



# Blockchain Technologies and Remittances: From Financial Inclusion to Correspondent Banking

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Since their emergence, blockchain technologies have shown potential for financial inclusion and the formalization of remittances. Recently, regulators and practitioners have studied the capabilities of blockchain technologies to streamline and, potentially, replace the infrastructure underpinning cross-border payments and remittances, i.e., correspondent banking. Correspondent Banking Relationships, also called “Nostro-Vostro accounts,” are continuous bilateral arrangements that enable banks to provide services in countries where they do not directly operate. After the Global Financial Crisis, this infrastructure has undergone “de-risking,” i.e., a reduction of correspondent accounts and their concentration in fewer financial institutions, with especially detrimental effects on costs and speed of retail cross-border remittances. The existing literature has mostly focused on the point of sale of remittances, often overlooking correspondent banking. This paper, in contrast, connects remittances, blockchain technologies, and correspondent banking with the growing interest of critical social science in the significance of payment infrastructures for the constitution and configuration of money, finance, and markets. By unpacking the critical case of Ripple, this paper shows that blockchain applications to remittances focus on profits, risks, costs, interoperability, “trapped liquidity,” and “idle capital” in correspondent banking accounts, rather than on financial inclusion *per se*. In so doing, this paper contributes to critical social studies literature on the formalization of remittances, understood as the transformation of remittances into a market frontier. Blockchain applications are shown to foster, rather than resist, remittances formalization, and they are presently being incorporated into existing infrastructures, business models, and regulatory structures. Rather than representing radically alternative monetary systems, blockchain technologies are the latest iteration of technologies heralding frictionless capitalism. Lastly, this paper shows the tensions and ambiguities inherent to interoperability and formalization. Blockchain technologies are dynamic in a way that problematizes dichotomies such formal-informal and mainstream-alternative. Hence, rather than providing a quantitative assessment of the impact of blockchain technologies, this paper investigates the ambiguities and tensions in the political economy and imaginaries inscribed in the materiality and design of blockchain-enabled payment systems.

**Keywords:** remittances, formalization, correspondent banking, de-risking, blockchain technologies, cross-border payments, infrastructures, inclusion

## INTRODUCTION

Cross-border payments have been one of the earliest and most promising applications of blockchain technologies (Mills et al., 2016). This is hardly surprising since blockchain technologies emerged to manage monetary transactions in Bitcoin's distributed network (Nakamoto et al., 2019). Blockchain and Distributed Ledger Technologies (DLTs) promise instant clearing and settlement, and immutable and transparent recording of transactions (Ali et al., 2014; Mori, 2016; Godfrey-Welch et al., 2018). Emerging at the fringe of formal finance, and often in opposition to it, blockchain technologies are presently caught in a dynamic of "co-opetition" (Leal, 2014), i.e., of de-politicization of their design, and increased competition between business implementations. Corporate co-optation of blockchain technologies leads to ambiguous dynamics in the payment space, caught in between interoperability and enclosure, disintermediation and re-intermediation, disruption, and rent extraction (O'Dwyer, 2012, 2015).

Regulators, established financial institutions, and non-governmental organizations (NGOs) are turning toward blockchain technologies as promising tools for financial inclusion of the "unbanked" and "underserved," and for the "formalization" (Mitchell, 2007) of hitherto informal value transfers, such as remittances (Silverberg et al., 2015; IMF, 2017; World Bank, 2017). Several start-ups and established firms are pursuing a similar agenda for more inclusive cross-border payments and remittance transfers. Four firms are frequently mentioned: BitPesa, Abra, Stellar, and Ripple. This study focuses on Ripple, a start-up that promises to use blockchain technologies and interoperability protocols to streamline the underpinning infrastructure of remittances, that is, correspondent banking.

Remittances have long been part of a "financial inclusion assemblage" (Schwittay, 2011) that comprises public agencies, NGOs, IGOs, private actors, and consortia, striving toward inclusion, and, more recently, digitization. At the same time, the "migration-development nexus" discourse frames remittances as an untapped market of informal value transfer (Durand et al., 1996; Bailey, 2005; Davies, 2007; Faist, 2008) that could explode in magnitude if more people had access to formalized financial services and mobile and digital technologies (cf. Kleine and Unwin, 2009; Roy, 2010; Mader, 2018). An impetus toward formalization drives both inclusion and digitization (Mader, 2016; Datta, 2017). Formalization stands for the effort toward making visible informal assets and internalizing them into market dynamics (Mitchell, 2007). Formalization turns remittances into assets that can be capitalized upon by extracting transaction fees, monetizing users' data, and leveraging these payment streams into more sophisticated financial products (Hudson, 2008; Gabor and Brooks, 2017).

The existing critical, inter-disciplinary social scientific literature in which this paper is situated tends to focus on the point of sale and the everyday experiences and subjectivities of remittance payers and payees, and thereby leaves payment infrastructures under-researched. This paper, in contrast, will make a distinctive contribution by connecting the study of remittances with the growing interest of critical social

science in the significance of payment infrastructures for the constitution and configuration of money, finance, and markets. In this literature, payment infrastructures are understood to be political-economic technologies that produce and shape spatialities of inclusion, exclusion, and monetary circulation (see Jeffs, 2008; Desan, 2014; Roy and Crane, 2015). This paper does therefore not provide an economic analysis of the impact, success, or failure of applications of blockchain technologies in remittances, nor does it measure and assess the efficiencies they generate in the payment industry more broadly.

Instead, this paper investigates the political economy inscribed in the materiality and design of applications of blockchain and DLTs in remittances and cross-border payments (see Bátiz-Lazo et al., 2014; Nelms et al., 2018; Swartz, 2018). Specifically, we will focus on how blockchain technologies formalize remittances by streamlining their underpinning clearing and settlement infrastructure, i.e., correspondent banking. Correspondent banking is "the provision of banking services by one bank (the "correspondent bank") to another bank (the "respondent bank")" (FATF, 2016, p.7). These Correspondent Banking Relationships (CBRs), organized in "Nostro and Vostro" accounts, are the infrastructural backbone of most cross-border payments, including remittances (CPMI, 2014). Despite its importance, however, correspondent banking barely figures at all in the literature on cross-border payments and remittances (CPMI, 2016a).

