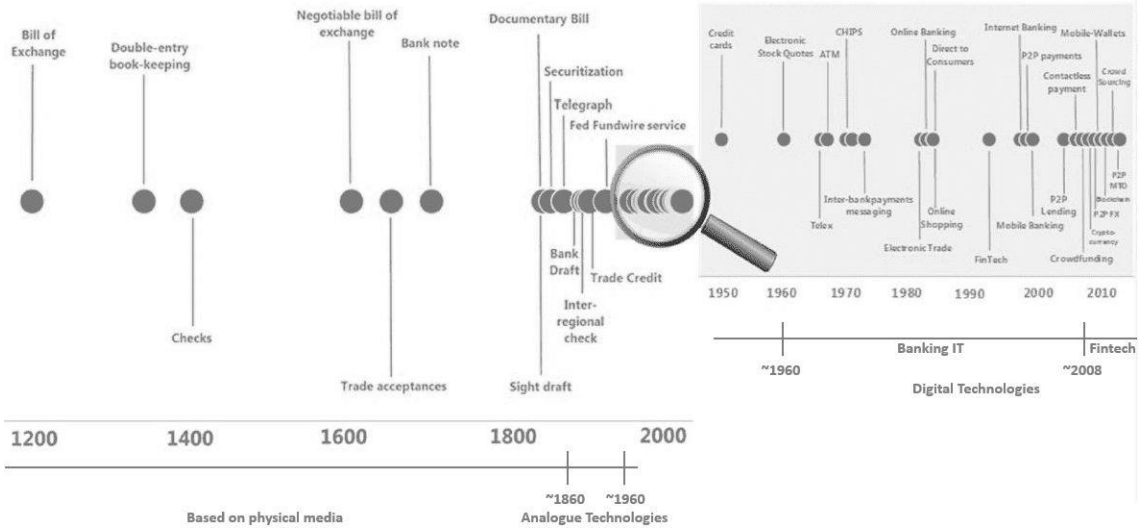
Appendix 3. Evolution of technological change in finance

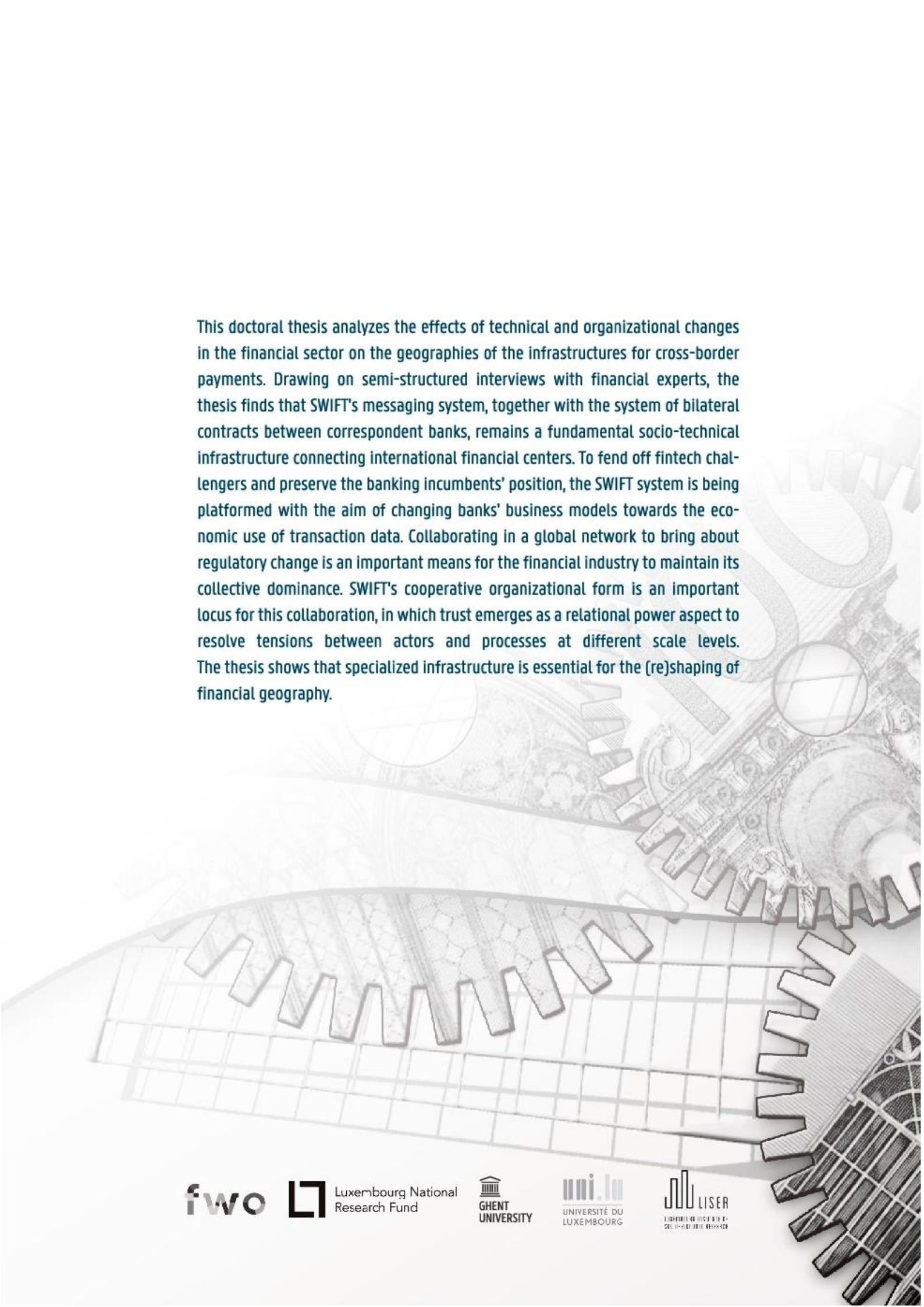
Figure A3.1. Evolution of technological change in finance



Sources: Alt, Beck, and Smits (2018); He et al. (2017)

Figure A3.1 shows technological change in finance over time, tracing at the bottom of the figure three broad ranges based on physical media from around 1200 to 1860, analogue technologies from roughly 1860 to 1960, and digital technologies from around 1960 on. The zoomed in section on the right shows the accelerated and concentrated changes that have happened since the advent of digital technologies, beginning around 1960.

This doctoral thesis analyzes the effects of technical and organizational changes in the financial sector on the geographies of the infrastructures for cross-border payments. Drawing on semi-structured interviews with financial experts, the thesis finds that SWIFT's messaging system, together with the system of bilateral contracts between correspondent banks, remains a fundamental socio-technical infrastructure connecting international financial centers. To fend off fintech challengers and preserve the banking incumbents' position, the SWIFT system is being platformed with the aim of changing banks' business models towards the economic use of transaction data. Collaborating in a global network to bring about regulatory change is an important means for the financial industry to maintain its collective dominance. SWIFT's cooperative organizational form is an important locus for this collaboration, in which trust emerges as a relational power aspect to resolve tensions between actors and processes at different scale levels. The thesis shows that specialized infrastructure is essential for the (re)shaping of financial geography.



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