As a consequence of the Global Financial Crisis, CBRs are presently undergoing "de-risking," i.e., a reduction in the number of active bilateral arrangements ("corridors") between currency areas, and a concentration in the number of banks managing correspondent relationships (World Bank, 2015a, p.1). De-risking is particularly detrimental for remittances, in that it disproportionately affects Money Transfer Operators (MTOs), NGOs, and local banks (FATF, 2016; Eckert et al., 2017). Furthermore, for many financial institutions, correspondent banking accounts are increasingly understood to represent costly and inefficient "idle capital." The result of de-risking is that some banks and even entire countries might be completely cut off from transnational remittance corridors. Hence, customers may find themselves incapable of sending and receiving remittance payments, or they might incur in dramatically higher fees (World Bank, 2015b, p. 31).

The core argument of this paper is that concerns about risks and efficiencies presently animating correspondent banking arrangements—rather than financial inclusion agendas *per se*—are driving the application of blockchain and DLTs in remittances. Previous critical social scientific research argues that digital technologies for financial inclusion are actually motivated by the monetization of users' data (Maurer, 2015a). This paper argues that the application of DLTs within existing correspondent banking arrangements aims to reduce costs and fees, and to mobilize the idle liquidity "locked up" in Nostro and Vostro accounts (Maurer, 2016). This is achieved through interoperability, understood as the visibility and synchronization of payment systems to and with each other. Interoperability, in turn, enables real-time clearing and settlement of transactions. Ripple is almost the only case where blockchain, correspondent

banking, and remittances overlap. Hence, a study of this company is timely and relevant to apprehend the tensions and opportunities inherent to the application of blockchain technologies to cross-border payments.

This article comprises four parts. Section Materials and Methods will outline the methodology followed for this study. Section The Remittance industry from the Point of Sale to Cross-Border Payment Infrastructures will provide an overview of the literature on remittances and its relative neglect of payment infrastructures. Combining Results and Discussion section will unpack correspondent banking and its present transformation. Moreover, it will illustrate the application of blockchain technologies for payments and remittances through the case study of Ripple. Section Results and Discussion will also conclude by illustrating the limitations and ambiguities inherent to the promises that blockchain technologies purport. Section Conclusions concludes by elaborating further on the contribution of this paper to critical social literature on money, finance, and blockchain technologies.

## MATERIALS AND METHODS

This paper draws on 18-month fieldwork constituted of participant observation of industry meetings, conferences and trade fairs (Høyer Leivestad and Nyqvist, 2017), online ethnography in online forums and group skype calls (Hjorth et al., 2017), 15 in-depth interviews, and analysis of regulation, policy papers, and other online multimedia material. This research project has received ethical approval and clearance by the Departmental Research Ethics Geography Sub-Committee of the Department of Geography at Durham University, UK, on the 31st May 2017. All subjects gave written informed consent following the Declaration of Helsinki.

This paper follows a case study research design that lies between and takes insight from both gaps and holes (GAH), and social construction of reality (SCR) research designs as recently defined by Treiblmaier (2019) in this journal. First, following the GAH research design, correspondent banking and payment infrastructures were identified as the paramount gap in the existing literature on remittances. Hence, potential case studies were selected among companies that operated at the infrastructural level, rather than at the point of sale of remittances. Subsequently, theory-building followed an SCR design derived from the critical social science literature on money, finance, and markets, especially drawing on poststructuralism and Science and Technology Studies (STS). Rather than using case studies to test or disprove new and existing theories, Ripple here represents a *critical case*, one that achieves “the greatest possible amount of information on a given problem or phenomenon” (Flyvbjerg, 2001, p. 77). Hence, this study does not provide generalizability through replication. Instead, it “builds theory from the rich descriptions gained during the analysis process” (Treiblmaier, 2019, p. 7). Rather than assessing success and failure in deploying a specific technology, the research design of this study follows a radically interpretivist epistemology (Cavaye, 1996). This paper unpacks the politics

of design of a particular technology together with the cultures, imaginaries, and political economies associated with its use. In this context, the very criteria of assessment of success and failure form part and parcel of the technology itself: the case “assumes the sociality of knowledge, the circulation of discourse as its condition” (Berlant, 2007, p. 668). In so doing, one has to be aware that “one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion” (Yin, 2003, p. 18; cf. Leszczynski, 2018).

This paper focused on blockchain applications to interbank payment infrastructures, rather than user-centered retail remittances because this emerged as the central gap in the existing literature. A survey of the current literature evidenced BitPesa, Abra, Ripple, and Stellar as the most cited use cases of blockchain technologies for remittances and payments (Vigna and Casey, 2015; Tapscott and Tapscott, 2016; World Bank, 2017, 2018; Burniske and Tatar, 2018; DuPont, 2019). As it will be expanded upon in section The Application of Blockchain Technologies to Correspondent Banking, only Ripple and Stellar provide applications of DLTs to correspondent banking infrastructures. Stellar solutions for cross-border correspondent banking are still in their infancy, while Ripple has a well-documented record of partnerships with banks and MTOs. The difference in empirical material also made it hard to justify a comparative research design between Stellar and Ripple. Hence, Ripple was chosen as the critical case of this research.

## THE REMITTANCE INDUSTRY FROM THE POINT OF SALE TO CROSS-BORDER PAYMENT INFRASTRUCTURES

Remittances are “household income from foreign economies arising mainly from the temporary or permanent movement of people to those economies” (IMF (ed), 2009), p. 272). These transfers happen through a variety of formal or informal channels. Informal arrangements comprise physical transportation of cash and *hawala*, i.e., informal credit networks of intermediaries called *hawaladars* (Thompson, 2008; Martin, 2009; Rusten Wang, 2011). At the formal end of the spectrum, meanwhile, Remittance Service Providers (RSPs) include banks, post offices, and credit unions and non-bank financial intermediaries (NBFIs) of which Money Transfer Organizations (MTOs) are the most important (Orozco, 2004; UPU, 2013; Deloitte, 2017). Remittances grew from US\$2 billion in 1970 to US\$31.2 billion in 1990, to more than US\$400 billion in 2016 (Datta, 2017, p. 539). In this period, remittances overtook overseas development assistance (ODA), coming second to foreign direct investment (FDI) in many developing countries (Ratha, 2003; IDB, 2006; Wills et al., 2010; Hudson, 2015). This impressive growth caused remittances to attract attention from researchers and practitioners.

Development economics frames remittances as “aid that reaches its destination” (Bracking and Sachikonye, 2010, p. 218), and assesses their economic impact in terms of net gains and losses, efficiencies, and market failures (Heilmann, 2006; Yang,

2011). This literature focused on measuring the “migration-development nexus,” whereby remittances ostensibly transfer resources in a way that is beneficial for both the global South and North (Datta, 2012, p. 141). Remittances are also praised as counter-cyclical, informal welfare systems that to lift families out of poverty, and that benefit the originating countries’ balance of payments (Barham and Boucher, 1998; De Haas, 2005; Brown, 2006; Hudson, 2008; Mazzucato, 2009).

However, critical scholarship has questioned the emancipatory and transformative potential of remittances by highlighting its distributive asymmetries and hierarchies, illuminating how inclusion entails a dynamic of “adverse incorporation” (Aitken, 2010). Remittances are traversed by a “mission drift from poverty alleviation to profit maximization” (Roy, 2010, p. 386). The constellation of actors that push for the formalization of remittances is critically understood as “poverty capital” (Roy, 2010), or the “financial inclusion assemblage” (Schwittay, 2011). According to the “migration-development nexus,” remittance formalization fosters development through financial inclusion, freeing the untapped markets and idle assets that compose the “fortune at the bottom of the pyramid” (Pralhad, 2005; Collins et al., 2009). But, understood more critically, the poor constitute a frontiers market (Mitchell, 2007; Aitken, 2015): they are the “missing billions to be discovered, accounted for, channeled and harnessed for development” (Kunz, 2011, p. 49). In short, poor people “do not only possess assets but are assets” (Roy, 2010, p. 64).

Within the poverty capital business, the expansion of retail payment technologies has fostered the emergence of “poverty payment,” i.e., “the idea that the design of digital platforms for the transfer of value, agnostic as to what value is being transited or what it is being used for, has positive spillover effects that ultimately benefit poor people” (Maurer, 2015a, p. 128). This proliferation of mobile technologies and the political and industry-led effort toward cashless transactions lead to the emergence of a “fintech-philanthropy-development complex” (Donovan, 2012; Omwansa and Sullivan, 2012; Ojong, 2016). While payments are usually capitalized upon via transaction fees (Cirasino and Ratha, 2009; Cross, 2015), poverty payment is inscribed in a tendency across the payment industry away from fees and toward leveraging behavioral and transaction data (Freund and Spatafora, 2008; Maurer, 2012a, 2016).

As Datta (2017) has it, we can understand this move toward inclusion and digitization as an effort toward the formalization and mainstreaming of alternative and informal remittance flows. Mitchell (2007, p. 248) argues that markets have boundaries and limits, and there is a frontier region that lies between “market” and “nonmarket” relations. This frontier separates the formal economy, where assets’ ownership is recorded and fixed, and where everything can be traded for a price, from informal economic relations, where ownership regimes and freedom of exchange are more flexible. Development economics helps to extend the rules of markets into informal economies by “technologies of representation” such as “property records, prices, or other systems of reference.” These technologies allow the mobilization, pricing, and trading, in short, the capitalization on “dead capital” and idle assets (Soederberg, 2013, 2014;

Schwittay, 2014; Mader, 2018). Blockchain technologies are a particular form of technologies of representation that allow interoperability and seamlessness of transactions between the members of the network.

In sum, the existing literature on remittances has productively unpacked the “point of sale” of remittances (Maurer et al., 2013), their affective economies (Hudson, 2015, p. 246), their cultural content (Carling, 2014; Isaakyan and Triandafyllidou, 2017), and the motives of senders and of recipients (Levitt, 1998; Levitt and Lamba-Nieves, 2011; Lacroix et al., 2016; Vari-Lavoisier, 2016). More broadly, it has also pointed toward the place of remittances and digital payments in the business of poverty capital, or what Maurer (2015a) aptly terms “poverty payment.” However, comparatively less attention has been given to payment infrastructures, i.e., the technologies, devices, social and institutional arrangements, and accounting practices, that allow and measure the value transfer from payer to payee (Lindley, 2009; Siegel and Fransen, 2013; Pollard et al., 2016; Rea et al., 2017). Payment systems and their design have to be appreciated in their profound distributional and, indeed, political implications (Desan, 2014; Maurer, 2015b). This is the focus of the next section.

## RESULTS AND DISCUSSION

### Correspondent Banking and Remittances

While banks themselves tend to take a back-seat position when it comes to providing *direct* remittance services, formal remittance services often rely *indirectly* on a network of cross-border Correspondent Banking Relationships (CBRs) (Erbenová et al., 2016, p. 17). Correspondent Banking is a continuous arrangement between financial institutions that enable banks to provide services in countries where they do not directly operate. It covers cash management, international wire transfers, check clearing, payable-through accounts, and foreign exchange (FX) services (The Wolfsberg Group, 2014). Correspondent Banking Relationships (CBRs) encompass so-called “Nostro and Vostro” accounts. Nostro is the account of the respondent bank held by the correspondent bank. Vostro is the account on the books of the correspondent bank, conducted on behalf of the respondent bank (World Bank, 2015b, p. 13). Correspondent banking can be either limited to one respondent-correspondent relation, or “nested” or “downstream,” when one correspondent bank serves several respondent financial institutions simultaneously (BCBS, 2017, p. 24).

Correspondent banking is a distinctive feature of cross-border payments, due to the lack of a worldwide infrastructure of clearing and settlement. Clearing entails the exchange of relevant payment information between the payer’s and payee’s accounts, and the calculation of claims to settle. Settlement is the final discharge of a valid claim by moving funds from the payer’s account to the payee’s account (Rambure and Nacamuli, 2008). In domestic payments, messaging, clearing, and settlement frequently happen in parallel to each other through Automated Clearing Houses (ACH), and central bank Deferred Net Settlement (DNS) retail payment systems (BIS, 2013). In cross-border payments, however, no such worldwide clearinghouse

exists, and transactions must pass through CBRs. Partial exceptions are card payments, which are cleared by the card provider, e.g., Visa or MasterCard, and some large transnational MTOs like Western Union, which might manage independent end-to-end payment services depending on jurisdiction-specific conditions (CPSS, 2003; CPMI, 2014).

While flows of funds happen in the books of respondent and correspondent banks, interbank messaging flows mainly through the Society for Worldwide Interbank Financial Telecommunications (SWIFT) (Scott and Zachariadis, 2013). SWIFT is a member-owned, cooperative society comprising more than 11,000 financial institutions across more than 200 countries and territories (SWIFT, 2019). SWIFT, however, does not provide clearing and settlement, but only transaction messages. Once received, correspondent banks process these messages to calculate the amounts to clear. Settlement, finally, happens through Foreign Exchange (FX) markets. Due to this high number of intermediaries, clearing and settlement are typically slower and more expensive in cross-border payments than in domestic payments. Partial fixes to these risks and costs are the introduction of the Continuous Linked Settlement (CLS) bank in 2002 (CLS Group, 2019), and some voluntary schemes in place in specific corridors, such as the one between US and Mexico (Orozco, 2004, p. 24).

In the past 10 years, the number of CBRs has decreased, and it was concentrated in the hands of fewer financial institutions. First, CBR reduction and concentration is a consequence of de-risking, i.e., risk and cost reduction strategies, based on regulatory compliance costs—e.g., Know-Your-Customer (KYC) Anti-Money Laundering (AML) and Combating of the Financing of Terrorism (CFT)—and real or perceived risk profiles of partnering financial institutions (FSB, 2015). Second, revenues typically associated with cross-border payments have been shrinking, such as transaction fees, FX margins, interest on Nostro-Vostro accounts, and float. Float is money “in flight” between sender and receiver of a payment, and it is hence briefly counted on both accounting books (Federal Reserve Bank of New York, 2007). In 2015, cross-border payments accounted for 20% of the volume, but 40% of the revenues associated with payments, for a total of US\$ 300 billion, and remittances accounted for US\$ 25 billion (McKinsey, 2016, p. 14). The growth in revenues from cross border payments decreased from 4% in 2011 to 2% in 2015, and revenue margins declined 2% on average between 2011 and 2015 (Ibid). Furthermore, the drop in interest rates made the liquidity stored in Nostro and Vostro account less profitable (Bansal et al., 2016).

In 2015, the World Bank (2015a) found that 80% of responding financial institutions reported CBR reduction and consolidation, and 55% of local and regional banks reported spill-over effects onto remittance-related companies. The Association of Supervisors of Banks in the Americas (ASBA) confirmed that, in 60% of responses, remittances were affected by CBR reduction (Erbenová et al., 2016, p. 12). While this reduction does not seem to impact on the volume and value of remittances, it shows to have a severe impact on their costs (IMF, 2017, p. 19). The number of active correspondent accounts worldwide fell from more than 520,000 to 480,000 (CPMI, 2016a, p. 15).

Another study by the World Bank (2015b) found that half of the respondents directly experienced a decline in correspondent banking relationships. Most of the large banks declared that they actively reduced the number of their correspondent banking relations in the 2012–15 period. The Financial Stability Board estimated that, between 2011 and 2016, the number of active corridors decreased by 6.3% (from 13,072 to 12,242), and the number of active correspondents decreased by 6%. For the corridors to and from the Dollar and the Euro, that jointly represent more than 80% of the value of SWIFT payment messages, the decrease was by 15% (FSB, 2017, p. 1).

These trends are uneven geographically, bearing disproportionately on the Global South. While Europe and South and Central Asia have seen a somewhat consistent reduction in transaction costs between 2011, East Asia, Pacific, Middle East, and both North and Sub-Saharan Africa have seen an increase in transaction fees after 2014 (IMF, 2017, p. 20). In the Middle East and North Africa, 40% of banks reported higher costs related to compliance and fees associated with remittances. Palestinian banks are under increased pressure and fears of CBR terminations that would impact on a financial system already in dire straits due to the relevance of the shekel in the Palestinian economy (IMF, 2017, p. 17). In Sub-Saharan Africa, Liberia saw the termination of almost 50% of its CBRs (36 out of 75) between 2013 and 2016 (Erbenová et al., 2016, p. 15).

Sub-Saharan Africa, the Caribbean, and the Pacific are especially affected geographies. Angola has been highlighted as particularly severely hit by Correspondent Banking reduction and concentration. Just one correspondent bank was serving six Angolan banks for foreign exchange services, and it was providing US Dollar notes to 10 financial institutions in total. In 2015, all those relations ceased. Hence Angolan banks had to resort to downstream and nested correspondent banking relationships with subsidiaries of Angolan banks in EU, Africa, and Asia (World Bank, 2018, p. 15). The case of Angola is emblematic of some commonalities across Africa, such as the heavy reliance on correspondent banking and foreign currency (mainly US dollar) to fund international trade, such as the Sino-Africa trade (Sy and Wang, 2016; IMF, 2017, p. 18). In the Caribbean, the Bahamas-Haiti corridor is another critical case: 75% of remittances are same-day settlement payments, which means that de-risking could have close-to-immediate effects on Haitian economy through remittance reduction (CPMI, 2015, p. 10). The Pacific is considered problematic geography for the relationship between correspondent banking and remittances: the decrease of CBRs and the closure of remittance providers brought to a halt. In the case of Samoa, furthermore, remittances compose 18% of the GDP, with 80% flowing through Money Transfer Operators that rely on the correspondent banking infrastructure (IMF, 2017, p. 17).

These trends also affect MTOs and charities disproportionately, due to their real or perceived higher risk profile and lower profitability as clients of correspondent banks. Between 2010 the number of MTOs that had at least one bank account closed, resulting in an impediment to conduct cross-border business grew from 26 to 54%, while the amount of MTOs that did not have any account closed each year decreased

from 67 to 42% (World Bank, 2015a, p. 7). As the World Bank (2018, p. 13) has it, “remittances are a volume business, and for small states, in particular, volumes are by definition small.” Hence, a price increase and a reduction of channels through which to send payments affect smaller countries more than bigger ones, local banks more than transnational ones, and Money Transfer Operators more than banks.

De-risking is particularly detrimental for remittances, because it affects the Global South and MTOs more acutely. Furthermore, CBR reduction and concentration could push back a sizeable amount of remittance forms back into informality (IFC, 2017, p. 49) potentially also making AML and CFT screenings less effective (cf. de Goede, 2003; Vlcek, 2010). To offset these consequences, the IMF and the World Bank investigated blockchain technologies as potential alternatives to Nostro and Vostro accounts. Blockchain technologies promise to introduce shared ledgers without the need to establish centralized clearinghouses, making Nostro and Vostro accounts redundant (IMF, 2017; World Bank, 2018). The next section, hence, will focus on the relationship between Correspondent Banking, blockchain technologies, and formalization.

## The Application of Blockchain Technologies to Correspondent Banking

The application of blockchain technologies in correspondent banking centers on interoperability, i.e., with the mutual visibility of ledgers, standards, payment infrastructures, and of individual customers and transactions for spotting illicit behavior. As the CPMI has it:

“Interoperable payment systems enable the seamless interaction of two or more proprietary acceptance and processing platforms, and possibly even of different payment products, thereby promoting competition, reducing fixed costs, enabling economies of scale that help in ensuring the financial viability of the service, and at the same time enhancing convenience for users of payment services. The consequences of low interoperability are overlapping or limited coverage, sunken investment costs, and inefficiency” (CPMI, 2016b, p. 34).

Blockchain technologies promise interoperability through shared ledgers held by all banks operating cross-border remittances. In 2017, the IMF outlined some of the potential use cases of blockchain technologies in correspondent banking, focusing on risk management, cost reduction, and real-time settlement (IMF, 2017, p. 35–36). The World Bank further summarized distributed ledgers’ potential as that of “creating a distributed network for cross-currency funds settlement that replaces the correspondent banking network [...] lowering settlement costs and increasing efficiency [...]. DLT can also allow for new approaches to correspondent banking, which can potentially be part of a solution for addressing de-risking” (World Bank, 2017, p. 23).

Blockchain technologies emerged at the fringe of formalized capitalism, and often in opposition to it. However, blockchain technologies are undergoing co-optation by market actors, de-politicization of their design, and increased competition between business implementation, a dynamic labeled as “co-opetition”

(Leal, 2014). Corporate co-optation of blockchain technologies leads to ambiguous dynamics in the payment space, caught in between interoperability and enclosure, disintermediation and re-intermediation, disruption, and rent extraction (O’Dwyer, 2012, 2015). Some examples are the UBS-led Utility Settlement Coin (Kaminska, 2017), R3 Corda (2018), the experiments by SWIFT (2018), and CLS (Allison, 2018) for distributed messaging, clearing, and settlement, and the newly launched coin by Morgan (2019). Furthermore, cryptocurrencies are striving to achieve the status of a new asset class (Burniske and Tatar, 2018) to enable different ways of capitalizing on payments, in addition to transaction fees and data monetization. In June 2019, Facebook, together with a consortium of partners, announced its cryptocurrency Libra, to be launched in 2020, which focuses on financial inclusion and remittances (Libra, 2019).

Payments and remittances have been a crucial use case of blockchain technologies since their inception. Bitcoin, the first-ever blockchain promised to manage a distributed payment network without a centralized institution for accounting, clearing, and settlement institution (Nakamoto et al., 2019). The first use case of blockchain technologies has been BitPesa. Born in 2013, and inspired by the success of the Kenyan payment system M-Pesa (Omwansa and Sullivan, 2012), BitPesa manages payments between two fiat currencies by matching them with payments from the originating currency to Bitcoin, and from Bitcoin to the currency of the country of destination (McKay, 2014; Scott, 2016). BitPesa has since expanded in geographical reach by serving eight countries across Africa, and it changed focus, from person-to-person (P2P) remittances to business-to-business (B2B) operations, hence losing the original emphasis on remittances *per se* (DuPont, 2019, p. 19). Hence, BitPesa would not make a suitable case to study correspondent banking, remittances and DLTs. The second example, Abra, was mentioned by The World Bank as a system to manage “instant peer-to-peer money transfers with no transaction fees [...] combining cryptocurrency with physical bank tellers” (World Bank, 2018, p. 29). Currently, however, Abra seems to have focused on providing cryptocurrency wallets, as well as investing and trading services, rather than cross-border payments (cf. Cotton, 2018, p. 116). Ripple, on the other side, remained focused on cross-border payments, but it shifted focus from P2P to interbank payments, with the specific aim of replacing correspondent banking (Rosner and Kang, 2015). Stellar, which was born by branching out from Ripple’s source code in 2015 (Mazières, 2016), is undergoing a similar path through the implementation, with IBM, of World Wire, that aims to compete with both Ripple and SWIFT (IBM, 2019a). The next section will delve in more detail into the Ripple case.

## Ripple: Formalization of Remittances and Correspondent Banking

Older than Bitcoin itself, Ripple emerged in 2004 as a mutual credit network like a *hawala*, a time bank, or a Local Exchange Trading System (LETS). The primary use case for Ripple was to provide an infrastructure for scaling up LETS and other alternative currencies (Fugger, 2004). Between 2012 and 2013, Ripple morphed into a distributed ledger technology—the XRP

Ledger—that combines the mutual credit network with the cryptoasset XRP and a distributed currency exchange (XRP Ledger Project, 2019). Ripple is also the name of the company that offers payment solutions built on top of the XRP Ledger, as well as on other technologies. While Ripple still owns a significant amount of the cryptoasset XRP, the XRP Ledger remains an open distributed ledger, that is not under the direct control of the company Ripple. Since 2015, the company Ripple focused primarily on interbank payments, aiming to become a competitor to SWIFT, and it currently counts 200 customers in 40 countries.

The XRP Ledger represents money in two ways: trust lines and XRP. Trust lines are IOUs representing promises to pay denominated in any unit of account they want. The system, in fact, allows users to create entirely new currencies and to program their behavior. If a direct trust line connects them, people can pay each other by changing the balances on that trust line. Otherwise, they can send payments across mutual acquaintances. Payments “ripple” through trust lines between payer and payee if there is an uninterrupted chain of trust lines. Alternatively, they can send each other XRP, which can be sent from any user to any other without the need for trust lines. If the payment requires a currency exchange, the amount flows through offers on the distributed exchange, which works like a digital FX marketplace. People post offers on the Ledger, and the system matches outgoing payments with open offers to exchange one currency with another and finds the most suitable option. The offers included in the calculation do not only include direct exchanges between one currency and another, but also offers to exchange the outgoing currency with XRP, and XRP to the destination currency. This feature is called autobridging, and it uses XRP as a bridge asset in exotic or illiquid currency pairs (Birla, 2018). Furthermore, XRP promises to provide “on-demand liquidity” (Ripple, 2019a): rather than relying on batched payments as in the case of foreign exchange payments routed through major international currencies, the XRP ledger sources liquidity on a payment-by-payment basis.

From the beginning, Ripple marketed itself as a “new and better Bitcoin” for the unbanked and underbanked (Bullington, 2014; Detmering, 2014; Long, 2014). Bitcoin promised a cheap and fast means for value transfer, but its high transaction fees and slow transaction processing prevented Bitcoin from delivering on that promise (Schwartz et al., 2014). Ripple, conversely, promised higher speed, and lower fees and by providing an interoperability layer between payment systems. Ripple promises to be the Internet Protocol for a new Internet of Value in the making (Leonard, 2017). A 2014 post perfectly encapsulates this turn of blockchain technologies into a new frontier of capital expansion:

“Far from its misunderstood characterization as an ideological revolution to usurp institutions or a subversive vehicle for the dark arts, the cryptocurrency movement is about advancing the frontier” (Liu, 2014).

Ripple’s proposition for the poor focuses primarily on new opportunities for profits and market expansion for financial institutions:

“In addition to allowing poor customers to become a profitable market segment, open protocols and distributed architectures can enable entirely new and novel offerings.” (Aranda and Zagone, 2015).

To allow the poor to become a profitable market segment, hence advancing the frontier, Ripple’s interoperability protocols promise to unlock the pools of liquidity “trapped” in Nostro and Vostro accounts, that Ripple estimated between US\$ 1.6 to 5 trillion (Zagone, 2016; Ripple, 2018a). Here is a statement of one of Ripple’s software developers:

“We found in our research that the biggest cost was the cost of capital. So, banks had a huge amount of money sitting in Nostro and Vostro accounts all over the world to be able to facilitate payments. So, you have two options: I can either offer you, my customer, an immediate payment, or I can make you wait. If I want to provide you with instant payments, I need to have liquidity sitting in the destination country where you want to send to, all the time<sup>1</sup>.”

As said before, this liquidity pressure is particularly hard, especially in low-value payments, for MTOs rather than banks. Here is a comment from a Brazilian remittance company, part of RippleNet:

“So, the client would pay in our account, and we would have to send these transactions to a partner bank’s account for them to be able to send it abroad. If we had, let’s say, 100 transactions a day, we would send 100 SWIFT messages. And that, of course, brings up the cost of the transactions, because it depends on the corridor, but it’s 20 reais to send a SWIFT [...]. The euro is worth more than four times more than reais, so when I am increasing the volumes that I settle in euros, I actually send a lot of reais abroad. That means that I have less liquidity in Brazil, and at the end of the day it’s really hard for a small company to operate at high volumes if you actually have to pre-fund an account<sup>2</sup>.”

MTOs are more vulnerable to de-risking because of the inherently hierarchical design of payment systems: payment systems are layered, resembling a pyramid, with central banks at the top, hosting commercial banks’ accounts, which in turn host MTOs’ and individuals’ accounts (CPSS, 2003, p. 3). On the XRP Ledger, conversely, any account can issue liabilities in the form of a trust line, and all issuers are treated equally by the Ledger. This quote from an interview with a former software engineer at Ripple explains this principle quite clearly:

“Now if you’re a lower level business like a remittance company, you have a bank account. You keep your money in a bank, and you are a lower tier organization. If [an MTO] tried to help move money for banks and said, “Oh good, you deposit money here,” banks would go “No, no, no. That’s the wrong way around. You’re below us.” In the financial ecosystem, if you are a bank and you want to use XRP to send money, you need to buy it from someone, and where do you buy it from? You can’t go “Oh bank,

<sup>1</sup>Confidential interview, 25th May 2018, minutes 10:10 – 10:35.

<sup>2</sup>Confidential interview, 5th December 2018, minutes 51:00 – 52:00.

we want you to deposit a bunch of Euros into [a cryptocurrency exchange],” that’s upside down for them. But for a payment service provider like a remittance company, that’s fine: they have lots of bank accounts with people. If you say, “We’ll open a bank account at [this exchange]” They’d go “Awesome, I’ve got to keep my money somewhere, might as well use XRP<sup>3</sup>.”

The promise of leveling the payment system hierarchy is mirrored by another interviewee, this time about the relationship between banks and countries in the Global South:

“In Thailand, they are quite keen [to use crypto], because their credit score is already comparatively lower than advanced economies [...]. In Mexico, again, because the country’s score is quite low, they are quite happy to use cryptocurrencies. You sell USD, buy XRP, you sell XRP and buy Mexican peso. The thing is that those two separate transactions happen precisely at the same time, so a bank would never have to hold XRP, would never have a position, being exposed if the value might go down. Because that’s a significant risk, right?<sup>4</sup>”

Originally, Ripple’s business proposition was to substitute CBRs and SWIFT with the XRP Ledger. Financial institutions and MTOs would have been gateways, i.e., accounts on the XRP Ledgers that accept deposits off-ledger and issue trust lines on the ledger to represent those deposits. Messaging, clearing, and settlement of cross-border payments would have happened by rippling on trust lines from payers to payees through the gateways. FX market makers and liquidity providers would have issued exchange offers and provided the liquidity necessary to fund cross-currency payments. Regulatory uncertainties and reluctance from financial institutions—especially banks—made Ripple develop the Interledger Protocol or ILP (Thomas and Schwartz, 2015). ILP does not send payments over a blockchain: instead, it synchronizes the ledgers of all financial institutions in the Ripple network (RippleNet). This ensures that both legs of cross-border transactions happen simultaneously, and they either both succeed or they both fail. In transaction-processing software jargon, this property is called atomicity and, together with consistency, isolation, and durability, constitutes the so called ACID test of transaction processing. As Amsterdam (2001; cf. IBM, 2019b) succinctly puts it,

“An activity is atomic if it either happens in its entirety, or does not happen at all. Atomicity is crucial for writing correct software in many applications; for example, a bank’s software may implement a transfer from account A to account B as a withdrawal from A followed by a deposit to B. If the first action happens, then the second had better happen as well.”

The promise of mobilizing idle assets by synchronizing circulation performs an imaginary of money as liquidity and lubricant of the engine of the economy. At the same time, it fulfills

<sup>3</sup>Confidential interview, 15th May 2018, minutes 1:01:25 – 1:02:31. Names of partners and companies removed.

<sup>4</sup>Confidential interview, 10th October 2017, minutes 20:00 – 21:40. Names of partners and companies removed.

the promise of the seamlessness of exchanges and frictionlessness of flows typical of logistics (Maurer, 2012b; Plantin and Punathambekar, 2019). Much as just-in-time logistics promised to make the warehouse obsolete, so instant payments promise to make Nostro and Vostro accounts outdated, or so the belief goes (Gregson et al., 2017). Standardization of messaging, clearing, and settlement work like the size of the railway gauge, the standardized dimensions of the shipping container, and the open telecommunication protocols of Ethernet, SMTP, and TCP-IP in making flows seamless and reserves and warehouses redundant (Liu, 2015; Rossiter, 2016).

On top of cutting transaction costs, Ripple also promises to tackle another source of correspondent banking de-risking, namely KYC-AML compliance costs. In multiple hearings and public consultations, Ripple pledged to provide stronger visibility of funds transfers than what SWIFT can deliver. As a response to the UK Payment System regulator, Ripple articulated the visibility of transactions on the XRP Ledger in this way: “Unlike payments sent through correspondent banking today, which are opaque at best, Ripple Ledger provides complete end-to-end transaction traceability” (Gifford, 2015, p. 13). This is a sharp change from the concern with anonymity and privacy that heralded the very emergence of blockchain technologies and cryptocurrencies (Swartz, 2018, p. 632).

In at least one case an MTO reported that the integration in Ripple was a success, saying:

“We have since seen very good results: we were able to bring down the prices of the operations, we don’t charge a SWIFT fee to our clients anymore. Previously we were charging a cost of 20 Brazilian reais, which is about 7 dollars<sup>5</sup>.”

However, Ripple’s website only rarely provides assessments of the direct savings for intermediaries and end-users. Furthermore, it is too early to tell whether there is uniformity in the benefits across the Ripple network. Rather than assessing Ripple’s successes and failures, this paper illustrates the changing landscape of actors, interests, and promises surrounding new payment technologies.

While payments powered by the Interledger Protocol are now live in many corridors, payments using the cryptocurrency XRP are being rolled out only recently. Ripple announced that xRapid, their corporate product that uses XRP as a bridge asset, was being used in the US-Mexico corridor on the 1st of October 2018. On the 17th of June 2019, Ripple entered an agreement with MoneyGram. This company is the world’s second-largest MTO after Western Union (Meola, 2016), with a market capitalization of US\$ 148 million (Nasdaq, 2019) and an average revenue per quarter of US\$ 300 million (MoneyGram, 2019). According to this agreement, Ripple will provide up to US\$ 50 million in exchange for equity in MoneyGram over 2 years, and the two companies will jointly work on XRP-enabled payments (Ripple, 2019b). After signing this agreement, MoneyGram’s stock increased by 155% in valuation (Easton and Bloomberg, 2019).

<sup>5</sup>Confidential interview, 5th December 2018, minutes 1:45–17:35.



The application of Ripple to correspondent banking entailed a change both of its money cultures and the political economy of its actual use. From a *hawala* credit network geared toward Local Exchange Trading System (LETS), Ripple became more oriented toward profit maximization. A senior Ripple employee synthesized Ripple's morphing thusly:

"You can still use the XRP Ledger as a distributed exchange, as a LETS system, as a *hawala*-like community credit and lending. And now, we kind of said "what is the product-market fit for this Ledger? What's the market that we can target with it?" And most of the use cases that we were most interested in the early days like community credits and the LETS feature and the issued asset feature, there just wasn't really a market for it, we didn't see a way that we as Ripple as a company could target. That does not mean that if another company wanted to use the XRP Ledger to target community credit market, that would be wonderful, but Ripple had to focus on something<sup>6</sup>."

Ripple raised a total of US\$ 93.6 million in Venture Capital (VC) funding across eight funding rounds between 2012 and 2016. The company also holds a sizeable amount of the cryptoasset XRP, which brought its valuation at US\$ 20 billion in January 2019, given the market price of XRP in cryptocurrency exchanges (CoinMarketCap, 2019; Rooney, 2019). The MTO TransferGo, presenting at a public Ripple event, described the aim of the partnership in enabling its business to grow: "how do you get from 1 to 10 to 100 million users?" (Ripple, 2018d minute 5:45). The Siam Commercial Bank (SCB), furthermore, recently launched a Japan-Thailand remittance product based on Ripple's technologies (Marquer, 2017). As SCB's Chief Technology Officer reported, the partnership with Ripple and the focus on remittances aim toward an "aggressive ambition and expansion" of SCB (Ripple, 2018c minute 7:00).

The move of Ripple's solutions toward profit maximization entails and implies Ripple's incorporation in existing regulatory structures. Ripple was the second blockchain company to obtain a New York bitcoin license in July 2016 (NYS - DFS, 2016). Ben Lawsky, the very author of the bitcoin license, went on to join Ripple's board of directors (Ripple, 2019a). Ripple has also been a member of payment improvements working groups of established by the Automated Clearing House and the Federal Reserve in the US, and it collaborated on Real-Time Gross Settlement (RTSG) improvement efforts in the UK and Saudi Arabia (Bank of England, 2017; Ripple, 2018b).

Blockchain technologies are the latest development in network technologies promising "frictionless capitalism" (Pesch and Ishmaev, 2019, 4) in the form of low transaction costs and disintermediation. However, as these technologies gain traction, new forms of expertise, specialization, and institutionalization create new frictions and costs. While blockchain technologies disintermediate internally, they re-intermediate, albeit in a decentralized way, between each other. As Nelms et al. (2018) have it, blockchain disintermediation coexists with walled gardens and "siloes" networks that cannot interoperate with

each other. The frontier of disintermediation and transaction fee reduction is moving to the so-called "Layer 2" and "Layer 3" technologies, such as payment channels, decentralized exchanges, and open interoperability protocols (Poon and Dryja, 2016; Casey, 2018; Herlihy, 2018). The Interledger Protocol or ILP is one such technology. However, by making Ripple potentially interoperable with other payment systems, the ILP simultaneously puts Ripple in danger of seeing its margins eroded by the competition fostered by its technology (Bloomberg, 2019; Coppola, 2019; Sloane, 2019).

As the struggle for interoperability moves away from immediate end-users, blockchain technologies tend to disappear from view. This eclipse is inherent to technologies becoming infrastructural: they become taken for granted, and they reappear only when they break down (Star, 1999). In fact, an MTO employee said that the application of Ripple's technologies to their remittance platform was not associated with co-branding or with major changes in the user interface and experience<sup>7</sup>. However, this disappearance can never be full, lest it becomes unworkable and economically unviable for the actors deploying and running it. Rather than leading to the vanishing of *any* geographical articulation, these media entail specific geographies of calculation (DuPont, 2019, 189). The tensions between "fictions and frictions" (Pesch and Ishmaev, 2019) that propel blockchain technologies' expansion in the payment space is not accidental, but inherent to the economic theories, models, and assumptions that these technologies perform.

## CONCLUSIONS

This paper analyzed remittances by foregrounding the infrastructure that makes these payments possible, i.e., correspondent banking. This focus is all the more timely as formalization draws a bigger and bigger proportion of remittance flows into formal banking channels. Blockchain technologies do not represent a rupture in the tendency toward remittance formalization. Instead, these innovations may strengthen formalization and capitalization on remittances. By promising interoperability and frictionless payments, blockchain technologies aim to free idle capital, democratize liquidity and flatten the existing "pyramid" of monies encompassing MTOs, correspondent banking accounts, clearinghouses, and central bank settlement systems (Caytas, 2016; Wandhöfer, 2017). Simultaneously, the use of blockchain technologies to expand the frontier of market relations turns blockchain technologies themselves into a new market frontier through their incorporation in legacy infrastructures, business solutions, and public and private regulation. Furthermore, the original stress and focus on anonymity is attenuated by harnessing the capacity of blockchain technologies to better track transactions.

The imaginary of frictionless circulation and transaction cost annihilation has its own inherent limits. While a blockchain can provide interoperability and simultaneity of clearing and settlement, each blockchain is a separate network,

<sup>6</sup>Confidential interview, 30th May 2019, minutes 59:00 – 1:00:00.

<sup>7</sup>Confidential interview 5th December 2018, minutes 45:40 – 47:00.

following its own rules and following different accounting standards. As more and more blockchain technologies emerge, this creates more, not fewer intermediaries, with the result of reproducing the transaction costs that were meant to disappear. Hence, blockchain interoperability moves the competition from the cross-border to cross-chain payments, as testified by the emergence of “Layer 2” interoperability solutions. Despite the flamboyance of blockchain marketing, its most important applications will impact on less flashy and more “boring” sectors of banking and payments, such as middleware (DuPont, 2019, p. 172) and back-office reporting and interoperability (Fanning and Centers, 2016).

Hence, the “inherent” tendency of blockchain technologies toward disintermediation is not unambiguous. As existing and incumbent financial players are flocking toward blockchain technologies for clearing and settlement of payments, existing power structures can be challenged but also reinvented and reinforced. Maurer (2015b) rightly pointed out that the ownership, design, and access to payment infrastructures are deeply political problems that refer to the nature of money as a social institution. Blockchain research, based on the novelty and unruly origins of the technology, has produced a wealth of literature both on its technical aspects and inner workings, on the alternative imaginaries that inform this design, and on the economic practices that it can enable. The increased corporate co-optation and competition, comparatively, received far less scrutiny. This paper, hence, tried to show the process of co-optation and formalization without giving analytical primacy to either existing infrastructures or emergent technologies.

The impact of blockchain technologies is ambiguous, both in terms of costs, risks, and speed, and in political and moral terms (Campbell-Verduyn and Goguen, 2018). As Caytas (2016) has it, cost-benefit analyses are particularly hard in this field, due to its ever-changing transformations (Godfrey-Welch et al., 2018). Again, the interviews I conducted seem to point toward a general appreciation of the improvements brought by Ripple, but more research is needed in the lived experience of the payers. This paper pointed out that there is a gap in the literature on the “rails and pipelines” that underpin remittance transfers, and that most of the research tends to concentrate on the point of sale. This paper’s limitation is specular: by foregrounding remittance infrastructure, this paper has comparatively overlooked the individual end-users.

For both blockchain enthusiasts and skeptics, the literature tends to produce an infrastructural double inversion. Bowker and Star (2000, p. 34) defined infrastructural inversion as a methodological move that, counter to infrastructure’s invisibility in everyday life, foregrounds the material and technological substratum that makes social practices possible. Blockchain literature has been beneficial in foregrounding and in making “transparent” this technology (DuPont, 2019). However, it has somehow obscured and forgotten the broader social processes in which it is inscribed and deployed. The adoption of these technologies is often narrated as a process of

actualization of inherent positive or negative tendencies and potentialities, rather than a process of mutual shaping, dependent on enabling and disabling factors. This literature needs to reconcile with previous scholarship on money and finance to understand not only how the new technology impacts on existing hierarchies, but how both existing and emerging technologies influence one another. Blockchain technologies are neither embryonic forms of radically different societies and monetary systems, nor business as usual. Instead, they “productively engage in and perform a plurality [of modes of finance], thus blurring the line between alternative and dominant, formal and informal, embedded and disembedded” (Maurer, 2012c, p. 415). The study of digital money needs to foreground competition, conflict, and redistribution of resources, beyond both solutionism (Morozov, 2013) and dystopian cynicism (Golumbia, 2016).

## DATA AVAILABILITY STATEMENT

The datasets for this manuscript are not publicly available because of confidentiality and anonymity agreements with research participants. Requests to access the datasets should be directed to LR, ludovico.rella@durham.ac.uk.

## ETHICS STATEMENT

This research project has received ethical approval and clearance by the Departmental Research Ethics Geography sub-Committee of the Department of Geography at Durham University, UK, on the 31st May 2017. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

## AUTHOR’S NOTE

This paper draws on 18-month online and offline fieldwork constituted of participant observation of industry meetings, conferences and trade fairs, online ethnography in online forums and group skype calls, 15 in-depth interviews, and analysis of regulation, policy papers, and other online multimedia material.

## AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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**Conflict of Interest:** The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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